OVERCURRENT RELAY

VAMP 11F

Technical Manual

(V11F/EN M v3.1)

(1st July 2015)

Note: The technical manual for this device gives instructions for its installation, commissioning, and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of any questions or specific problems arising, do not take any action without proper authorization. Contact the appropriate Schneider Electric Energy technical sales office and request the necessary information.

Any agreements, commitments, and legal relationships and any obligations on the part of Schneider Electric Energy including settlements of warranties, result solely from the applicable purchase contract, which is not affected by the contents of the technical manual.

This device MUST NOT be modified. If any modification is made without the express permission of Schneider Electric Energy, it will invalidate the warranty, and may render the product unsafe.

CONTENTS

SAFETY SECTION

SS

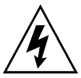
CONTENTS

STANDARD SAFETY STATEMENTS AND EXTERNAL LABEL INFORMATION FOR SCHNEIDER ELECTRIC ENERGY EQUIPMENT

1. INTRODUCTION

This Safety Section and the relevant equipment documentation provide full information on safe handling, commissioning and testing of this equipment. This Safety Section also includes reference to typical equipment label markings.

The technical data in this Safety Section is typical only, see the technical data section of the relevant equipment documentation for data specific to a particular item of equipment.



Before carrying out any work on the equipment the user should be familiar with the contents of this Safety Section and the ratings on the equipment's rating label.

Reference should be made to the external connection diagram before the equipment is installed, commissioned or serviced.

Language specific, self-adhesive User Interface labels are provided in a bag for some equipment.

2. HEALTH AND SAFETY

The information in the Safety Section of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

It is assumed that everyone who will be involved with the equipment is familiar with the contents of this Safety Section, or the Safety Guide (SFTY/4L M).

When electrical equipment is in operation, dangerous voltages are present in certain parts of the equipment. Failure to observe warning notices, incorrect use, or improper use may endanger personnel and equipment and also cause personal injury or physical damage.

Before working in the terminal strip area, the equipment must be isolated.

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel may work on or operate the equipment.

Qualified personnel are individuals who:

- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorized to energize and de-energize equipment and to isolate, ground, and label it;
- Are trained in the care and use of safety apparatus in accordance with safety engineering practices;
- Are trained in emergency procedures (first aid).

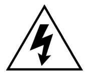
The equipment documentation gives instructions for its installation, commissioning, and operation. However, the manuals cannot cover all conceivable circumstances or include detailed information on all topics. In the event of any questions or specific problems arising, do not take any action without proper authorization. Contact the appropriate Schneider Electric Energy technical sales office and request the necessary information.

3. SYMBOLS AND LABELS ON THE EQUIPMENT

For safety reasons the following symbols which may be used on the equipment or referred to in the equipment documentation, should be understood before it is installed or commissioned.

3.1 Symbols

Caution: refer to equipment documentation



Caution: risk of electric shock

Protective Conductor (*Earth) terminal

Functional/Protective Conductor (*Earth) terminal

Note: This symbol may also be used for a Protective Conductor (Earth) Terminal if that terminal is part of a terminal block or sub-assembly e.g. power supply.

*NOTE: THE TERM EARTH USED THROUGHOUT THIS TECHNICAL MANUAL IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.

3.2 Labels

See Safety Guide (SFTY/4L M) for typical equipment labeling information.

4. INSTALLING, COMMISSIONING AND SERVICING

Equipment connections

Personnel undertaking installation, commissioning or servicing work on this equipment should be aware of the correct working procedures to ensure safety.

The equipment documentation should be consulted before installing, commissioning, or servicing the equipment.

Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated.

Any disassembly of the equipment may expose parts at hazardous voltage, also electronic parts may be damaged if suitable electrostatic voltage discharge (ESD) precautions are not taken.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electric shock or energy hazards.

Voltage and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety.

Watchdog (self-monitoring) contacts are provided in numerical relays to indicate the health of the device. Schneider Electric Energy strongly recommends that these contacts are hardwired into the substation's automation system, for alarm purposes.

To ensure that wires are correctly terminated the correct crimp terminal and tool for the wire size should be used.

The equipment must be connected in accordance with the appropriate connection diagram.

Protection Class I Equipment

- Before energizing the equipment it must be earthed using the protective conductor terminal, if provided, or the appropriate termination of the supply plug in the case of plug connected equipment.

- The protective conductor (earth) connection must not be removed since the protection against electric shock provided by the equipment would be lost.
- When the protective (earth) conductor terminal (PCT) is also used to terminate cable screens, etc., it is essential that the integrity of the protective (earth) conductor be checked after the addition or removal of such functional earth connections. For M4 stud PCTs the integrity of the protective (earth) connections should be ensured by use of a locknut or similar.

The recommended minimum protective conductor (earth) wire size is 2.5 mm² (3.3 mm² for North America) unless otherwise stated in the technical data section of the equipment documentation, or otherwise required by local or country wiring regulations.

The protective conductor (earth) connection must be low-inductance and as short as possible.

All connections to the equipment must have a defined potential. Connections that are pre-wired, but not used, should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

Before energizing the equipment, the following should be checked:

- Voltage rating/polarity (rating label/equipment documentation);
- CT circuit rating (rating label) and integrity of connections;
- Protective fuse rating;
- Integrity of the protective conductor (earth) connection (where applicable);
- Voltage and current rating of external wiring, applicable to the application.

Accidental touching of exposed terminals

If working in an area of restricted space, such as a cubicle, where there is a risk of electric shock due to accidental touching of terminals which do not comply with IP20 rating, then a suitable protective barrier should be provided.

Equipment use

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Removal of the equipment front panel/cover

Removal of the equipment front panel/cover may expose hazardous live parts, which must not be touched until the electrical power is removed.

UL and CSA listed or recognized equipment

To maintain UL and CSA approvals the equipment should be installed using UL and/or CSA listed or recognized parts of the following type: connection cables, protective fuses/fuse holders or circuit breakers, insulation crimp terminals, and replacement internal battery, as specified in the equipment documentation.

Equipment operating conditions

The equipment should be operated within the specified electrical and environmental limits.

Current transformer circuits

Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation. Generally, for safety, the secondary of the line CT must be shorted before opening any connections to it.

For most equipment with ring-terminal connections, the threaded terminal block for current transformer termination has automatic CT shorting on removal of the module. Therefore external shorting of the CTs may not be required, the equipment documentation should be checked to see if this applies.

For equipment with pin-terminal connections, the threaded terminal block for current transformer termination does NOT have automatic CT shorting on removal of the module.

External resistors, including voltage dependent resistors (VDRs)

Where external resistors, including voltage dependent resistors (VDRs), are fitted to the equipment, these may present a risk of electric shock or burns, if touched.

Battery replacement

Where internal batteries are fitted they should be replaced with the recommended type and be installed with the correct polarity to avoid possible damage to the equipment, buildings and persons.

Insulation and dielectric strength testing

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage should be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.

Insertion of modules and pcb cards

Modules and PCB cards must not be inserted into or withdrawn from the equipment whilst it is energized, since this may result in damage.

Insertion and withdrawal of extender cards

Extender cards are available for some equipment. If an extender card is used, this should not be inserted or withdrawn from the equipment whilst it is energized. This is to avoid possible shock or damage hazards. Hazardous live voltages may be accessible on the extender card.

External test blocks and test plugs

Great care should be taken when using external test blocks and test plugs such as the MMLG, MMLB and MiCOM P990 types, hazardous voltages may be accessible when using these. *CT shorting links must be in place before the insertion or removal of MMLB test plugs, to avoid potentially lethal voltages.

***Note:** **When a MiCOM P992 Test Plug is inserted into the MiCOM P991 Test Block, the secondaries of the line CTs are automatically shorted, making them safe.**

Fiber-optic communication

Where fiber-optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.

Cleaning

The equipment may be cleaned using a lint free cloth dampened with clean water, when no connections are energized. Contact fingers of test plugs are normally protected by petroleum jelly, which should not be removed.

Maintenance and installation

For safety reason, no work must be carried out on the V11F until all power sources to the unit have been disconnected

5. DE-COMMISSIONING AND DISPOSAL

De-commissioning

The supply input (auxiliary) for the equipment may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the equipment (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to de-commissioning.

Disposal

It is recommended that incineration and disposal to water courses is avoided. The equipment should be disposed of in a safe manner. Batteries should be removed from any equipment before its disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of the equipment.

6. TECHNICAL SPECIFICATIONS FOR SAFETY

Where UL Listing of the equipment is not required the recommended fuse type is a high rupture capacity (HRC) type with a maximum current rating of 16 Amps and a minimum DC rating of 250 Vdc, for example the Red Spot NIT or TIA type.

To maintain UL and CUL Listing of the equipment for North America a UL Listed fuse shall be used. The UL Listed type shall be a Class J time delay fuse, with a maximum current rating of 15 A and a minimum DC rating of 250 Vdc, for example type AJT15.

The protective fuse should be located as close to the unit as possible.

6.1 Protective fuse rating

DANGER - CTs must NOT be fused since open circuiting them may produce lethal hazardous voltages.

6.2 Protective class

IEC 60255-27: 2005	Class I (unless otherwise specified in the equipment documentation).

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6.3 Installation category

IEC 60255-27: 2005	Installation category III (Overvoltage Category III):
EN 60255-27: 2005	Distribution level, fixed installation.
	Equipment in this category is qualification tested at 5 kV peak, 1.2/50 µs, 500 Ω, 0.5 J, between all supply circuits and earth and also between independent circuits.

6.4 Environment

The equipment is intended for indoor installation and use only. If it is required for use in an outdoor environment then it must be housed in a specific cabinet which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP54 (dust and splashing water protected).

Pollution Degree - Pollution Degree 2	Compliance is demonstrated by reference to safety Altitude - Operation up to 2000 m standards.

IEC 60255-27:2005

EN 60255-27: 2005

IT

INTRODUCTION

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

IT

CONTENTS

FIGURES

1. VAMP DOCUMENTATION STRUCTURE

The manual provides a functional and technical description of the VAMP protection relay and a comprehensive set of instructions for the relay's use and application.

The section contents are summarized below:

V11F/EN IT Introduction

A guide to the VAMP range of relays and the documentation structure. Also a general functional overview of the relay and brief application summary are given.

V11F/EN TD Technical Data

Technical data including setting ranges, accuracy limits, recommended operating conditions, ratings and performance data. Compliance with norms and international standards is quoted where appropriate.

V11F/EN GS Getting Started

A guide to the different user interfaces of the protection relay describing how to start using it. This section provides detailed information regarding the communication interfaces of the relay, including a detailed description of how to access the settings database stored within the relay.

V11F/EN ST Settings

List of all relay settings, including ranges, step sizes and defaults, together with a brief explanation of each setting.

V11F/EN OP Operation

A comprehensive and detailed functional description of all protection and non-protection functions.

V11F/EN AP Application Notes

This section includes a description of common power system applications of the relay, calculation of suitable settings, some typical worked examples, and how to apply the settings to the relay.

V11F/EN MR Measurements and Recording

Detailed description of the relays recording and measurements functions.

V11F/EN CM Commissioning

Instructions on how to commission the relay, comprising checks on the calibration and functionality of the relay.

V11F/EN MT Maintenance

A general maintenance policy for the relay is outlined.

V11F/EN TS Troubleshooting

Advice on how to recognize failure modes and the recommended course of action. Includes guidance on whom at Schneider Electric Energy to contact for advice.

V11F/EN SG Symbols and Glossary

List of common technical abbreviations found within the product documentation.

V11F/EN IN Installation

Recommendations on unpacking, handling, inspection and storage of the relay. A guide to the mechanical and electrical installation of the relay is provided, incorporating earthing recommendations. All external wiring connections to the relay are indicated.

V11F/EN CM Communication Database

This section provides an overview regarding the SCADA/DCS communication interfaces of the relay.

V11F/EN VH Firmware and Service Manual Version History

History of all hardware and software releases for the product.

2. INTRODUCTION TO VAMP

VAMP is a comprehensive solution capable of meeting all electricity supply requirements. It comprises a range of components, systems and services from Schneider Electric Energy.

Central to the VAMP concept is flexibility.

VAMP provides the ability to define an application solution and, through extensive communication capabilities, integrate it with your power supply control system.

VAMP products include extensive facilities for recording information on the state and behavior of the power system using disturbance and fault records. They can also provide measurements of the system at regular intervals for a control center enabling remote monitoring and control to take place.

For up-to-date information on any VAMP product, visit our website:

www.schneider-electric.com

3. PRODUCT SCOPE

The V11F is a 3 phase and earth fault non-directional overcurrent protection relay which has been designed to control, protect and monitor industrial and distribution installations. Refer to section 3.2.

The scope of V11F applications includes:

- industry and distribution LV networks (refer to “3.3. Protection functions suitable for low voltage” section in this chapter)
- industry and distribution MV and HV networks,
- back-up protection in HV applications.

The relay protects one, two or three-phase applications against earth fault and phase-to-phase short-circuit faults. Thanks to a built-in USB port, disturbance records (selected models), fault records, events and relay settings can be downloaded to a local PC (selected Models).

Settings for the protection elements are entered using the front panel keyboard and can be checked on the local display or using the MiCOM S1 Studio 5.1.0 (or higher) setting software (selected Models).

3.1 Key for the manual

The V11F relays are available in several hardware versions offering different numbers of outputs, inputs, communication ports etc. called “Models” (Model: L, N, A, B, E).

Please refer to the commercial publication for further information on the product features and application arrangements.

3.2 Functional overview

The V11F relay offers a wide variety of protection functions.
The protection features are summarized below:

PROTECTION FUNCTIONS OVERVIEW		Function available
50/51	Three non-directional overcurrent stages are provided for each phase. The first (I>) and the second stage (I>>) may be set to Inverse Definite Minimum Time (IDMT) or Definite Time (DT); the third stage (I>>>) may be set to DT only.	All models
50N/51N	Three non-directional overcurrent stages are provided. The first stage (IN>) may be set to Inverse Definite Minimum Time (IDMT) or Definite Time (DT); the second and third stage (IN>> and IN>>>) may be set to DT only.	All models (IN>>>:E only)
SOTF	Switch On To Fault Phase Overcurrent Stage.	A,B,E
BOL	The Blocked Overcurrent Logic is available for each protection element. This consists of a start signal and protection block timer that can for instance be used to implement busbar blocking schemes.	A,B,E
SOL	The Selective Overcurrent Logic provides the capability of temporarily altering (i.e. lengthen) the time-delay settings for stages 2 and 3 of the phase overcurrent and earth fault elements.	E
46	One stage is provided to be used as backup protection for both phase-to-earth and phase-to-phase faults.	E
49	RMS thermal overload (single time constant) protection with thermal characteristics, suitable for both cables and transformers. Both Alarm and trip stages are provided.	N,A,B,E

PROTECTION FUNCTIONS OVERVIEW		Function available
46BC	Broken conductor (open jumper) used to detect open circuit faults using the I2/I1 ratio.	E
50BF	Circuit breaker failure element with undercurrent detection.	All models
79	Four-shot three-pole auto-recloser with external initiation and sequence coordination capability.	E
	Second harmonic blocking that can be associated with all the protection elements.	A, E
	USB port (in models: A,B,E with powering feature)	N,A,B,E
	Rear communication port (RS485)	L(optional), N,A,B,E
	CB Control via a rear communication port (RS485) or dedicated binary input	A,B,E
	Binary inputs	L(0), A(4), B(4), E(8)
	Output contacts (Watchdog included)	L(4), N(6), A(8), B(4), E(6)
	4 timers (AUX)	A,B,E
	Comprehensive disturbance recording (waveform capture)	A,E
	Time synchronization via binary input	B,E
	Circuit breaker status & condition monitoring	A, E
	Nominal current (In and Ien) 1A or 5A switchable in menu	All models

The V11F also offers the following relay management functions in addition to the functions listed above.

- Up to 20 Fault Records, 5 Alarm Records, 200 Events (if ports are available) (when the available space is exhausted, the oldest record is automatically overwritten by the new one)
- Readout of actual settings available via the USB port or rear communication port (RS485) (if ports are available)
- 2 alternative setting groups
- 3 phase current inputs
- Earth fault current input
- CB Control via the front panel menu
- Counters
- Programmable allocation of binary inputs and outputs
- Multi-level password protection

Application overview

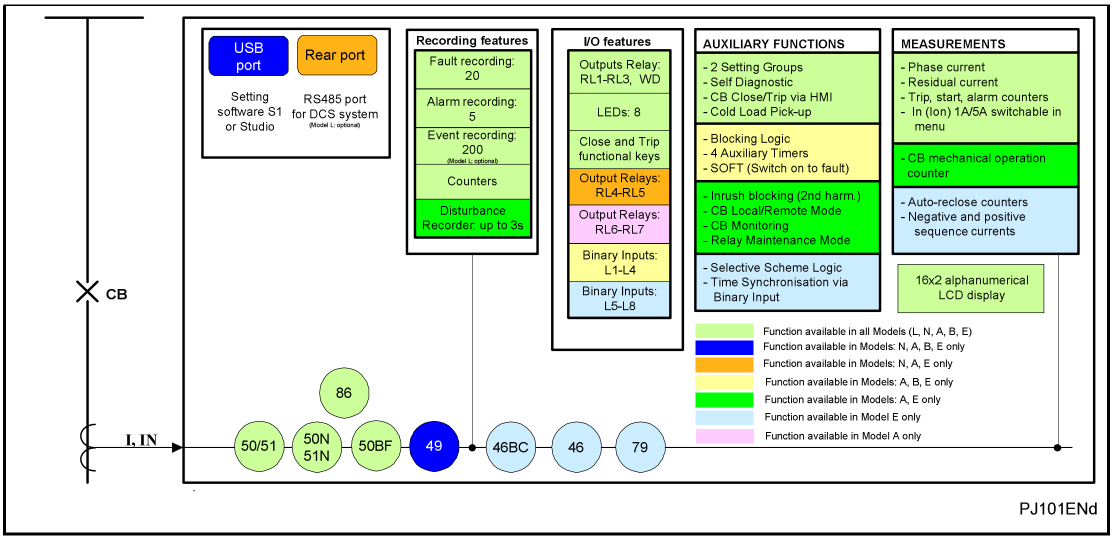

Figure 1: Functional diagram of the V11F

3.3 Protection functions suitable for low voltage

3.3.1 Low voltage earthing systems

There are 4 low voltage (LV) earthing systems designated by a 2 or 3-letter acronym:

- **TN-S**
- **TN-C**
- **TT**
- **IT**

The letters making up the acronym have the following meanings:

Letter	Meaning
First letter	Transformer neutral point
I	Earthed with an impedance
T	Directly earthed
Second letter	Electrical exposed conductive parts of the consumer
T	Earthed
N	Connected to the neutral conductor
Third letter (optional)	Protective Earth conductor
S	Separate N neutral conductor and PE Protective Earth conductor
C	Combined N neutral conductor and PE Protective Earth conductor (PEN)

3.3.2 Capability of VAMP low voltage protection function

VAMP protection function can be used with low voltage (LV) as long as the conditions below are met:

- The distribution circuit must be rated higher than 32A
- The installation must comply with standard IEC 60364.

For additional information about the compability of VAMP protection functions with low voltage, please contact Schneider Electric technical support.

The table below lists the VAMP protection functions suitable for low voltage according to earthing system used. VAMP protection functions not listed in this table are not suitable for low voltage. The protection functions listed in this table are available according to the VAMP type.

Protection	ANSI code	Earthing system				Comments
		TN-S	TN-C	TT	IT	
Phase overcurrent	50/51	■	■	■	■	Neutral conductor not protected
Earth fault /Sensitive earth fault	50N/51N	■	■	■	(1)	
Earth fault /Sensitive earth fault	50G/51G	■	■	■	(3)	
Negative sequence /unbalance	46	■	■	■	■	Threshold to be adopted to the phase unbalance
Thermal overload for cables /capacitors /transformer / generic	49RMS	■	■	■	■	Neutral conductor not protected
Restricted earth fault	64REF	■	■	■	(3)	
Two-winding transformer differential	87T	■	■	■	■	
Directional phase overcurrent	67	■	■	■ (4)	■ (4)	
Directional earth fault	67N/67NC					Incompability with LV diagrams (4-wire)
Directional active overpower	32P	■	■	(2)	(2)	
Directional reactive overpower	32Q	■	■	(2)	(2)	
Under-voltage (L-L or L-N)	27	■	■	■	■	
Remanent overvoltage	27R	■	■	■	■	
Over-voltage (L-L or L-N)	59	■	■	■	■	
Neutral voltage displacement	59N	■	■	(4)	(4)	Residual voltage not available with 2 VTs
Negative sequence over-voltage	47	■	■	■	■	
Over-frequency	81H	■	■	■	■	
Under-frequency	81L	■	■	■	■	
Rate of change of frequency	81R	■	■	■	■	
Synchro-check	25	■	■	■	■	

■ : Protection function suitable for low voltage (according to VAMP)
(1) : Not recommended even on the second fault
(2) : 2-wattmeter method not suitable for unbalanced loads
(3) : Residual current too low in IT
(4) : 2 phase-to-phase VTs

IT

3.4 Ordering options Information (Required with Order)

V11F Overcurrent Protection	V11F		1	N		N					N	N		1	

Three Phase Overcurrent and Earth Fault Protection.
2x16 LCD display [5],
Flush mounting case,
USB front port [4] (not available in model L),
8 LEDs, 4 current inputs
Close and Trip keys on the front panel
Real time clock [6]

Model

Enhanced Model L (no Binary Inputs, 4 Binary Outputs)	L
Enhanced Model N (no Binary Inputs, 6 Binary Outputs)	N
Enhanced Model B (4 Binary Inputs, 4 Binary Outputs) [1]	B
Enhanced Model A (4 Binary Inputs, 8 Binary Outputs)	A
Enhanced Model E (8 Binary Inputs, 6 Binary Outputs) [1]	E

Case type (mounting)

Standard flush-mounting case	1

Earth current input

Ion = 1 A/5A (selectable via HMI); 0.01 – 2 Ion	0
Ion = 1 A/5A (selectable via HMI); 0.05 – 12 Ion	3
Ion = 1 A/5A (selectable via HMI); 0.01 – 12 Ion [3]	4

Phase current inputs

In=1A/5A , (selectable via HMI); 0.1 – 40 In	9

Vx Auxiliary Voltage Supply

Model A, B, E: 24 - 60 Vac/dc [2]	1
Model L, N: 24 – 240 Vac/250 Vdc; **Model** A, B, E: 90 - 240 Vac/250 Vdc;	2

Type of binary inputs; Auxiliary voltage range for binary inputs

Standard; Voltage range as for Vx auxiliary voltage supply (see above)	N

Communication port / protocol

Model L: Without USB port and RS485	0
Model L [1],N,B,A,E: USB port [4] and RS485 with settable switching between Modbus or IEC103 via HMI	1

Language

English /German/ French/ Spanish / Russian / Turkish / Regional (Polish)	1

Application

Standard	1

V11F accessories

Without	N
Wall mounting case adaptor	S

NOTES:

1) Model available in selected countries only

2) This option is not available for model N and L, because these models have increased Vx range (24-240 Vac/250 Vdc) for option 2

3) This hardware version is available in selected countries only

4) In Model N USB port has not V11F supplying facilities

5) In Model L and N LCD has no back-lit feature

6) In Model L and N have no backup capacitor to support RTC. Typical support time for break in auxiliary voltage powering is 60s.

IT

TD

TECHNICAL DATA

Date: **1st July 2015**
Connection Diagrams: **10V11F01**

CONTENT

TD

TD

1. Mechanical specification

1.1 Case

Design	Flush mounting case
Weight	approx. 0.5 kg

1.2 Terminals

AC Current Input Terminals

Threaded M3 screw-type plug-in terminals, with wire protection for conductor cross-section

(i) 0.2 - 6 mm^2 single-core

(ii) 0.2 - 4 mm^2 finely stranded

General Input/Output Terminals

For power supply, binary and contact inputs, output contacts and COM for rear communications.

Threaded M3 screw-type plug-in terminals, with wire protection for conductor cross-section

(i) 0.2 - 4 mm^2 single-core

(ii) 0.2 - 2.5 mm^2 finely stranded

Local communication

USB port

Cable Type: USB 2.0

Connectors:

PC: type A male

V11F: type mini B 5-pin male

USB Cable: minimum 1P*28AWG/2C*24AWG, max : 2m

Rear Communications Port

EIA(RS)485 signal levels, two wire

Connections located on general purpose block, M3 screw

For screened twisted pair cable, distance to be bridged: multi-endpoint link: max. 100 m

Isolation to SELV level.

2. RATINGS

2.1 Power Supply

Nominal auxiliary voltage Vx (ordering options)	24 – 60 Vdc/ 24 – 60 Vac (50/60 Hz) 90 – 250 Vdc/ 90 – 240 Vac (50/60 Hz) 24 – 250 Vdc/ 24 – 240 Vac (50/60 Hz) (L and N)
Operating range	19 – 72 V (dc), 19 – 66 V (ac) 71 – 300 V (dc), 71 – 265 V (ac) 19 – 300 Vdc/ 19 – 265 Vac (50/60 Hz) (L and N)
Tolerable AC ripple	Up to 12% for a dc supply, per IEC 60255-11: 2008

TD

Nominal Burden Auxiliary Power Supply Vx

Note: (i) Initial position: no output nor LED energized.

(ii) Active position: all outputs and LEDs energized.

For AC max. approx.:

Vx range	Vx	S	
	V	VA	
		Initial position	Active position
24 – 60 Vac	24	2.5	4.5
	48	3.0	5.5
90 – 240 Vac (L, N : 24 -240Vac)	110	4.0	6.5
	220/230	6.0	9.0
	264	7.0	10.0

For dc Vx voltage max. approx:

Vx range	S	
	W	
	Initial position	Active position
24 – 60 Vdc	1.5	3.5
90 – 240 Vdc	2.0	3.5

Auxiliary Power Supply Voltage Interruption	IEC 60255-11: 2008	Within the auxiliary supply range: - 90-250Vdc, the relay will withstand a 50 ms; - 24-48Vdc, the relay will withstand a 20 ms; Interruption of the DC auxiliary supply without de-energizing.
	EN 61000-4-11: 1997	Within the auxiliary supply range: - 90-250Vac, the relay will withstand a 50 ms; - 24-48Vac, the relay will withstand a 20 ms; Interruption of the AC auxiliary supply without de-energizing.
Power-up Time for Auxiliary Supply Voltage only		Time to power up via auxiliary supply: < 0.5s

2.2 Frequency (Current Inputs)

Nominal frequency	50 or 60 Hz (selectable in V11F menu)

2.3 Current Inputs

Phase current inputs:

Nominal current (In)	1 or 5 A (selectable via HMI)
RMS measurement in range	40 Hz – 1 kHz
Fundamental harmonic measurement in range	40 Hz – 70 Hz
Operating range	0.1 – 40 In
Nominal Burden at In	< 0.3 VA at In=5A; < 0.1 VA at In=1A;
Thermal withstand	1 s @ 100 x rated current 2 s @ 40 x rated current 10 s @ 30 x rated current continuous: 4 x rated current
Connection	Refer to section 12 of V11F Installation chapter (V11F/EN IN)
Current transformer requirements	Detailed information and CT requirements are given in the Application chapter (V11F/EN AP)

Earth current inputs:

Ion: earth fault input nominal current (Ien)

Nominal current (Ien):	1 or 5 A (selectable via HMI)
Fundamental harmonic measurement in range	40 Hz – 70 Hz
Operating range	Selected at order (Cortec): 0.01 – 2Ion 0.05 – 12Ion 0.01 – 12Ion (special version for some regions only)
Nominal Burden at Ion	< 0.3 VA at In=5A; < 0.1 VA at In=1A;
Thermal withstand	1 s @ 100 x rated current 2 s @ 40 x rated current 10 s @ 30 x rated current continuous @ 4 x rated current
Connection	Refer to section 12 of V11F Installation chapter (V11F/EN IN)
Current transformer requirements	Detailed information and CT requirements are given in the Application chapter (V11F/EN AP)

Detailed information about CT requirements are given in the Application chapter (V11F/EN AP)

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2.4 Binary Inputs

Binary inputs type: Optically isolated inputs

Ordering Code of Vx	Filtering time approx.	Binary Inputs				
		Nominal Voltage range	Voltage operating range	Minimum polarisation voltage (Logic 1) approx.	Maximum polarisation current approx.	Maximum continuous withstand
1	30 ms[1)]	24 – 60 Vac/dc	19.2 – 66 Vac/dc	16 Vdc 18 Vac	12 mA (66V)	110 Vdc 78 Vac
2	30ms[1)]	90 – 240 Vac/dc	71 – 264 Vac/dc	66 Vac/dc	2.5 mA (264V)	300 Vdc 264 Vac

Note:
[1)] Filtering time is declared for Nominal Voltage range. For voltage value below this range additional filtering time delay: < 30ms must be taken into account.

Binary input energy consumption	
Logic input burden for Vx ordering code 0	R imput = approx. 6kOhm
Logic input burden for Vx ordering code 1	R imput = approx. 109kOhm
Logic input recognition time	As filtering time + 2 ms

2.5 Output Relay Characteristics

Contact ratings	
Contact relay	Dry contact, Ag Ni
Carry capability	5 A continuous
Rated Voltage	250 Vac
Breaking characteristics for RL1, RL2, RL3 and WD	
Short-duration capacity	25 A for 3 s
Making capacity	150 A for 30 ms
AC breaking capacity	1250 VA resistive (cos ϕ = unity) 1250 VA inductive (cos ϕ = 0.7)
DC breaking capacity	250 Vdc; 50 W resistive 25 W inductive (L/R = 40 ms)
Operation time	<10 ms
Durability	
Loaded contact	10 000 operations minimum
Unloaded contact	100 000 operations minimum
Breaking characteristics for RL4 RL5, RL6, RL7	
Short-duration capacity	25 A for 3 s
Making capacity	150 A for 30 ms
AC breaking capacity	1250 VA resistive (cos ϕ = unity) 1250 VA inductive (cos ϕ = 0.7)
DC breaking capacity	250 Vdc; 50 W resistive 25 W inductive (L/R = 40 ms)
Operation time	< 10 ms
Durability	
Loaded contact	10 000 operations minimum
Unloaded contact	100 000 operations minimum

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3. INSULATION

Insulation resistance	EN 60255-5: 2001	> 500 MΩ at 500 Vdc (Using only electronic/brushless insulation tester).
High Voltage (Dielectric) Withstand	EN 60255-27: 2005	2 kV rms AC, 1 minute: Between all case terminals connected together and the case earth. Between all terminals of independent circuits with terminals on each independent circuit connected together.
Impulse Voltage Withstand Test	EN 60255-27:2005	Front time: 1.2 µs, Time to half-value: 50 µs, Peak value: 5 kV Source Characteristics: 500 Ohm, 0.5 J. Common and differential mode: power supply, terminal block (excluding RS485), binary inputs, relays
Creepage Distances and Clearances	EN 60255-27:2005	Pollution degree 2, Overvoltage category III, Impulse test voltage 5 kV.

4. EMC TESTS

1 MHz Burst High Frequency Disturbance Test	EN 60255-22-1: 2008 Class III	Common-mode test voltage: 2.5 kV, Differential test voltage: 1.0 kV, Test duration: 2 s, Source impedance: 200 Ω
Immunity to Electrostatic Discharge	EN 60255-22-2: 2008 Class 3	8 kV discharge in air to all communication ports. 6 kV point contact discharge to any part of the front of the product.
Electrical Fast Transient or Burst Requirements	EN 60255-22-4: 2008 Test severity Class III	Amplitude: 2 kV, Burst frequency 5 kHz (Class III)
Surge Immunity Test	EN60255-22-5: 2002; EN 61000-4-5: 2006, Level 3	Time to half-value: 1.2/50 µs, Amplitude: 2 kV between all groups and case earth, Amplitude: 1 kV between terminals of each group
Immunity to Radiated Electromagnetic Energy	EN 60255-22-3: 2008, Class III:	Test field strength, frequency band: - 80 MHz to 1000 MHz: 10 V/m, - 1.4 GHz to 2.7 GHz: 10 V/m Test using AM: 1 kHz / 80% sinus
	ANSI C37.90.2: 2004	20V/m 80MHz-1GHz, 80% AM, 1kHz sinus, 20V/m 80% AM at 80MHz, 160MHz, 450MHz, 900MHz 20V/m, 900MHz 200Hz 50% pulse with modulation
Radiated Immunity from Digital Radio Telephones	EN 60255-22-3:2008	10 V/m, 900 MHz 100% AM, 200 Hz/50% square wave
Immunity to Conducted Disturbances Induced by Radio Frequency Fields	EN 61000-4-6: 2009, Level 3	Disturbing test voltage: 10 V, 150 Hz to 80 MHz, 80% AM, 1 kHz
Power Frequency Magnetic Field Immunity	EN 61000-4-8: 2010, Level 4	30 A/m applied continuously, 300 A/m applied for 3 s
Conducted Emissions	EN 55022: 2010	0.15 - 0.5 MHz, 79 dBµV (quasi peak) 66 dBµV (average); 0.5 - 30 MHz, 73 dBµV (quasi peak) 60 dBµV (average)
Radiated Emissions	EN 55022: 2010	30 - 230 MHz, 40 dBµV/m at 10 m measurement distance; 230 - 1 GHz, 47 dBµV/m at 10 m measurement distance
Logic Inputs at power frequency	IEC 61000-4-16 Level 4 IEC 60255-22-7	300V MC, 150 MD

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5. ENVIRONMENT

Ambient Temperature Range	EN 60255-1: 2010	Operating temperature range: -20°C to +60°C (–4°F to +140°F), Temporarily permissible temperature: –40°C to +85°C (–40°F to +185°F) with double errors Storage and transit: –25°C to +70°C (–13°F to +158°F).
Ambient Humidity Range	EN 60068-2-78: 2001	56 days at 93% relative humidity and +40°C.
	EN 60068-2-30: 2005	Damp heat cyclic, six (12 + 12) hour cycles, 93% RH, +25 to +55°C
Corrosive Environments	IEC 60068-2-60: 1995 Part 2, Test Ke, Flowing mixed gas corrosion test, Method (class) 4	Industrial corrosive environments/poor environmental control, mixed gas flow test. 21 days at 75% relative humidity and 25°C Exposure to elevated concentrations of H2S(10ppb), CL2 (10ppb), NO2 (200ppb), SO2 (200ppb)
Vibration Test	EN 60255-21-1: 1995	Response Class 1 Endurance Class 1
Shock and Bump	EN 60255-21-2: 1995	Shock response Class 1 Shock withstand Class 1 Bump Class 1
Seismic	EN 60255-21-3:1995	Class 2
Enclosure Protection	EN 60529: 1991	IP 40 Protection for relay housing IP 20 Protection for terminals. IP 54 Protection (front panel) against dust and dripping water for flash mounted case.

6. EU Directive

6.1 EMC Compliance

2014/30/EU

Compliance with the European Commission's EMC Directive.

Product Specific Standards were used to establish conformity:

– EN 60255-26: 2013

– EN 60255-1: 2010

6.2 Product Safety

2014/35/EU

Compliance with the European Commission's Low Voltage Directive. Compliance is demonstrated by reference to generic safety standards:

– EN60255-27:2014

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7. DEVIATIONS OF THE PROTECTION ELEMENTS

Glossary

I : Phase current

Is : setting value for I>, I>>, I>>>, SOTF

I2 : I2>

Ies : setting value for IN_1 (IN>), IN_2 (IN>>), IN_3 (IN>>>)

Ien ,Ion: Earth fault current input nominal current

DT : Definite time

IDMT : Inverse definite minimum time

OPERATION TIME*		
Typical operation time:	All types of faults	≤ 40ms

*During investigation of operation time - injection current must be 2 times greater than setting value.

PROTECTION ACCURACY					
Element	Range	Deviation	Trigger	Reset	Time deviation
Phase overcurrent elements (I> & I>> & I>>> & SOTF)	0.1 to 40 In	± 5%± 0.01In	DT: Is ± 5%± 0.01In IDMT: 1.1Is ±5%± 0.01In	0.95 Is ±5%± 0.01In 1.05 Is ±5%± 0.01In	±2% +20…50 ms* ±5% +20…50 ms
Earth fault overcurrent elements (IN_1 & I N_2 & IN_3)	0.01 to 2Ien 0.05 to 12 Ien 0.01 to 12 Ien	± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	DT: Ies ± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	0.95 Ies ± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	±2% +20…50 ms*
	0.01 to 2Ien 0.05 to 12 Ien 0.01 to 12 Ien	± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	IDMT: 1.1Ies ± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	1.05 Ies ± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	±5% +20…50 ms
Negative sequence phase overcurrent elements (I2>)	0.1 to 4 In	± 5%± 0.01In	DT: Is ± 5%±0.01In IDMT: 1.1Is ±5%±0.01In	0.95 Is ±5%± 0.01In 1.05 Is ±5%± 0.01In	±2% +20…50 ms* ±5% +20…50 ms
Broken conductor (I2/I1).	20 to 100%	± 5%± 0.01In	DT: Is ± 5%± 0.01In	0.95 Is ±5%± 0.01In	±5% +20…50 ms*
Thermal overload (I_{therm}, θ Alarm, θ Trip)	0.10 to 3.0 In	± 5%± 0.01In	I_{therm} ± 5%± 0.01In	0.97 I_{therm} ±5%±0.01In	±5% +20…50 ms (ref. IEC 60255-8)

*During investigation of operation time - injection value must be 2 times greater than setting value.

Note: For e/f settings below 0.1In it is strongly recommend to use screened cable between e/f CT and V11F terminals. Without using screened cable the accuracy can be worse than given in the table above (additional errors caused by external disturbances should be taken into account).

8. Deviations of Automation Functions Timers

Automation Function Timers	
Auto-reclose timers tDs, tR, tI	±2% +10…30 ms
CB fail & CB monitoring timers	±2% +10…30 ms
Auxiliary timers tAUX1, tAUX2, tAUX3, tAUX4	±2% +10…30 ms
Cold load pickup	±2% +20…40 ms
SOTF	±2% +20…40 ms

9. DEVIATIONS OF MEASUREMENTS

Measurement	Range	Deviation
Phase current	0.1 to 40 In	Typical ±2% at In
Earth current	0.01 to 2 Ien	Typical ±2% at Ien
	0.05 to 12 Ien	Typical ±2% at Ien
	0.01 to 12 Ien	Typical ±2% at Ien

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10. PROTECTION SETTING RANGES

Note: (A, B, E) – available in Model A, B and E

10.1 [50/51] Phase Overcurrent

– Phase current Fundamental, RMS

Note: When I> or I>> is associated with an IDMT curve, the maximum recommended setting is 2 In.

10.1.1 Protection Setting Ranges

[50/51] Phase OC	Setting Range		
	Min.	Max.	Step
I> ?	Disabled, Trip, Alarm, Trip with Inrush blocking (A, E), Trip Latch (A, E), Trip-Phase A (E), Trip-Phase B (E), Trip-Phase C (E)		
I>	0.1 In	4 In (IDMT) 40 In (DMT)	0.01 In
Delay type	DT or IDMT (IEC_SI, IEC_VI, IEC_EI, IEC_LTI, IEC_STI, C02_P20, C05, C06, C07, C08, C09, C011, IEEE_MI, IEEE_VI, IEEE_EI, RXIDG, BPN EDF, RI, RECT, C02_P40 curve)		
tI>	0.05 s	200 s	0.01 s
I> TMS	0.02	1.50	0.01
I> TD	0.02	100	0.01
I> Reset Delay Type	DT or IDMT (refer to Operation chapter)		
DT I> tReset	0.00 s	600 s	0.01 s
K (RI)	0.1	10	0.1
I>> ?	Disabled, Trip, Alarm, Trip with Inrush blocking (A, E), Trip Latch (A, E), Trip-Phase A (E), Trip-Phase B (E), Trip-Phase C (E)		
I>>	0.1 In	4 In (IDMT) 40 In (DMT)	0.01 In
Delay type	DT or IDMT (IEC_SI, IEC_VI, IEC_EI, IEC_LTI, IEC_STI, C02_P20, C05, C06, C07, C08, C09, C011, IEEE_MI, IEEE_VI, IEEE_EI, RXIDG, BPN EDF, RI, RECT, C02_P40 curve)		
tI>>	0.05 s	200 s	0.01 s
I>> TMS	0.02	1.50	0.01
I>> TD	0.02	100	0.01
I>> Reset Delay Type	DT or IDMT (refer to Operation chapter)		
DT I>> tReset	0.00 s	600 s	0.01 s
K (RI)	0.1	10	0.01
I>>> ?	Disabled, Trip, Alarm, Trip with Inrush blocking (A, E), Trip Latch (A, E), Trip-Phase A (E), Trip-Phase B (E), Trip-Phase C (E)		
I>>>	1 In	40 In	0.01 In
tI>>>	0 s	200 s	0.01 s

10.2 Switch on to fault (SOTF) (Model A, B, E)

– Phase current Fundamental only

10.2.1 Protection Setting Ranges

[50/51] SOTF	Setting Range		
	Min.	Max.	Step
SOTF ?	Disabled, Trip, Alarm, Trip with Inrush blocking (A, E), Trip Latch (A, E)		
SOTF	1 In	40 In	0.01 In
tSOTF	0 s	600 s	0.01 s

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10.3 [49] Thermal Overload Protection (Model N, A, B, E).

– Phase Current: RMS

10.3.1 Protection Setting Ranges

[49] Therm. OL	Setting ranges		
Therm. OL ?	Disabled, Enabled		
Itherm	0.1 In	3.0 In	0.01In
Te (heating)	1 mn	200 mn	1mn
Tr (cooling)	1 mn	999 mn	1mn
Theta Trip	50%	200%	1%
Theta Reset Ratio	20%	99%	1%
Theta Alarm ?	Disabled, Enabled		
Theta Alarm	20%	200%	1%

10.4 [50N/51N] Earth fault protection

– Earth fault current: Fundamental only

– Earth fault current ranges: See following table

Note: When IN> are associated to an IDMT curve, the maximum recommended setting is the highest in the range divided by 20.

10.4.1 Protection Setting Ranges

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[50/51N] Earth OC	Setting Range		
	Min.	Max.	Step
High sensitivity current set			
Cortec code V11Fxxx**0**xxxxxxxxxx (0.01-2Ien)			
IN_1 (IN>)	0.01 Ien	0.2 Ien (IDMT) 2.0 Ien (DMT)	0.01 Ien
IN_2 (IN>>)	0.05 Ien	2.0 Ien	0.01 Ien
IN_3 (IN>>>) (E)	0.05 Ien	2.0 Ien	0.01 Ien
Low sensitivity current set			
Cortec code V11Fxxx**3**xxxxxxxxxx (0.05-12Ien)			
IN_1 (IN>1)	0.05 Ien	1.2 Ien (IDMT) 12 Ien (DMT)	0.01 Ien
IN_2 (IN>>)	0.3 Ien	12 Ien	0.01 Ien
IN_3 (IN>>>) (E)	0.3 Ien	12 Ien	0.01 Ien
Wide range current set (available Model E in limited market version)			
Cortec code V11Fxxx**4**xxxxxxxxxx (0.01-12Ien) special			
IN_1 (IN>1)	0.01 Ien	1.2 Ien (IDMT) 12 Ien (DMT)	0.01 Ien
IN_2 (IN>>)	0.01 Ien	12 Ien	0.01 Ien
IN_3 (IN>>>) (E)	0.3 Ien	12 Ien	0.01 Ien
IN_1 stage?	Disabled, Trip, Alarm, Trip with Inrush blocking (A, E), Trip Latch (A, E)		
Delay type	DT or IDMT (IEC_SI, IEC_VI, IEC_EI, IEC_LTI, IEC_STI, C02_P20, C05, C06, C07, C08, C09, C011, IEEE_MI, IEEE_VI, IEEE_EI, RXIDG, BPN EDF, RI, RECT, C02_P40 curve)		
tIN_1	0.05 s	200 s	0.01 s
K (RI)	0.1	10	0.1
IN_1 TMS	0.02	1.5	0.01
IN_1 TD	0.02	100	0.01
IN_1 Reset Delay Type	DT or IDMT (refer to Operation chapter)		
DT IN_1 tReset	0.00 s	600 s	0.01 s

[50/51N] Earth OC	Setting Range		
	Min.	Max.	Step
IN_2 stage?	Disabled, Trip, Alarm, Trip with Inrush blocking (A, E), Trip Latch (A, E)		
tIN_2	0.00s (0.05 s in Model E V11Fxxx**4**xxxx xxxxxx)	200 s	0.01 s
IN_3 stage? (E)	Disabled (E), Trip (E), Alarm (E), Trip with Inrush blocking (E), Trip Latch (E)		
tIN_3 (E)	0 s	200 s	0.01 s

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10.5 Negative Sequence Overcurrent Protection (Model E).

– Phase current: Fundamental only

Note: When I2> is associated with an IDMT curve, the maximum recommended setting is 2 In.

10.5.1 Protection Setting Ranges

[46] Neg.Seq. OC	Setting ranges		
	Min.	Max.	Step
I2> ?	Disabled, Trip, Alarm, Trip with Inrush blocking, Trip Latch		
I2>	0.1 In	4 In	0.01 In
Delay Type	DT or IDMT (IEC_SI, IEC_VI, IEC_EI, IEC_LTI, IEC_STI, C02_P20, C05, C06, C07, C08, C09, C011, IEEE_MI, IEEE_VI, IEEE_EI, RXIDG, BPN EDF, RI, RECT, C02_P40 curve)		
tI2>	0.05 s	200s	0.01s
I2> TMS	0.02	1.5	0.01
I2> Reset Delay Type	DT or IDMT (refer to Operation chapter)		
DT I2> tReset	0.00 s	600 s	0.01 s

10.6 [46BC] Broken Conductor Protection (Model E).

Principle used: I2/I1

Functionality available for: (IA or IB or IC) > 10% In

10.6.1 Protection Setting Ranges

[46BC] Broken Conductor	Setting ranges		
	Min.	Max.	Step
Broken Cond. ?	Disabled, Trip, Alarm, Trip with Inrush blocking, Trip Latch		
Ratio I2/I1	20%	100%	1%
tBCond	0.05 s	600s	0.01s
GLOBAL SETTINGS/ O/C ADVANCED	**Setting ranges**		
	Min.	**Max.**	**Step**

[46BC] Brkn.Cond I< Block.	0.1 In	1.00 In	0.01 Ien

10.7 [50BF] CB Fail Protection

– Undercurrent: Fundamental only

10.7.1 Protection Setting Ranges

[50BF] CB Fail	Setting ranges		
	Min.	Max.	Step
CB Fail ?	Disabled, Retrip, Alarm		
CB Fail Time tBF	0.1 s	10 s	0.01 s
I< CBF	0.1 In	2 In	0.01 In
High sensitivity current setting	V11Fxxx**0**xxxxxxxxxx (0.01-2Ien)		
IN< CBF	0.1 Ien	2 Ien	0.01 Ien
Low sensitivity current setting	V11Fxxx**3**xxxxxxxxxx (0.05-12Ien)		
IN< CBF	0.1 Ien	2 Ien	0.01 Ien
Wide range e/f current setting (Model E)	V11Fxxx**4**xxxxxxxxxx (0.01-12Ien)		
IN< CBF	0.1 Ien	2 Ien	0.01 Ien
Block I>?	No, Yes		
Block IN>?	No, Yes		

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10.8 Multishot Autoreclose Function (Model E).

Main shots: 4 independent shots.

External Binary inputs: 5 inputs (CB Faulty External Signal, CB status 52A, CB status 52B, blocking Autoreclose).

Internal programmable trigger from phase and earth fault on all re-closing cycles.

External trigger from logic input (using AUX timer)

Programmable dead times and reclaim time setting.

10.8.1 Multishot auto-recloser Settings

[79] Autoreclose G1/G2	Setting range		
	Min.	Max.	Step
Autoreclose ?	Disabled, Enabled		
Dead time			
tD1	0.01 s	600 s	0.01 s
tD2	0.01 s	600 s	0.01 s
tD3	0.1 s	600 s	0.1 s
tD4	0.1 s	600 s	0.1 s
Reclaim time			
Reclaim Time tR	0.02 s	600 s	0.01 s
Phase O/C			
Fast tripping shots	5 4 3 2 1	Settings	
Fast O/C Trip (I>, I>>, I>>>)	0 0 0 0 0	0 – relay O/C protection element 1 – with Fast Trip delay	
Fast O/C Trip Delay setting	0 ms	9.99 s	10 ms
E/GND			
Fast tripping shots	5 4 3 2 1	Settings	
Fast E/Gnd Trip (IN_1, IN_2, IN_3)	0 0 0 0 0	0 – Time relay E/GND protection element 1 – with Fast Trip delay	
Fast E/Gnd Trip Delay setting	0 ms	9.99 s	10 ms
Close Shot	4 3 2 1	Settings	
tI>	0 0 0 0	0 or 1	
tI>>	0 0 0 0	0 or 1	
tI>>>	0 0 0 0	0 or 1	
tIN_1	0 0 0 0	0 or 1	
tIN_2	0 0 0 0	0 or 1	
tIN_3	0 0 0 0	0 or 1	
tAux1	0 0 0 0	0 or 1	
tAux2	0 0 0 0	0 or 1	

[79] Autoreclose G1/G2	Setting range		
	Min.	Max.	Step
Inhibit Trip on [79] close shot	4 3 2 1	Settings	
Inhibit Trip tI> Shot:	0 0 0 0	0 or 1	
Inhibit Trip tI>> Shot:	0 0 0 0	0 or 1	
Inhibit Trip tI>>> Shot:	0 0 0 0	0 or 1	
Inhibit Trip tIN_1 Shot:	0 0 0 0	0 or 1	
Inhibit Trip tIN_2 Shot:	0 0 0 0	0 or 1	
Inhibit Trip tIN_3 Shot:	0 0 0 0	0 or 1	
Inhibit Trip tAux1 Shot:	0 0 0 0	0 or 1	
Inhibit Trip tAux2 Shot:	0 0 0 0	0 or 1	

Cycles:
0 = no action on auto-recloser: definitive trip
1 = trip on protection element pick-up, followed by a reclose cycle
Inhibit Trip on Shot:
0 = no inhibit function
1 = auto-reclose without protection trip (trip command inhibited for protection element - no trip command from the auto-reclose function).

[79] Autoreclose Advanced Settings	Setting range		
	Min.	Max.	Step
Ext. CB Faulty Monitoring ?	Yes or No		
Ext Block via Input ?	Yes or No		
Start Dead Time on	Protection Reset or CB trips		
Rolling demand ?	Yes or No		
Maximum cycle number	2	100	1
Time period Rolling demand	1 mn	24 h	1 mn
Time Inhibit on Close tI	0.0 s	600 s	0.01 s
Signaling Reset	No or Close via 79		

10.8.2 Further Time-delays

Timeout upon lack of CB opening signal after a trip:
tOpen Pulse (*) + 0.1 s (not settable)

tClose Pulse (*): from 0.1 to 10.00 s in steps of 0.01 s
(*) Setting available in the CIRCUIT BREAKER menu.

Timeout upon lack of CB closing signal after a close control and its associated dead time: tOpen Pulse (*) + 0.1 s (not settable)

tClose Pulse (*): from 0.1 to 10.00 s in steps of 0.01 s
(*) Setting available in the CIRCUIT BREAKER menu.

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11. AUTOMATION CONTROL FUNCTIONS

Note: “(BE)” means that the function is available in B and E model only.

11.1 Trip Commands

12. The following protection elements may be set to *'Disabled'* or *'Trip'* or *'Alarm'* or *'TRIP-Inrush Bl*" (AE) or *‘TRIP-Latch’* (AE): tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3(E), tSOTF(ABE), I2>(E), tBrkn Cond(E), tAUX1(ABE), tAUX2(ABE), tAUX3(ABE), tAUX4(ABE)

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The trip command is enabled with the following protection options:

– TRIP

– TRIP with Inrush Blocking (AE)

– TRIP with Latch (AE)

For [50/51] o/c protection, additional options:

– TRIP – Phase A (E)

– TRIP – Phase B (E)

– TRIP – Phase C (E)

Thermal Overload can be set to *'Enabled'* or *'Disabled'*.

CB Fail can be set to *'Disabled'* or *'Retrip'* or *'Alarm'*

The first Thermal stage is for Alarm the second one is for trip.

12.1 Latch Functions

Thermal Overload can be latched using the Theta Reset threshold setting only.

12.2 Blocking Logic

The following time-delayed stages may be blocked:

– tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3, tI2>(E), tBrkn Cond(E), tSOTF(ABE), Itherm(NABE), tAUX1(ABE), tAUX2(ABE), tAUX3(ABE), tCB Fail.

12.3 Inrush blocking Logic (Model A and E)

Inrush blocking is based on second harmonic criteria.

The following protection elements may be set to *'Disabled'* or *'Trip'* or *'Alarm'* or *'TRIP-Inrush Bl'*(AE) or *'TRIP-Latch'* (AE): tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3(E), tSOTF(ABE), I2>(E), tBrkn Cond(E), tAUX1(ABE), tAUX2(ABE), tAUX3(ABE), tAUX4(ABE).

The trip command with Inrush Blocking function is enabled with the following option:

– ***Trip-Inrush Bl***

There are two methods available:

– Permanent action based on a 2nd harmonic ratio threshold (***Inrush Blocking? 1: Yes***). The "Inrush Reset Time" setting is available to this effect.

– Activation 2nd harmonic after CB closing for defined time period (***Inrush Blocking? 1: Closing***). The "Unblock Inrush Time" setting is available to this effect.

For more details please refer to the Application chapter of this manual.

Blocking Inrush	Setting range		
	Min.	Max.	Step
Blocking inrush	No, Yes, Closing		
2nd Harmonic Ratio	10%	50%	1%
Inrush Reset Time	0 s	200 s	10 ms
Unblock Inrush Time	0 s	200 s	10 ms

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12.4 Logic Selectivity (Model E)

Logic selectivity 1 and logic selectivity 2: This function is used to assign a time-delay to the protection elements mapped to the “Log Sel” inputs.

Logic Selectivity G1/G2	Setting range		
	Min.	Max.	Step
Sel1?	Disabled or Enabled		
t Sel1	0 s	600 s	10 ms
Sel2?	Disabled or Enabled		
t Sel2	0 s	600 s	10 ms

The inputs can be mapped to the following protection elements: tI>>, tI>>>, tIN>>, tIN>>> (E).

12.5 Output Relays

Assignable functions: Protection Trip, Protection Trip (pulse), Trip CB Order, Close CB Order, Alarm, I>, I>>, I>>>, SOTF(ABE), IN_1, IN_2, IN_3(E), I2>(E), Start Broken Conductor(E), AUX1(ABE), AUX2(ABE), AUX3(ABE), AUX4(ABE), AUX5(ABE), AUX6(ABE), tI>, tI>>, tI>>>, tSOTF(ABE), tIN_1, tIN_2, tIN_3(E), tI2>(E), tBrkn Cond(E), Thermal Trip(NABE), Thermal Alarm(NABE), CB Fail, tAUX1(ABE), tAUX2(ABE), tAUX3(ABE), tAUX4(ABE), [79] in Progress(E), [79] Final Trip(E), [79] Lockout(E), [79] Blocked(E), [79] Success. (E), CB Alarm(AE), tCB Faulty(E), Active Setting Group .

12.6 Latch of the auxiliary Output Relays

All output relays (WD not included) can be latched.

12.7 Reverse Output Relay Logic

All logic of the output relays can be reversed.

Note: Reverse logic means that if a function assigned to outputs is disabled the contact is closed. If the function is enabled the contact is opened.

12.8 Inputs (Model A, B and E)

12.8.1 Input Assignation

A single function or multiple automation functions can be assigned to 4(AB) or 8(E) logic inputs:

None, Maintenance Mode(AE), Reset Latched Signaling(ABE), Reset Latched Outputs(ABE), Block tI>(ABE), Block tI>>(ABE), Block tI>>>(ABE), Block tSOTF(ABE), Block tIN_1(ABE), Block tIN_2(ABE), Block tIN_3(E), Block tI2>(E), Block tBrkn Cond(E), Block Itherm(ABE), Block AUX1(ABE), Block AUX2(ABE), Block AUX3(ABE), Block AUX4(ABE), Block [79](E), Sel1 tI>>(E), Sel1 tI>>>(E), Sel1 tIN_2(E), tIN_3(E), Sel2 tI>>(E), Sel2 tI>>>(E), Sel2 tIN_2(E), tIN_3(E), AUX1(ABE), AUX2(ABE), AUX3(ABE), AUX4(ABE), AUX5(ABE), AUX6(ABE), Cold Load PU(ABE), Start tBF(AE), CB status 52a(ABE), CB status 52b(ABE), CB Faulty External Signal(ABE), Setting Group 2(ABE), Manual Close(ABE), Manual Trip(ABE), Trip Circuit Supervision (AE), Reset Theta Value(ABE), Start Disturbance Recorder(AE), Local CTRL Mode(AE), Time Synchronization(E).

12.8.2 Reverse Input Logic

The logic of the inputs can be reversed: Input L1 to L4 (model A, B) or L1 to L6 (model E)

Note: Reverse logic means that if an input is energized, the function assigned to this input is disabled. If the input is not energized, the function is enabled.

12.9 LEDs

Assignable functions: Protection Trip, Alarm, Start Phase A, Start Phase B, Start Phase C, I>, I>>, I>>>, SOTF(ABE), IN_1, IN_2, IN_3(E), I2>(E), Start Broken Conductor(E), AUX1(ABE), AUX2(ABE), AUX3(ABE), AUX4(ABE), AUX5(ABE), AUX6(ABE), tI>, tI>>, tI>>>, tSOTF(ABE), tIN_1, tIN_2, tIN_3(E), tI2>(E), tBrkn Cond(E), Thermal Trip(NABE), Thermal Alarm(NABE), CB Fail, tAUX1(ABE), tAUX2(ABE), tAUX3(ABE), tAUX4(ABE), [79] in Progress(E), [79] Final Trip(E), [79] Lockout(E), [79] Blocked(E), [79] Success.(E), Local CTRL Mode (AE), CB Alarm(AE), Maintenance Mode(AE), tCB Faulty(ABE), Active Setting Group.

12.10 Latch of the auxiliary Output Relays

All output relays (WD not included) can be latched.

12.11 Auxiliary Timers (available in B, A and E)

Auxiliary timers G1/G2	Setting range		
	Min.	Max.	Step
Aux1 ?	Disabled (ABE), Trip(ABE), Alarm(ABE), Trip with Inrush blocking (AE), Trip with Latching,(AE) Load Shedding (LS) (E), AR after LS Hi (Hi state – activates) (E), AR after LS Lo (Lo state – activates) (E)		
Time-delay tAux1	0	600 s	10 ms
Aux2 ?	Disabled (ABE), Trip(ABE), Alarm(ABE), Trip with Inrush blocking (AE), Trip with Latching,(AE) Load Shedding (LS) (E), AR after LS Hi (Hi state – activates) (E), AR after LS Lo (Lo state – activates) (E)		
Time-delay tAux2	0	600 s	10 ms
Aux3 ?	Disabled (ABE), Trip(ABE), Alarm(ABE), Trip with Inrush blocking (AE), Trip with Latching,(AE) Load Shedding (LS) (E), AR after LS Hi (Hi state – activates) (E), AR after LS Lo (Lo state – activates) (E)		
Time-delay tAux3	0	600 s	10 ms
Aux4 ?	Disabled (ABE), Trip(ABE), Alarm(ABE), Trip with Inrush blocking (AE), Trip with Latching,(AE) Load Shedding (LS) (E), AR after LS Hi (Hi state – activates) (E), AR after LS Lo (Lo state – activates) (E)		
Time-delay tAux4	0	600 s	10 ms

12.12 Cold Load Pickup

Cold Load PU G1/G2	Setting range		
	Min.	Max.	Step
Cold Load PU ?	Disabled or Current+Input or Input (AE)		
Cold load PU Level	20%	999%	1%
Cold load PU tCL	0s	6000 s	100 ms
CLPU I>	Yes or No		
CLPU I>>	Yes or No		
CLPU I>>>	Yes or No		
CLPU IN_1 (IN>)	Yes or No		
CLPU IN_2 (IN>>)	Yes or No		
CLPU IN_3 (IN>>>) (E)	Yes or No		
CLPU Brkn Cond (E)	Yes or No		
CLPU Itherm (NABE)	Yes or No		
CLPU I2> (E)	Yes or No		

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TD

12.13 Circuit Breaker

12.13.1 CB Time Setting Ranges

CB Control Time	Model	Setting range		
		Min.	Max.	Step
tOpen Pulse min	All models	0.1 s	10 s	0.01 s
tClose Pulse	All models	0.1 s	10 s	0.01 s
Time-delay for Close	A and E	0.0 s	200 s	0.01 s

12.13.2 Time-delay for Faulty CB External Signal (Model A, B and E)

CB Faulty External Monitoring	Setting range		
	Min.	Max.	Step
tCB FLT ext	1 s	200 s	1 s

12.13.3 Remote Control Mode (Model A and E)

Remote Control Mode	Setting range
Remote CTRL Mode	Remote only Remote + Local

12.13.4 Unblock SOTF Time pulse after CB Close (Model A , B and E)

Unblock SOTF Time	Setting range		
	Min.	Max.	Step
52 Unblock SOTF Time	0 s	200 s	0.01 s

12.13.5 Trip Circuit Supervision Setting Ranges (Model A and E)

TC Supervision	Setting range		
	Min.	Max.	Step
TC Supervision ?	No or Yes or Yes-52A		
TC Supervision tSUP	0.1 s	10 s	0.01 s

12.13.6 Circuit Breaker Control and Monitoring Setting Ranges (Model A and E)

CB Supervision	Setting range		
	Min.	Max.	Step
CB Time Supervision?	Yes or No		
CB Open time	0.01 s	10 s	0.01 s
CB Close time	0.01 s	10 s	0.01 s
CB Diagnostic ?	Yes or No		
Max CB Open NB	1	50000	1
ΣAmps(n)	0.1 MA^n	6535.5 MA^n	0.1MA^n
n	1	2	1

13. RECORDING FUNCTIONS

13.1 Event Records

(not available in model L without RS485)

Capacity	200 events
Time-tag	1 millisecond
Triggers	Any selected protection alarm and threshold Logic input change of state Setting changes Self test events

13.2 Fault Records

Capacity	20 faults
Time-tag	1 millisecond
Triggers	Any selected protection which trip CB
Data	Fault date Protection thresholds Setting Group AC inputs measurements (RMS) Fault measurements

13.3 Instantaneous Recorder (Model E)

Capacity	5 starting information (instantaneous)
Time-tag	1 millisecond
Triggers	Any selected protection which trip CB
Data	Date, hour origin (any protection)

13.4 Alarm Recorder

Capacity	5 alarm information
Time-tag	1 millisecond
Triggers	Any selected protection which is selected for signaling only (set to Alarm)
Data	Date, hour origin (any protection alarm)

TD

13.5 Disturbance Records (Model A and E)

13.5.1 Triggers, Data, Setting Ranges

Disturbance Records	Total record: up to 3s, but not more than 5 records			
Triggers	Any selected protection alarm and threshold, logic input, remote command			
Data	AC input channels digital input and output states frequency value			
	Default value	**Setting range**		
		Min.	**Max.**	**Step**
Pre-fault Time	0.1	0.1	2	0.01
Post-fault Time	0.1	0.1	1	0.01
Max duration time	4	0.10	4	0.01
Disturb rec Trig	on Inst	on Trip or on Inst.		
Trigger	Protection selected for tripping, Logic input (Start Distur.R.)			

14. COMMUNICATION (in Model L : option)

Type Port	Physical Link	Connectors	Data Rate	Comms. mode	Protocol
RS485 (in L option)	Screened twisted pair	Screws or snap-on	4.8 or 9.6 or 19.2 or 38.4 (default:19.2 kbit/s)	Data Bit: 8 Stop bit: 1/ 2 Parity: None/Odd/Even Adress: 1 to 254	Modbus RTU, IEC60870-5-103 (selectable in menu)
USB	USB2.0	PC: type A male V11F: type mini B male	115.2 kbits/s (fixed)	Data Bit:8 Stop bit: 1 Parity: None Adress: 1	Modbus RTU

15. CURVES

15.1 General

Although the curves tend towards infinite when the current approaches Is (general threshold), the minimum guaranteed value of the operating current for all the curves with the inverse time characteristic is 1.1 Is (with a tolerance of ± 0.05 Is).

15.1.1 Inverse Time Curves

The first phase (or earth) overcurrent stage can be selected with an inverse definite minimum time (IDMT) characteristic. The time-delay is calculated using a mathematical formula. In all, there are eleven IDMT characteristics available.

TD

The mathematical formula applicable to the first ten curves is:

$$t = T \times \left(\frac{k}{\left(\frac{G}{Gs}\right)^{\alpha} - P} + c \right)$$

Where:

t Operation time

k, c, α, P Constant (see table)

G Value of measured current

Gs Value of the programmed threshold (pick-up value)

T Time multiplier setting (V11F label for T: see table below)

Type of curve (according to IEC60255-151 std definition)	Standard	T	k	c	α	P
IEC Standard inverse (SI)	IEC/A	TMS	0.14	0	0.02	1
IEC Very inverse (VI)	IEC/B	TMS	13.5	0	1	1
IEC Extremely inverse (EI)	IEC/C	TMS	80	0	2	1
Long time inverse (LTI)	IEC	TMS	120	0	1	1
FR Short time inverse (STI)	FR	TMS	0.05	0	0.04	1
US Short time inverse	C02 P20	TD	0.02394	0.01694	0.02	1
US Short time inverse	C02 P40	TD	0.16758	0.11858	0.02	1
US Long Time (CO5)	US	TD	4.842	1.967	1.1	1
US Definite Minimum Time (CO6)	US	TD	0.3164	0.1934	1.4	1
US Moderately Inverse Time (CO7)	US	TD	0.0094	0.0366	0.02	1
US Time Inverse (CO8)	US	TD	5.95	0.18	2	1
US Very Inverse Time (CO9)	US	TD	4.120	0.0958	2	1
US Extreme Inverse Time (CO11)	US	TD	5.570	0.028	2	1
Long time inverse	C08	TD	5.95	0.18	2	1
Moderately Inverse	IEEE (IEC/D)	TD	0.0515	0.114	0.02	1
Very inverse	IEEE (IEC/E)	TD	19.61	0.491	2	1
Extremely inverse	IEEE (IEC/F)	TD	28.2	0.1217	2	1

UK Rectifier protection	RECT	TD	45900	0	5.6	1
BNP (EDF)	EDF	TMS	1000	0.655	2	1
RI		TMS	-4.2373	0	-1	1.43644

RXIDG Curves

RXIDG curves can be selected on V11F Model E with wide earth current (corresponding to Cortec model number V11Fxxx**4**xxxxxxxxxx)

TD

The first earth thresholds can be selected with dedicated RXIDG curves.

The curves available follow the formula:

t = 5.8 – 1.35 * ln (1/ (k * Is/I))

Where:

t = tripping time

k = coefficient (from 0.3 to 1, by steps of 0.01)

Is = value of the programmed threshold (Pick-up value)

I = value of measured current

In order to be compliant with the Netmanagement specifications the relay must be used with:

- An earth current range 0.01 Ion to 12 Ien
- A rated current wiring 1A
- A core balanced CT with a ratio 25/1.

15.1.2 Reset Timer

The first phase and earth overcurrent stages and the second phase overcurrent stage are provided with a timer hold facility: "t Reset".

The value that is set for this reset timer corresponds to the minimum time during which the current value needs to be lower than 95% of the phase (or earth) threshold before the corresponding phase (or earth) time-delay is reset.

Note: There is an exception to this rule when the protection triggers. In fact, in that case, the time-delays (tI> and tIe>) are immediately reset.

The value of the Reset Timer depends on the type of timer associated with the pick-up of the first phase (or earth) stage.

Type of timer associated with the first & second phase O/C stages and the first earth fault stage	Reset Timer	
	DMT Reset characteristic	IDMT characteristic
DMT, Rectifier, LTI, STI, Rectifier, BNP EDF, RXIDG	Settable from 0 to 600 ms	Not available. If IDMT is selected: reset timer is set to 0s (see table below: K=0)
IDMT IEC or RI	Settable from 0 to 600 ms	Based on RTMS value (refer to Operation chapter)

IDMT IEEE or CO	Settable from 0 to 600 ms	Based on RTD value (refer to Operation chapter)

TD

Reset timer:

The first phase, earth and negative sequence overcurrent stages are provided with a timer hold facility: "t Reset".

It may be set to a definite time value or to an inverse definite minimum time characteristic (IEC/IEEE/ANSI curves only). This may be useful in certain applications, for example when grading with upstream electromechanical overcurrent relays that have inherent reset time-delays.

The second and third earth fault stages have only a definite time reset.

A possible situation where the reset timer may be used is to reduce fault clearance times where intermittent faults occur.

An example may occur in a cable with plastic insulation. In this application it is possible that the fault energy melts the cable insulation, which then reseals after clearance, thereby eliminating the cause for the fault. This process repeats itself to give a succession of fault current pulses, each of increasing duration with reducing intervals between the pulses, until the fault becomes permanent.

When the reset time of the overcurrent relay is set to its minimum, the relay will be repeatedly reset and will not be able to trip until the fault becomes permanent. By using the reset timer hold function the relay will integrate the fault current pulses, thereby reducing the fault clearance time.

The mathematical formula applicable to the five curves is:

$$t = RT \times \left(\frac{tr}{1 - \left(\frac{G}{Gs} \right)^p} \right)$$

Where:

t Reset time

tr, p Constant (see table)

G Value of the measured current

Gs Value of the programmed threshold (pick-up value)

RT Reset time multiplier (V11F label for RT: see table below)

Type of curve	Standard	RT	tr	p
US Short time inverse	C02_P40	RTD	2.261	2
US Short time inverse	C02_P20	RTD	0.323	2
Long time inverse	C08	RTD	5.950	2
IEEE Moderately inverse (MI)	IEEE	RTD	4.850	2
IEEE Very inverse (VI)	ANSI/IEEE	RTD	21.600	2
IEEE Extremely Inverse (EI)	ANSI/IEEE	RTD	29.100	2
IEC Standard Inverse Time (SI)	IEC/A	RTMS	8.2	6.45
IEC Very Inverse Time (VI)	IEC/B	RTMS	50.92	2.4
IEC Extremely Inverse Time (EI)	IEC/C	RTMS	44.1	3.03
IEC Long Time Inverse (LTI)	IEC	RTMS	40.62	0.4

US Long Time (CO5)	US	n/a	0	2
US Definite Minimum Time (CO6)	US	n/a	0	2
US Moderately Inverse Time (CO7)	US	n/a	0	2
US Time Inverse (CO8)	US	n/a	0	2
US Very Inverse Time (CO9)	US	n/a	0	2
US Extreme Inverse Time (CO11)	US	n/a	0	2
FR Short Time Inverse (STI)	FR	n/a	0	2
UK Rectifier (Rect)	UK	n/a	0	2
BNP EDF	BNP EDF	n/a	0	2
RXIDG	RXIDG	n/a	0	2
RI	RI	n/a	0	2

TD

15.2 Thermal Overload Curves

The thermal time characteristic is given by:

$$e^{\left(\frac{-t}{\tau}\right)} = \frac{\left(I^2 - I_{therm}{}^2\right)}{\left(I^2 - I_P{}^2\right)}$$

Where:

t = Tripping time, following application of the overload current, I

τ = Heating and cooling time constant of the protected plant

I = Highest phase current

I_{therm} = Setting value of thermal model. It is the full load current rating (I_{FLC}) multiplied by a safety factor (for example 1.05, which allows continuous operation up to < 1.05 I_{FLC})

I_P = Steady state pre-loading current before application of the overload

The tripping time varies depending on the load current carried before application of the overload, i.e. whether the overload was applied from "hot" or "cold".

The thermal overload time characteristic curves are given in the Technical Data chapter.

If the current in any phase is above 0.1 x I_{therm} setting value the mathematical formula is following:

$$\text{t Trip} = \text{Te In}\left(\frac{\left|K^2 - \theta_p\right|}{\left|K^2 - \theta_{t\,rip}\right|}\right)$$

Where:

t Trip = Tripping time (in seconds)

T_e = Thermal time constant of the protected plant (in seconds)

K = Thermal overload equal to $\frac{I_{eq}}{I_{therm}}$

I_{eq} = Equivalent current corresponding to the RMS value of the highest phase current

I_P = Steady state pre-loading current before application of the overload

I_{therm} = Setting value. It is the full load current rating increased by a safety factor k (for example if k = 1.05 then I_{therm} = k*I_{FLC} =1.05*I_{FLC}) given by the national standard or by the supplier

θ_P = Steady state pre-loading thermal state before application of the overload

θ_{alarm} = Initial thermal state. If the initial thermal state = 30% then θ =0.3

θ_{trip} = Trip thermal state. If the trip thermal state is set at 100%, then θ trip = 1

TD

The settings of these parameters are available in the various menus. The calculation of the thermal state is given by the following formula:

$$\Theta_{\tau+1} = \left(\frac{I_{eq}}{I_{therm}}\right)^2 \left[1 - e^{\left(\frac{-t}{Te}\right)}\right] + \Theta_{\tau} e^{\left(\frac{-t}{Te}\right)}$$

θ is calculated every 10 ms.

If all the phase currents are above 0.1 x I_{therm} the value of Tr (time constant for cooling) is used instead of Te (time constant for heating).

In a typical application (transformer, cable, ...) Tr should be equal to Te. Different setting values

TD

GS

GETTING STARTED

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

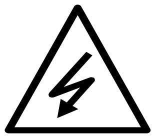
CONTENTS

GS

GS

FIGURES

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4L M/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTION OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.



For safety reasons, no work must be carried out on the V11F until all power sources to the unit have been disconnected.

1. RELAY POWER UP

Follow the following instructions carefully in order to correctly power up the relay.

1.1 System Connections

Check the wiring scheme of your installation.

Check that the output relay contacts are included in your trip circuit.

1.2 Auxiliary Power Supply Connections

Connect a DC or AC (according to nominal supply rating V_{AUX}) voltage power supply.

Positive V_{AUX} to terminal A1
Negative V_{AUX} to terminal A2

Turn on the auxiliary power supply and set to approximately the rated voltage as shown on the relay's front panel.

The display should show:

```
1.00 A    1.00 A
1.00 A    1.00 A
```

Displays:
- first line: phases A and B currents,
- second line: phase C current and earth current, taking into account the phase CT ratio (CONFIGURATION/CT RATIO submenu).

The **LEDs** should be configured as follows:

– The green LED "Healthy" (watchdog) is illuminated

The configuration of the remaining LEDs depends on the relay's history before powering (if the LEDs are configured as latching their state is stored in memory, therefore after repowering they are illuminated again until they are manually reset).

1.3 Powering up from the USB port (function not available in Model N)

Only some of the relay's electronic circuits, for the HMI and RS485 communications, are supplied from the USB port.

Note: Since the I/O boards are not supplied from the USB port the inputs' status is set to default value.
Additionally, output contacts are not operational therefore it is impossible to execute any commands.

2. USER INTERFACES AND MENU STRUCTURE

The settings and functions of the VAMP 11x protection relay can be accessed both from the front panel keypad and LCD, and via the front and rear communication ports. Information on each of these methods is given in this section to describe how to start using the relay.

Note:

"(**AE**)" means that function is available in model A and E only.

"(**A**)" means that function is available in model A, etc.

2.1 Introduction to the relay

2.1.1 Front panel

The front panel of the relay is shown in Figure 1.

The front panel of the relay includes:

– a 16-character by 2-line alphanumeric liquid crystal display (LCD)

– a 9-key keypad comprising 4 arrow keys (8, 4, 2, 6), an HMI OK key, a clear key (C), a read key (), a trip command key (O) and a close command key (I).

– 8 LEDs

– a USB port for local communications

2.1.2 Special symbols on the LCD display

The following special symbols may appear on the LCD display:

- It is possible to move up by pressing the 8 key.

- It is possible to move left by pressing the 4 key.

- It is possible to move down by pressing the 2 key.

- It is possible to move right by pressing the 6 key.

- The last menu cell in the column. If the 2 key is pressed here the cursor will reach the first cell in the column.

- It is possible to edit the displayed values.

<0.1 40> - Setting range: from 0.1 to 40.

0.01 - Setting value step: 0.01.

1 - On the last line: Setting group 1 is displayed.
In the upper-right corner: Setting group 1 is active.

2 - On the last line: Setting group 2 is displayed.
In the upper-right corner: Setting group 2 is active.

- Edition of values on the display password-protected

- Edition of setting value is possible (the level correct password has been entered)

A - An alarm is still active (the cause of alarm is highlighted)

2.1.3 Indications

Note: "(**AE**)" means that function is available in model A and E only.

Fixed Function LEDS:

Healthy – Powering of microprocessor and no hardware problems detected (green LED)

Trip – Any trip caused by protection criteria

And 6 programmable LEDS for the following functions (OR logic):

Protect.Trip –	Trip by protection elements
Alarm –	Alarm signal
Start Phase A –	Start of the phase overcurrent element (set to trip) in phase A
Start Phase B –	Start of the phase overcurrent element (set to trip) in phase B
Start Phase C –	Start of the phase overcurrent element (set to trip) in phase C
I> –	Start of the first phase overcurrent stage
I>> –	Start of the second phase overcurrent stage
I>>>–	Start of the third phase overcurrent stage
SOTF –	Start of the Switch On To Fault overcurrent element (**ABE**)
IN_1 –	Start of the first earth fault overcurrent stage
IN_2 –	Start of the second earth fault overcurrent stage
IN_3 –	Start of the third earth fault overcurrent stage (**E**)
AUX1 –	Trigger of AUX1 timer (via a binary input) (**ABE**)
AUX2 –	Trigger of AUX2 timer (via a binary input) (**ABE**)
AUX3 –	Trigger of AUX3 timer (via a binary input) (**ABE**)
AUX4 –	Trigger of AUX4 timer (via a binary input) (**ABE**)
AUX5 –	Trigger of AUX5 timer (via a binary input) (**ABE**)
AUX6 –	Trigger of AUX6 timer (via a binary input) (**ABE**)
tI> –	Trip by the first phase overcurrent stage (if flashing: start)
tI>> –	Trip by the second phase overcurrent stage (if flashing: start)
tI>>> –	Trip by the third phase overcurrent stage (if flashing: start)
tSOTF –	Trip by SOTF element (if flashing: start) (**AE**)
tIN_1 –	Trip by the first earth fault overcurrent stage (if flashing: start)
tIN_2 –	Trip by the second earth fault overcurrent stage (if flashing: start)
tIN_3 –	Trip by the third earth fault overcurrent stage (if flashing: start) (**E**)
tI2> –	Trip by the negative sequence o/c element (if flashing: start) (**E**)
t Brkn Cond –	Trip by Broken Conductor protection (if flashing: start) (**E**)
Therm Trip –	Trip by Thermal Overload protection (if flashing: alarm) (**NABE**)
Therm Alarm –	Thermal Overload protection alarm (**NABE**)
CB Fail –	Circuit Breaker Failure protection time-delay elapsed
tAUX1 –	tAUX1 time-delay elapsed (if flashing: start) (**ABE**)
tAUX2 –	tAUX2 time-delay elapsed (if flashing: start) (**ABE**)
tAUX3 –	tAUX3 time-delay elapsed (if flashing: start) (**ABE**)

tAUX4 – tAUX4 time-delay elapsed (if flashing: start) (**ABE**)

[79] in Progress – The auto-reclose function is running (**E**)

[79] F. Trip – Auto-reclose not successful: Final Trip (**E**)

[79] Lockout – Lockout of the auto-reclose function (**E**)

[79] Blocked – The auto-reclose function is blocked (**E**)

[79] Success – The auto-reclose operation is successful (the CB remains closed) (**E**)

Local CTRL Mode – Local Control Mode (**AE**)

CB Alarm – Circuit Breaker condition alarm signal (CB Open NB, Sum Amps(n), CB Open Time and CB Close Time) (**AE**)

Maintenance Mode – Maintenance Mode (outputs are disconnected from all functions) (**AE**)

tCB FLT Ext.Sign. – An input mapped to this function detects CB problems that may influence control possibilities (for example spring problem, insufficient pressure, etc.). Signaling is active during a settable time (*GLOBAL SETTINGS/CIRCUIT BREAKER/tCB FLT ext*) (**ABE**)

Setting Group n – Setting Group n active (n= 1, 2)

Every LED can be configured to be latched or self-resetting (***SETTING GROUP 1/ LEDS CONFIGURATION G1/ Latched LEDs***).

If a LED is configured as latching, the manner in which it will be reset is selectable:

- Resetting of LEDs via manual reset (***GLOBAL SETTINGS/LOC/Signaling Reset 0: Manual only***)
- Resetting of LEDs via any protection start (set for CB tripping) or via manual reset (***GLOBAL SETTINGS/LOC/Signaling Reset 1: Start protect.)***
- Resetting of LEDs via manual close command (RS485, HMI or Input) or via manual reset (***GLOBAL SETTINGS/LOC/LEDs Reset 2: Close Command)***

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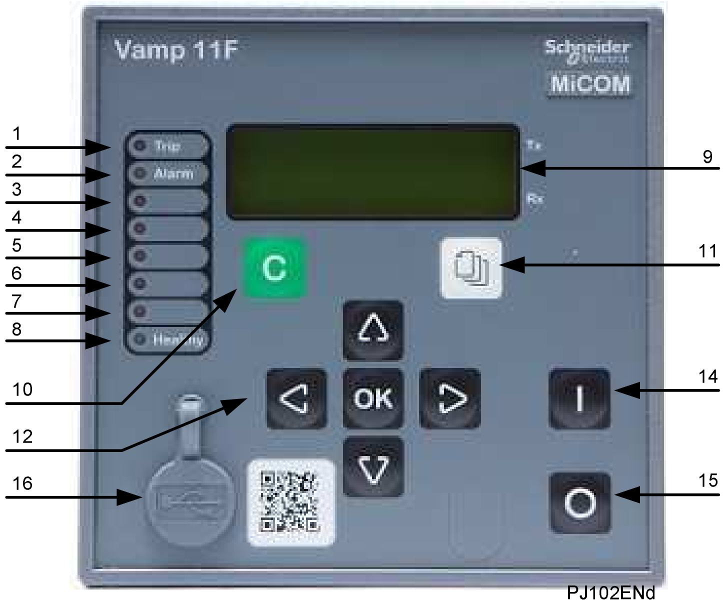
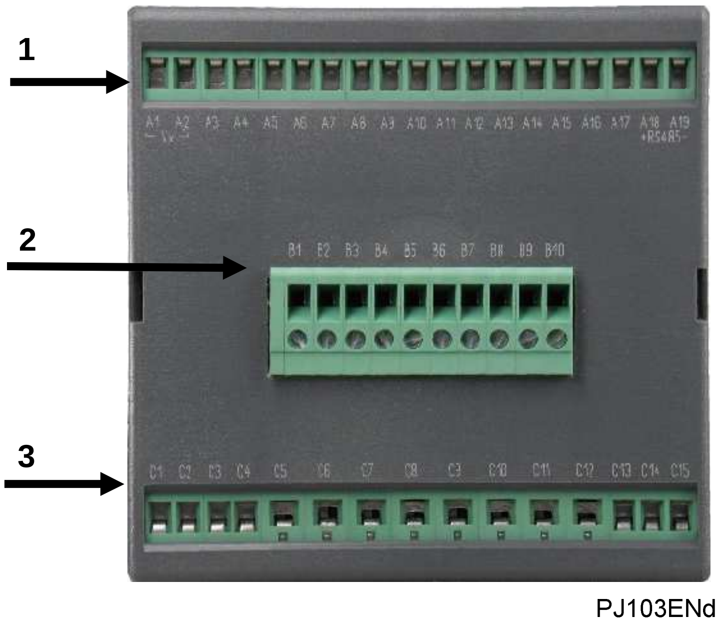


1 – Red “Trip” LED: Protection trip
2 – Yellow “Alarm” LED: Alarm signaling
3, 4, 5, 6, 7 – Red programmable LED
8 – Green “Healthy” LED: Watchdog
9 – 16-character by 2-line alphanumeric liquid crystal display (LCD)
10 – Clear key
11 – Read key
12 – 4 arrow keys, an enter key
14 – CB Close key
15 – CB Open Key
16 – USB port for local connection

Figure 1: V11F Front Panel



1 – Terminal block A: Auxiliary voltage Vaux, contact outputs (WD, RL1, RL2, RL3) and binary inputs (L1, L2) and RS485
2 – Current ring terminal block B: contact outputs (**E**): RL4, RL5 or (**A**): RL6, RL7 and binary inputs (**A**): L3, L4 or (**E**): L5, L6, L7, L8
3 – Terminal block C: current analogue inputs (phases and earth), (**BE**) binary inputs: L3,L4 or (**NA**) output contacts: RL4, RL5
Refer to Installation chapter V11F/EN IN.

Figure 2: Rear View of the V11F

2.2 Relay connection and power-up

The relay can be powered from the following sources:

- Auxiliary voltage Vaux (terminals A1-A2)
- USB port (only some electronic boards: to ensure HMI, USB and/or RS485 communications)

Note:

1. USB is not available in model L
2. USB not supply electronic of V11F in model N. The auxiliary voltage have to present on A1 - A2 terminals

2.2.1 Auxiliary Supply Voltage (Vaux) connection

Before applying the auxiliary supply voltage to the relay, check that the rated nominal ac or dc voltage is appropriate for the application and that it will be connected to the correct terminals (A1&A2). The relay's serial number, current rating, and power rating information can be viewed on the upper side of the case. The ac or dc supply voltage must be within the corresponding nominal range of the device, as indicated in the table below, for the appropriate nominal rating of the equipment:

Model	Nominal ranges of auxiliary voltage Vaux	Operative dc range	Operative ac range
ABE	24 to 60 Vac/dc	19 to 72 Vdc	19 to 66 Vac
ABE	90 to 250 Vdc and 90 to 240 Vac	71 to 300 Vdc	71 to 265 Vac
LN	24 to 250 Vdc and 24 to 240 Vac	19 to 300 Vdc	19 to 265 Vac

Once the ratings have been verified for the application, connect the equipment to an external power source capable of delivering the requirements specified on the label, to perform the relay familiarization procedures. Please refer to the wiring diagrams in the Installation section for complete installation details, ensuring that the correct polarities are observed in the case of dc supply.

Note: The label specifies the auxiliary voltage for the V11F supply input and binary inputs (dependent on ordering options).

2.2.2 Current inputs

The measuring current inputs of the V11F should be connected to the secondary wires of the power system CTs as shown in the connection diagrams in section 8 of V11F Installation chapter V11F/EN IN.

The parameters of the CTs that can be connected to the V11F’s current input terminals are detailed in section 3 of chapter V11F/EN AP - Applications.

2.2.3 Earthing

V11F have no the Protective (Earth) Conductor Terminal, because has of the plastic case.

2.2.4 Output contacts

Depends on the model the V11F has:

- Model L: 3 output contacts + WD(RL0)

- Model N: 5 output contacts + WD(RL0)

- Model B: 3 output contacts + WD(RL0)

- Model A: 7 output contacts + WD(RL0)

- Model E: 5 output contacts + WD(RL0)

V11F is delivered with the following default factory settings for the outputs:

- Output RL0/WD (**LNABE**) (N/O: A3-A5, N/C: A3-A4) - watchdog is not configurable
- Output RL1 (**LNABE**) (N/O: A6-A8, N/C: A6-A7) is not configured
- Output RL2 (**LNABE**) (N/O: A9-A11, N/C: A9-A10) is not configured
- Output RL3 (**LNABE**) (N/O: A12-A13) is not configured
- Output RL4: (**AE**) (N/O: B1-B2) is not configured; (**N**) (N/O: C1-C2) is not configured;
- Output RL5 (**AE**) (N/O: B3-B4) is not configured; (**N**) (N/O: C3-C4) is not configured;
- Output RL6 (**A**) (N/O: C1-C2) is not configured
- Output RL7 (**A**) (N/O: C3-C4) is not configured

To modify the outputs' configuration, refer to section 2.2 of chapter V11F/EN ST - Settings.

The output connection diagram is shown in section 8 of chapter V11F/EN IN - Installation.

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2.2.5 Binary inputs

Depends on the model the V11F has:

- Model L and N: no binary inputs

- Model A and B: 4 binary inputs

- Model E: 8 binary inputs

Binary inputs:

- Input L1 (**ABE**): A14-A16 terminals (terminal block A)
- Input L2 (**ABE**): A15-A16 terminals (terminal block A)
- Input L3 (**BE**): C1-C2 terminals (terminal block C); (**A**):B5-B7 terminals (terminal block B)
- Input L4 (**BE**): C3-C4 terminals (terminal block C); (**A**):B6-B7 terminals (terminal block B)
- Input L5 (**E**): B5-B7 terminals (terminal block B)
- Input L6 (**E**): B6-B7 terminals (terminal block B)
- Input L7 (**E**): B8-B10 terminals (terminal block B)
- Input L8 (**E**): B9-B10 terminals (terminal block B)

There operation range is the same as auxiliary voltage supply (A1 - A2 terminals) see chapter 2.2.1 (ordering option).

To modify the inputs' configuration, refer to section 1.2.3 of chapter V11F/EN ST - Settings.

The input connection diagram is shown in section 8 of chapter V11F/EN IN - Installation.

2.3 Introduction to the user interfaces and setting options

The relay has a USB user interface for use with MiCOM S1 STUDIO 5.1.0 (or higher) software.

With this interface it is possible to download the setting values, latest fault, alarm and instantaneous records (**E**) as well as disturbance records (**AE**) and fully configure the V11F.

Note: After connection to the USB port the ***Healthy*** LED is lit. If the LED is not lit refer to chapter V11F/EN TS - Troubleshooting.

The USB port integrates electronic boards only to allow communications with the V11F via the HMI/RS485/USB interfaces.

2.4 Changing parameters via the front panel user interface (HMI)

Changing of all parameters is password-protected.

After restart or powering up, the V11F is in ***Protection Mode***. This means that all settings are the same as in the relay's operation system and are available on the front panel user interface.

To change any parameters, it is necessary to switch the V11F to the ***SETTING CHANGE MODE****.*

The ***SETTING CHANGE MODE***, for entered password level which changes setting parameters, is indicated by the sequential flashing of the programmable LEDs (from 4 up to 8 LEDs) on the front panel.

Until it is switched back from the ***SETTING CHANGE MODE*** to the ***PROTECTION MODE****,* or restarted by disconnecting then reconnecting the power supply, the V11F uses the setting parameters that were active before the ***SETTING CHANGE MODE*** was entered (previous settings).

Press the **OK** navigation key, after changing a chosen parameter (confirmation of change). The new value is saved in FRAM memory but the V11F still uses the setting value that was active before the ***SETTING CHANGE MODE*** was entered (previous settings). The new value will be available in the operation system only after the firmware has been reset. When the firmware is reset, all the settings are loaded into the V11F system.

When switching from the ***SETTING CHANGE MODE*** to the ***PROTECTION MODE****, a* warm reset is applied.

The V11F therefore applies the new parameters to the relay's operation system.

Afterwards, the settings available on the front panel and those used by the operation system are consistent.

Note: While the LED’s (LED’s 3 - 7) start flashing subsequently (***SETTING CHANGE MODE*** *by entering* ***Administrator*** *or* ***Protection setting*** password) there can be a mismatch between the settings displayed on the front panel and those used by the operating system.

When “***Control only***” rights password is entered then LED’s (LED’s 3 - 7) start flashing in the same times. Additionally all changes are executed and recorded immediately (no need warm reset of firmware). Because this level is not signaled so after 5 minutes V11F switches back automatically from the ***SETTING CHANGE MODE*** to the ***PROTECTION MODE***.

The password protection of the relay comprises three levels:

- Administrator (***Without limits***)
- Protection setting (***Protection only***)
- Control only (***Test control***) – this level is used for tests and/or control execution only (no changing of setting parameters) so signaling of ***SETTING CHANGE MODE*** differs from above. On this password level there is no the sequential flashing of the programmable LEDs (from 3 up to 7 LEDs) but flashing in the same time. On the control windows is the special sign: which informs that control is allowed.

Administrator rights: all the menu settings may be changed (violet color on Fig.10-21).

Protection setting rights: it is possible to change settings in the ***PROTECTION*** column; ***CTRL Default Windows (CB status CTRL, L/R status CTRL, [79] CTRL)*** and ***COMMISSIONING/Maintenance Mode*** windows are also possible (green color on Fig.10 – 21).

Control rights: ***CTRL Default Windows (CB status CTRL, L/R status CTRL, [79] CTRL)*** and ***COMMISSIONING/Maintenance Mode*** windows from the front panel only (yellow color on Fig.10-21).

For each level the password consists of 4 digits (0 to 9)

NOTE: The default password is 0000 for every password protection level.

It is recommended to change default password from 0000 to unique value for every password level.

If the first password is different, this means that the *Administrator* password has been changed.

The *Protection setting* password is still 0000. Therefore, to protect settings against unauthorized access it is necessary to change the *Protection setting* password by first entering 0000 then a new value.

The Control password is still 0000. Therefore, if it is necessary to change it, first enter 0000 then the new value (*Control* right) of the password.

Notes: 1. If the *Protection setting* rights have not been changed, or if it has been set to the default value (0000), it is possible to change all the settings in the ***PROTECTION*** column, reset the counters and control the CB without entering a password, simply by pressing the OK navigation key. This makes it possible to change a chosen parameter by automatically switching the V11F to the ***SETTING CHANGE MODE*** (the programmable LEDs are flashing).
This means that even after changing only one parameter it is necessary to switch the V11F back to ***PROTECTION MODE*** in order to activate the new settings (warm restart).

2. If the *Control* rights password has not been changed or if it has been set to the default value (0000) it is possible to control the CB in menu without password protection.

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2.4.1 *SETTING CHANGE MODE*

The ***SETTING CHANGE MODE*** should be used to change settings.

Using the ***SETTING CHANGE MODE*** ensures that all changed parameters will be applied simultaneously so as to avoid any problems caused by possible setting inconsistencies.

The ***SETTING CHANGE MODE*** makes it possible to change settings while the relay is active without any risk (the V11F continues to use the previous settings).

After exiting the ***SETTING CHANGE MODE*** a warm reset of firmware is applied so that all the protection counters are reset.

Note: Latched LEDs and outputs are not reset (stored values are not cleared during a V11F reset)

To switch the V11F to the ***SETTING CHANGE MODE*** navigate to the ***SETTING CHANGE MODE*** main header (see Figure 9), then press the 2 key:

```
Edit settings?
Enter PSWD
```

Press the OK navigation key.

```
Edit settings?
Enter PSWD 0000
```

The 0 digit furthest to the right is flashing.

Enter the password:

1. If the digit is flashing, change the digit to the required value by pressing the 2 key or the 8 key.

2. Change the flashing digit by pressing the 4 key or 6 key.
3. Continue as above to set the whole password (4 digits)
4. If the correct password is set, press the OK navigation key

The LCD displays 'OK' during approximately 1 second, then the new ***SETTING CHANGE*** cell is displayed:

If the password entered is for:

- *Administrator* rights:

```
Setting change:
 Without limits
```

To indicate that the V11F is in ***SETTING CHANGE MODE*** on the level: ***"Without limits"*** the programmable LEDs are flashing

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- *Protection* settings:

```
Setting change:
 Protection only
```

To indicate that the V11F is in ***SETTING CHANGE MODE*** on the level: ***"Protection only"*** the programmable LEDs are flashing

- *Control* only:

```
Setting change:
 Test control
```

There is no any indication that this level is entered. ***SETTING CHANGE MODE*** is active by 5 minutes only.

The screen displays the scope of the current modification rights..

At this time it is possible to start changing the setting parameters.

Note: The parallel pressing: 8 and 4 key it makes jump from any place to:

```
Edit settings?
 Enter PSWD
```

the menu cell in which the password can be entered (hot key).

If all settings are changed, it is necessary to return to ***PROTECTION MODE*** to apply a warm reset.

Press the 8 and 4 keys simultaneously to jump to the following cell:

```
Edit settings?
Exit:press ENTER
```

Press the **OK** navigation key to apply a warm reset and display the following cell:

```
Setting change:
       Protected
```

The programmable LEDs do not flash sequentially. The V11F is in ***PROTECTION MODE***

Note: In ***SETTING CHANGE MODE*** all functions use the previously stored settings (before the ***SETTING CHANGE MODE*** was entered).

Changing of a single setting parameter

Go to the required setting cell (see section 2.5.8).

Press the HMI **OK** key.

```
Edit settings?
Enter PSWD 000
```

Using the 4, 6, 8, 2 keys, enter the password.

Press **OK** navigation key to confirm the password and switch to ***SETTING CHANGE MODE***.

Press **OK** navigation key to enter the chosen setting parameter.

Using the 4, 6, 8, 2 keys, set the required value.

Confirm the change by pressing the **OK** navigation key.

Switch from ***SETTING CHANGE MODE*** to ***PROTECTION MODE***.

For example, press the 4 and 8 keys simultaneously to display the following cell:

```
Edit settings?
Exit:press ENTER
```

Press the **OK** navigation key to switch from ***SETTING CHANGE MODE*** to ***PROTECTION MODE***.

The following cell should be displayed:

```
Setting change:
       Protected
```

The above cell confirms that settings are password-protected, and that the V11F is in ***PROTECTION MODE***.

Additionally the programmable LEDs do not flash sequentially.

Changing the password

To change the password, first enter the existing password to obtain the appropriate password protection rights.

Press the 2 key to display the following cell:

```
Change Password
```

Press the **OK** navigation key, to display:

```
Change Password
           0000
```

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Using the 4, 6, 8, 2 keys, enter the new password.

Press **OK** navigation key to confirm the new password and jump to the cell displaying information on protection rights

For example:

```
Setting change:
 Without limits
```

To exit the ***SETTING CHANGE MODE*** (apply a warm reset) press the 4 and 8 keys simultaneously to display the following cell:

```
Edit settings?
Exit:press ENTER
```

Press the **OK** navigation key to confirm switching from ***SETTING CHANGE MODE*** to ***PROTECTION MODE***.

The following cell should be displayed:

```
Setting change:
       Protected
```

The above cell confirms that the settings are password-protected and that the V11F is in ***PROTECTION MODE***. Additionally the programmable LEDs do not flash sequentially.

2.5 V11F Menu description

2.5.1 Headers

The main headers are shown in Figure 3.

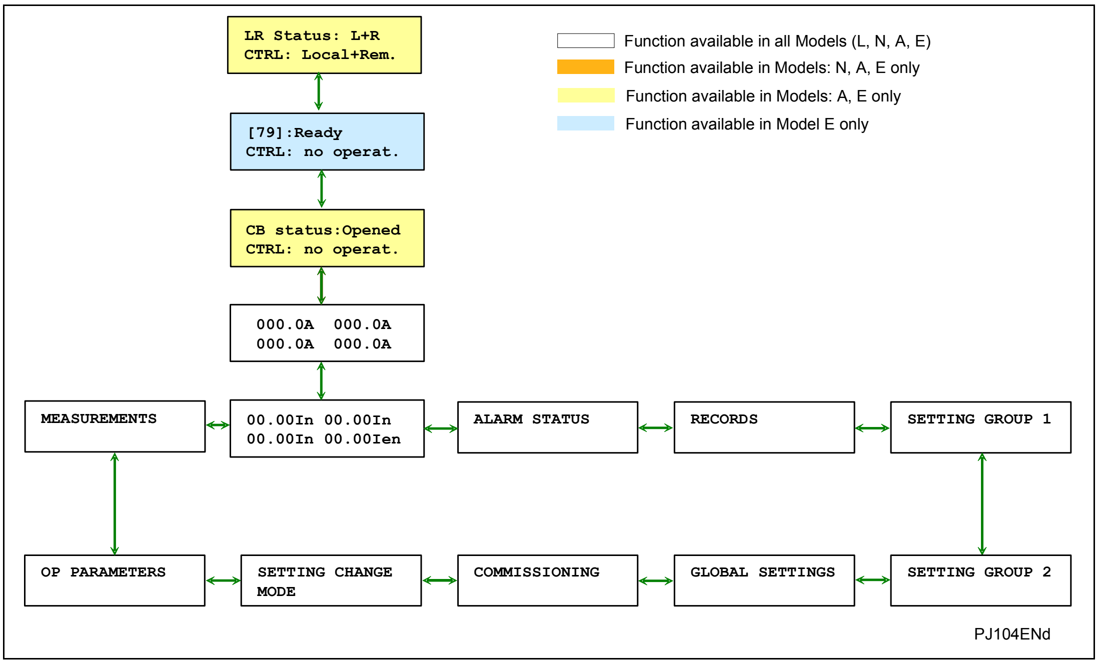

Figure 3: Column headers

2.5.2 ***ALARM STATUS*** column

ALARM STATUS (see Figure 4) information is available if the cause of alarm has been triggered. Therefore, if after pressing the 2 key no the new cell is displayed, it means that no alarms have been detected.

Depending on the V11F's configuration an alarm signal is self-resetting (no cause of alarm – no alarm signal; ***GLOBAL SETTINGS/LOC/Alarm Display 0: Self-reset***) or manually resettable (alarm signal latched; ***GLOBAL SETTINGS/LOC/Alarm Display 1: Latching***).

Default setting: ***0: Self-Reset***. This means that if an alarm signal has disappeared no information is available in the ***ALARM STATUS*** column.

If set to ***Latching***, this means that if an alarm signal has disappeared information is still available in the ***ALARM STATUS*** column until it is reset in the ***ALARM STATUS/ Alarm Reset*** window.

Alarm information is always available in the event recorder. However, the programmable LEDs can be used to store causes of alarm if required.

Figure 4 shows all causes of alarms (if alarms have been enabled in the main configuration column of the protection function).

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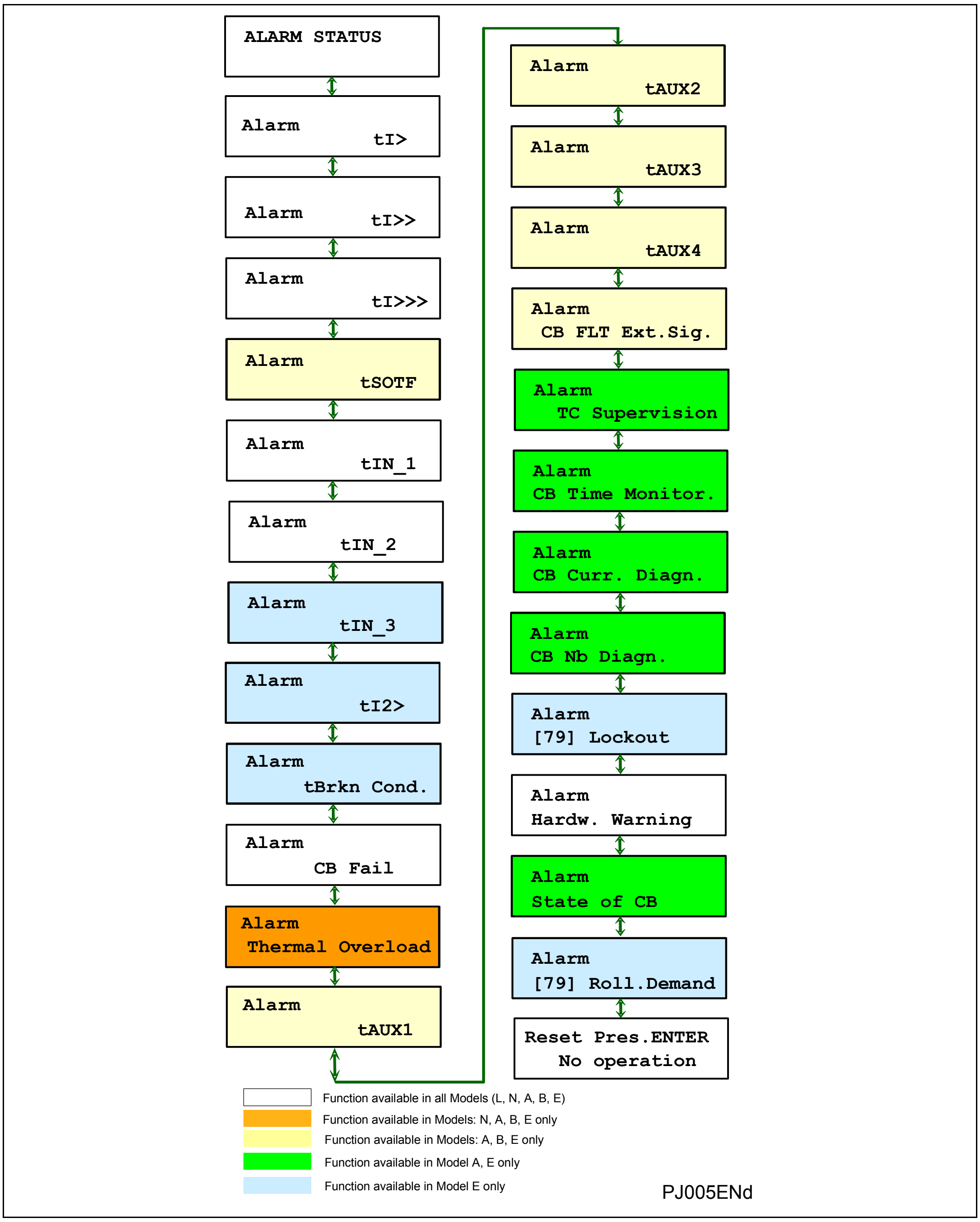

Figure 4: ALARM column

2.5.3 ***RECORDS*** column

Twenty fault records are available in the V11F.

Changing a record in the menu is possible in the ***Record Number*** menu cell, by pressing the **OK** navigation key then the 2 or 8 key. Once the required record is selected, press the HMI **OK** key to confirm the change. If the *Control* rights password has been set to the default value (0000), this operation does not require entering a password; otherwise it is necessary to enter the *Control* rights password.

Records in the ***Fault Recorder*** can be reset using the MiCOM S1 Studio 5.1.0 (or higher) communication software or via the RS485 link.

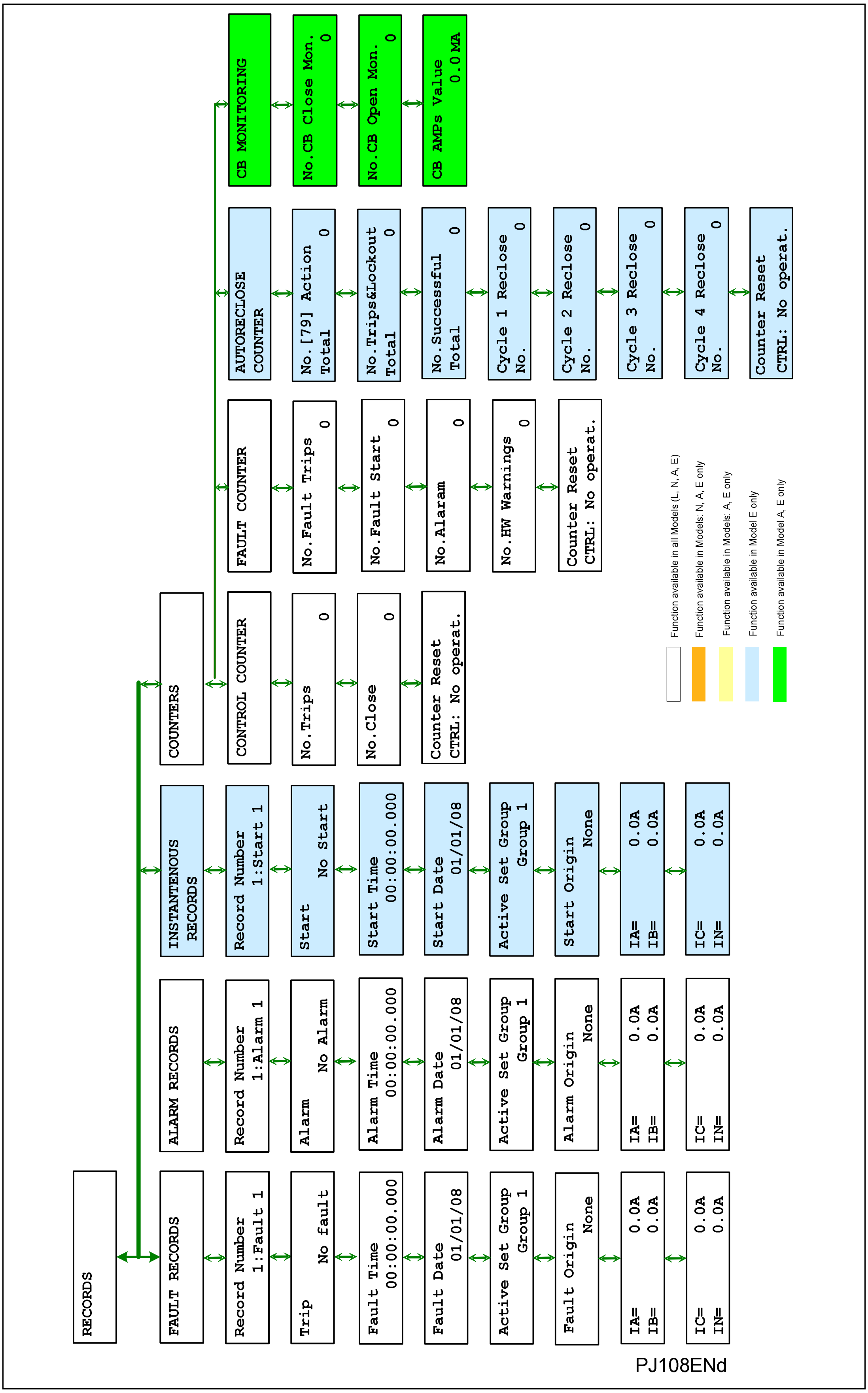

Figure 5: RECORDS column

Counters can be reset in the ***Counter Reset*** cell of the menu, by pressing the **OK** key then the 2 or 8 key. Once the required record is selected, press the **OK** key to confirm the change. This operation requires entering a ***Administrator*** password (***Without limits***).

In addition, counters can be reset using the MiCOM S1 Studio 5.1.0 (or higher) communication software or via the RS485 link.

2.5.4 ***SETTTING GROUP*** columns

The V11F has two setting groups. The relay is delivered with one setting group active only (factory default setting).

If two setting groups are to be used, the second setting group must be activated in the menu cell:

GLOBAL SETTINGS/SETTING GROUP SELECT/Setting Group Select*:*

Nb of Groups
0: One Group

by changing its setting from ***0: One Group*** to ***1: Two Groups***

Each setting group includes:

- Protection settings
- Output relay configuration
- Binary input configuration
- Programmable LED configuration

Switching between setting groups is possible via:

- Configured binary inputs
- Menu (**GLOBAL SETTINGS/SETTING GROUP SELECT/Setting Group Select** cell)
- MiCOM S1 Studio 5.1.0 (or higher) setting software
- Remotely via RS485

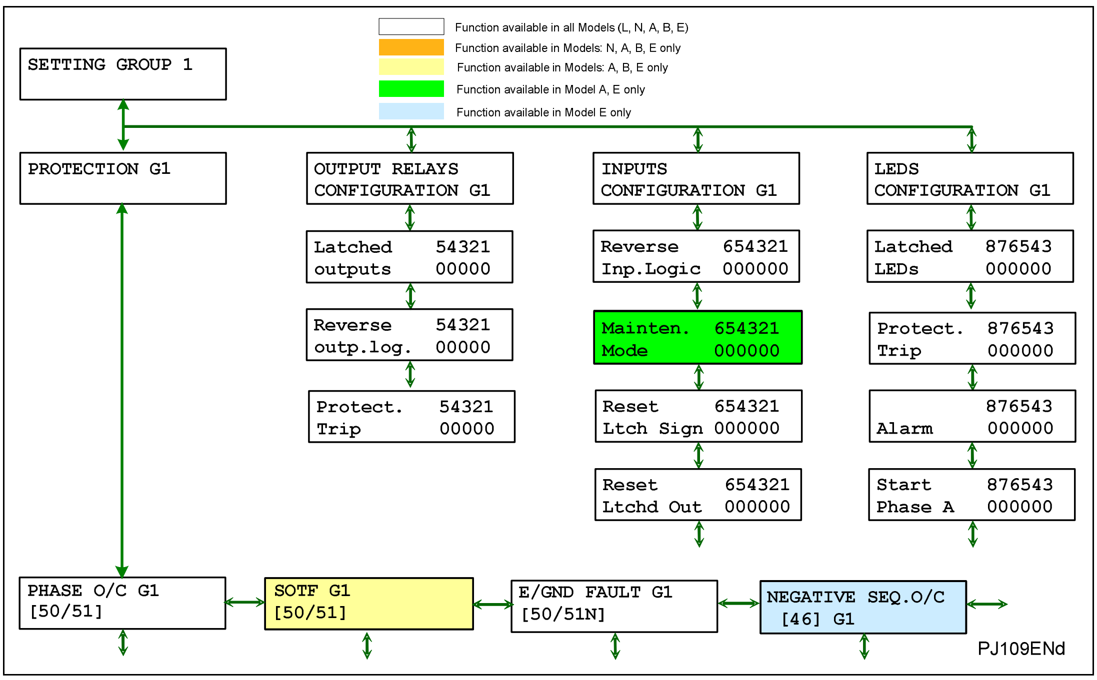

Figure 6: SETTING GROUP 1 columns

Information about the active setting group is available in menu: **OP PARAMETERS/ Active Set Group** cell.

Information about the active setting group can be displayed via the programmable LEDs by configuring them to that function and via a special symbol on the LCD display.

Notes: 1. If setting groups are to be switched using a binary input (AE), this binary input must be configured to setting group switch both in Setting Group 1 and Setting Group 2.

2. It is possible to copy all the parameters from Setting Group 1 to Setting Group 2 or vice versa (**GLOBAL SETTINGS/SETTING GROUP SELECT/Copy Settings** cell). It will then only be necessary to change the parameters' values.

2.5.5 *GLOBAL SETTINGS* column

Global Settings include all general settings, such as:

- Localization (***LOC***)
- Setting Group operation (***SETTING GROUP SELECT***)
- Current transformer parameters (***CT RATIO***)
- Time settings related to Circuit Breaker control or monitoring (***CIRCUIT BREAKER***)
- Inrush Blocking Logic (***INRUSH BLOCKING***) (**AE**)
- Advanced settings for the over-current protection elements (***O/C ADVANCED)***
- Advanced settings for the Auto-reclose function (***[79] ADVANCED SETTINGS***) (**E**)
- Advanced settings for the communication orders via RS485 (***COMMUNICATION ORDERS)*** (**AE**)
- RS485 communication parameters (***COMMUNICATION***) (in **L** optional)
- Disturbance recorder parameters (***DISTURBANCE RECORDER***) (**AE**)

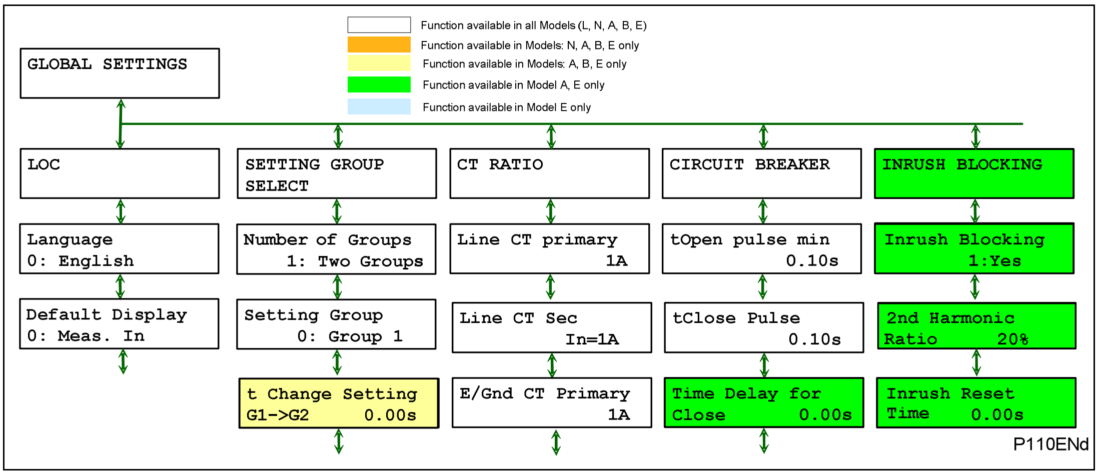

Figure 7: GLOBAL SETTINGS column

It is possible to Copy all parameters from Setting Group 1 to Setting Group 2 and inversely in the ***Copy settings*** cell by pressing the **OK** navigation key. Choose the required operation by pressing the 8 or 2 key (***Copy G1 → G2*** or **Copy G2 → G1**). Confirm the change by pressing the **OK** navigation key.

Note: The setting group change's time-delay, from Setting Group 1 to Setting Group 2 (***t Change Setting*** cell), applies to changes effected via a binary input only (ABE).

2.5.6 *COMMISIONING* column

The settings available in the the *COMISSIONING* column are:

- ***Opto I/P status*** – which binary inputs are active (logic status) (**ABE**),
- ***Relay O/P status*** – which binary outputs are active (logic status),
- ***Maintenance mode*** – allows the user to check the operation of the protection functions without actually sending any external command (tripping or signaling) (**AE**),
- ***Test Pattern*** – allows the user to set outputs contacts for tests (**AE**),
- ***Contact Test Time*** – defines the output's pulse length during the tests (**AE**),
- ***Test outputs*** – if set to **1: *apply test***, pressing the **OK** navigation key will execute the test of the outputs (**AE**),
- ***Functional Test*** – allows the user to set the protection criteria to be tested (**AE**),
- ***Functional Test End*** – defines the end of the functional test: ***CB opened*** or ***Time*** (**AE**),
- ***Functional Test Time*** – defines the pulse length during the functional test (**AE**),
- ***Functional Test*** – if set to ***CTRL: Operate***, pressing the **OK** navigation key will execute the functional test (**AE**).

It is possible to set following ***Maintenance mode*** options (**AE**) :

- "***No***" - ***Maintenance mode*** is disabled. All window cells below are hidden (***Maintenance mode*** is the latest cell in ***COMMISIONING*** column)
- "***Yes,outp.trips***" - ***Maintenance mode*** is enabled. In this mode all test cells in ***COMMISIONING*** column are available (see Fig.8 below). During tests outputs are energized.
- "***Yes,outp.block***" - ***Maintenance mode*** is enabled and all test cells in ***COMMISIONING*** column are available (see Fig.8 below). In this mode, the high state of output functions are ignored (control of outputs are blocked).

This operation requires entering a ***Control*** rights password (***Test control***).

It is possible to set additional programmable LED for Maintenance Mode.

Note: The Maintenance Mode is active up to 10 minutes only. After this time V11F automatically sets - ***Maintenance mode:*** "***No***". It protects user against leaving the V11F in this mode after tests.

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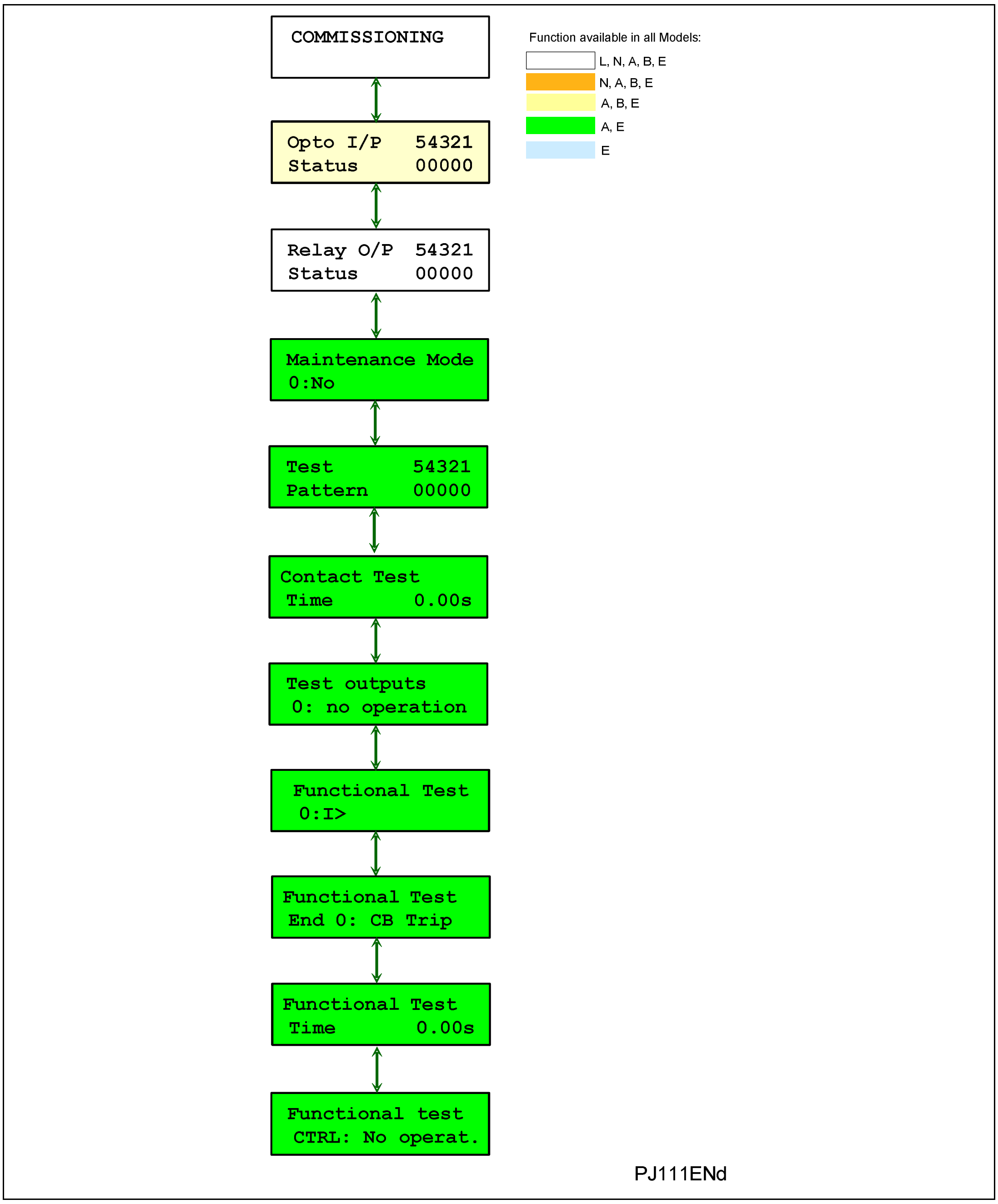

Figure 8: COMMISSIONING column

2.5.7 *SETTING CHANGE MODE* column

The ***SETTING CHANGE MODE*** column is used to:

- Allow changing of all parameters in the menu (***SETTING CHANGE MODE).***
- Set a new password or change the existing password (Change Password)

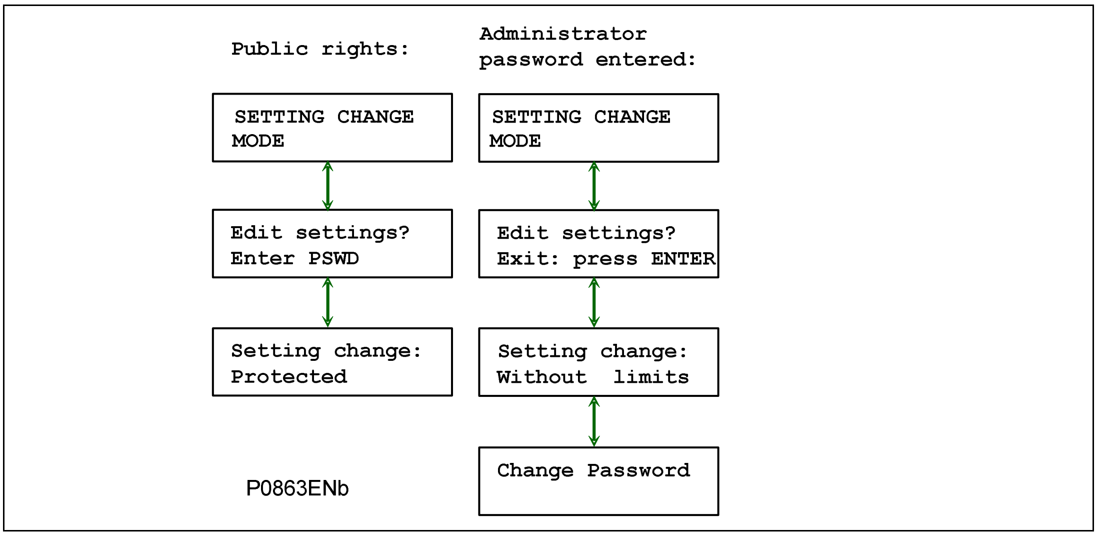

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Figure 9: SETTING CHANGE MODE column

2.5.8 Menu Map

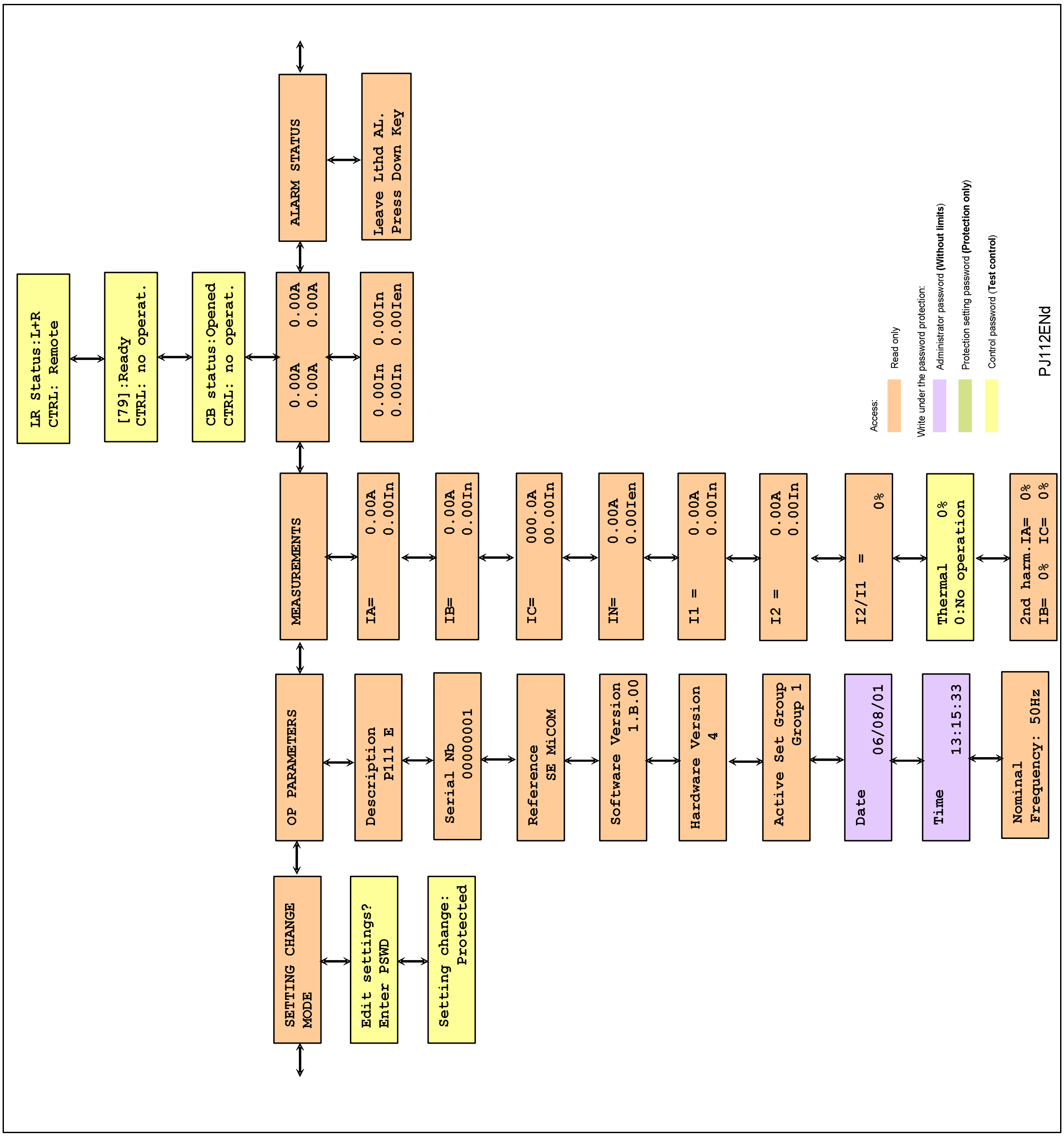

Figure 10: V11F Model E Menu Map part 1

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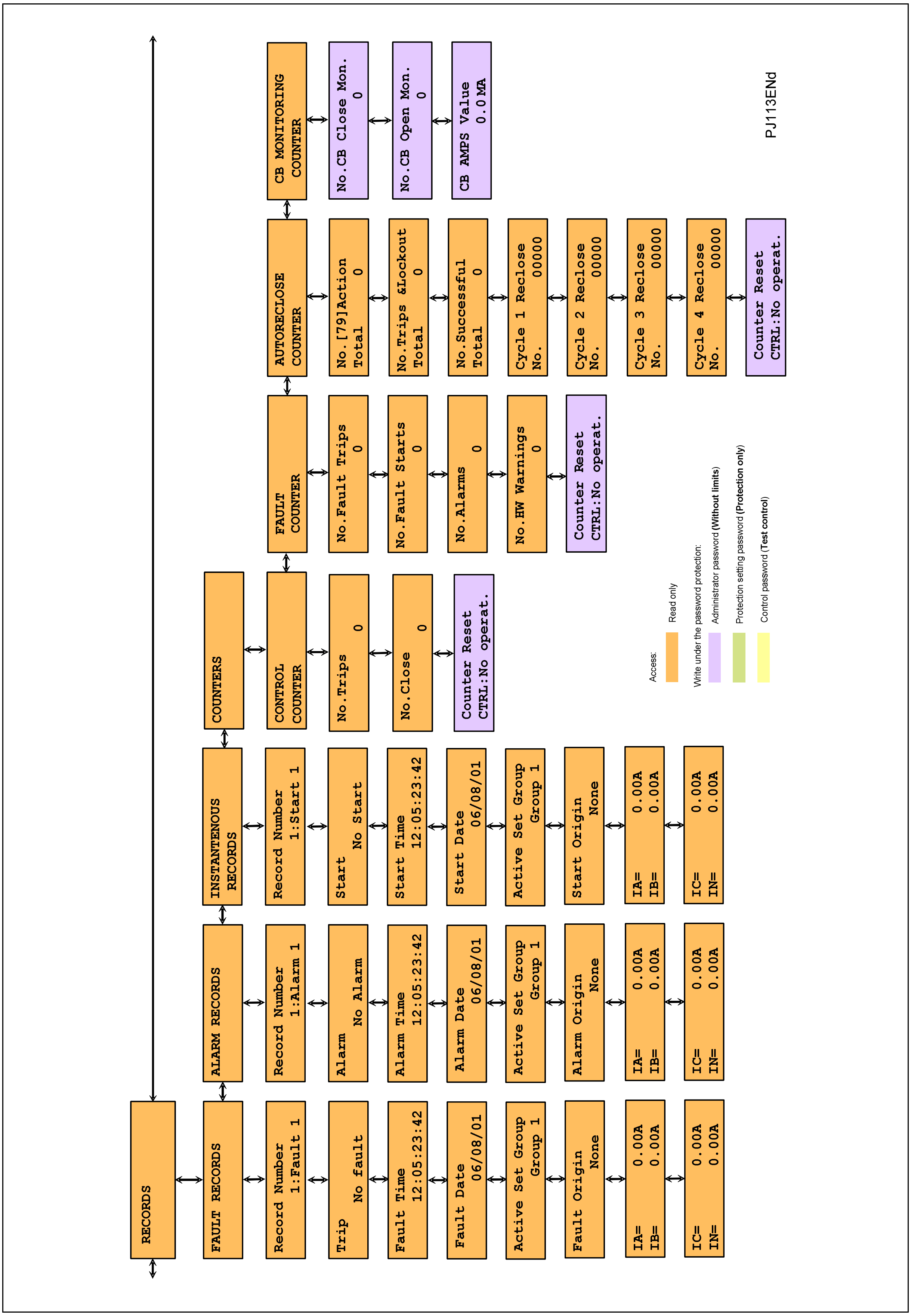

Figure 11: V11F Model E Menu Map part 2

Figure 12: V11F Model E Menu Map part 3

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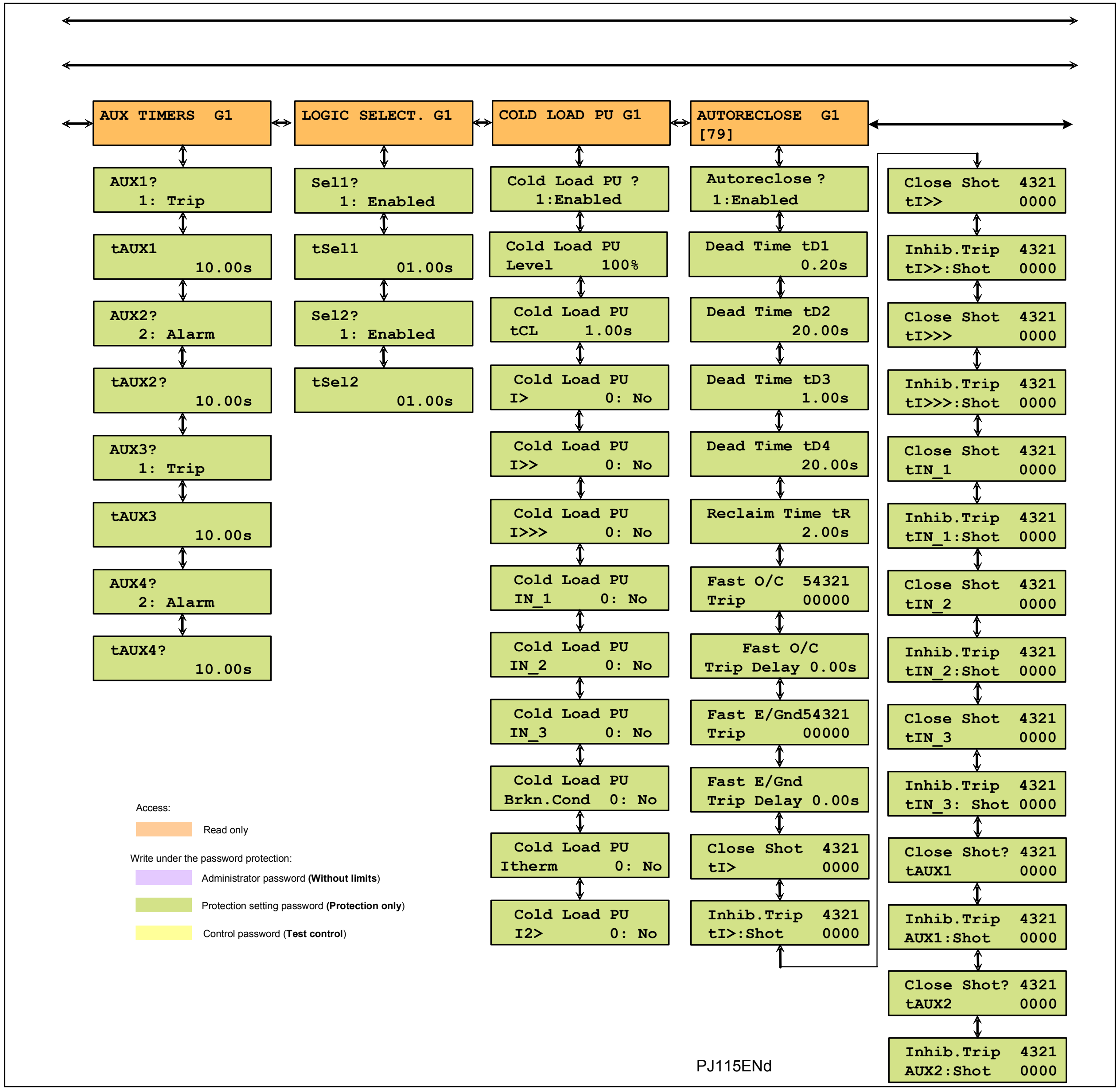

Figure 13: V11F Model E Menu Map part 4

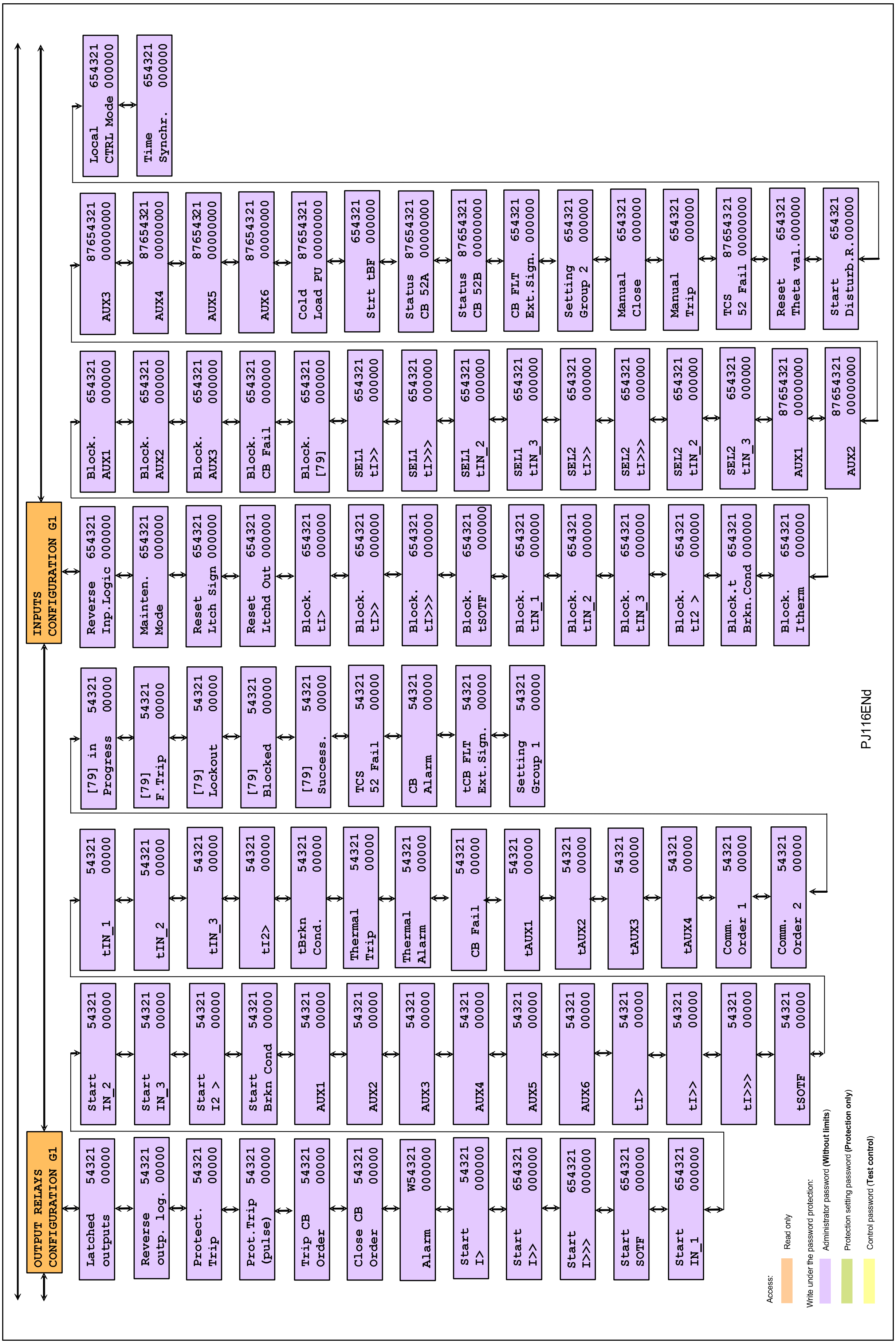

Figure 14: V11F Model E Menu Map part 5

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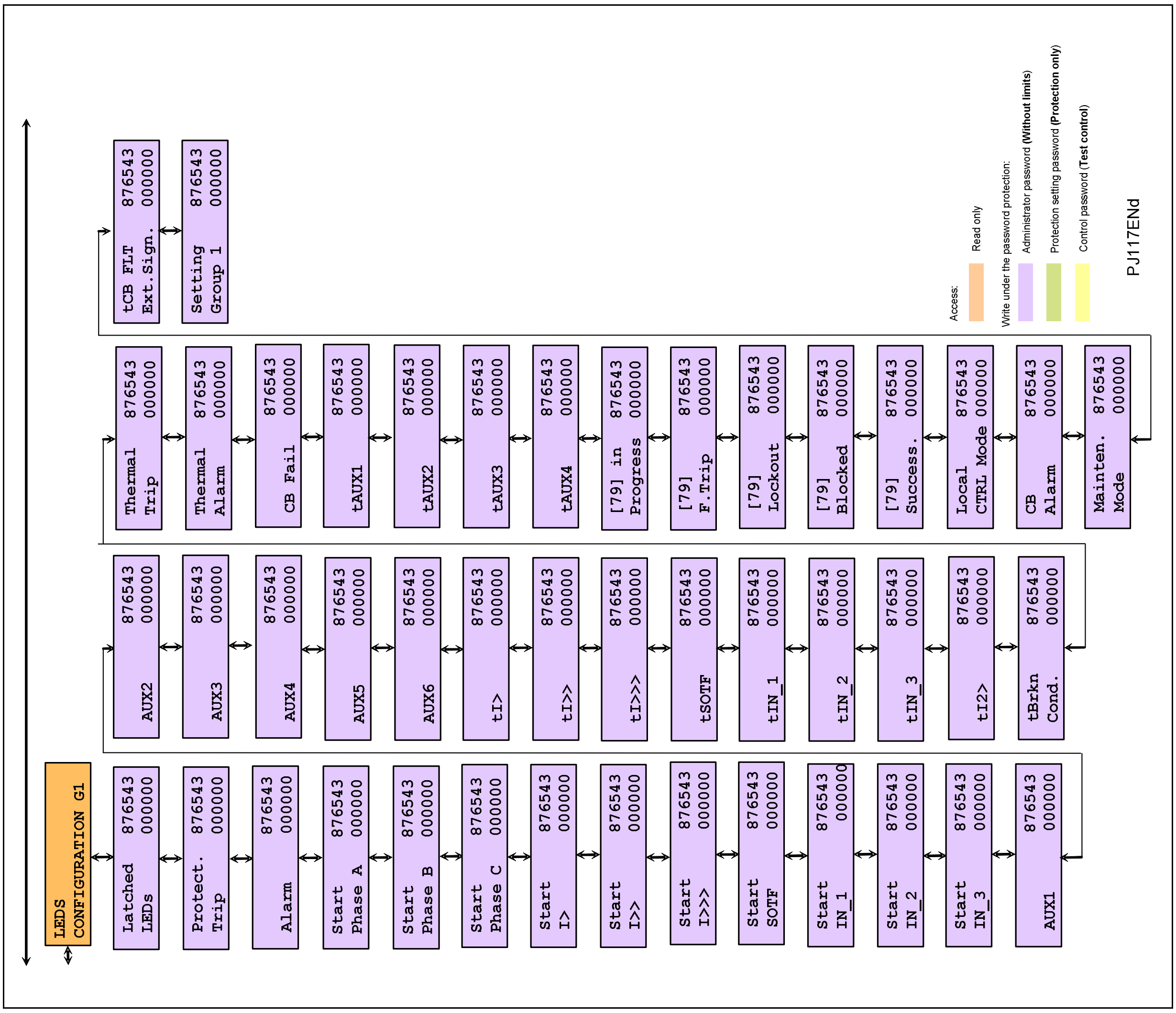

Figure 15: V11F Model E Menu Map part 6

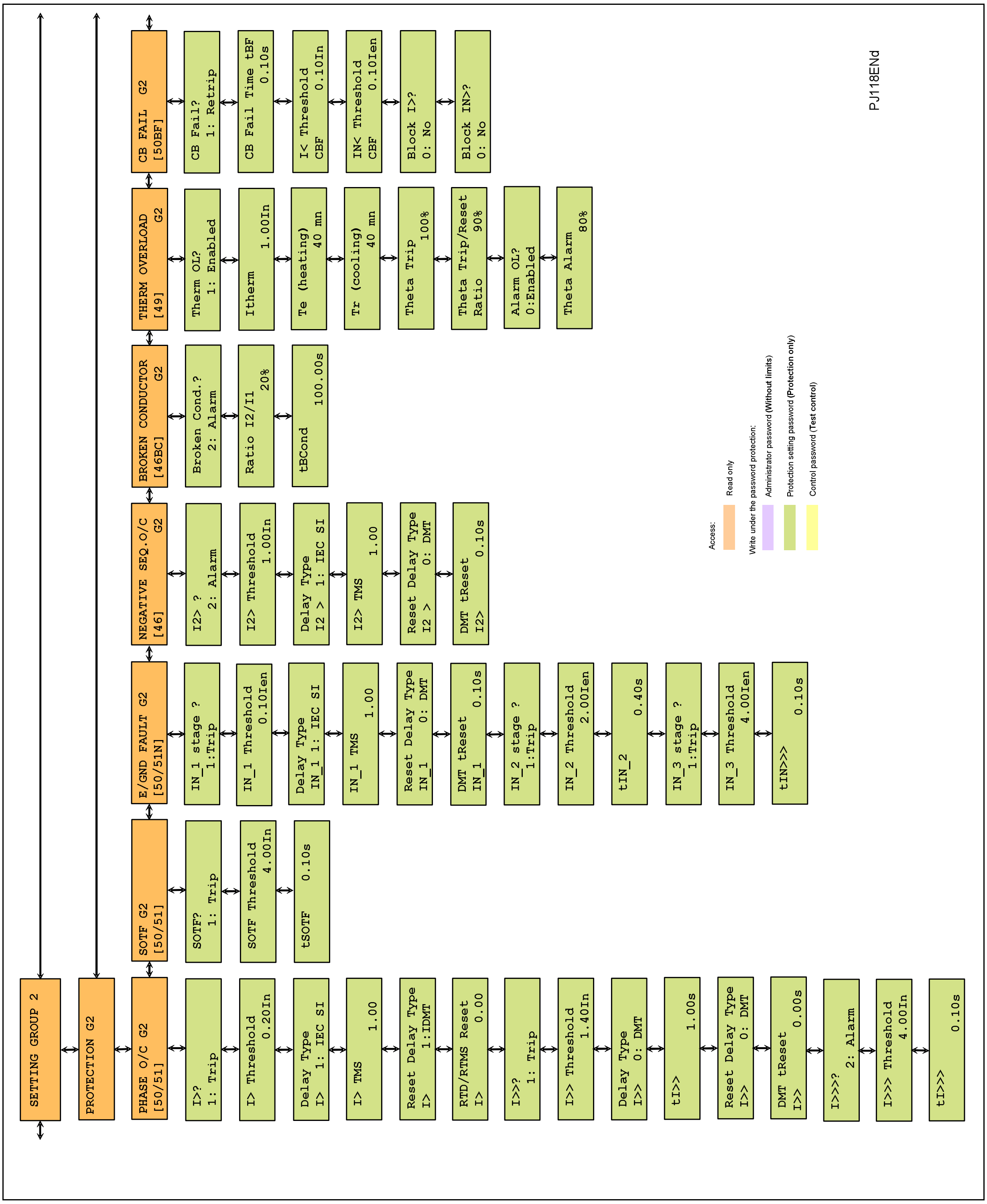

Figure 16: V11F Model E Menu Map part 7

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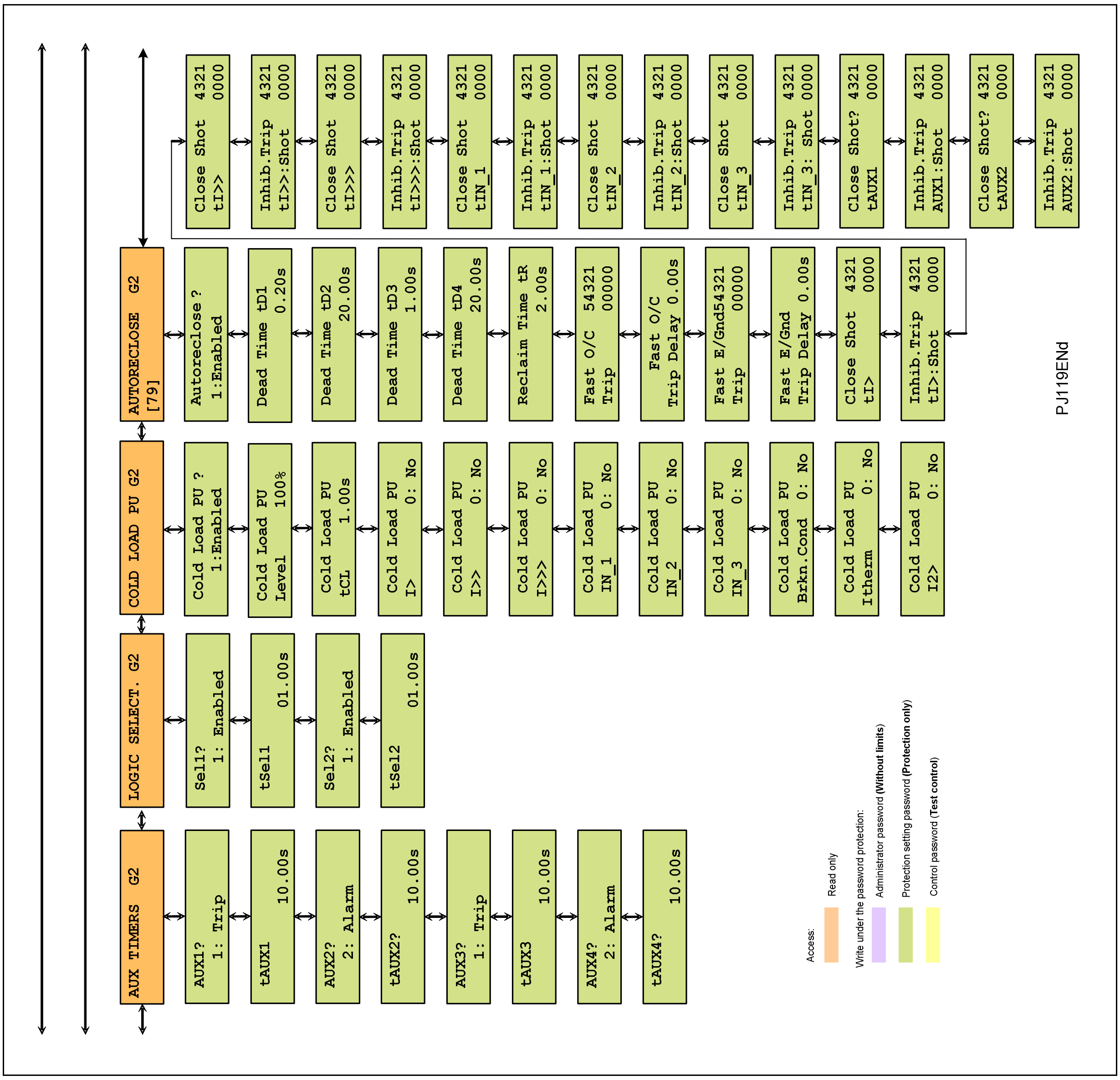


Figure 17: V11F Model E Menu Map part 8

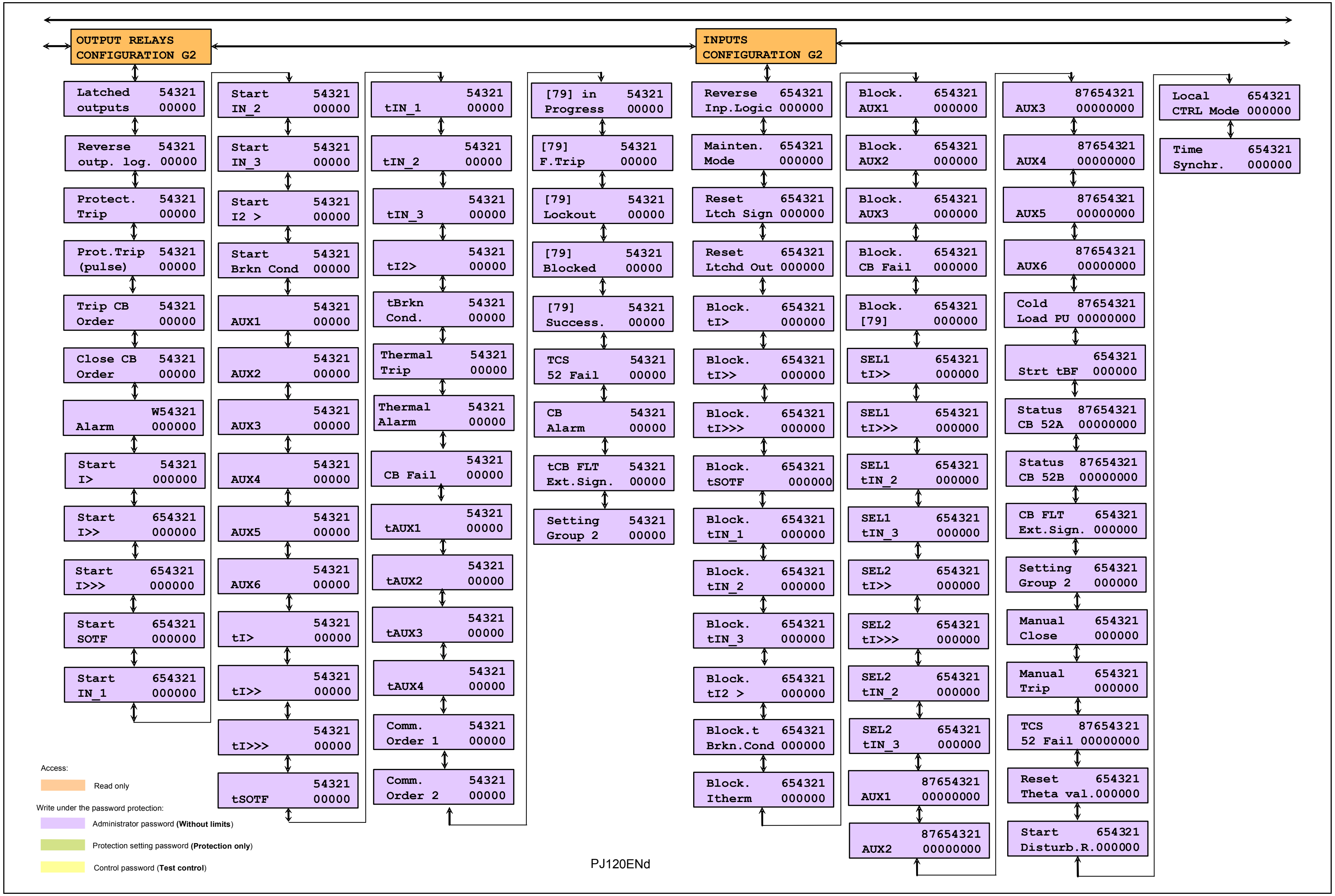


Figure 18: V11F Model E Menu Map part 9

GS

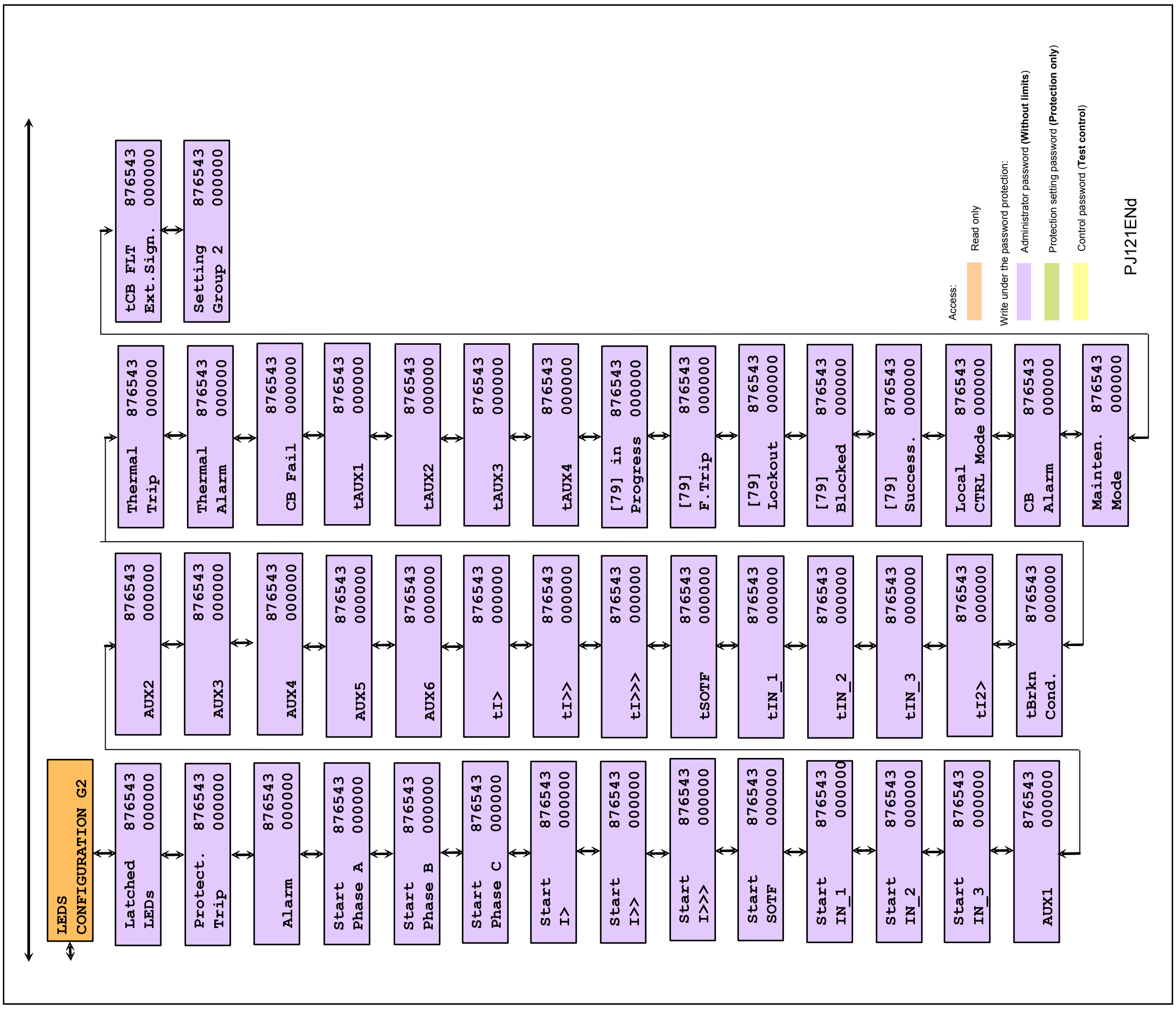


Figure 19: V11F Model E Menu Map part 10

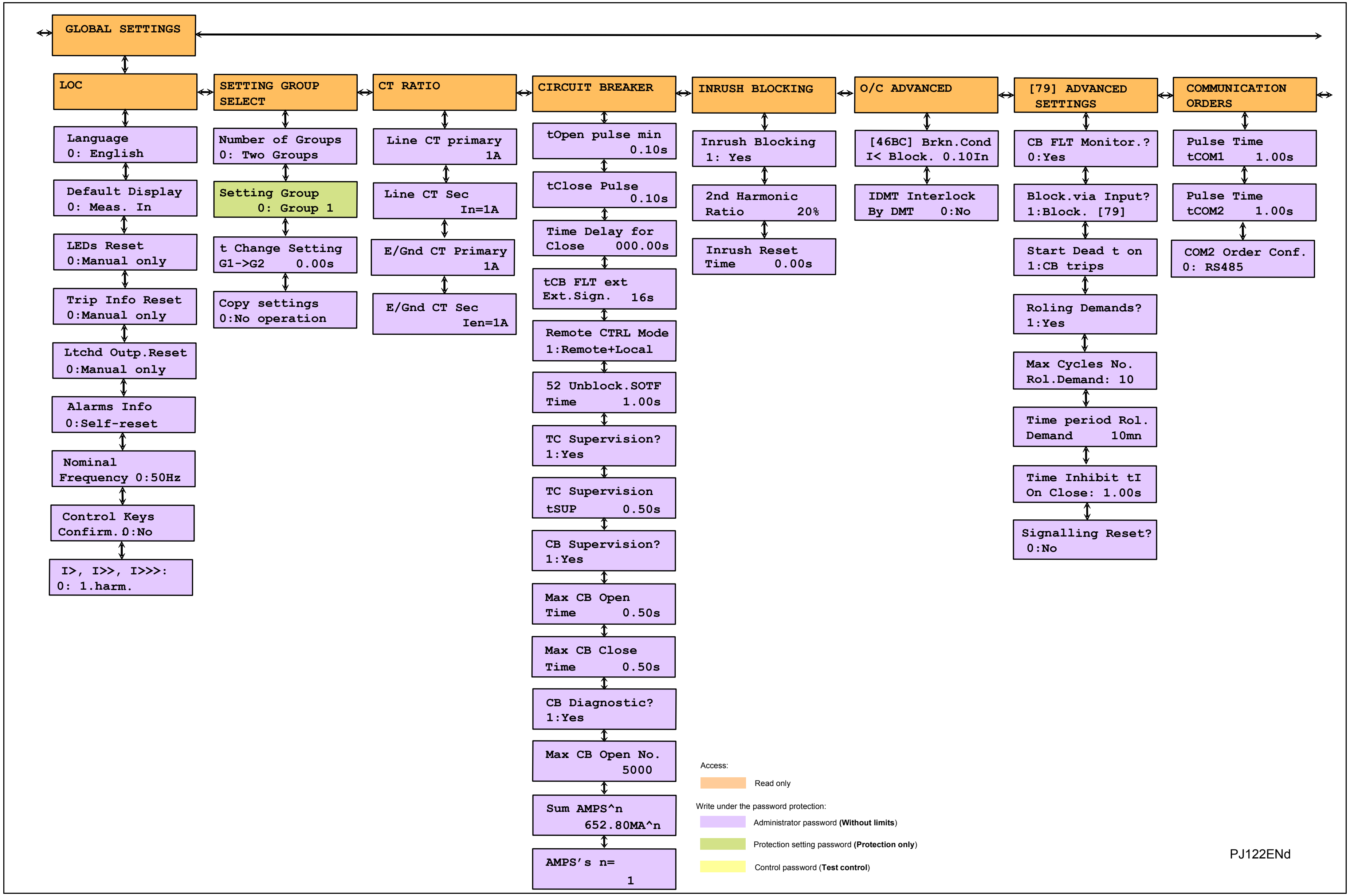


Figure 20: V11F Model E Menu Map part 11

GS

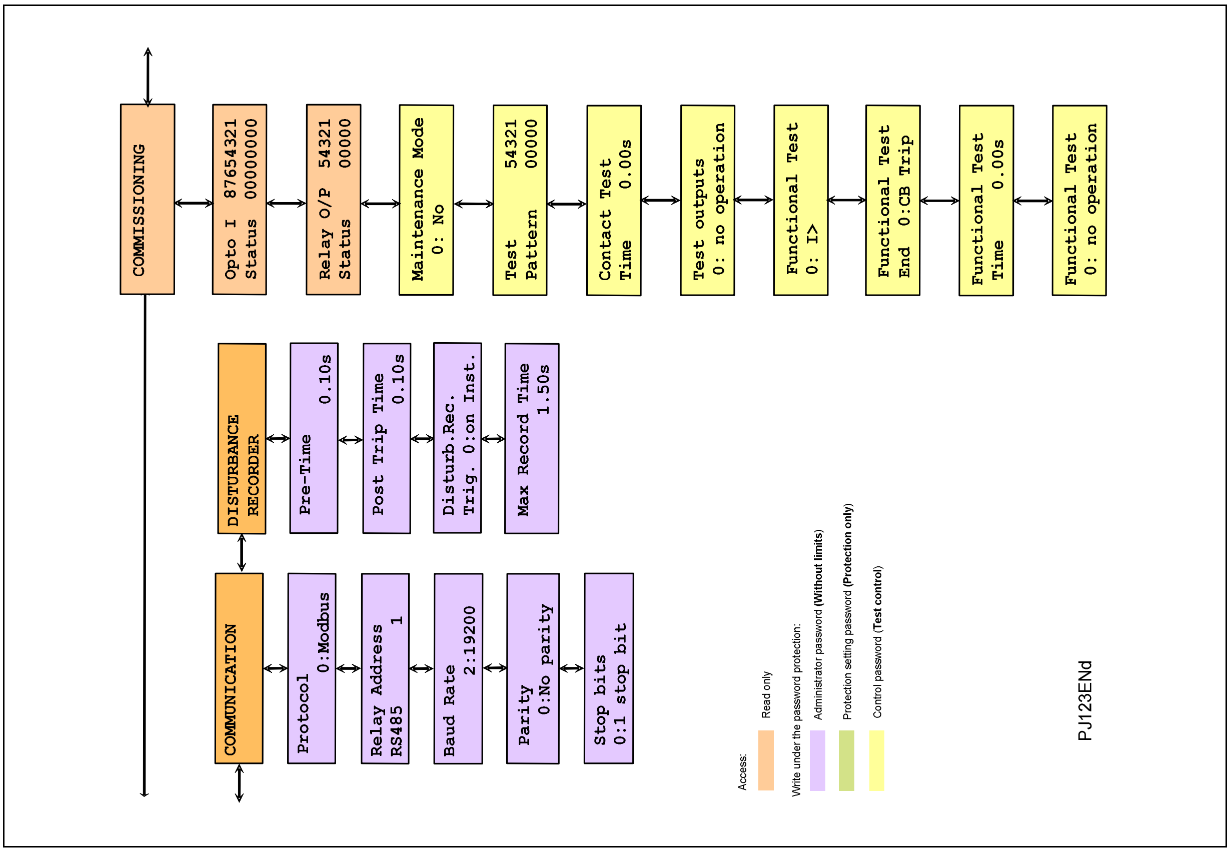


Figure 21: V11F Model E Menu Map part 12

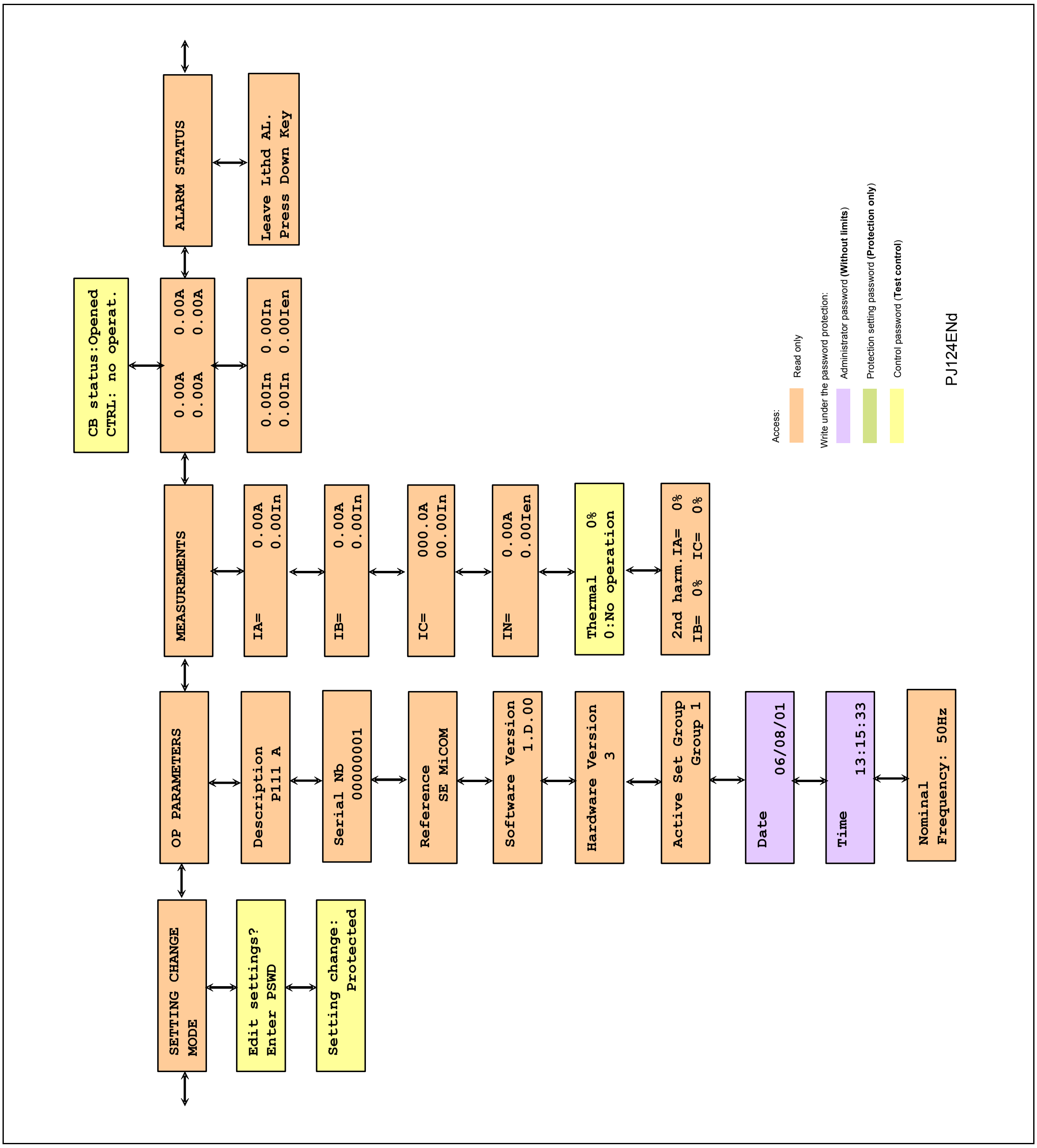


Figure 22: V11F Model A Menu Map part 1

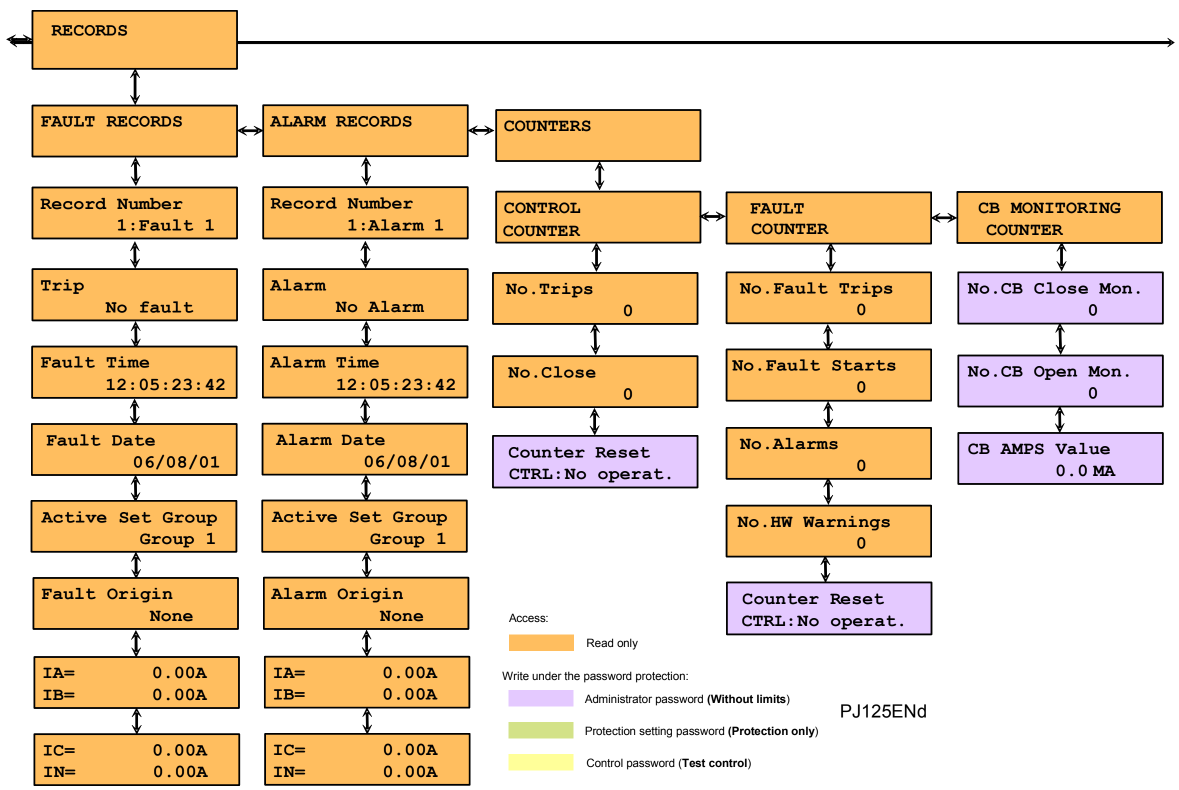


Figure 23: V11F Model A Menu Map part 2

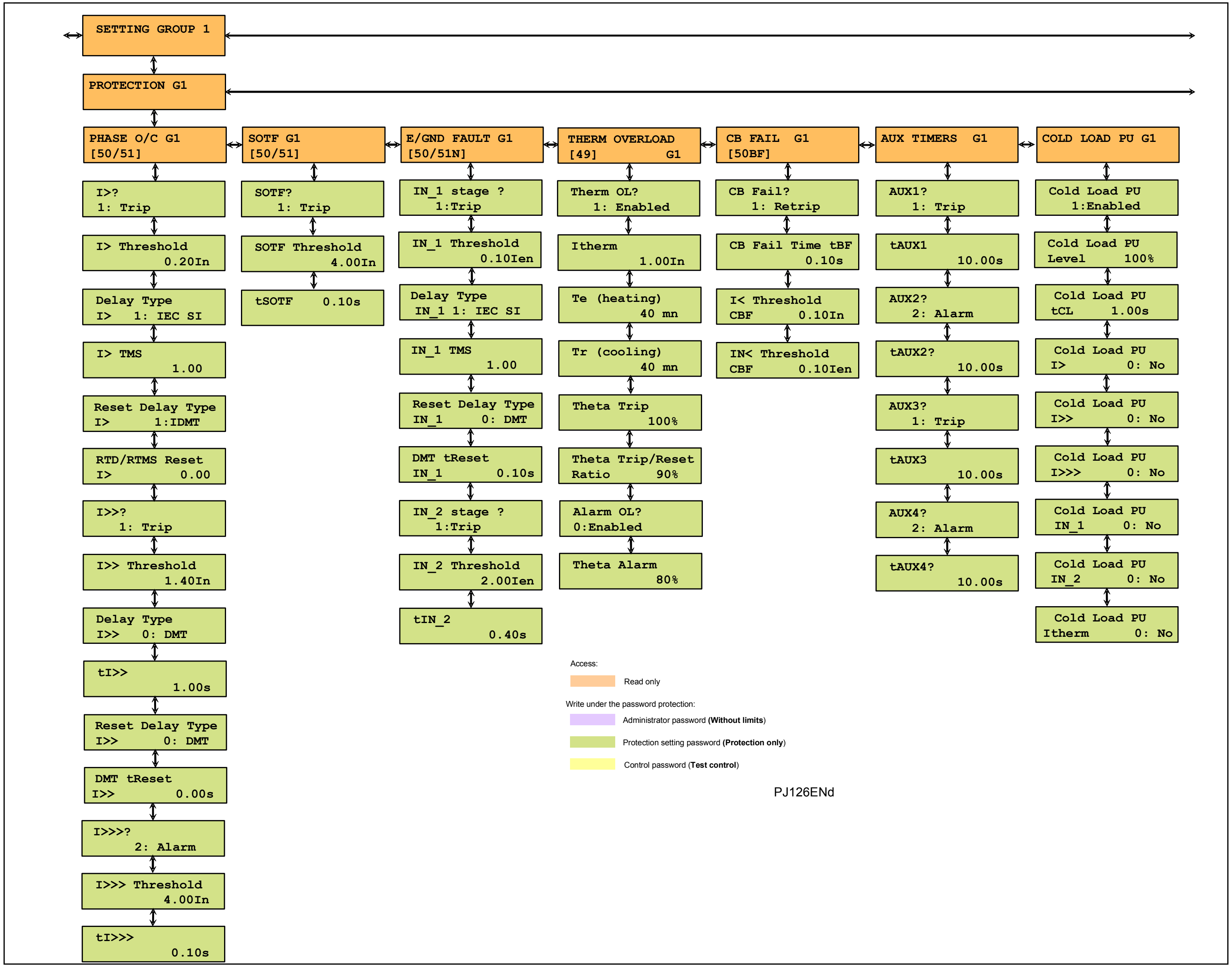
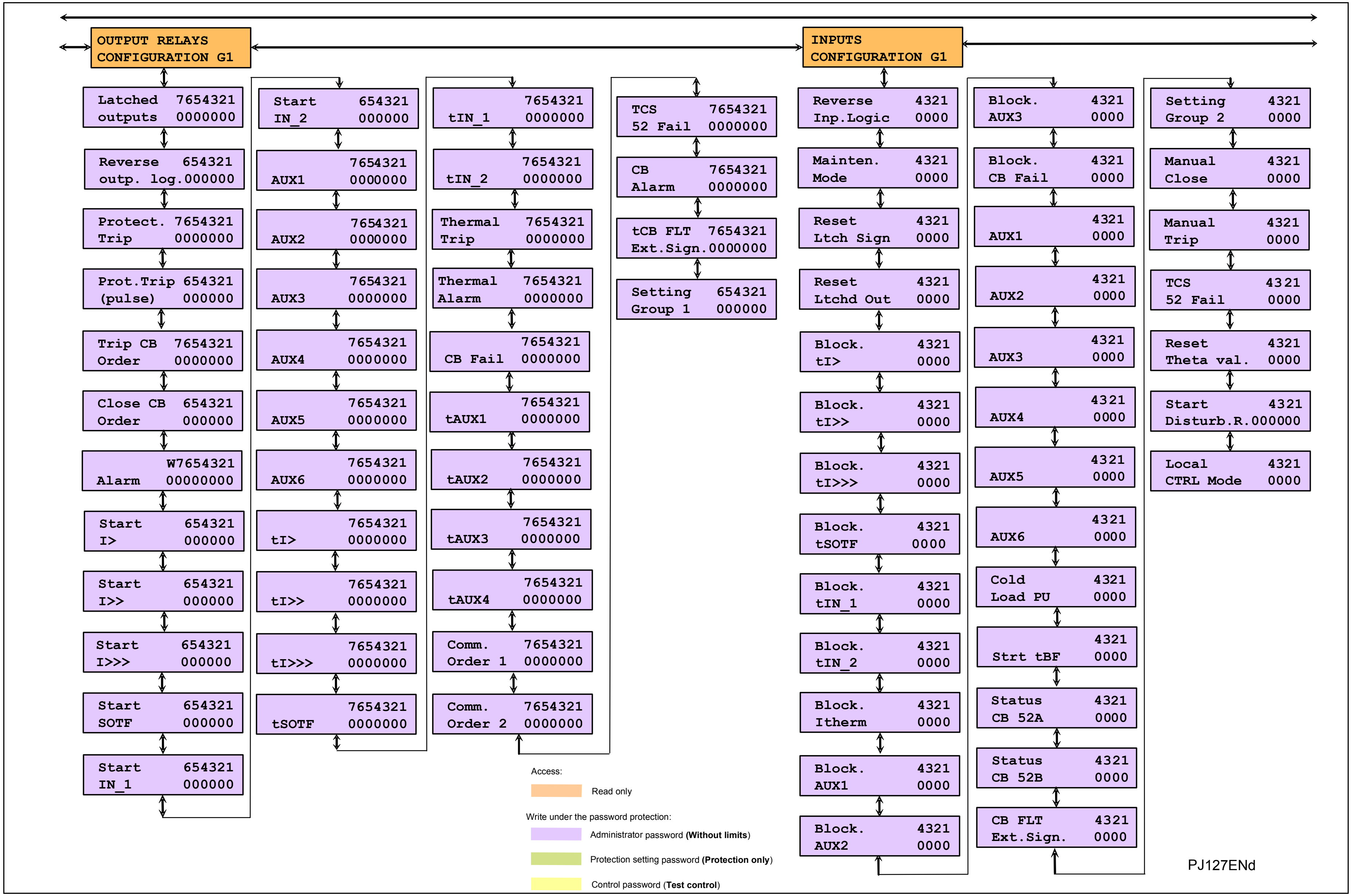


Figure 24: V11F Model A Menu Map part 3

Figure 25: V11F Model A Menu Map part 4



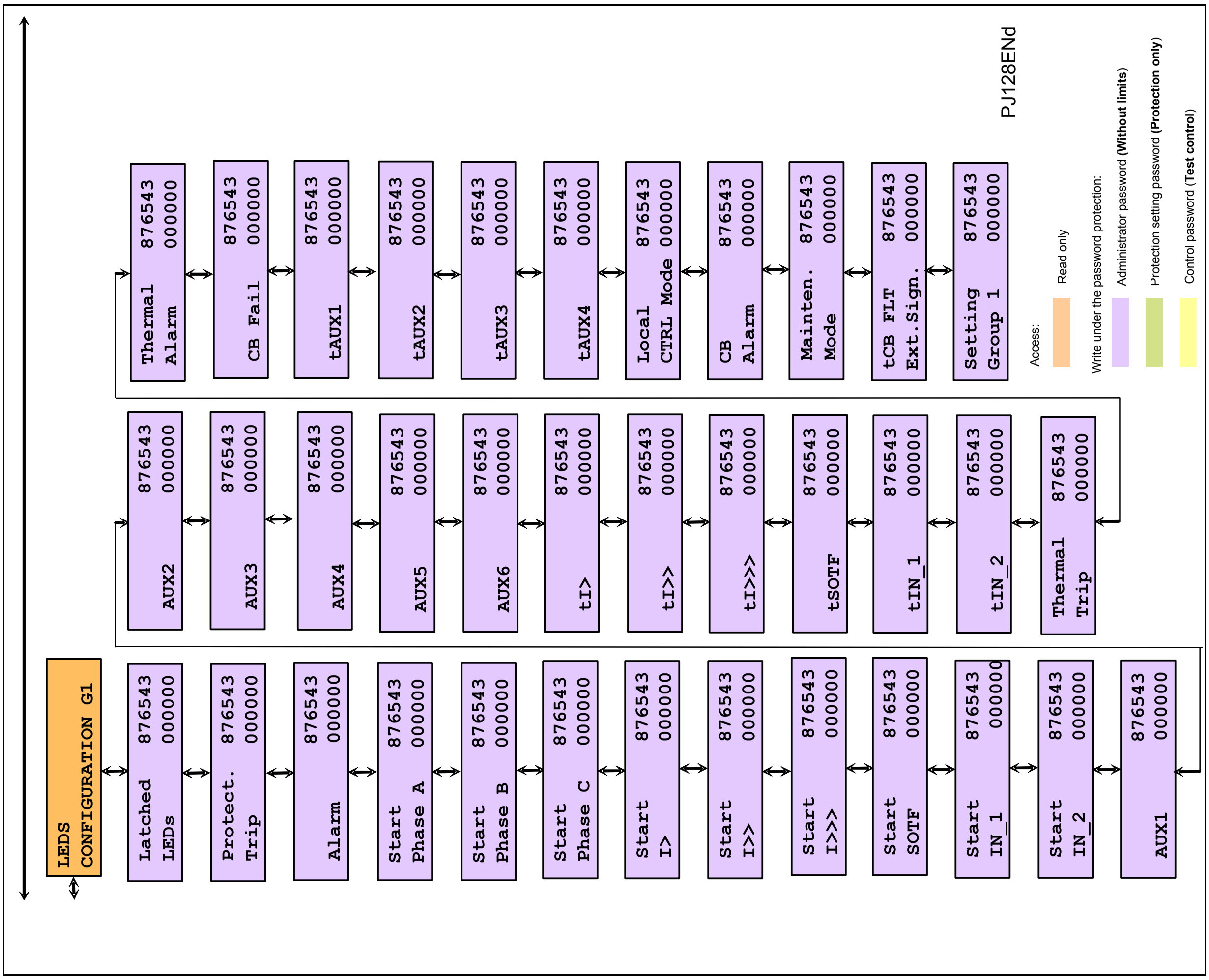


Figure 26: V11F Model A Menu Map part 5

Figure 27: V11F Model A Menu Map part 6

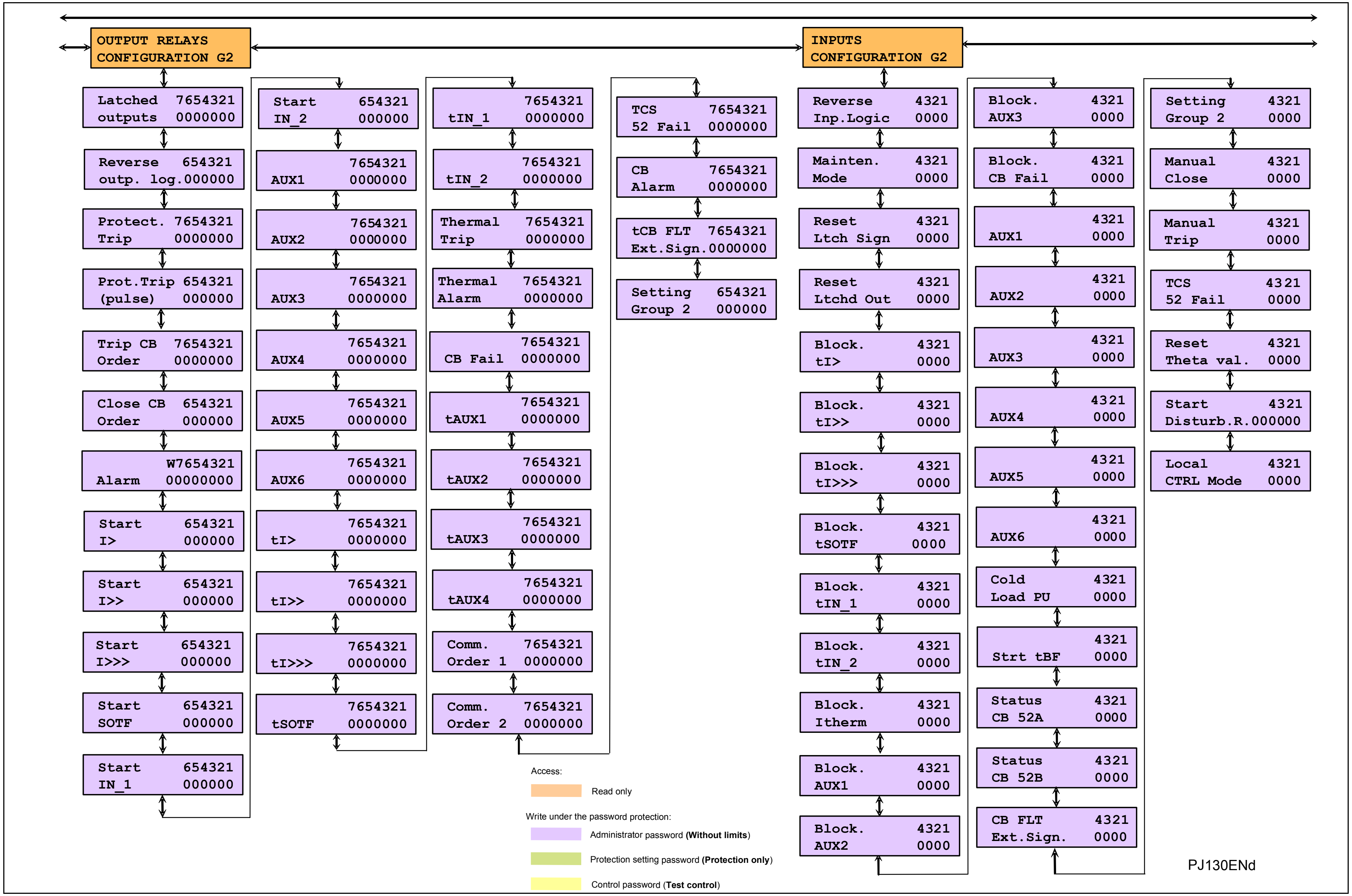


Figure 28: V11F Model A Menu Map part 7

GS

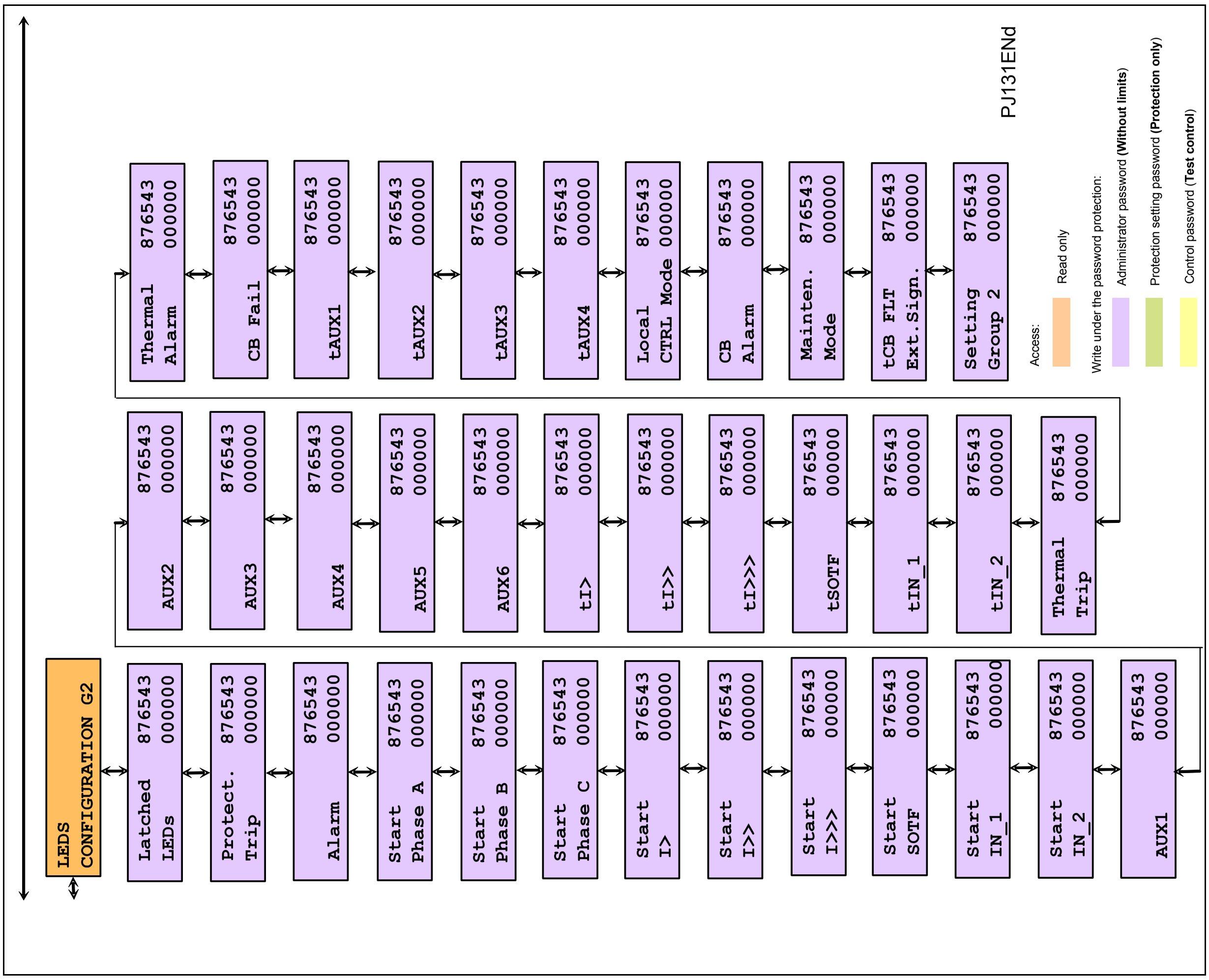
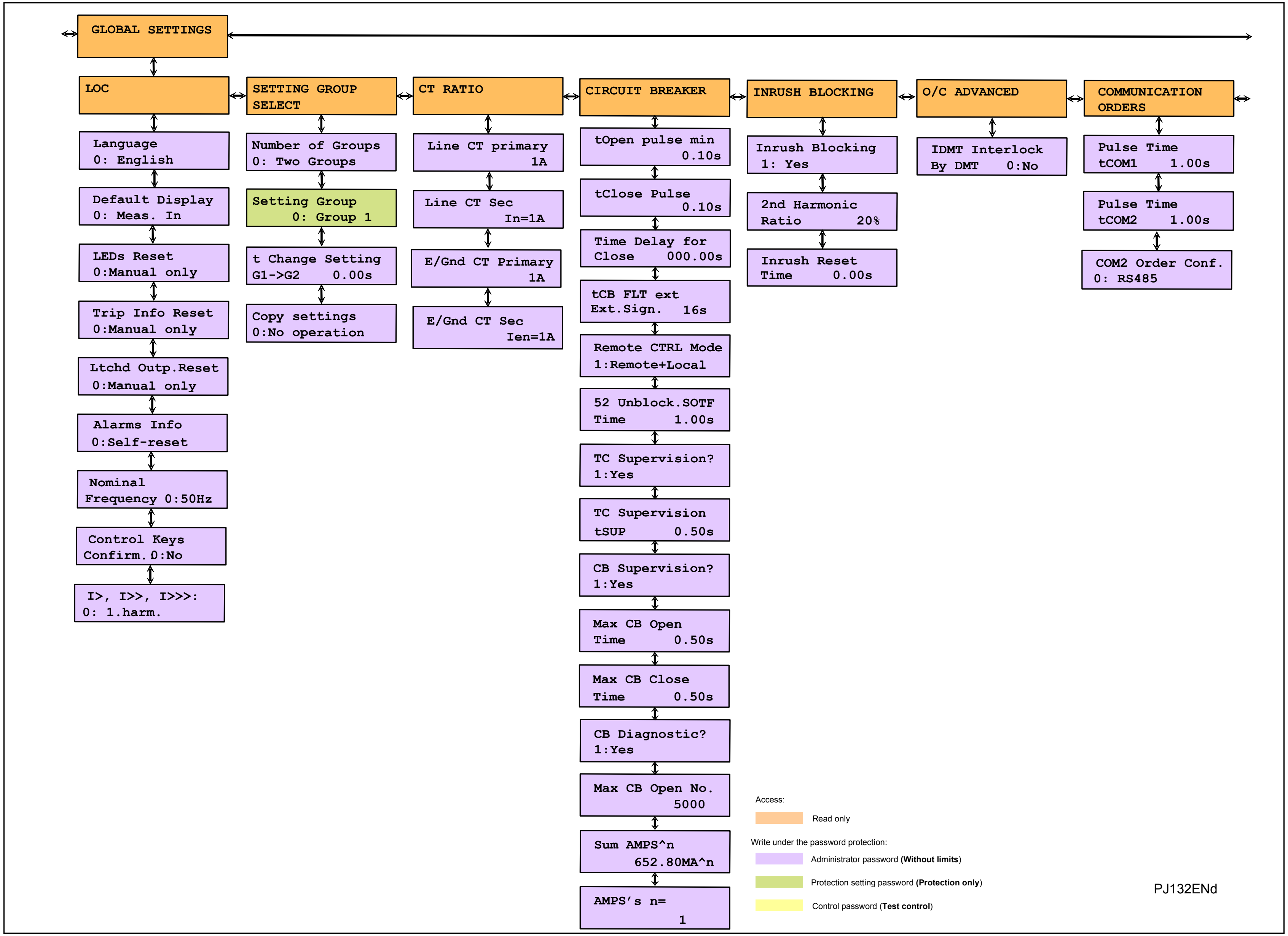


Figure 29: V11F Model A Menu Map part 8

Figure 30: V11F Model A Menu Map part 9



GS

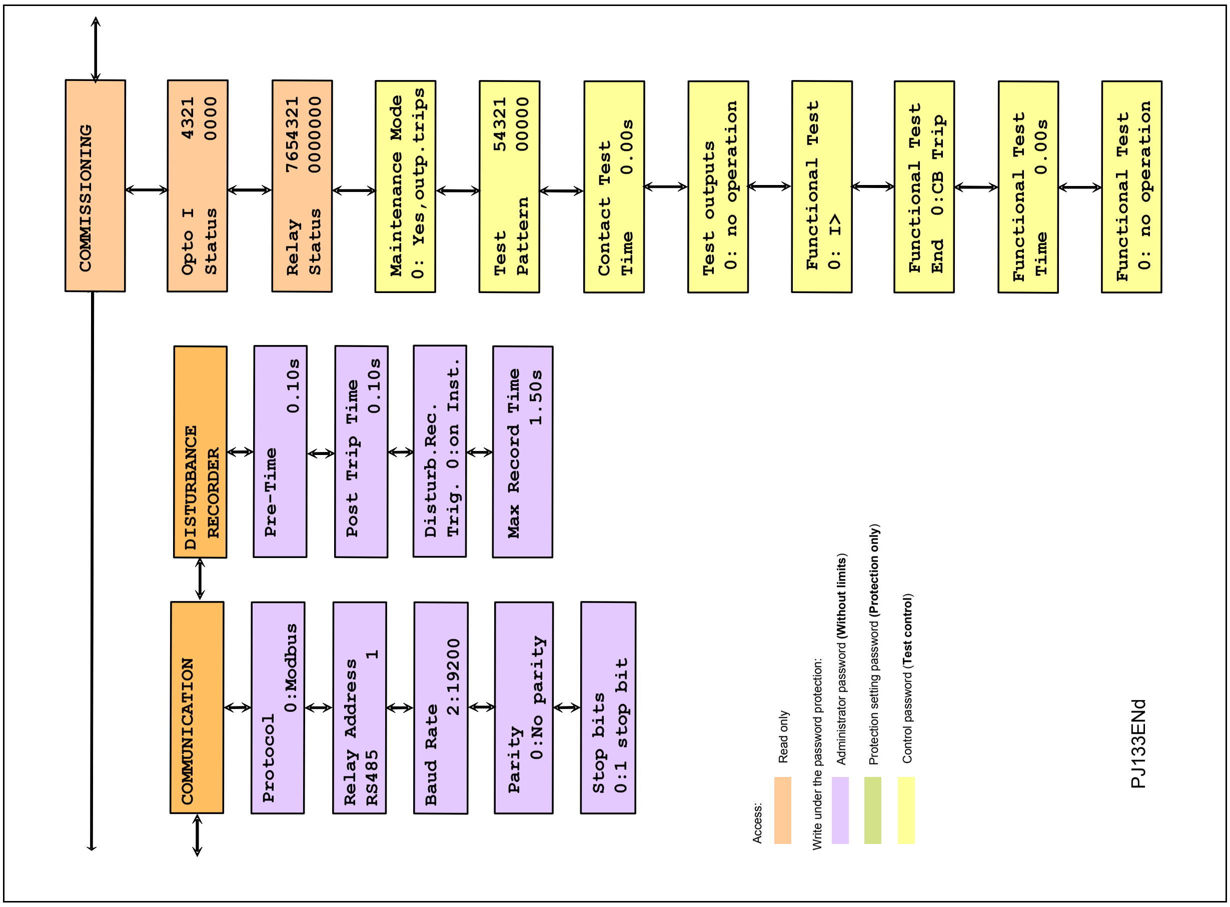


Figure 31: V11F Model A Menu Map part 10

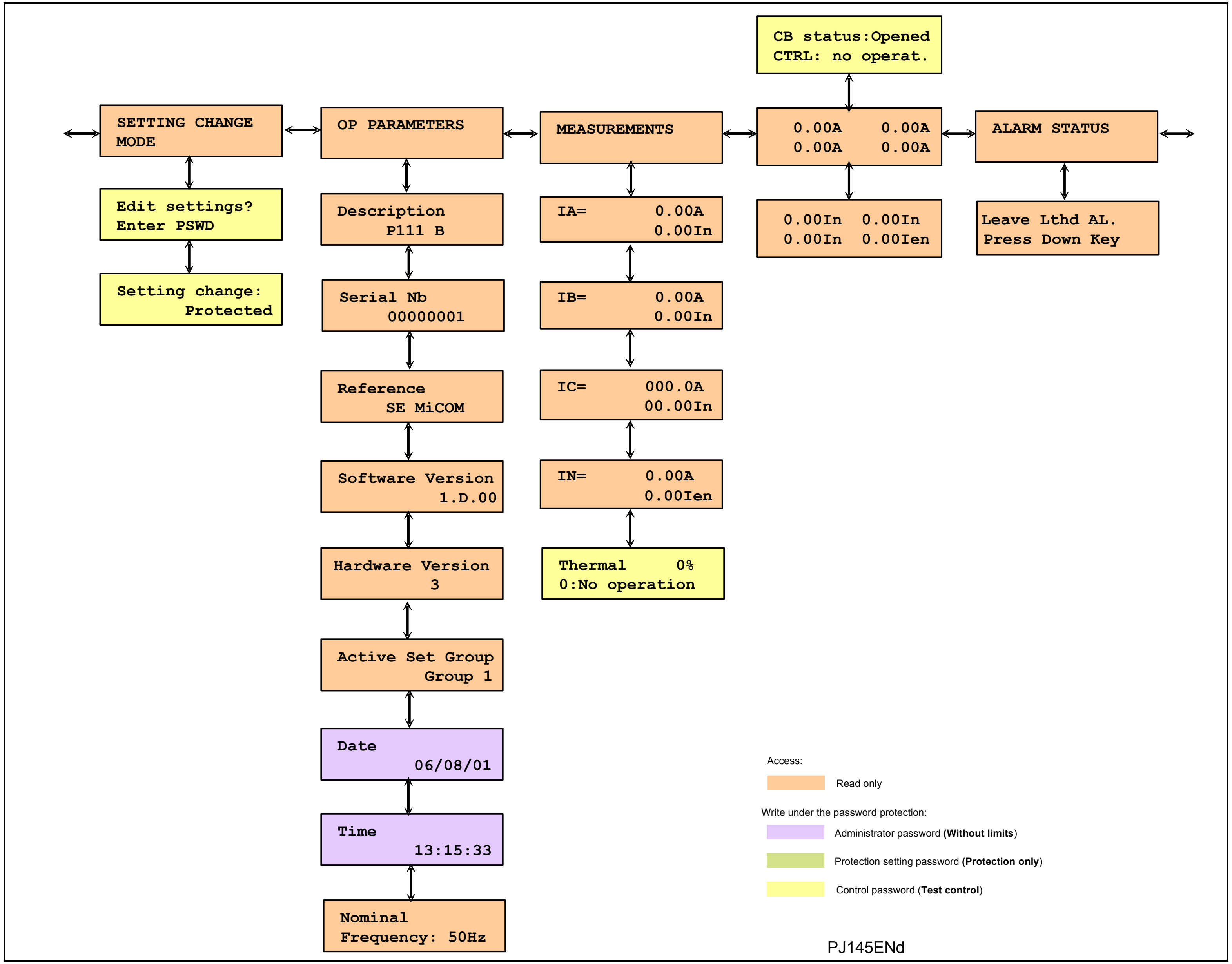


Figure 32: V11F Model B Menu Map part 1

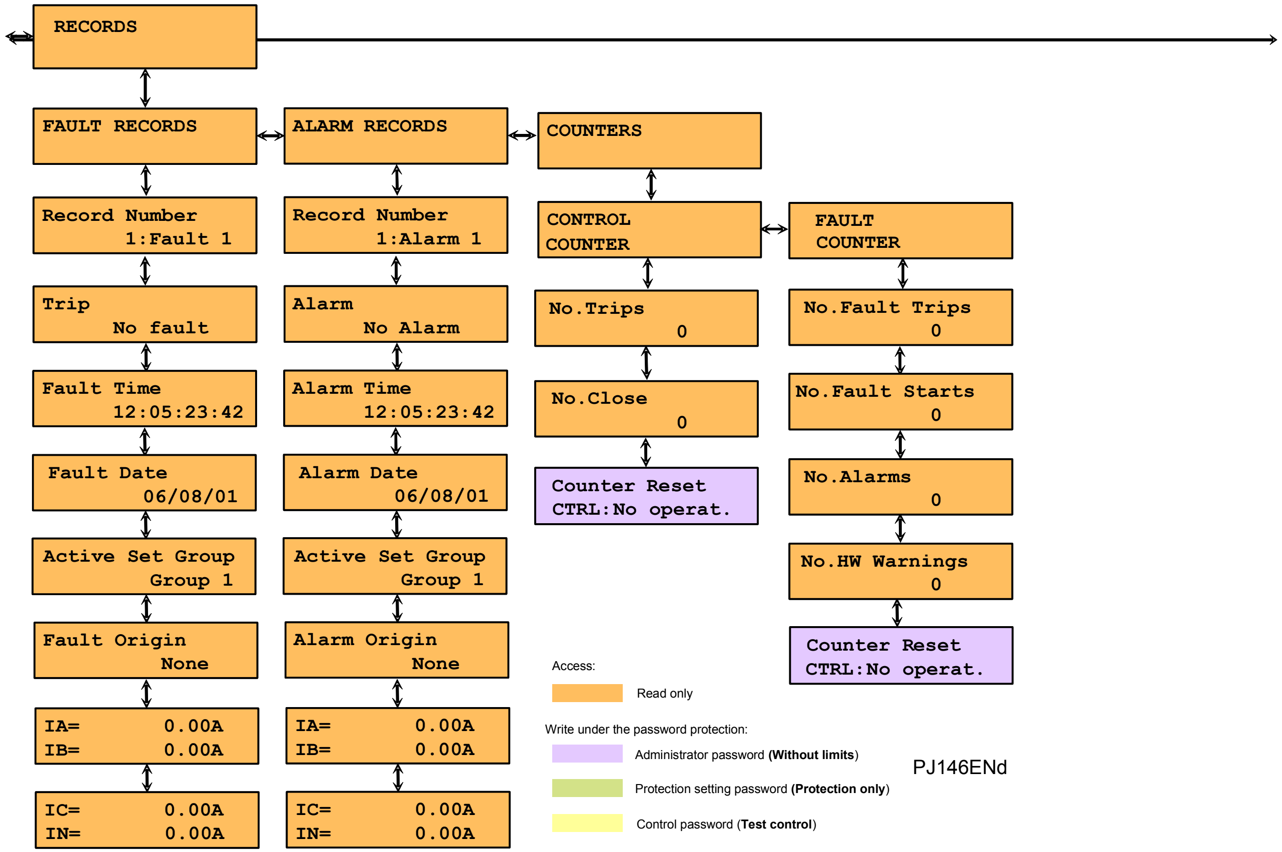


Figure 33: V11F Model **B** Menu Map part 2

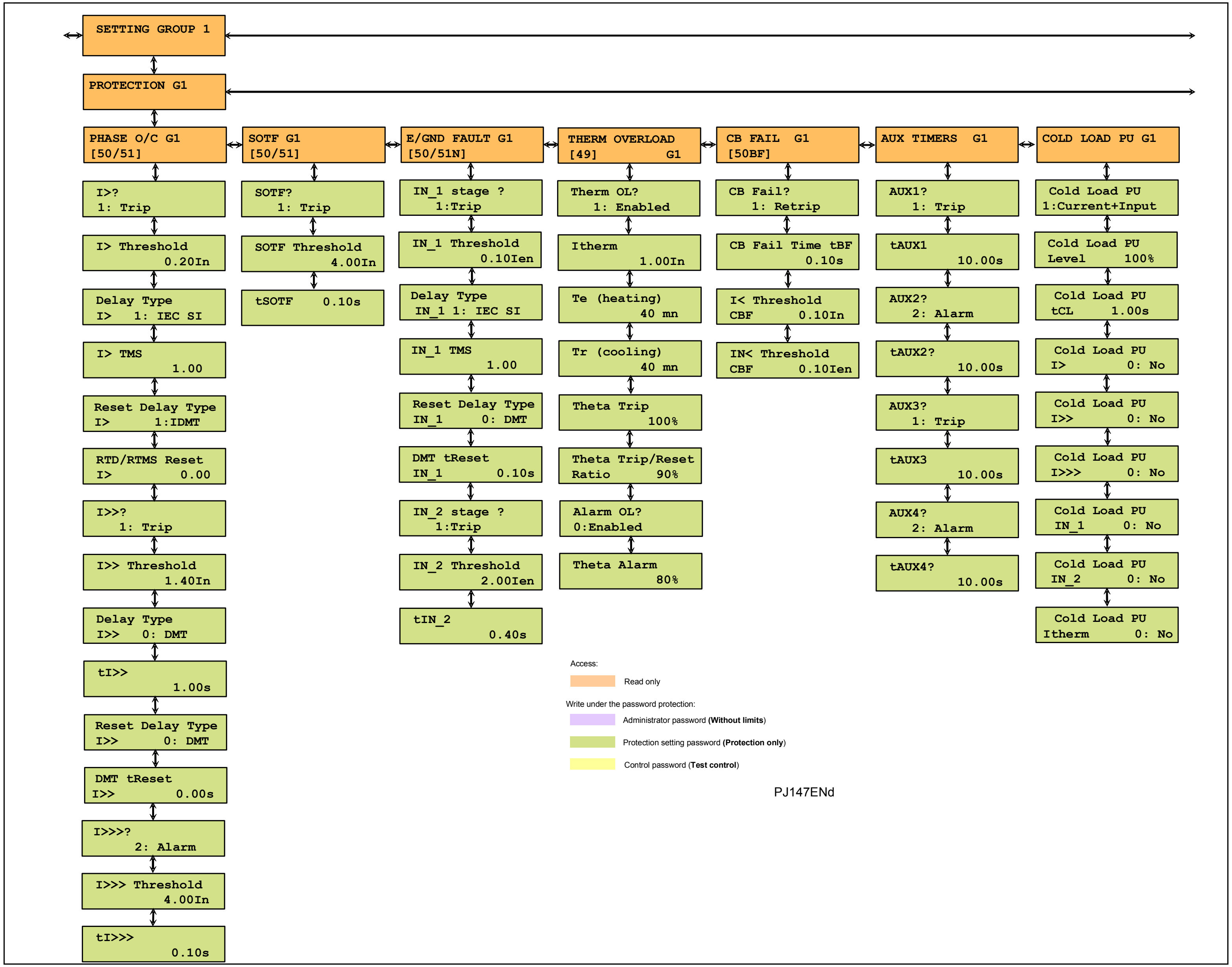
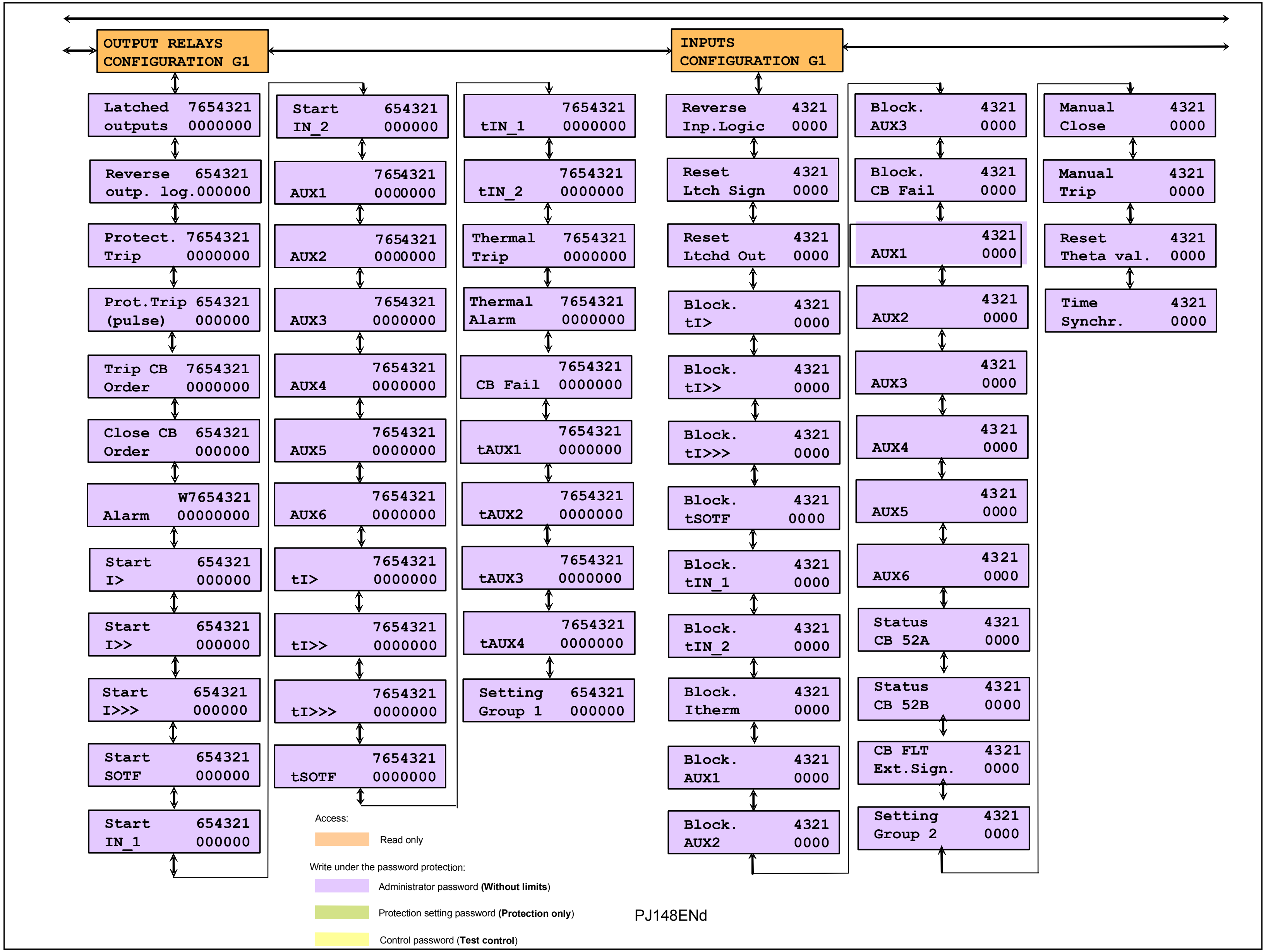


Figure 34: V11F Model B Menu Map part 3

Figure 35: V11F Model B Menu Map part 4



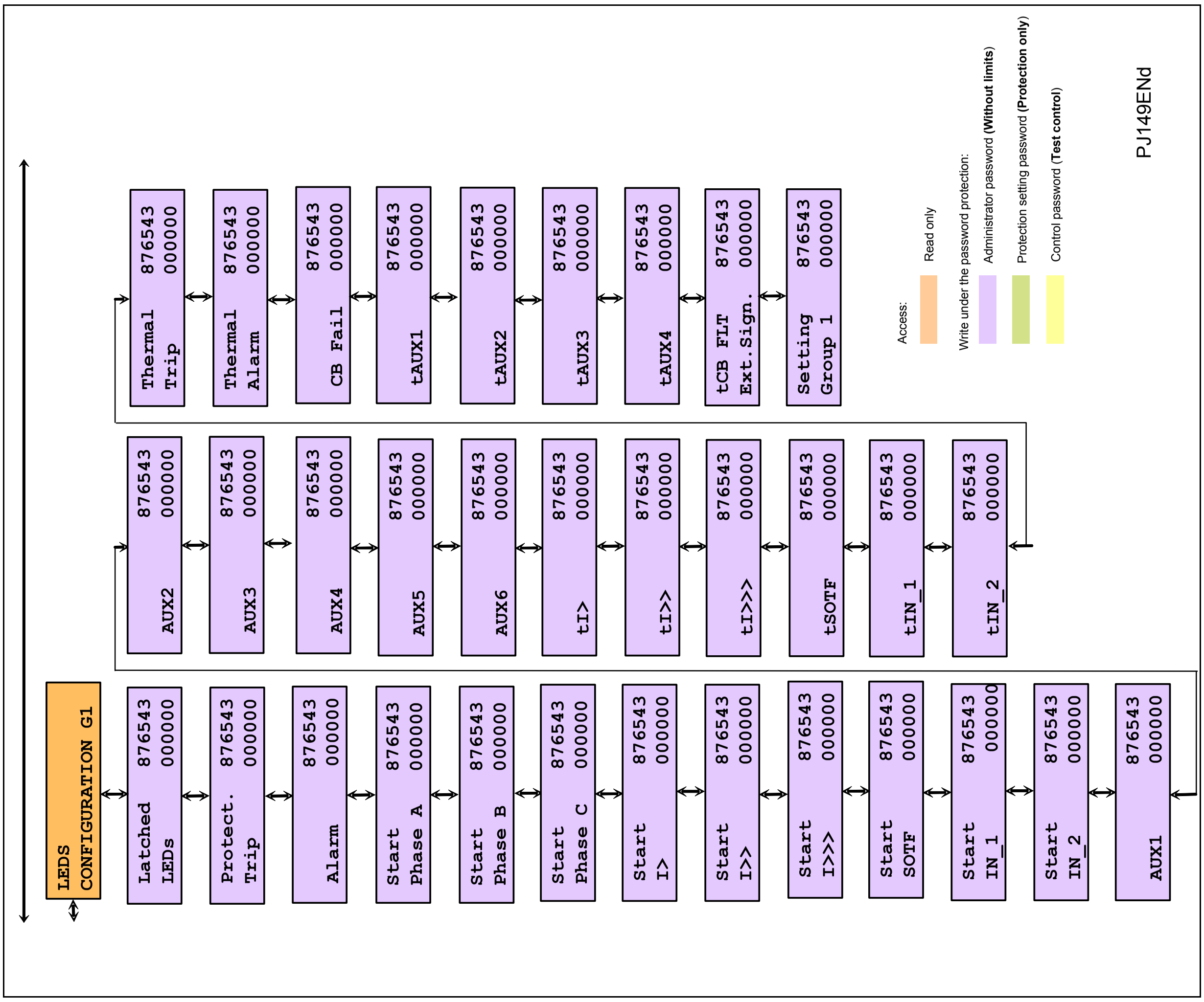


Figure 36: V11F Model B Menu Map part 5

GS

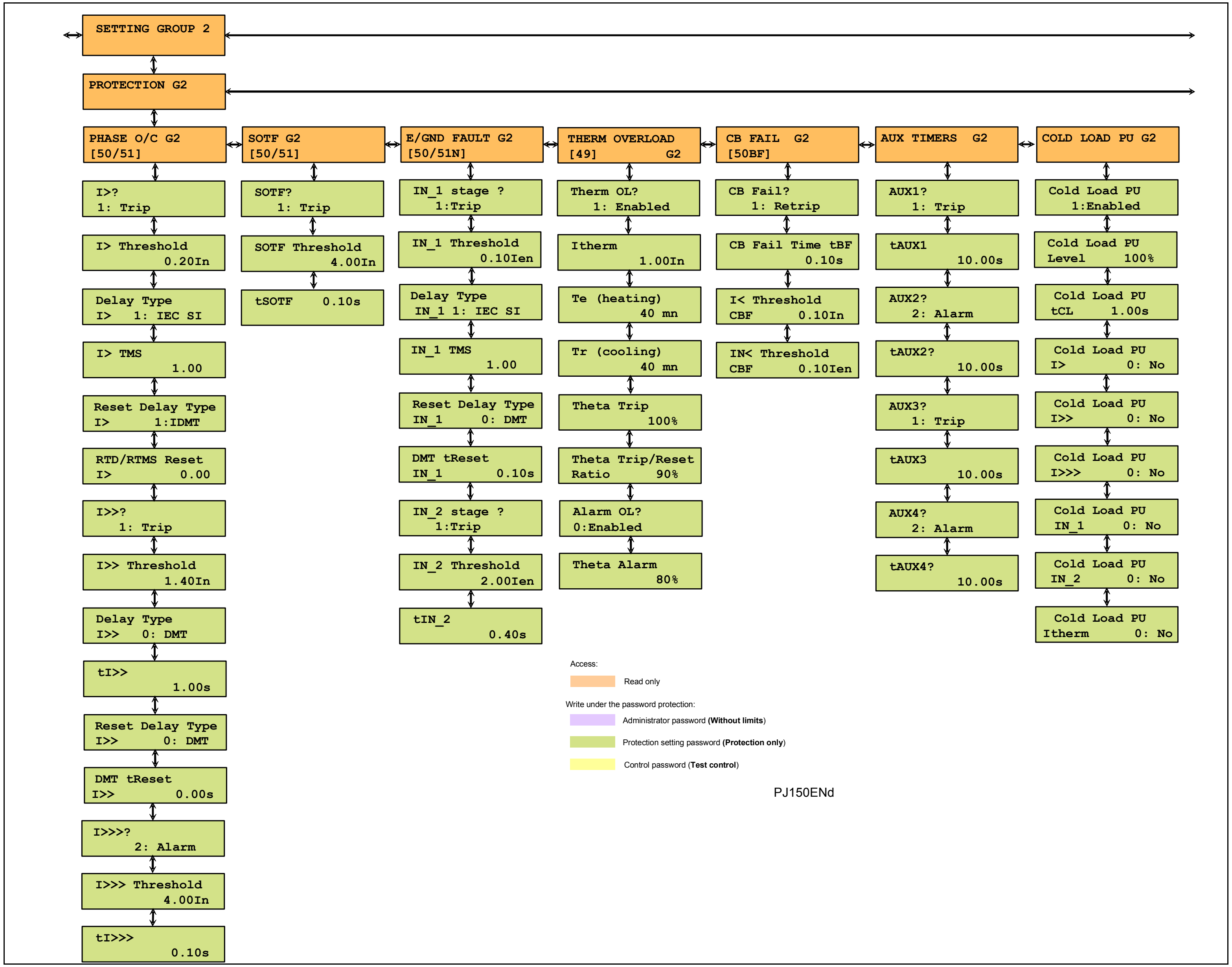


Figure 37: V11F Model B Menu Map part 6

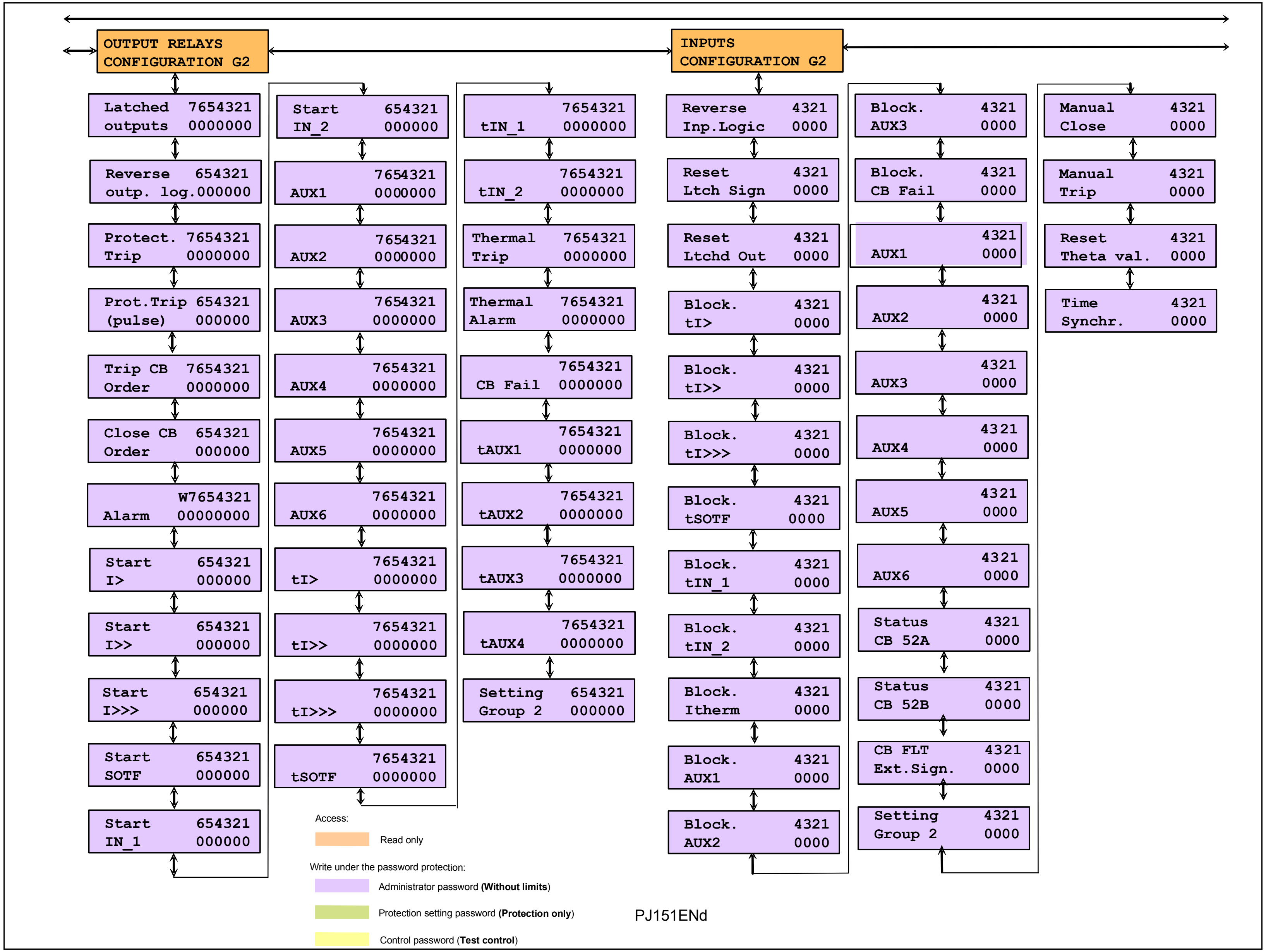


Figure 38: V11F Model B Menu Map part 7

GS

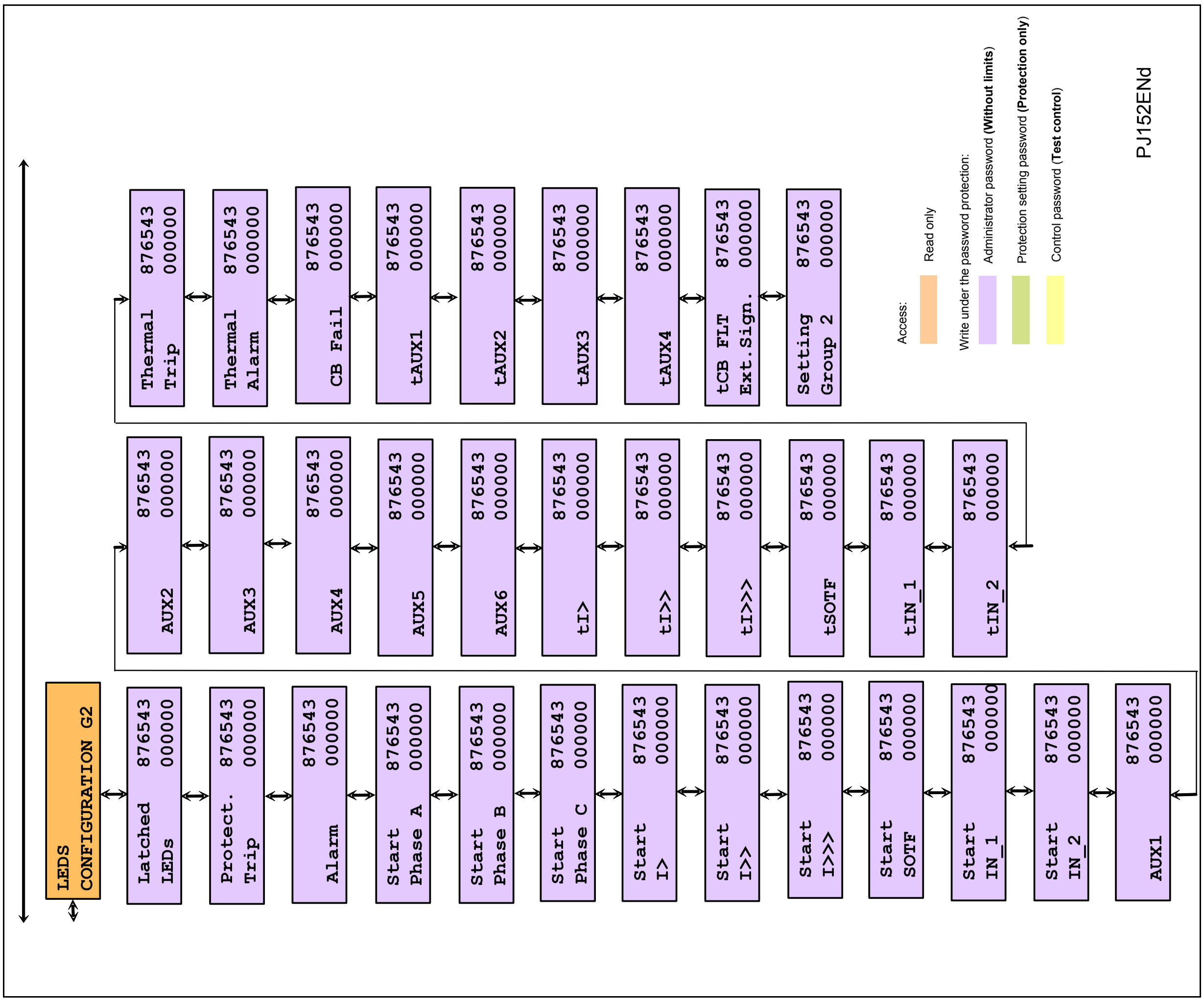


Figure 39: V11F Model B Menu Map part 8

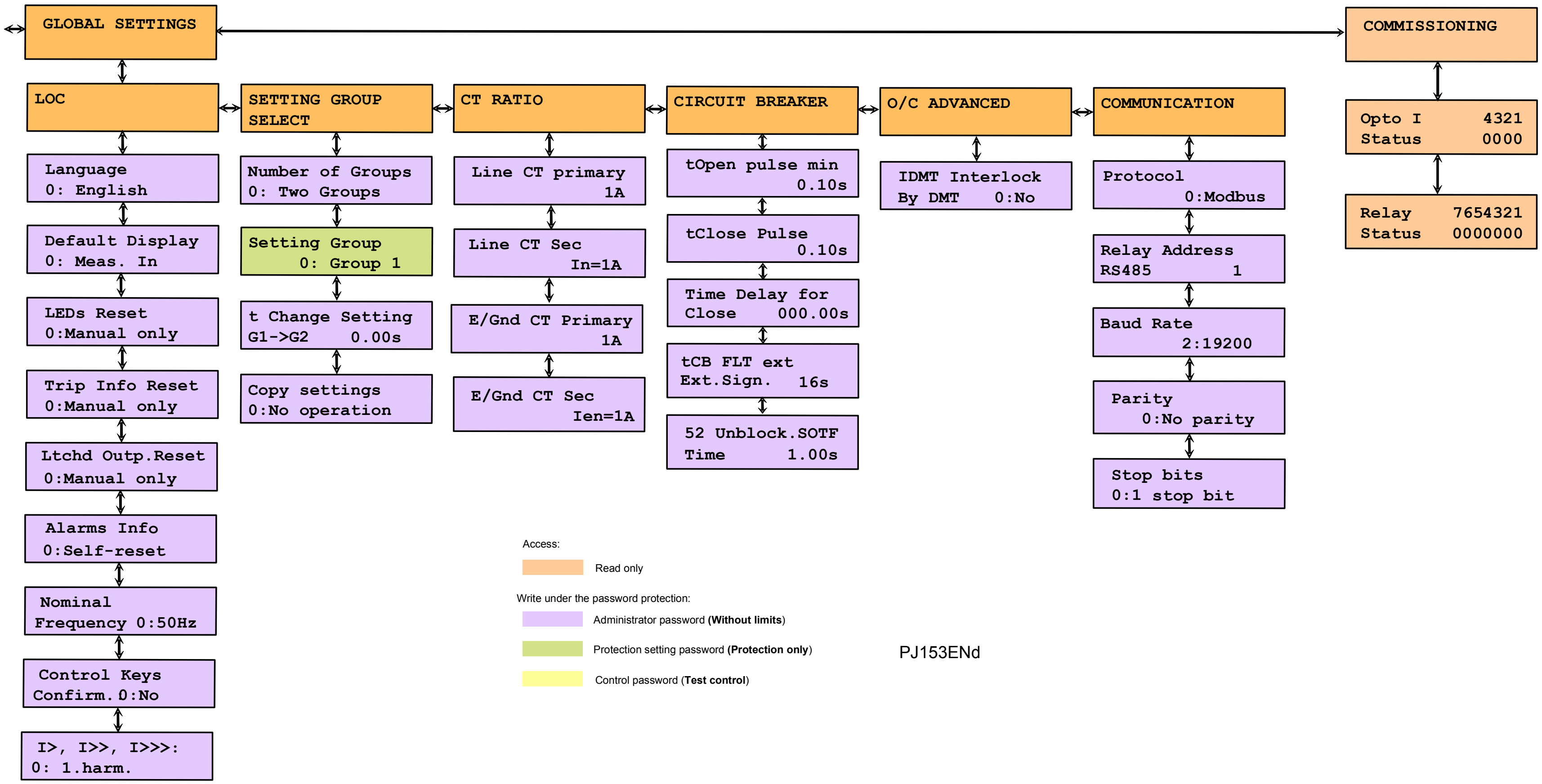


Figure 40: V11F Model B Menu Map part 9

GS

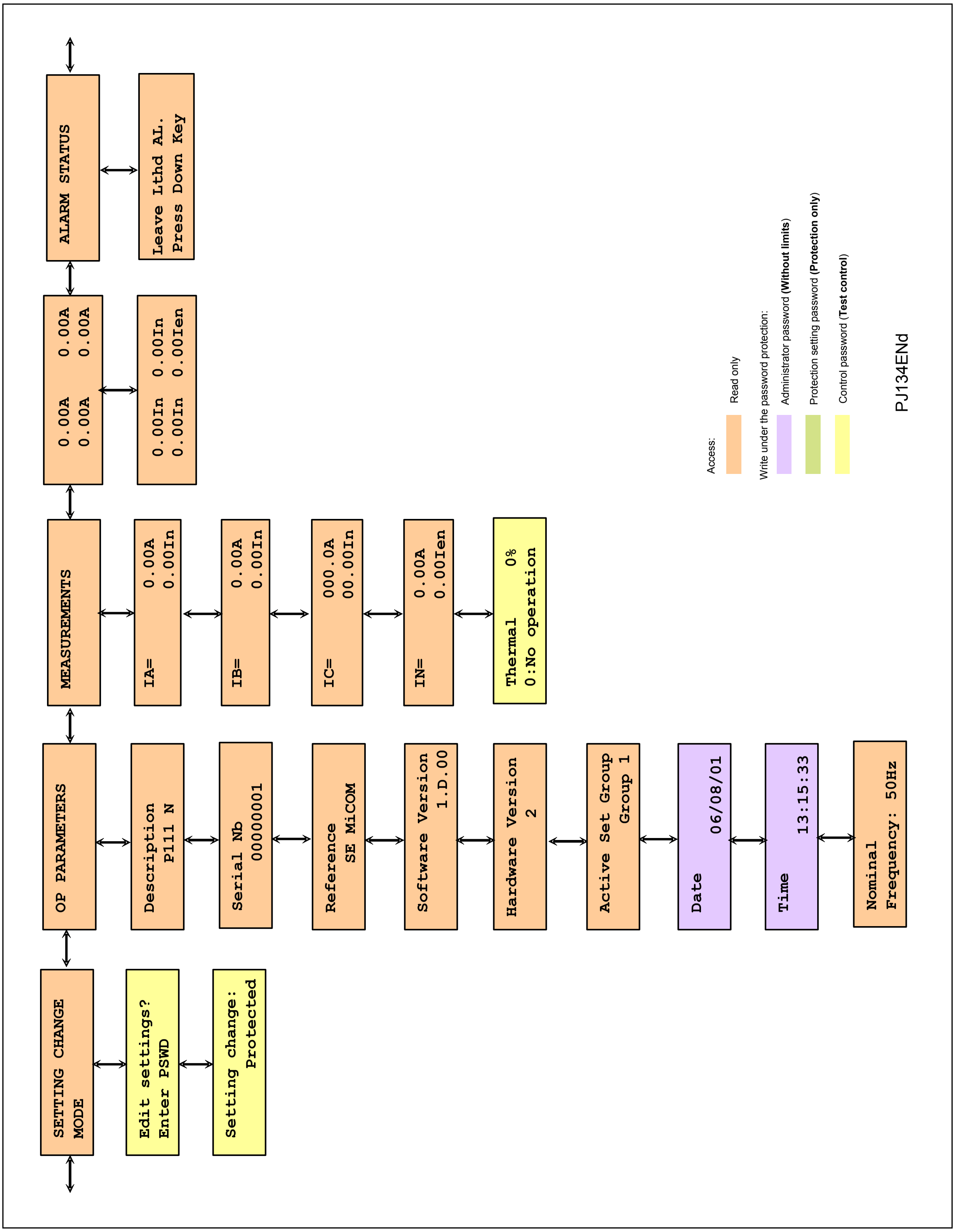


Figure 41: V11F Model N Menu Map part 1

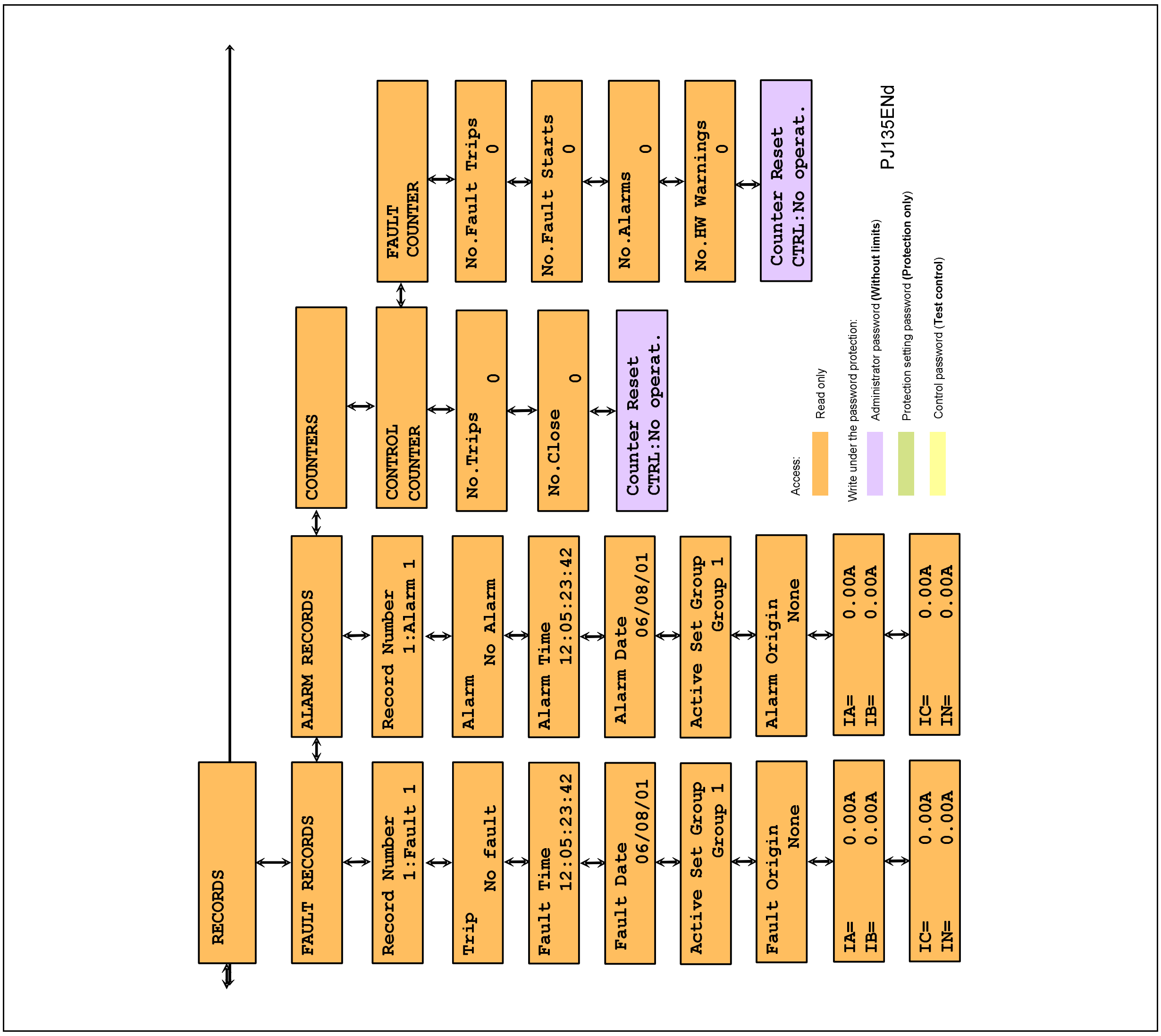


Figure 42: V11F Model N Menu Map part 2

GS

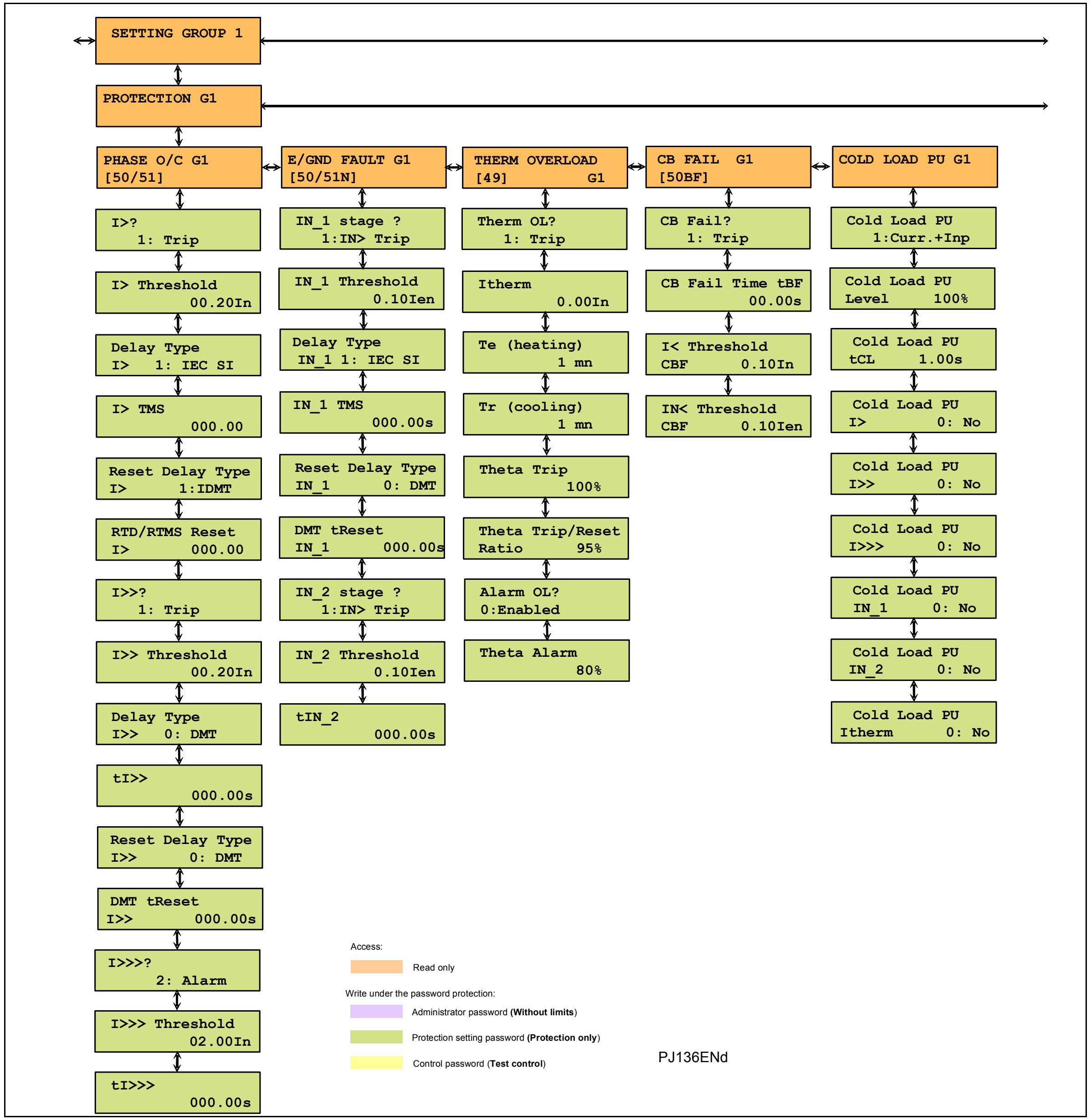


Figure 43: V11F Model N Menu Map part 3

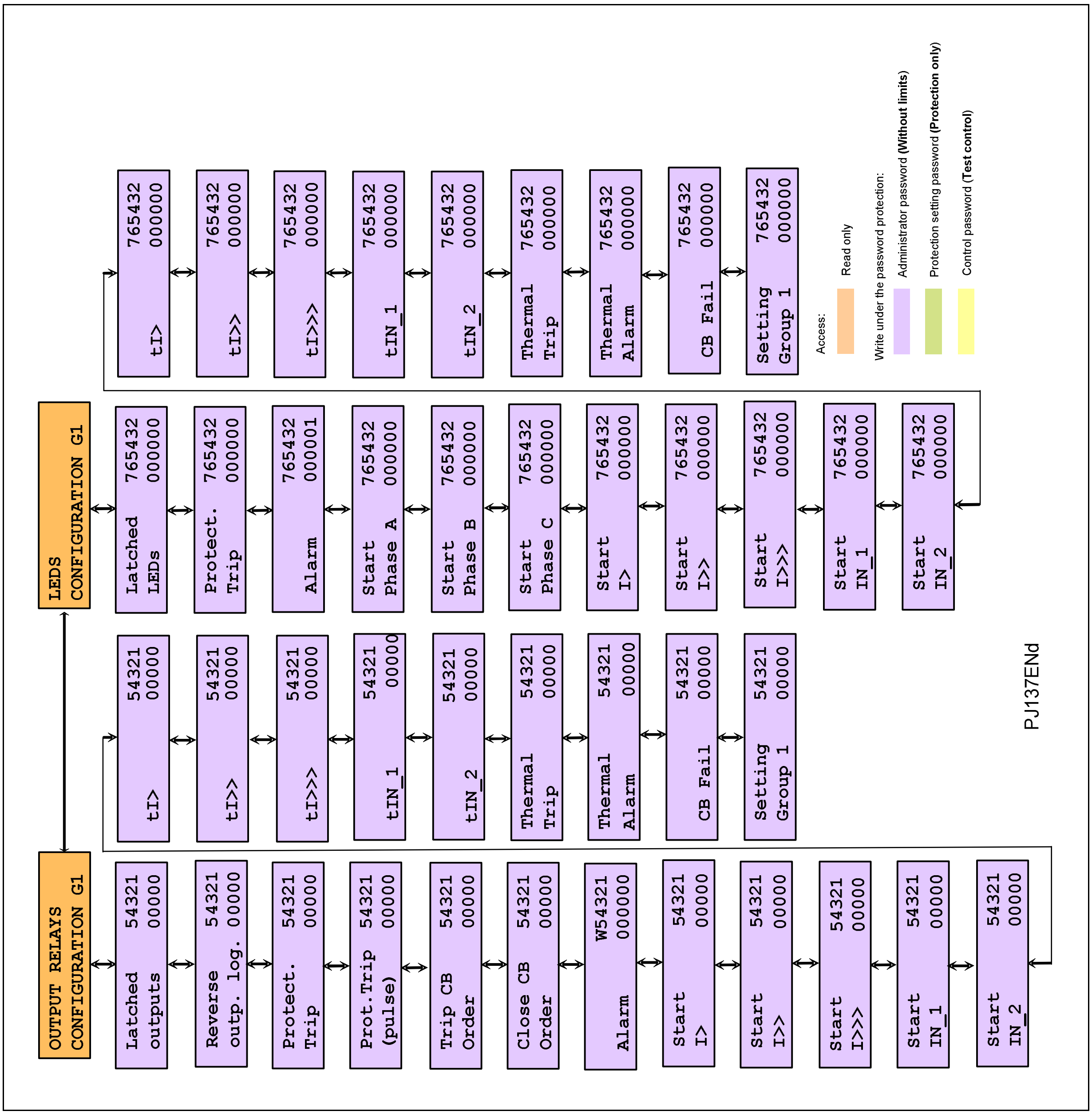


Figure 44: V11F Model N Menu Map part 4

GS

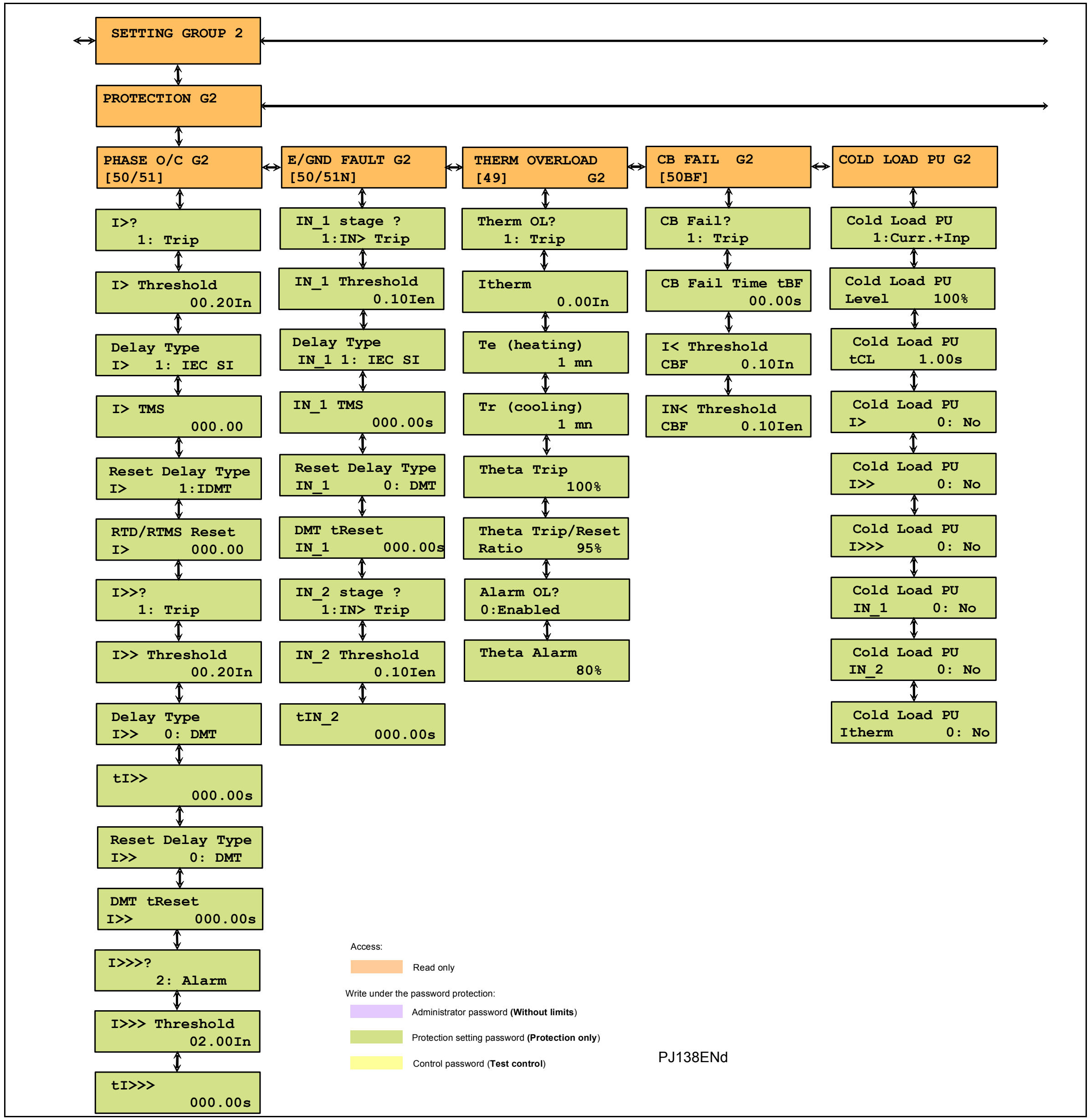


Figure 45: V11F Model N Menu Map part 5

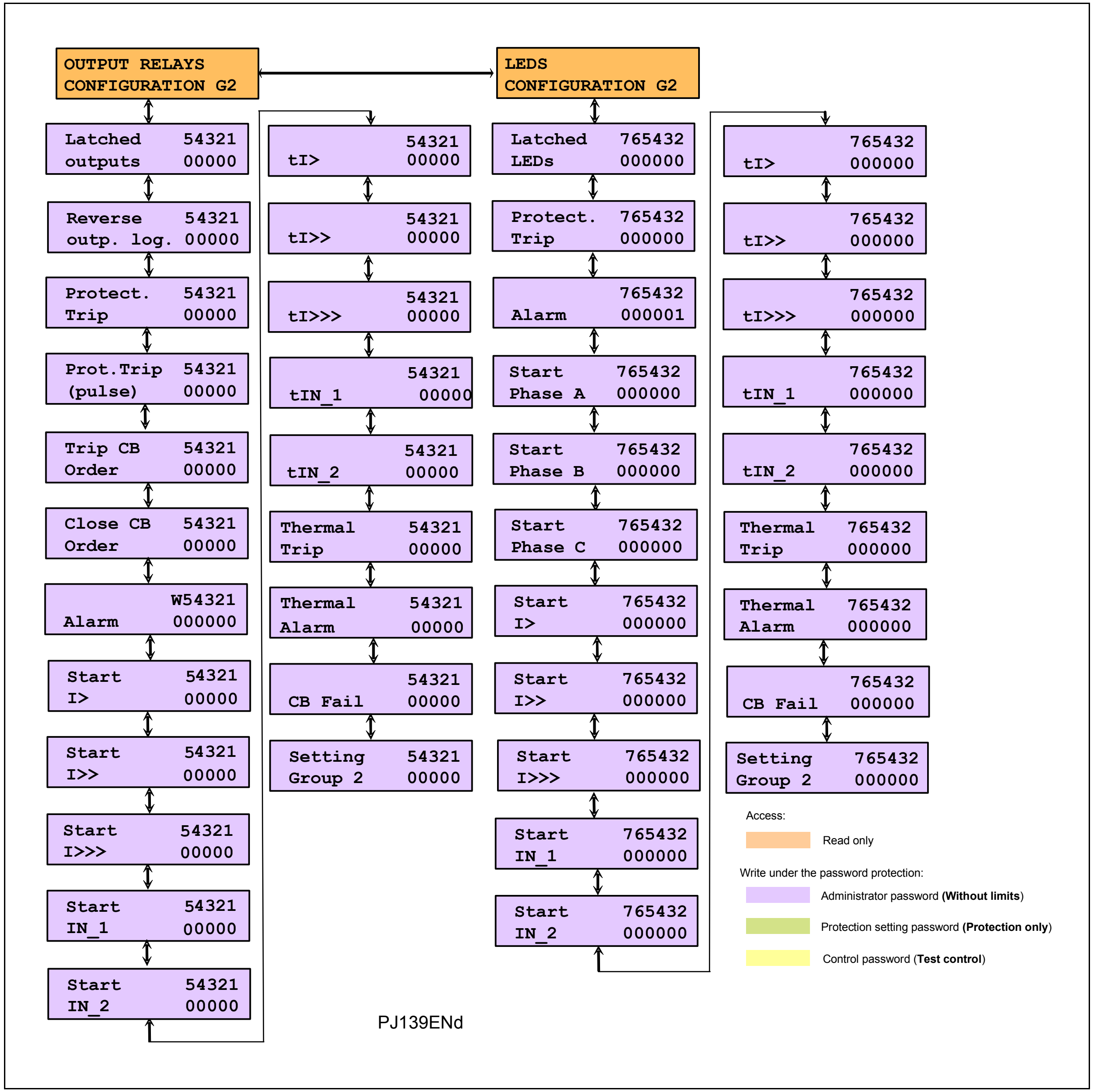


Figure 46: V11F Model N Menu Map part 5

GS

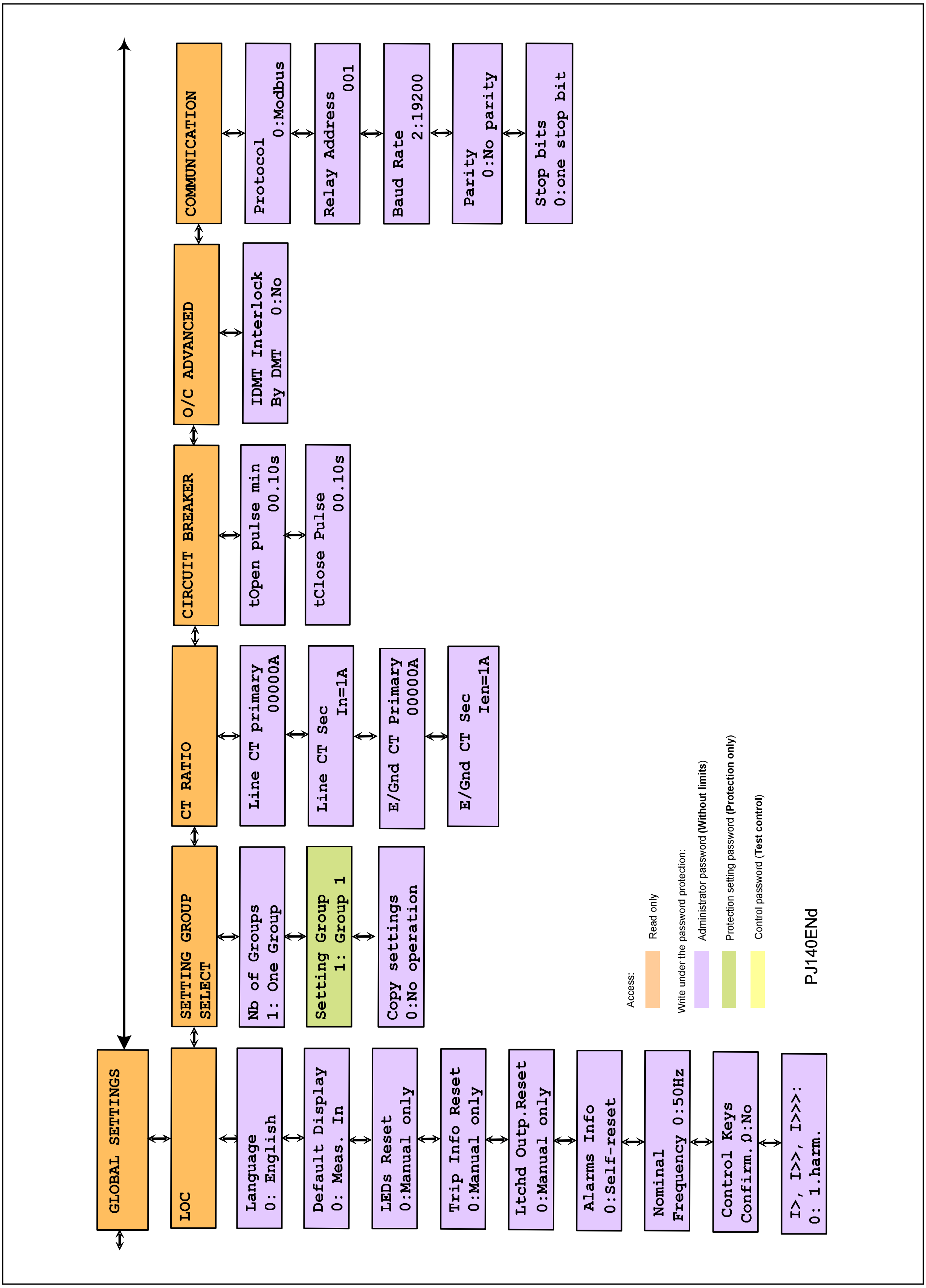


Figure 47: V11F Model N Menu Map part 6

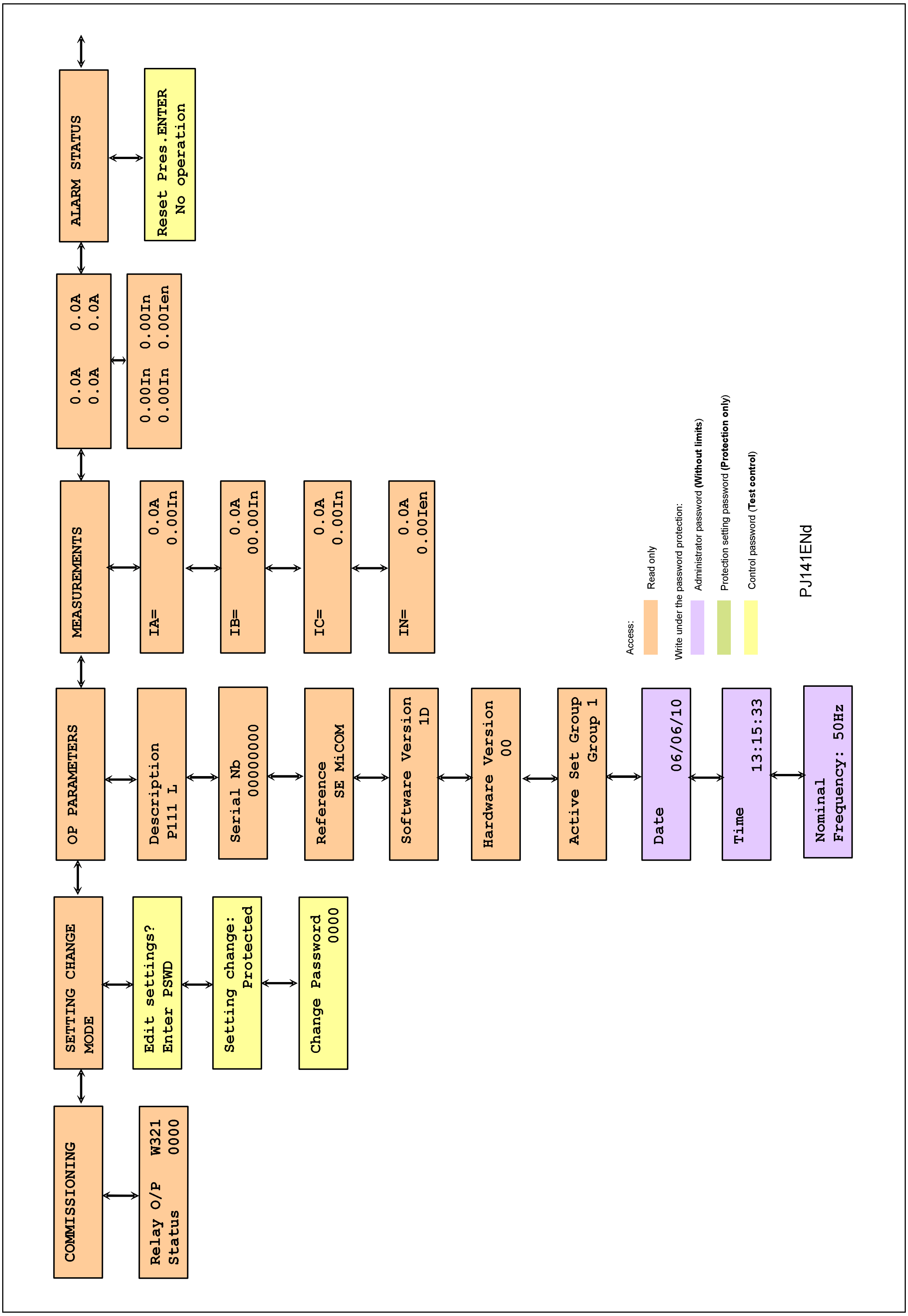


Figure 48: V11F Model L Menu Map part 1

GS

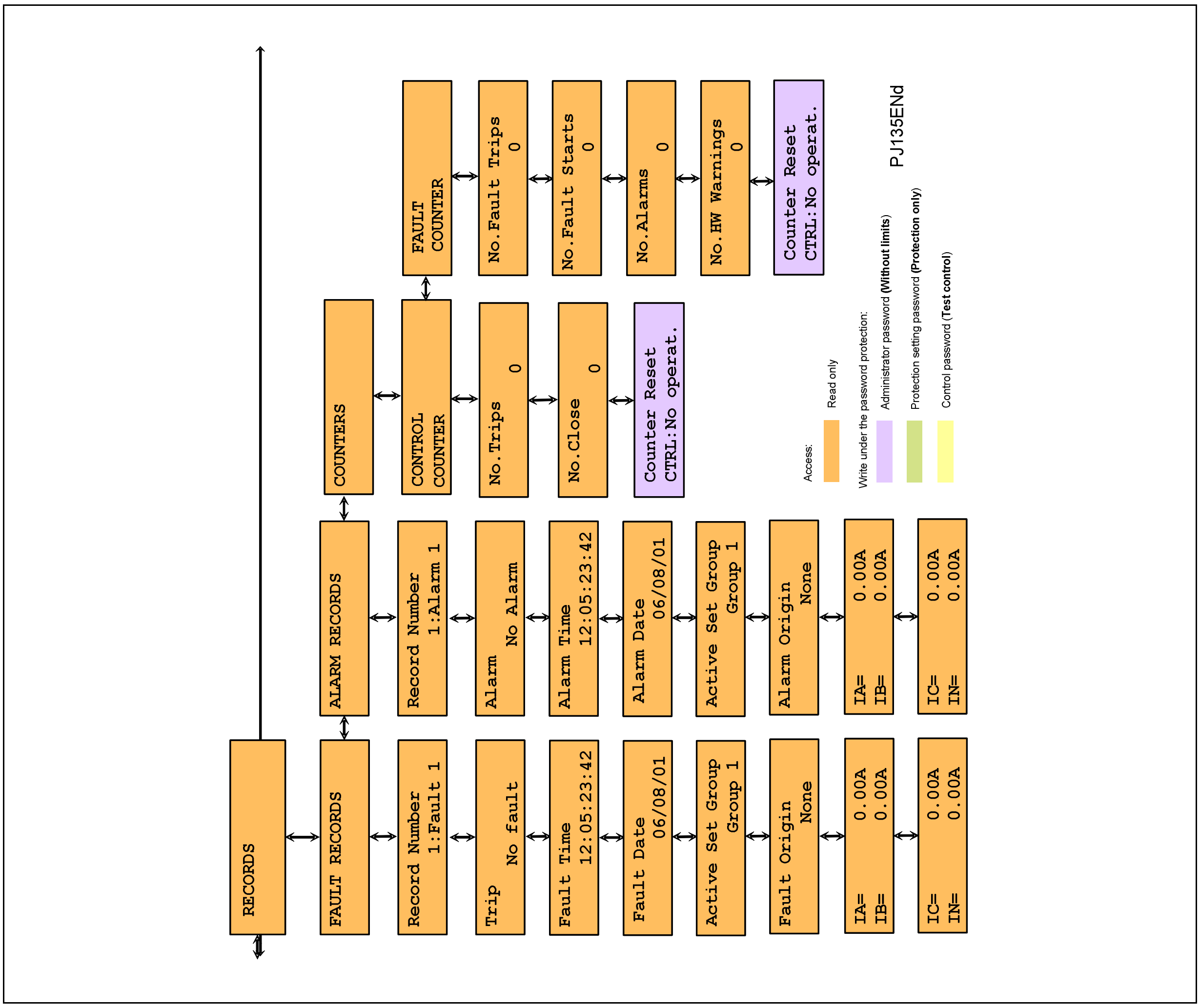


Figure 49: V11F Model L Menu Map part 2

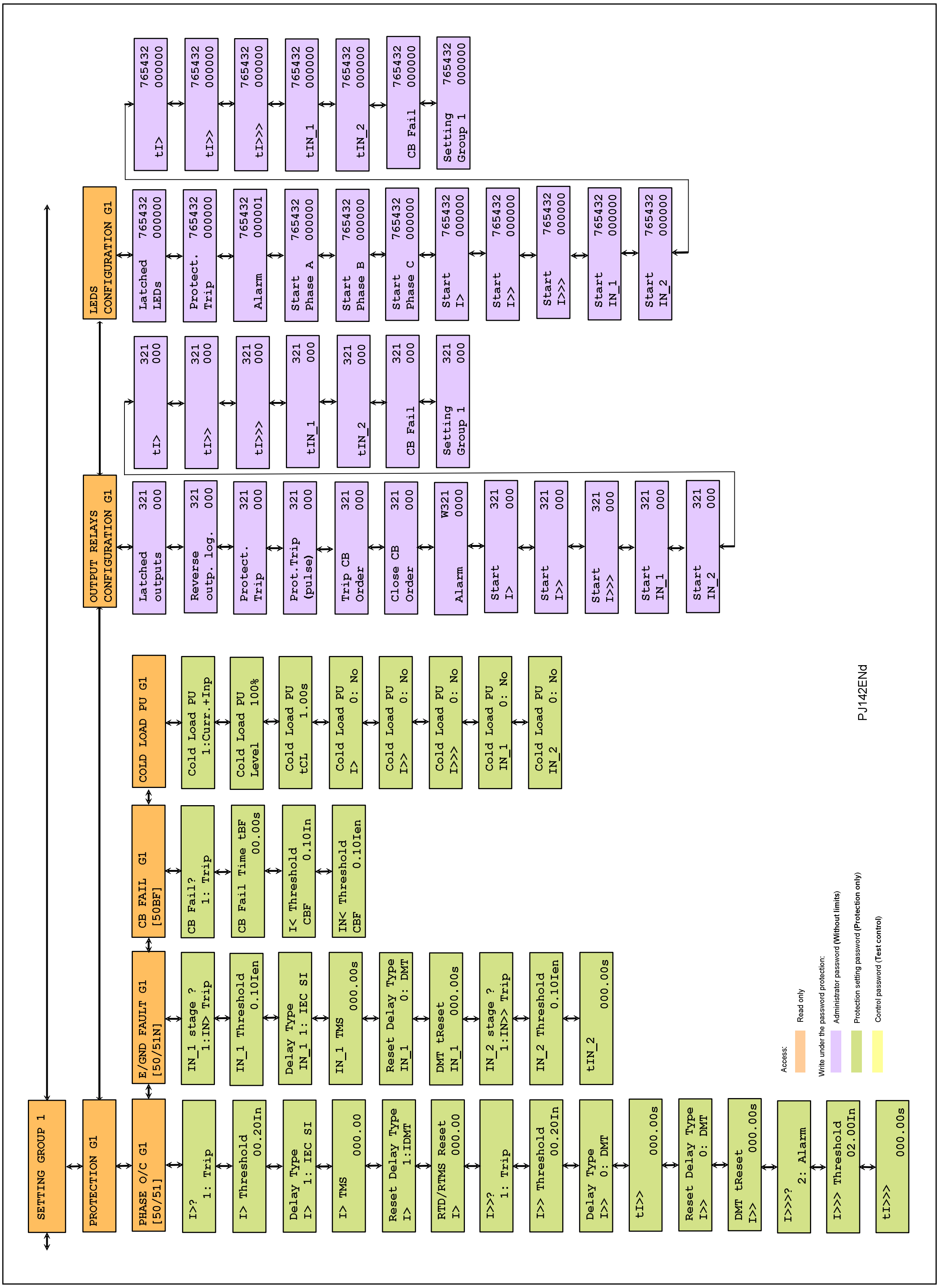


Figure 50: V11F Model L Menu Map part 3

GS

GS

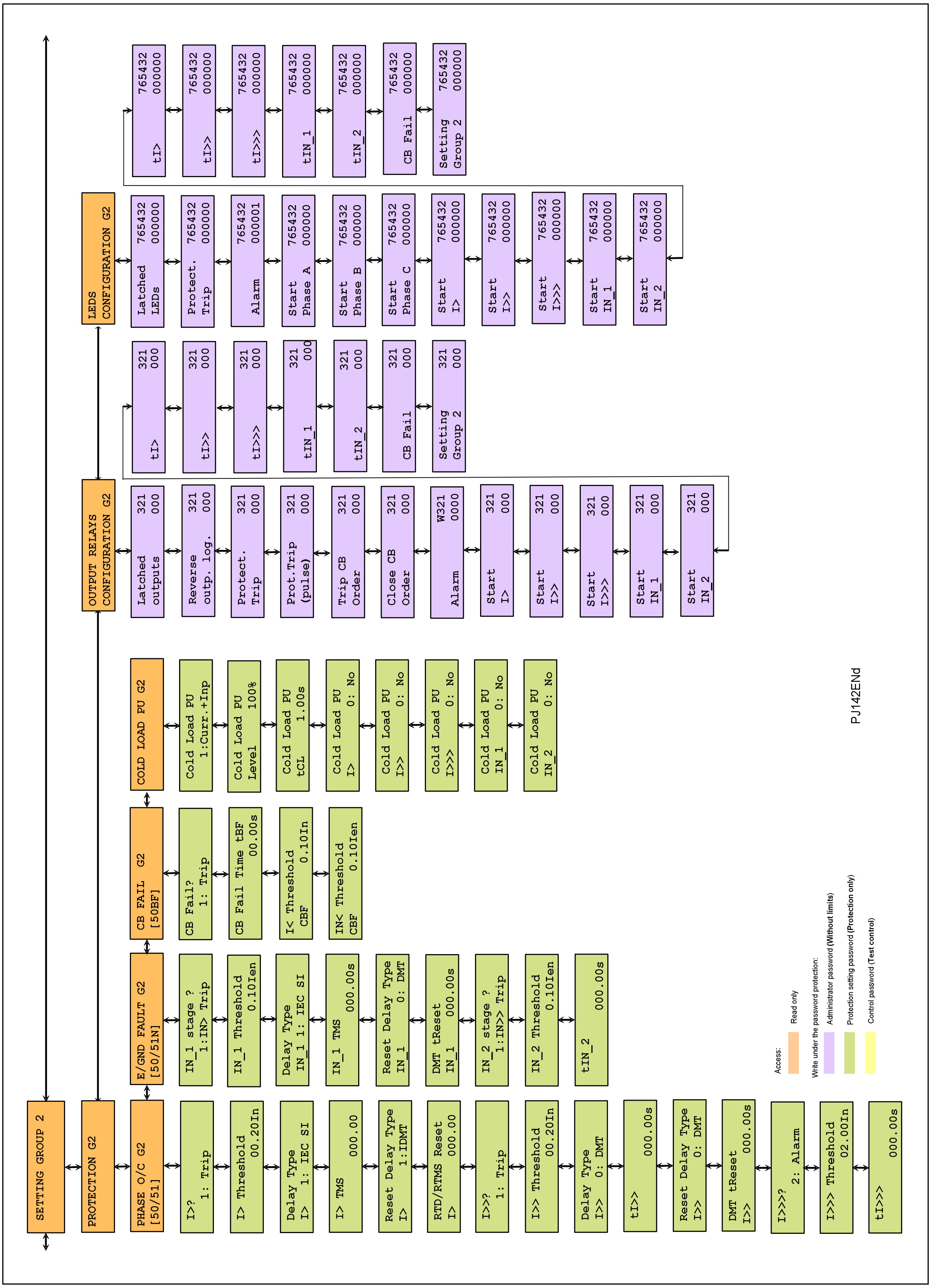


Figure 51: V11F Model L Menu Map part 4

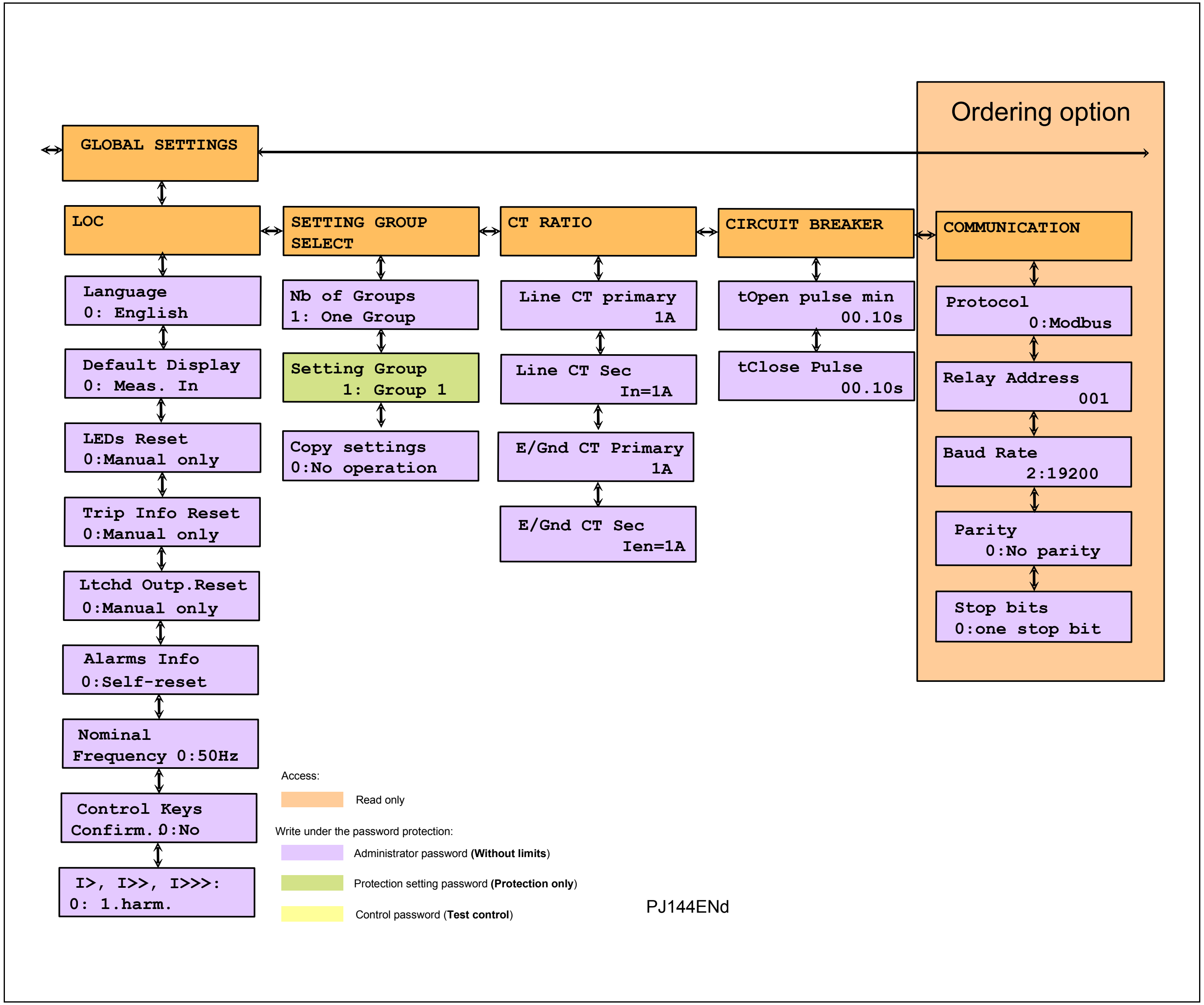


Figure 52: V11F Model L Menu Map part 5

3. LOCAL CONNECTION VAMP V11x TO A PC

3.1 Configuration

Local connection between a PC and the relay is made through a USB cable.

Before connection cable to USB socket it is necessary discharge static electricity from the body by touching a metal grounded object (such as an unpainted metal surface) to prevent against ESD damage.

Communications can be established between a PC and a device fitted with a USB port.

The MiCOM S1 Studio 5.1.0 (or higher) software has a built-in USB driver and virtual COM software.

3.2 USB Driver and virtual COM software installation

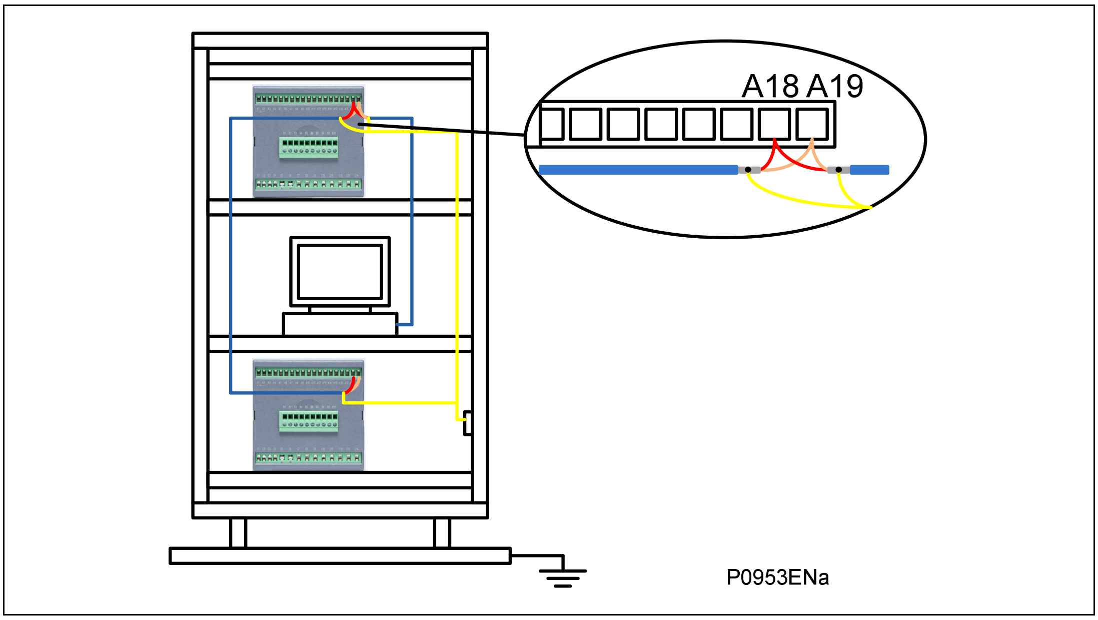
Two installation methods are available:

Note: The latest MiCOM S1 Studio 5.1.0 (or higher)software includes all drivers therefore no action is needed.

3.2.1 Remote connection

The below figure shows the recommended way to connect an RS485 cable to the relay in order to build a local network.

3.3 Products plugged into the same panel



3.4 MiCOM S1 Studio relay communications basics

MiCOM S1 Studio 5.1.0 (or higher) are the universal VAMP 11x IED Support Software packages which provide users with a direct and convenient access to all data stored in any VAMP 11x IED using the USB front communication port.

MiCOM S1 Studio 5.1.0 (or higher) provide full access to:

– VAMP 11x/MiCOM Px10 relays

– MiCOM Px20, Px30, Px40 relays

– MiCOM Mx20 measurements units

The following sections give the main procedures to connect to and to use MiCOM S1 Studio 5.1.0 (or higher).

Before starting, check that the USB serial cable is properly connected to the USB port on the front panel of the relay. Please follow the instructions given in section 3.1 in order to ensure proper connection between the PC and the relay before attempting to communicate with the relay.

This section is intended as a quick start guide to using MiCOM S1 Studio 5.1.0 (or higher), and assumes that you have a copy of MiCOM S1 Studio 5.1.0 installed on your PC. Please refer to the MiCOM S1 Studio User Manual for more detailed information.

3.5 MiCOM S1 Studio 5.1.0 (or higher)

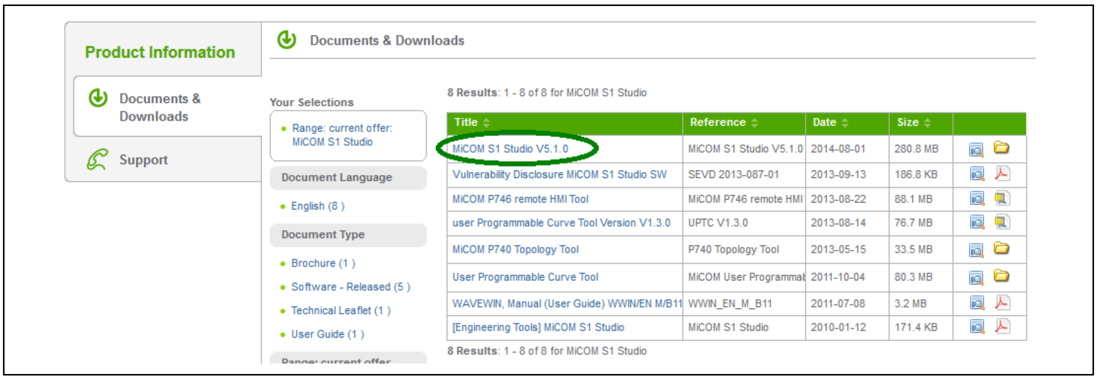
3.5.1 MiCOM S1 Studio downloading

The MiCOM S1 Studio can be downloaded from WEB site: www.schneider-electric.com.

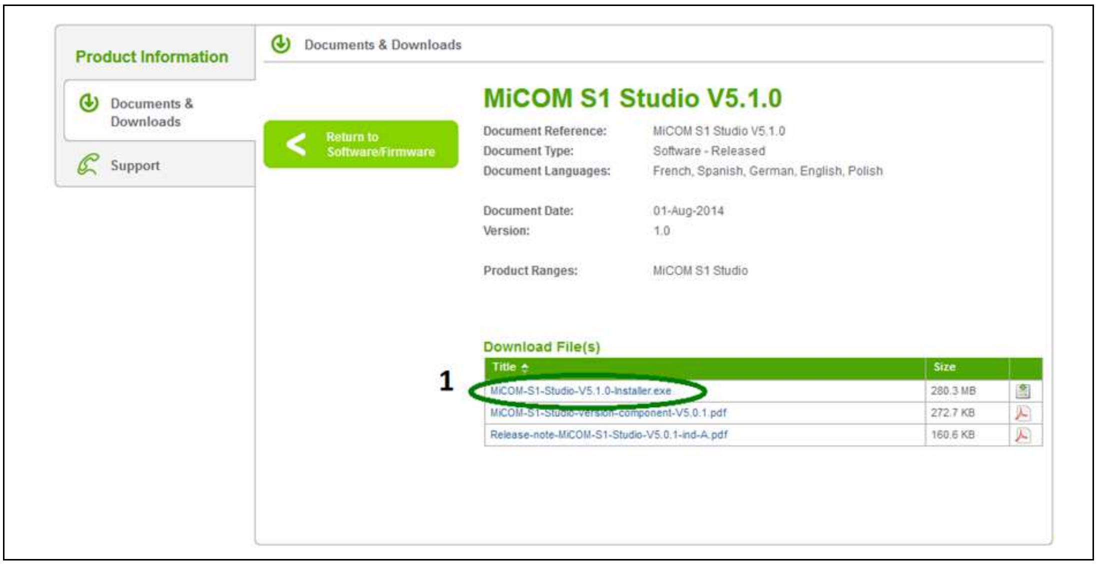
In the search field enter “Studio” (1)

During typing an advice will appear as above (type slowly), so select "MiCOM S1 Studio - IED Support Software” (2)

The new window will appear (see below). Click on “MiCOM S1 Studio 5.1.0” (1)”

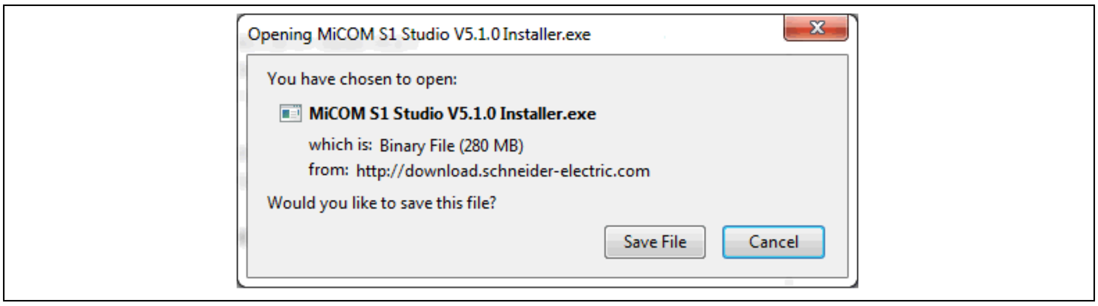


The new window will appear (see below). Click on MiCOM S1 Studio Installer 5.1.0 (1)



Note: in case of any problems with finding windows as above, it is possible to go directly to window below by typing in internet browser: “MiCOM-S1-Studio 5.1.0 Installer.exe”.

The new window will appear (see below). Click “Save file”, than run exe file for starting of installation.



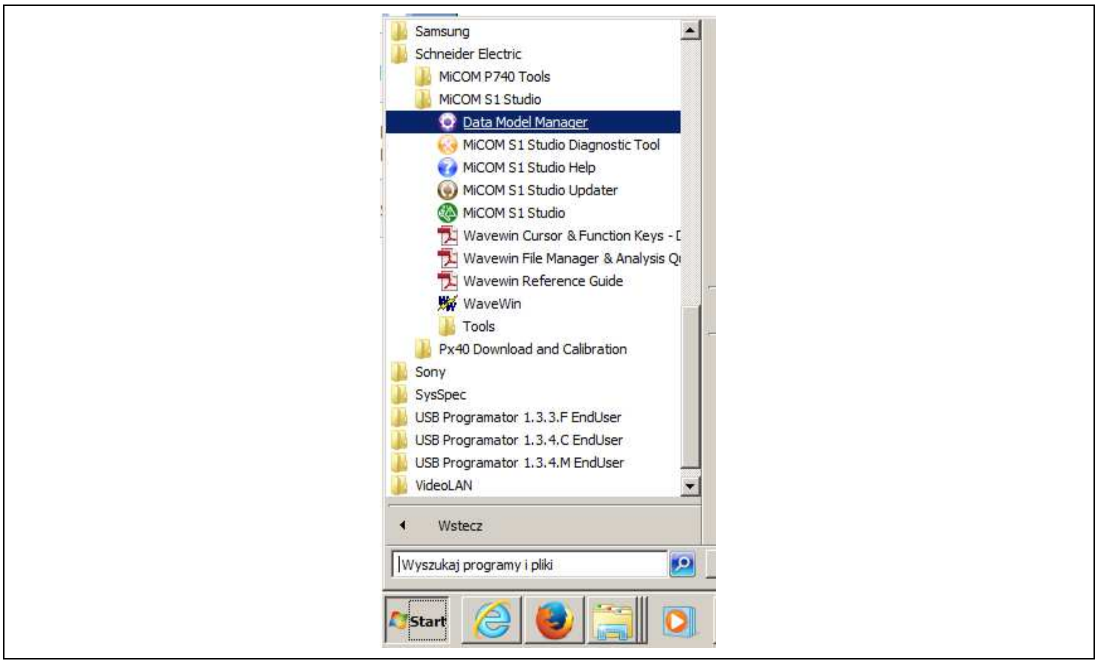
3.5.2 Data Model Management

The settings and parameters of the protection relay can be extracted from the relay or loaded using the Data Model manager. The Data Model Manager can load any model from a local file, a external disks/drives or an Internet server (if connected).

The Data Model Manager is used to add and remove data models, as well as to export and import data model files.

It is necessary to close MiCOM S1 Studio prior to launching the Data Model Manager.

To open the Data Model Manager, click on the icon: . Select "All programs" then "Schneider Electric" and than "MiCOM S1 Studio".



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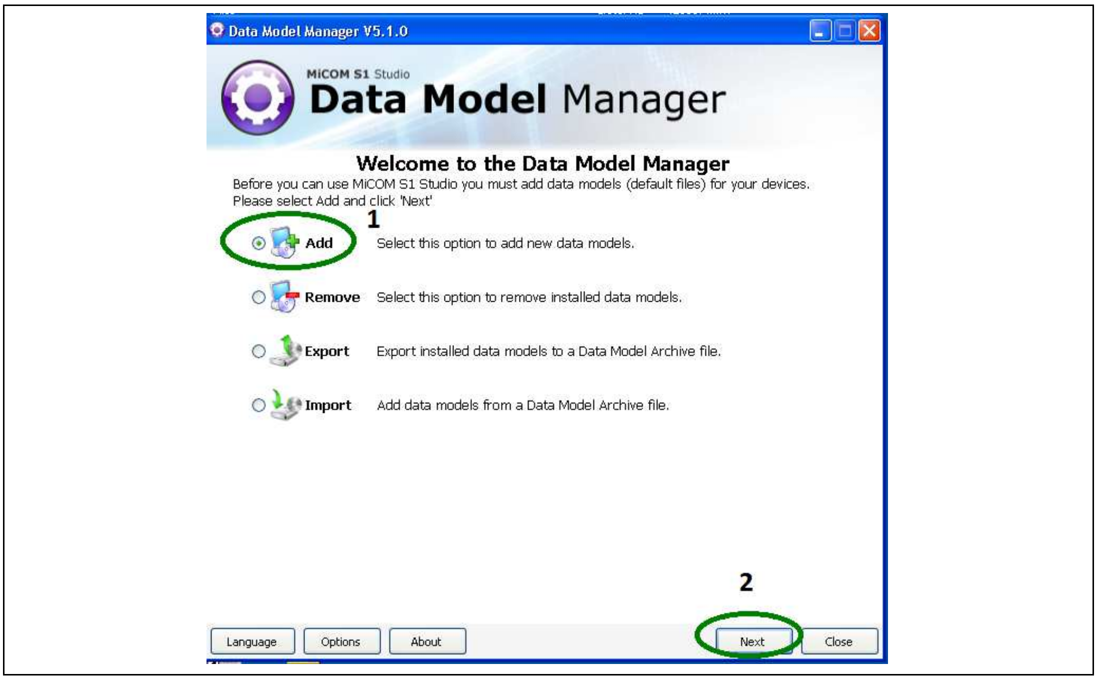
The following window is displayed:



Select the ***Add*** option to add the new data model then click on ***Next***.

The next window is used to select the data model's source (CD ROM, local folder or Schneider Electric FTP server). Select the data model's source then click on ***Next***.

Note: The procedure below assumes connection to Schneider Electric FTP server.

The Data Model Manager loads the data models' details then automatically displays the language selection panel. Select the menu language then click on ***Next***.

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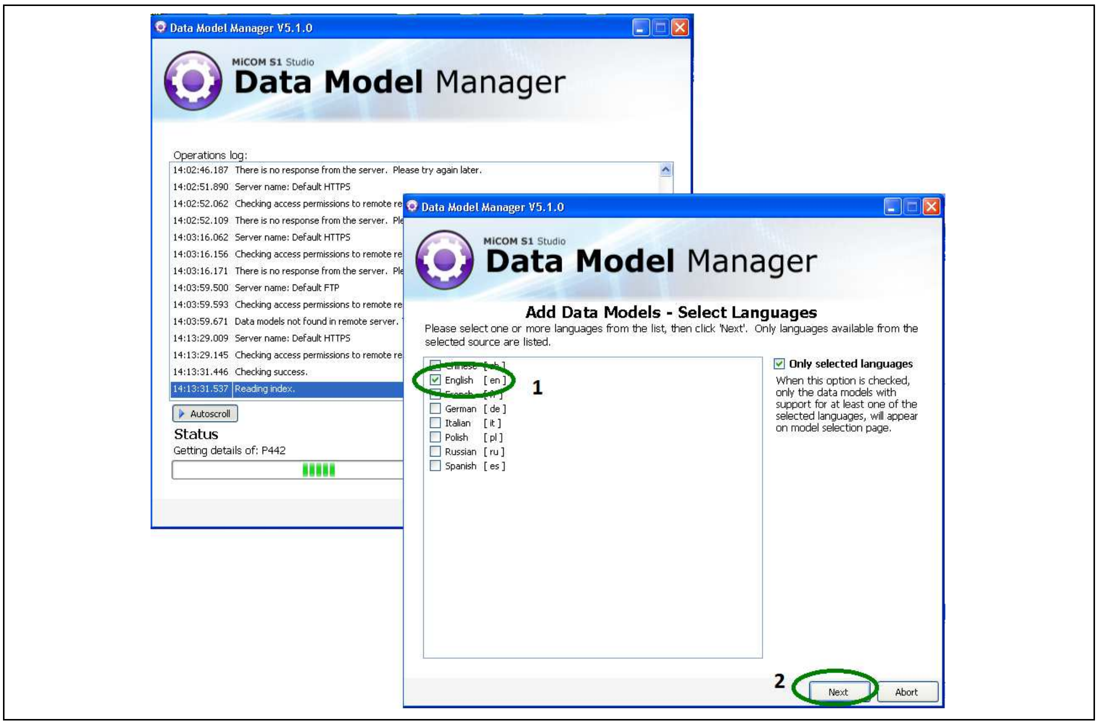
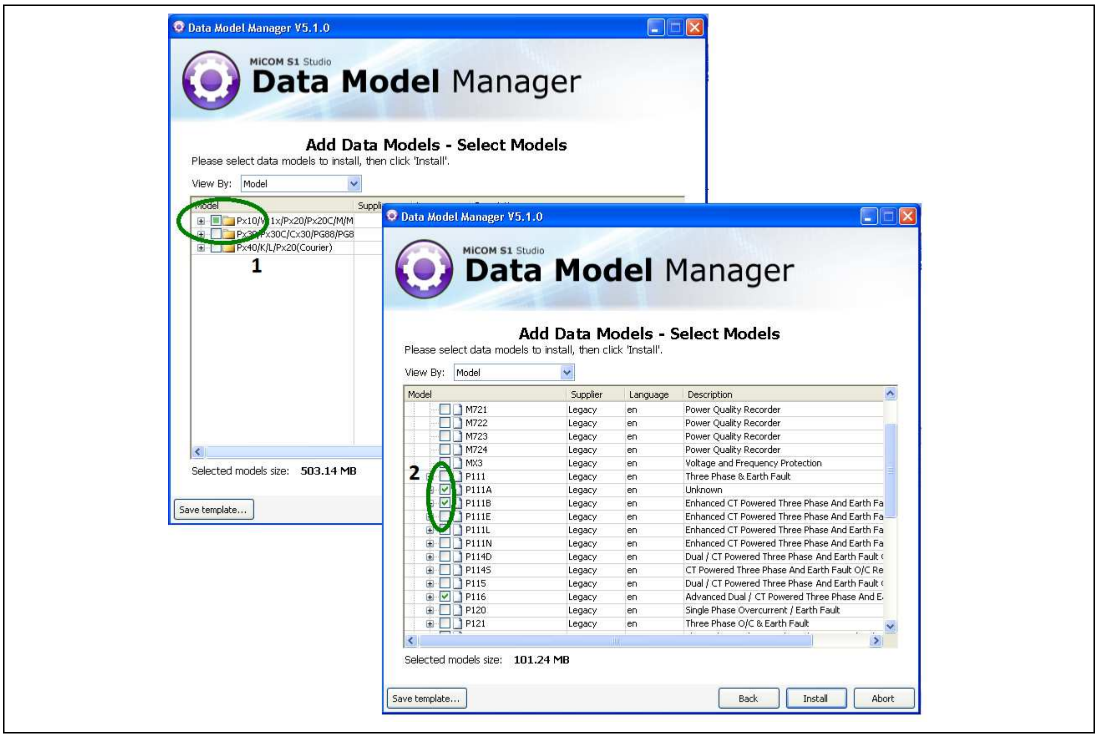
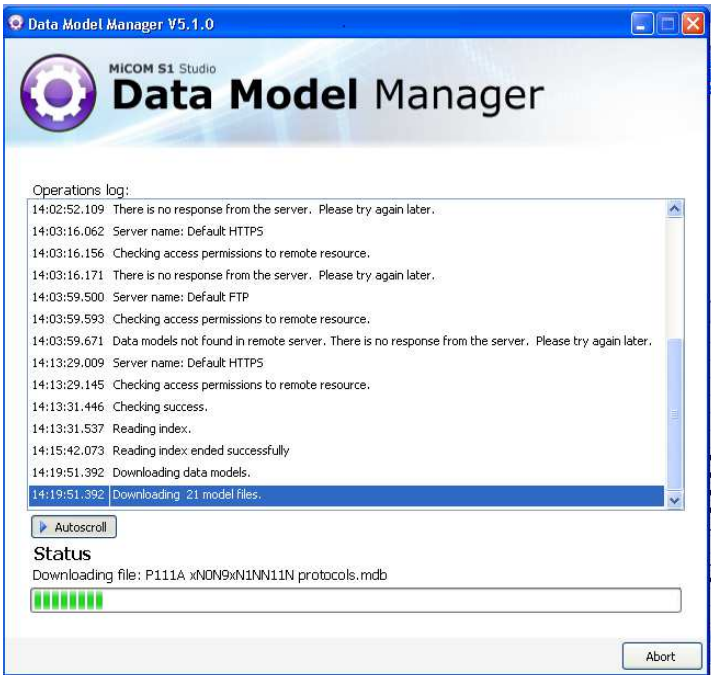


The data models panel is displayed. Select the data model relevant to your product (for instance, to download V11x data models, expand the ***V11x/Px10/Px20/Px20C/M/Modulex*** sub-menu (click on **+** then select the data model relevant to your product). Once the data models are selected, the Data Model Manager window displays the file size of the download.



Click on ***Install***. The data model files are downloaded and updated in your system.



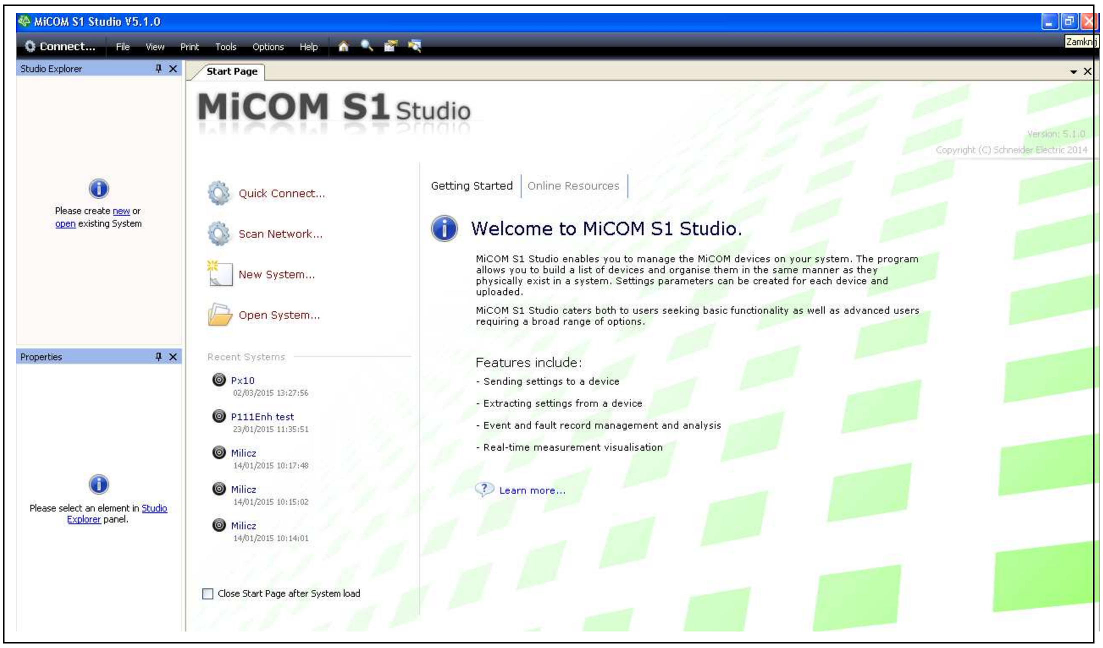
Once installation is complete, close the Data Model Manager. The downloaded Data Model will be used by MiCOM S1 Studio when a system file is opened or created. For more information on how to open this default setting file, refer to sub-chapter 3.5.9.

3.5.3 "Quick Connection" to the relay using MiCOM S1 Studio

To start MiCOM S1 Studio, click on the icon: 

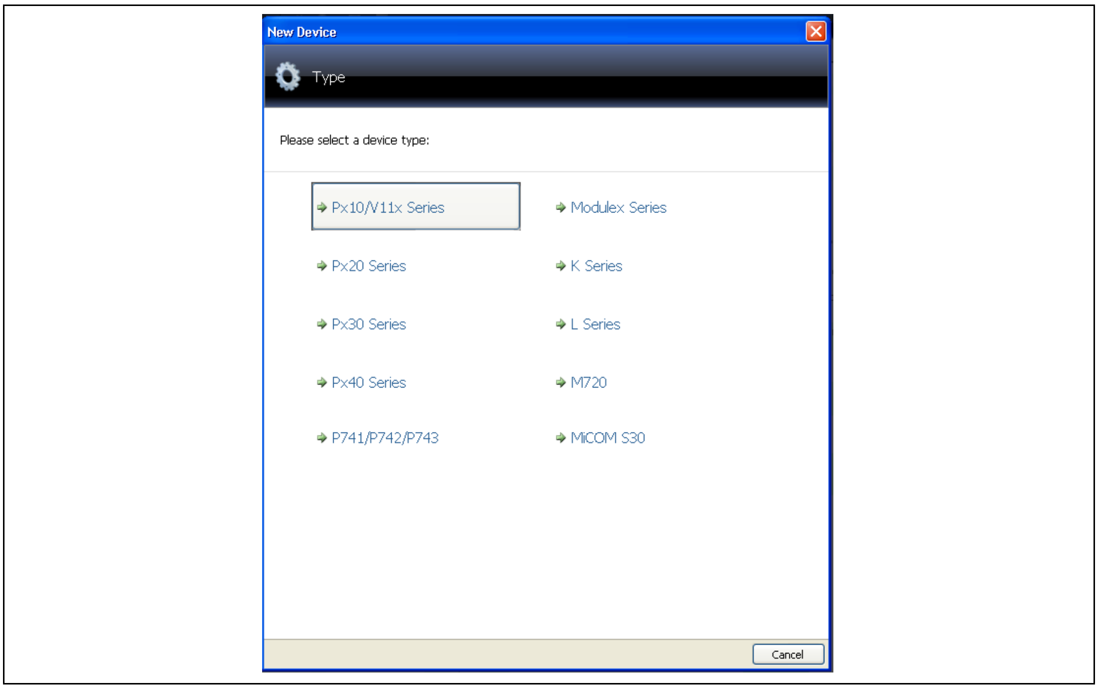
In the ***Programs*** menu, select Schneider Electric then ***MiCOM S1 Studio***.

The MiCOM S1 Studio launcher screen is displayed:



– Click on the Quick Connect button at the top left of the application's window.

– Select ***Px10/V11x Series*** from the presented options.



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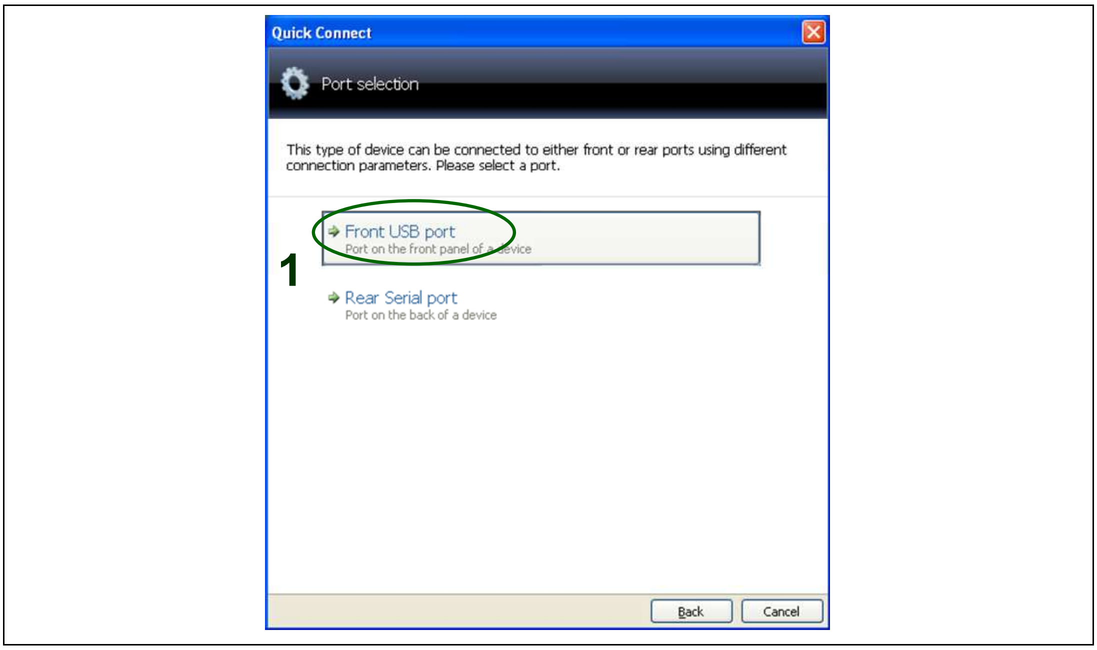
– Select ***Front USB port***.



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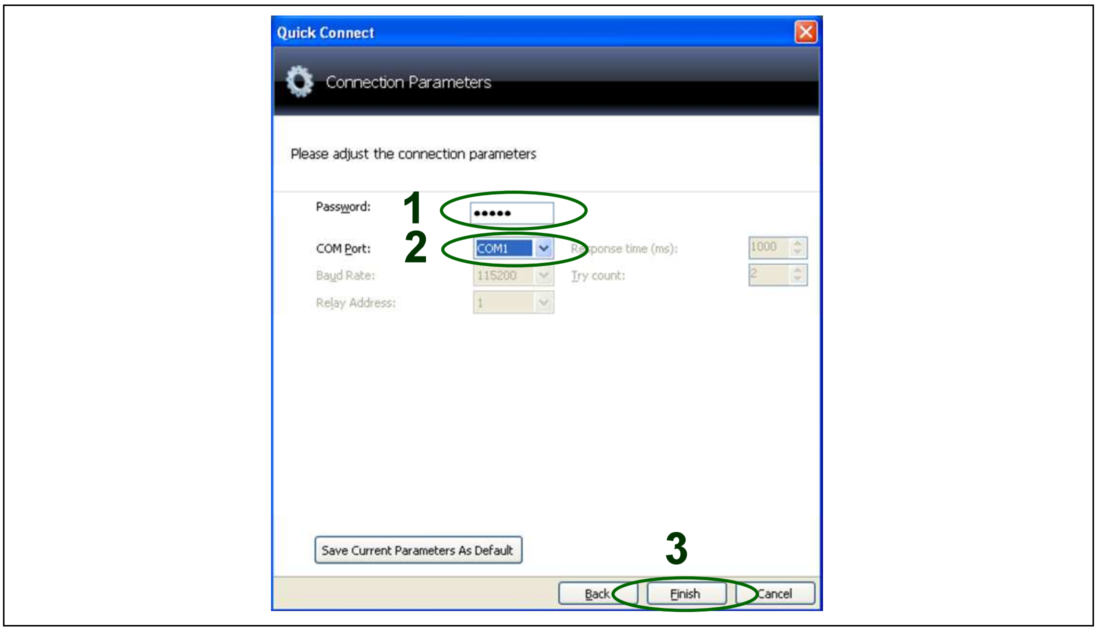
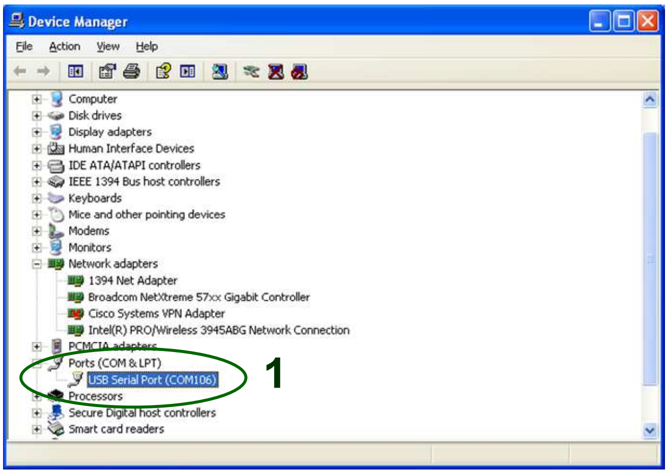
– Enter Password: administrator level (without limits) - the same as in the V11F which is connected via USB port. If the administrator password is not entered in the V11F – leave it as default. Note: the password could be unique for every V11F so if the password is forgotten – contact with SE service for help.

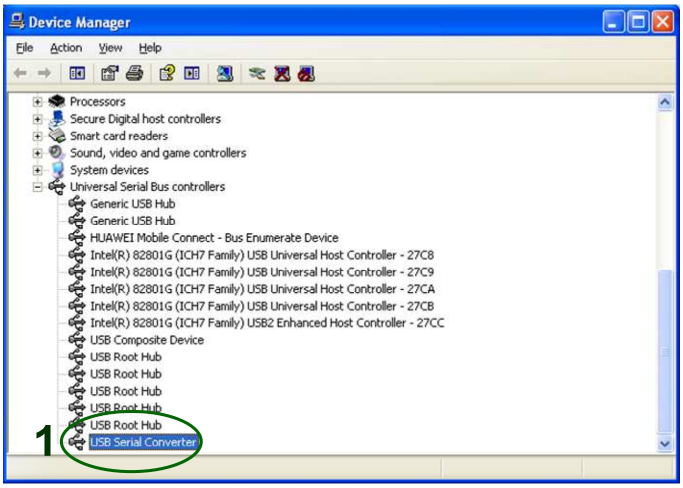
Select virtual COM (VCP) which was created by USB driver.



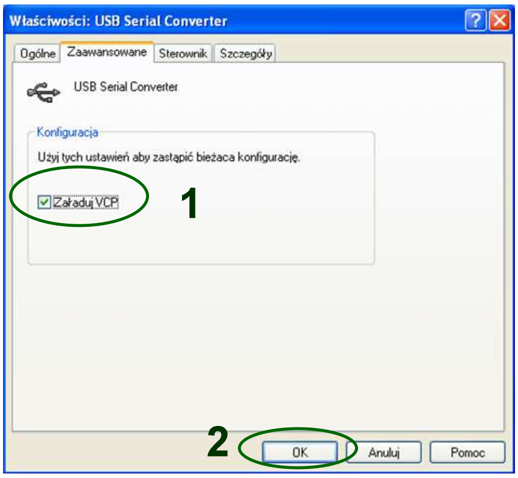
The virtual COM can be read in WINDOWS's "Device Manager" like below:



NOTE: If V11F is connected but no any USB Serial port is shown, it means that USB drivers are not installed or VCP (Virtual COM Port) option of USB Serial Converter is not selected. Check VCP option as below:



Right-click to open the contextual menu: Properties and Advanced:



Unplug USB cable and plug in again. Restart MiCOM S1 Studio and repeat the procedure.

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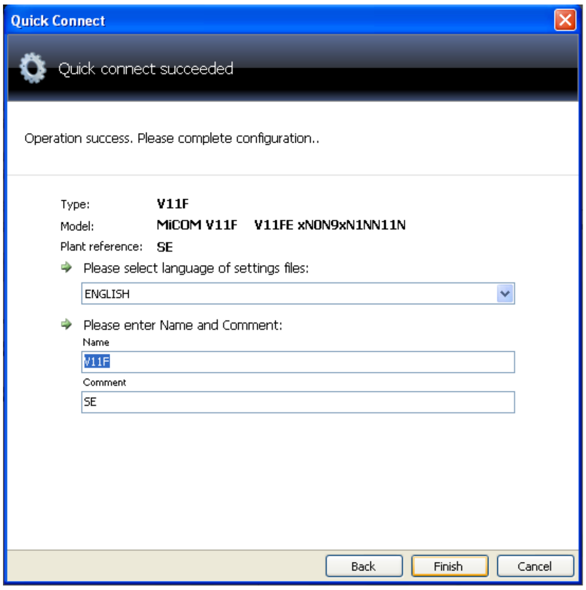
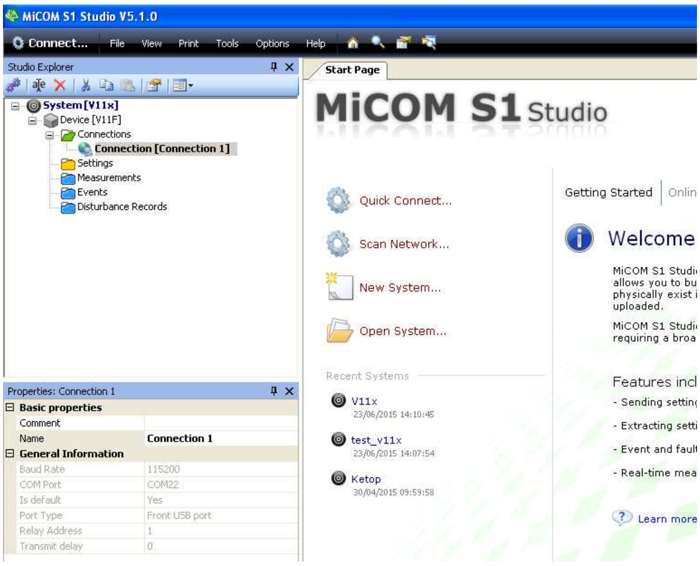
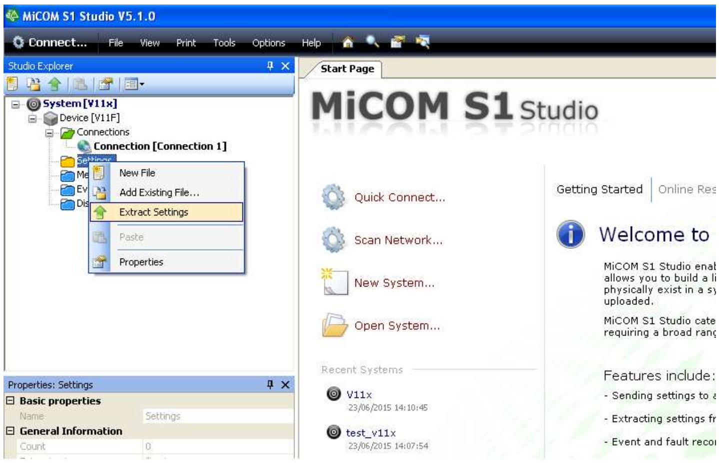
– Select ***Language***. Enter ***Name and Comment***.



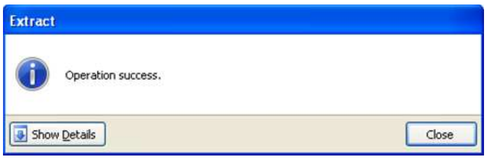
– The new Device is created:



– Select ***Settings.*** Right-click to open the contextual menu: ***Extract Settings***:

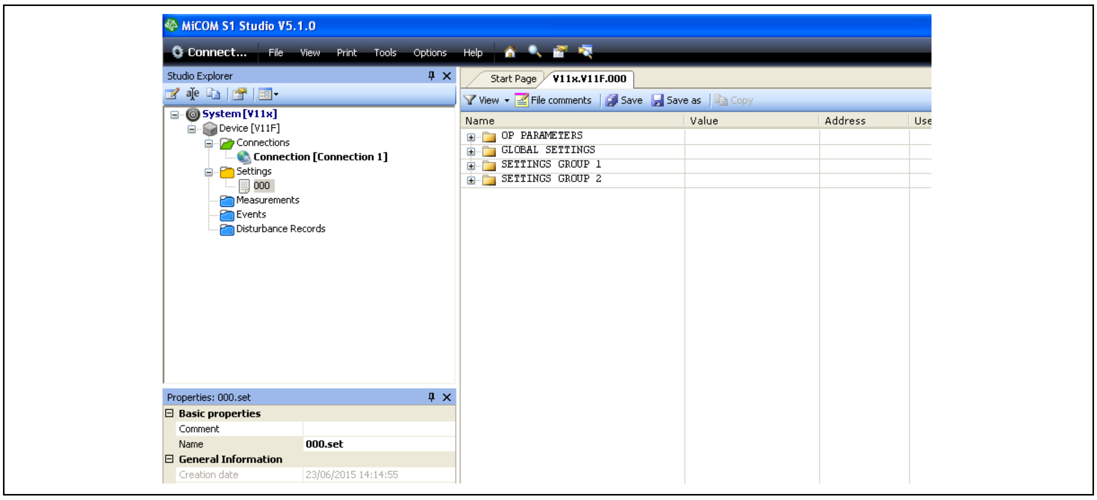


– Wait for the end of the process:



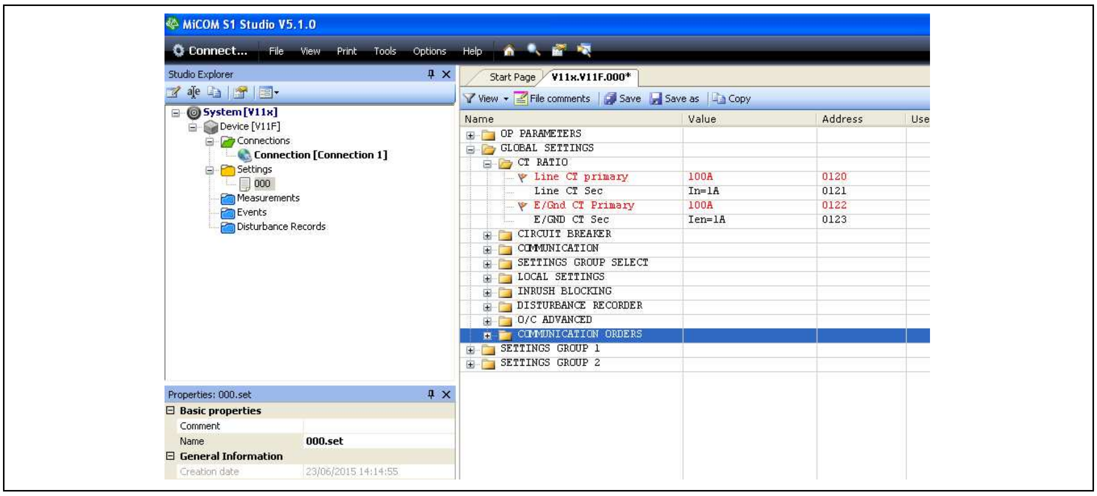
– V11F settings were saved on PC. The name of SET file is 000.set:

– Double Click on ***000.set*** SET file to see settings on the right window of MiCOM S1 Studio



– Change settings. ***Save*** changes.

Note: If the changed settings are not ***Saved*** on hard disk of PC, MiCOM S1 Studio send setting file before changing. Be sure that Save icon was pressed.



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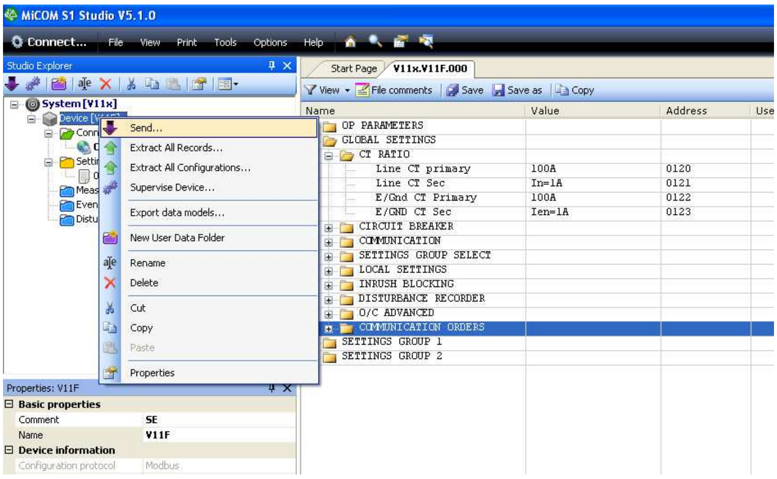
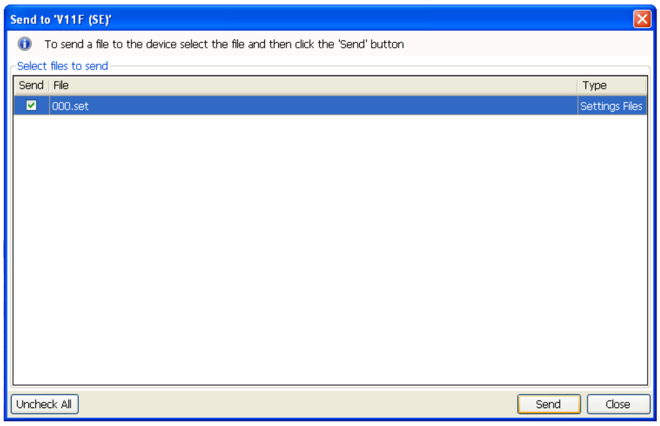
– Click on the name of ***Device*** and right-click to open the contextual menu: ***Send***:

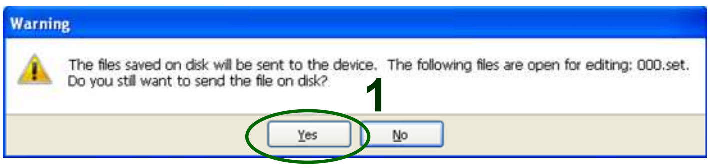


GS

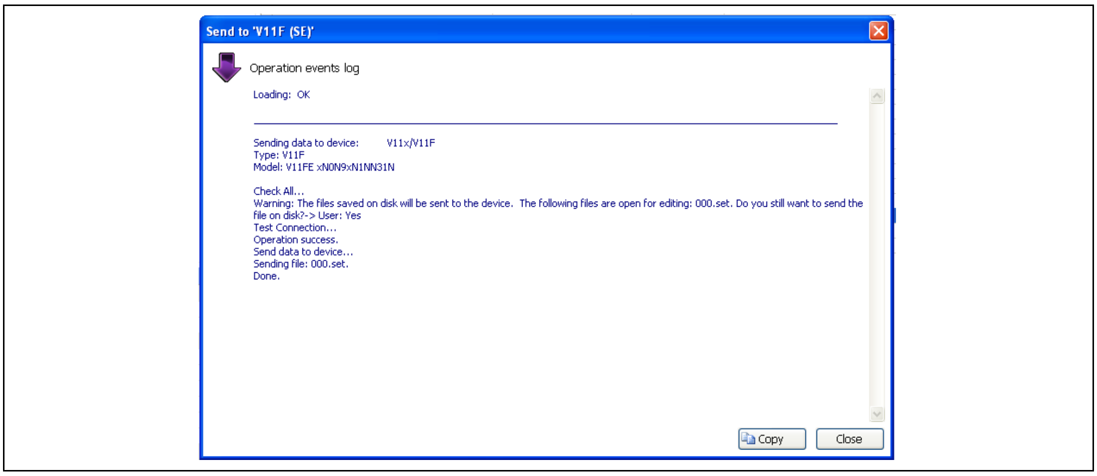
– Select setting (***000.set***) file for sending. Press ***Send***.



– If ***000.set*** file was saved on the PC disc, press ***Yes***.



– Wait for the end of operation. Press ***Close***.



GS

Settings were sent to V11F.

3.5.4 Create a system

In MiCOM S1 Studio, a System provides a root node in the Studio Explorer panel from which all subsequent nodes are created.

Add substations, bays, voltage levels and devices to the system.

If a system is no longer needed, delete it using the delete command.

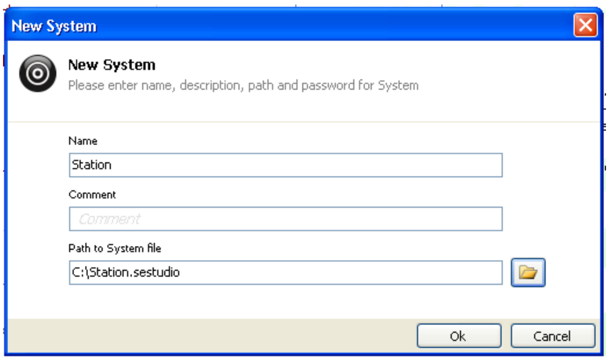
The use of Quick Connect will automatically create a default system, if one does not already exist. Systems are not opened automatically, unless ***Reopen last System at start-up*** is checked in the Preferences menu.

To create a new system:

– By default, the window displays the message “create new or open existing system”: click on "New" to create a new system.

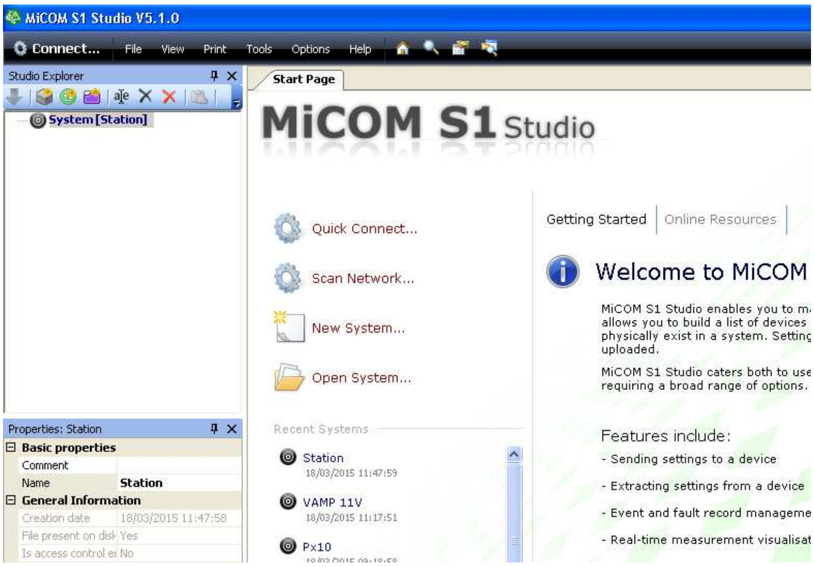
– If a system is loaded in the “***Studio Explorer*** window, right-click on the panel's background and select "New System" or the corresponding icon on Studio Explorer's toolbar.

– The following window is displayed: Enter the name of the system, and the path to save the system file. Click ***OK***.

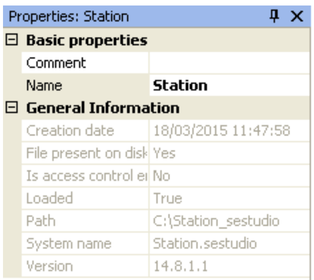


GS

The new System is displayed in the Studio Explorer panel:



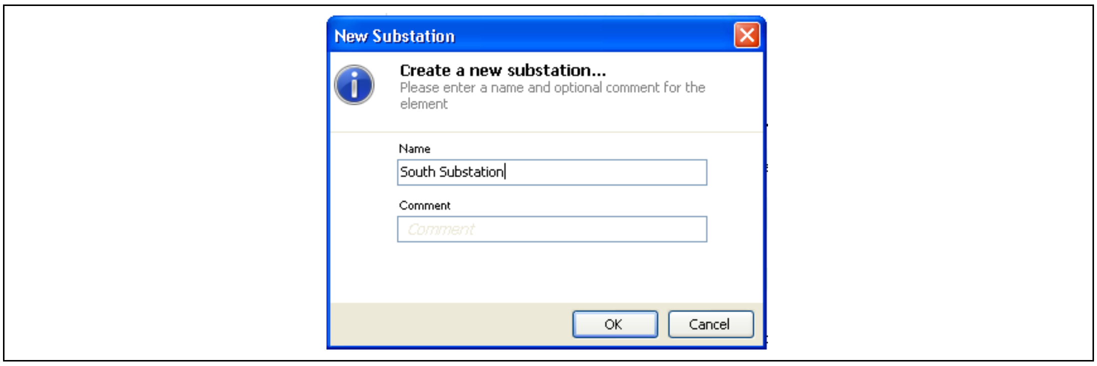
Note: If an item is selected in the Studio Explorer panel, its properties are displayed in the ***Properties*** panel.



3.5.5 Create a new substation

Select the system: the menu bar is updated with the ***New device***, ***New substation***, ***Close***, ***Delete***, ***Paste***, ***Properties*** and ***Options*** icons.

Click on the ***New substation*** icon (or right-click to open the contextual menu). The following window is displayed:



The new substation is displayed and the menu bar is updated when a substation is selected:

Click on the ***Import SCL*** button to import a Substation Configuration File.

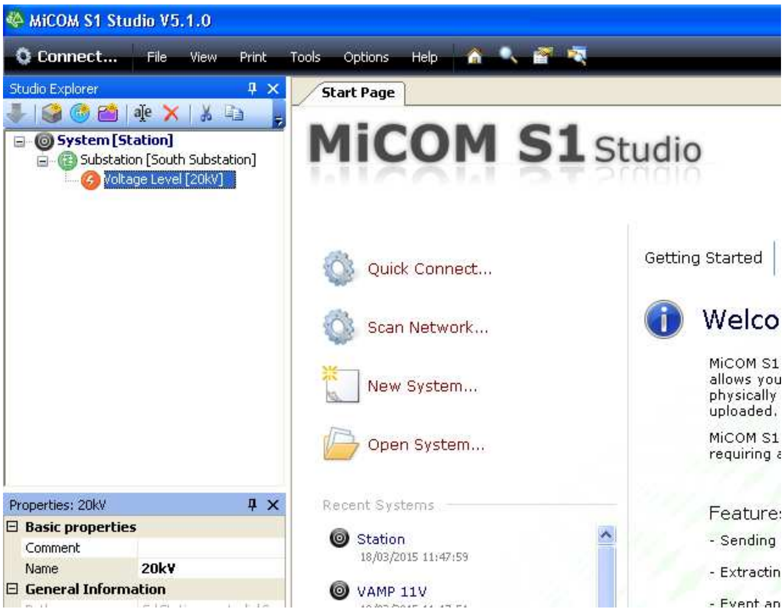
To create a substation configuration, click on the ***New voltage level*** button.

3.5.6 Create a new voltage level

Select the substation and click on the ***New station level*** button (or right-click to open the contextual menu).

In the ***Create a new voltage level***, enter the voltage level of the station.

The ***New voltage level*** is displayed and the ***New bay*** icon is displayed.



3.5.7 Create a new bay

Select the substation and click on the ***New bay*** button (or right-click to open the contextual menu).

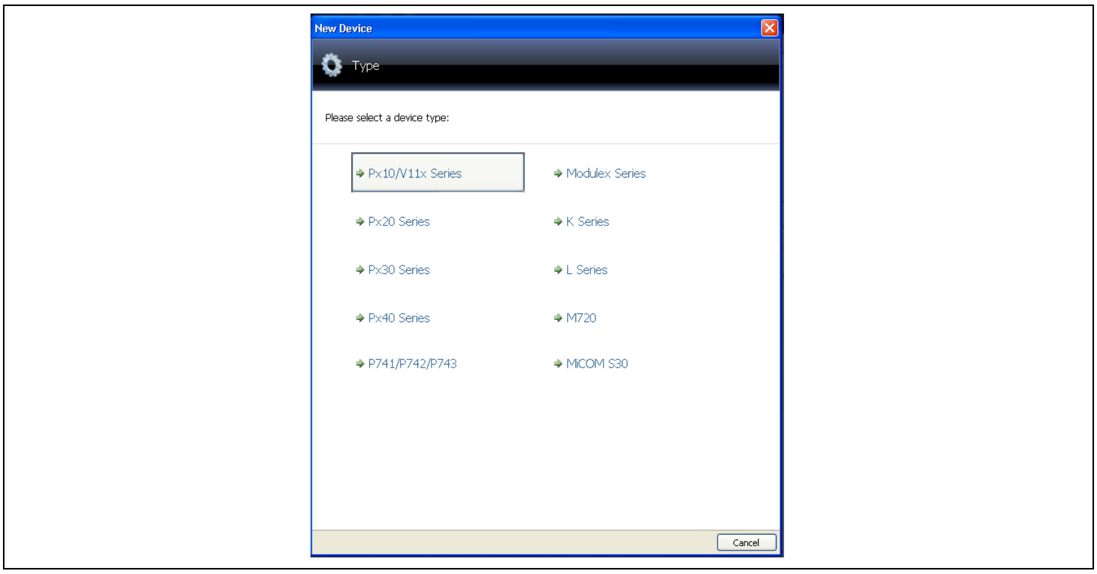
In the ***Create new bay…*** window, enter the bay indication,

The new bay is displayed.

3.5.8 Create a new device

Click on the ***New device*** button (or right-click to open the contextual menu).

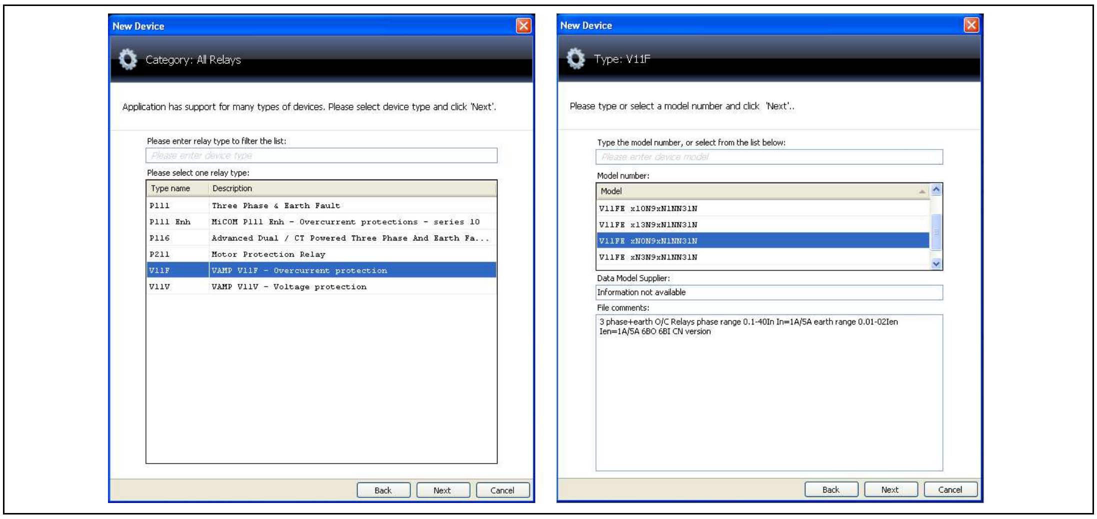
Select the device type.



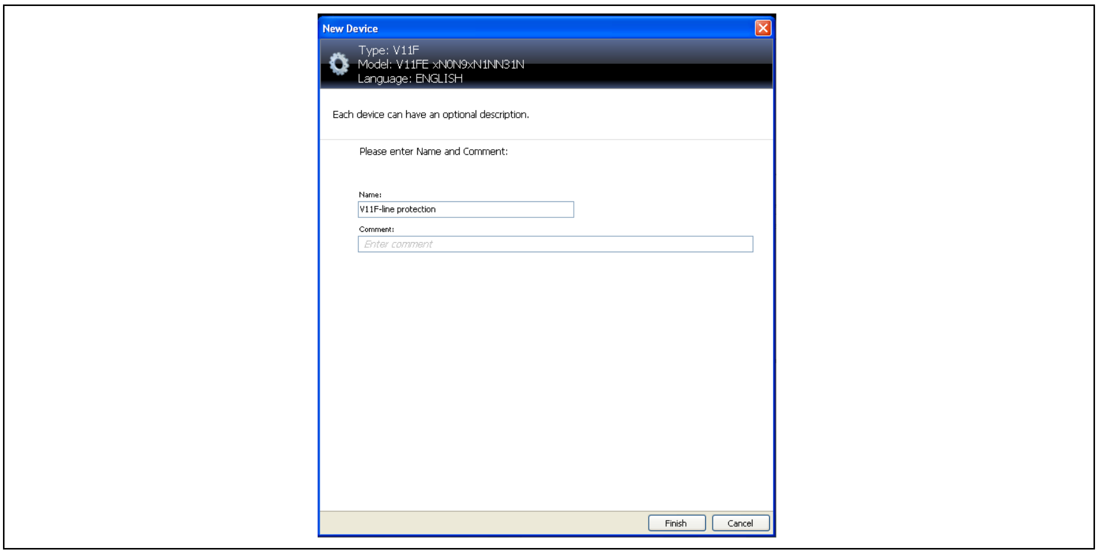
GS

Select the device type then click on ***Next***.

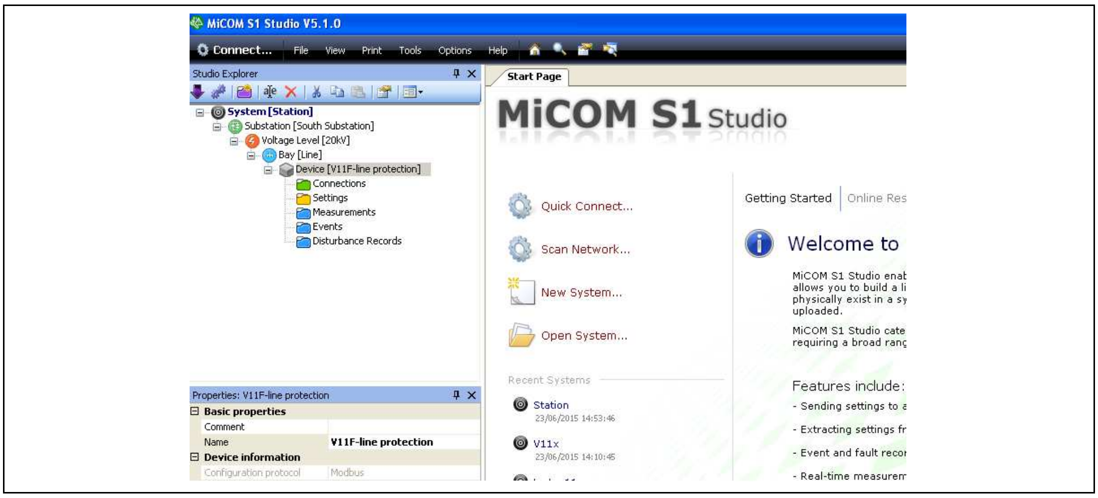
Select the model then click on ***Next***.



Enter the name and add a description to the device:



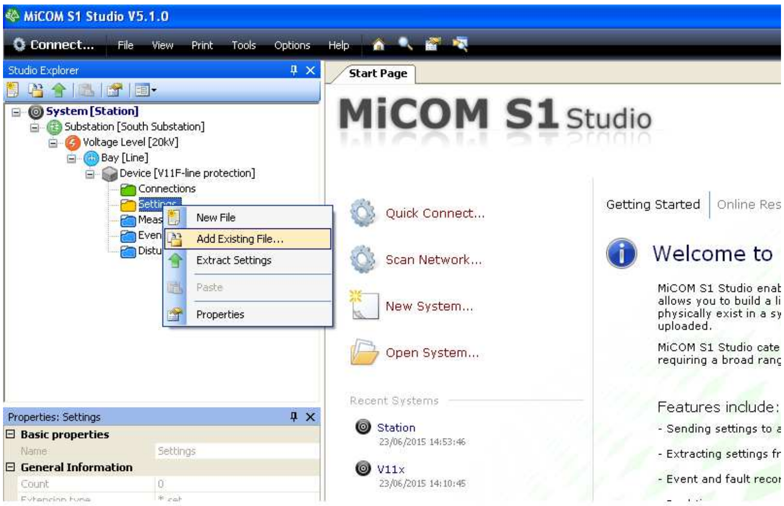
The new device is created and displayed.



3.5.9 Open a Settings File

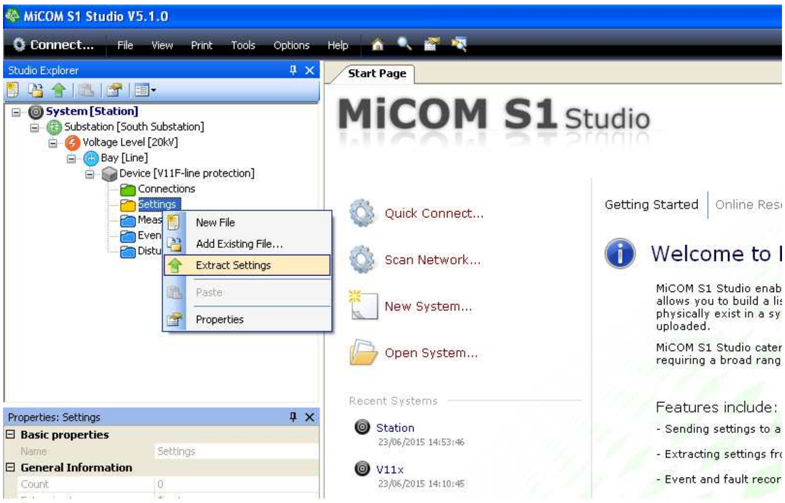
To open an existing file:

– If the file is saved or if the relay is not connected: Click on the ***Settings*** and right-click to open the contextual menu: ***Add Existing file***



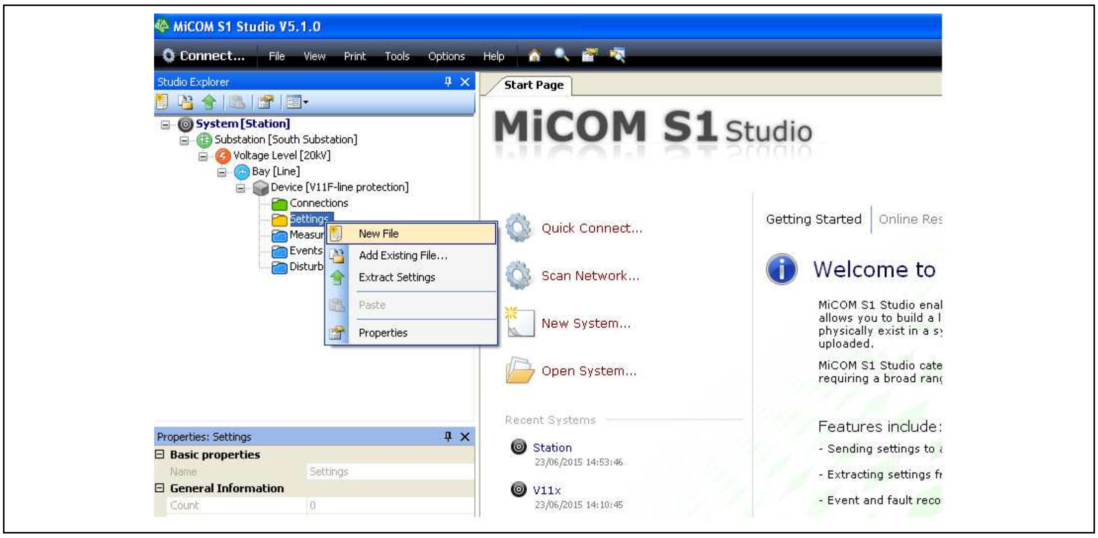
GS

– If the relay is connected, extract its settings: Click on the ***Settings*** and right-click to open the contextual menu: ***Extract Settings***



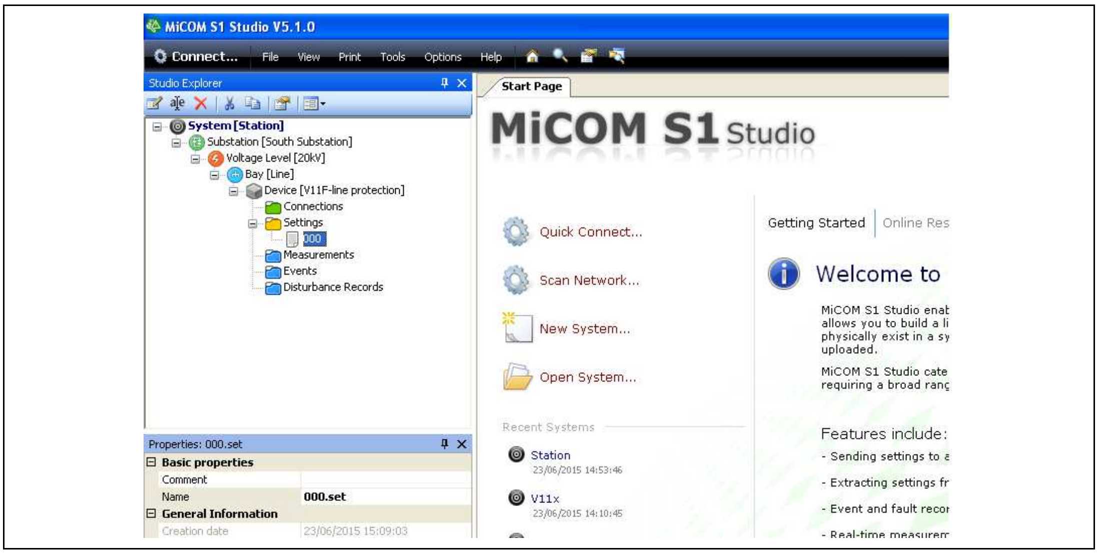
To open default settings:

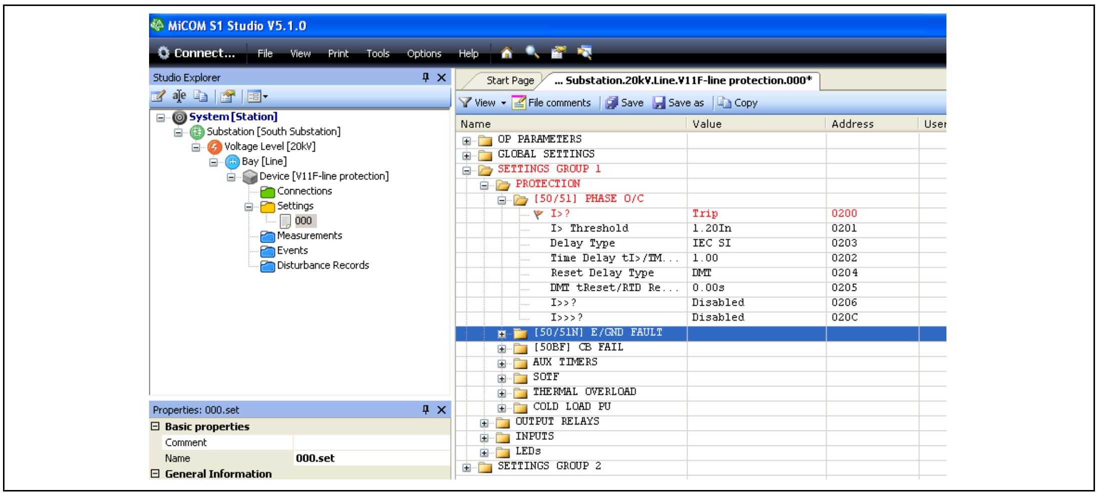
– Click on the ***Settings*** and right-click to open the contextual menu: ***New File***



GS

– The new setting file ***000.set*** is created:

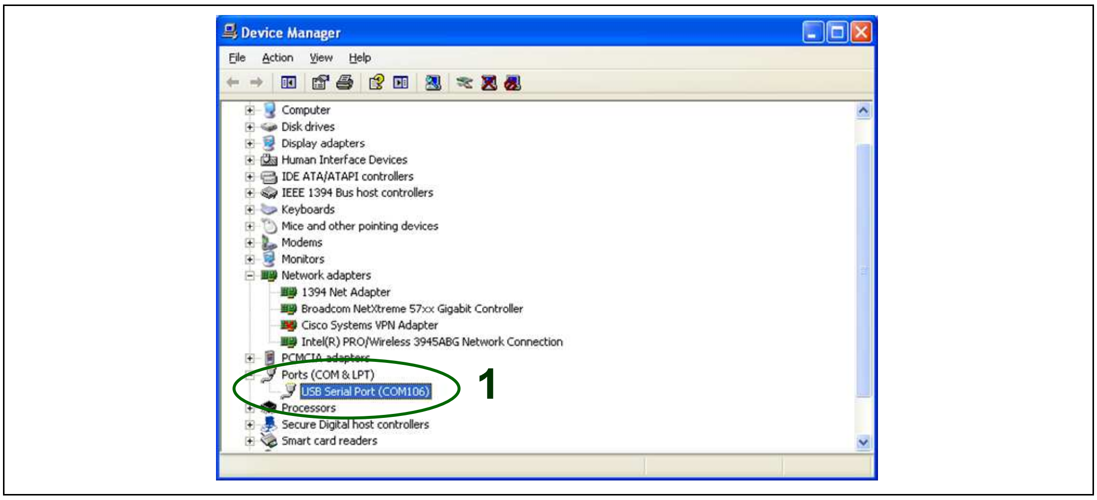




– Start working with VAMP V11F relay.

3.6 Troubleshooting USB connection

The virtual COM can be read in WINDOWS's "Device Manager" like below:



GS

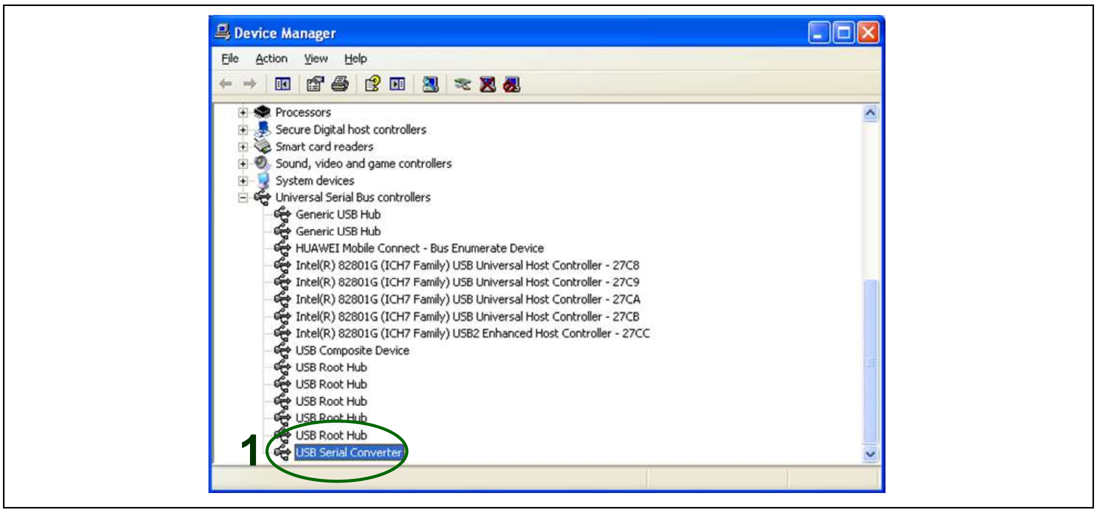
NOTE: If V11F is connected but no any USB Serial port is shown, it means that:

a) USB drivers are not installed

or

b) VCP (Virtual COM Port) option of USB Serial Converter is not selected.

<u>USB drivers:</u>

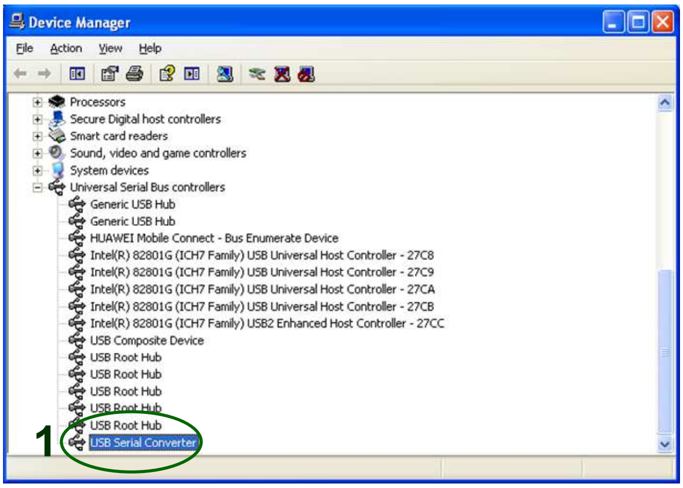


If you can't see "USB Serial Converter" it means that USB divers are not installed.

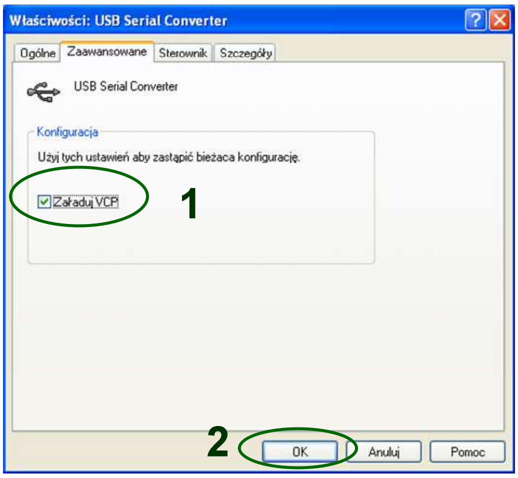
Refer section "3.2 USB Driver and virtual COM software installation"

VCP (Virtual COM Port)

On the window as below:



Check VCP option by right-click to open the contextual menu: Properties and Advanced:



Unplug USB cable and plug in again. Restart MiCOM S1 Studio and repeat the procedure.

GS

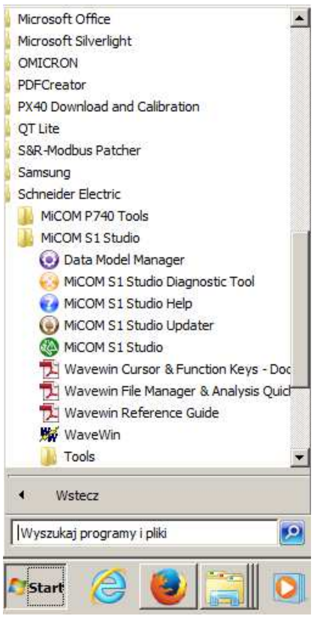
GS

3.7 Presentation and analysis of disturbances

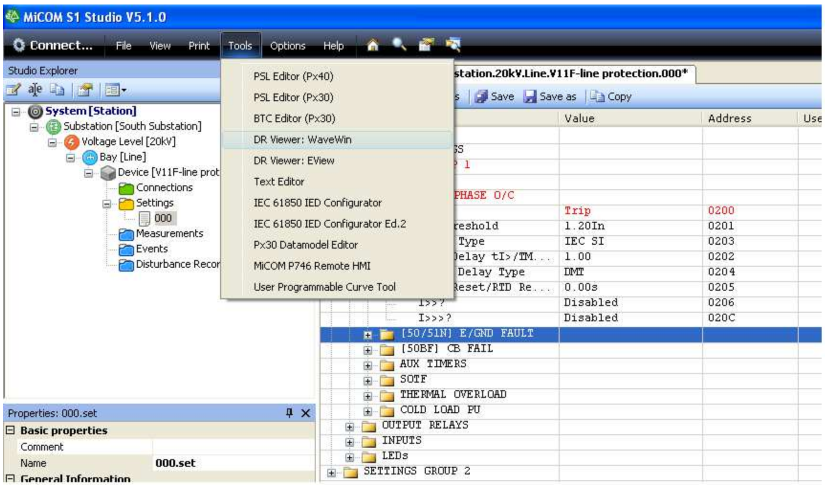
Reading and analysis of disturbance records is done using Wavewin.

To open Wavewin with MiCOM S1 Studio 5.1.0 (or higher):

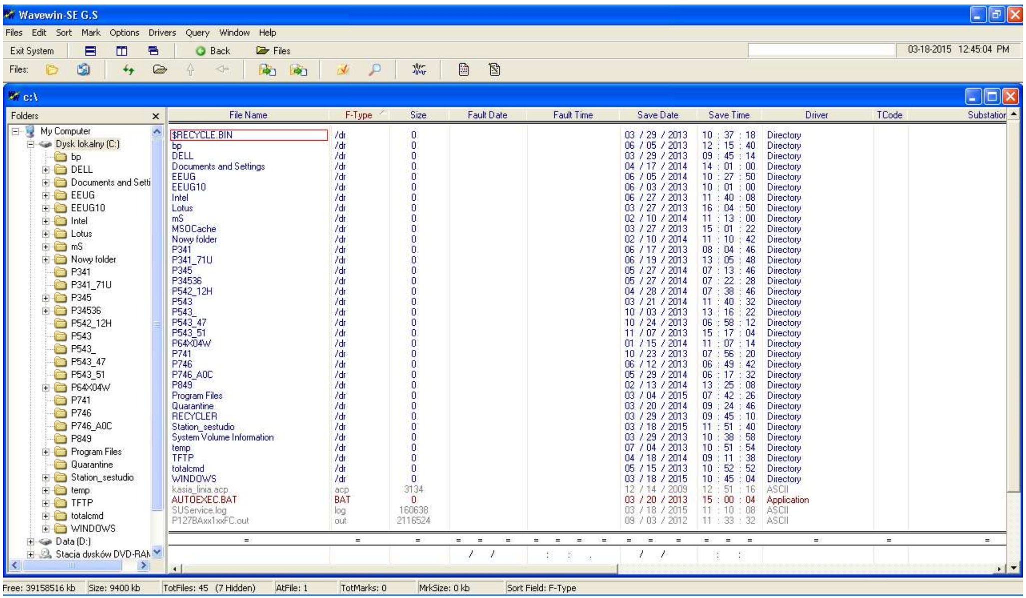
In the ***Programs*** menu, select ***MiCOM S1*** then ***PX20, Px20C, M, Modulex Series Tools*** then ***WaveWin***



Using MiCOM S1 Studio, open Wavewin using the ***Tools*** menu.



The Wavewin File Manager is displayed (refer to the Wavewin User's guide to operate Wavewin).


Wavewin-SE G.S
Files Edit Sort Mark Options Drivers Query Window Help
Exit System
Back
Files
03-18-2015 12:45:04 PM
c:\
Folders
File Name
F-Type
Size
Fault Date
Fault Time
Save Date
Save Time
Driver
TCode
Substation
Free: 39158516 kb
Size: 9400 kb
TotFiles: 45 (7 Hidden)
AtFile: 1
TotMarks: 0
MrkSize: 0 kb
Sort Field: F-Type

GS

4. COMPANY CONTACT INFORMATION

If you need information pertaining to the operation of the VAMP 11x product that you have purchased, please contact your local Schneider Electric agent or the After Sales Service Department of Schneider Electric. Do not forget to give the serial number and reference of the VAMP 11x product.

The VAMP 11x product reference and serial numbers are documented under the upper hinged cover on the front of the relay. For more precise information, refer to the section "Relay Identification" in this chapter.

PLEASE PROVIDE THE FOLLOWING INFORMATION WHEN CONTACTING SCHNEIDER ELECTRIC:

- CORTEC code of the VAMP 11x relay
- Serial number of the VAMP 11x relay
- Schneider Electric order reference
- Schneider Electric operator reference

Schneider Electric Worldwide Contact Centre:

- Website: http://www.schneider-electric.com/CCC

ST

SETTINGS

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

ST

CONTENTS

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1. GENERAL INFORMATION

The V11F must be configured to the system and application by means of the appropriate settings. This section gives instructions for determining the settings, which are located in the folder entitled, Schneider Electric Energy in the menu tree. The order in which the settings are listed and described in this chapter is: the protection settings, control and configuration settings (see section V11F/EN GS for the detailed relay menu map). The relay is supplied with a factory-set configuration of default settings

All current settings refer to nominal current (for **NBE** setting value, for **L** ordering option: 1 A or 5 A). The nominal current can be defined separately for phase (In) and earth (Ien) currents in the ordering process (ordering hardware option).

MiCOM S1 Studio 5.1.0 (or higher) can be used to download and upload protection and configuration setting values via the relay's USB port.

The protection and I/O settings include all the following items that become active once enabled in the configuration column of the relay menu database:

– Protection element settings.

– Output settings

– Input settings

– LED settings

There are two groups of protection and I/O settings, with each group containing the same setting cells. One group of protection and I/O settings is selected as the active group, and is used by the protection elements. The settings for group 1 are shown. The settings are discussed in the same order in which they are displayed in the menu.

The menu structure is as follows:

- **DEFAULT WINDOW** (Currents in multiples of In, currents in Amps, CB Control window, Local/remote control window, au to-reclose window)

- ***ALARM STATUS***

- ***RECORDS***

  - ***FAULT RECORDS***

  - ***ALARM RECORDS***

  - ***INSTANTANEOUS RECORDS* (E)**

  - ***COUNTERS***

    - ***CONTROL COUNTER***

    - ***FAULT COUNTER***

    - ***AUTORECLOSE COUNTER* (E)**

    - ***CB MONITORING COUNTER* (AE)**

- ***SETTING GROUP 1***

  - ***PROTECTION G1***

    - ***PHASE O/C G1 [50/51]***

    - ***SOTF G1 [50/51]* (ABE)**

    - ***E/GND FAULT G1 [50N/51N]***

    - ***NEGATIVE SEQUENCE O/C G1 [46]* (E)**

    - ***BROKEN CONDUCTOR G1* (E)**

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- *THERMAL OVERLOAD G1 [49]* **(NABE)**
- *CB FAIL G1 [50BF]*
- *AUX TIMERS G1* **(ABE)**
- *LOGIC SELECTIVITY G1* **(E)**
- *AUTORECLOSE G1 [79]* **(E)**

- *OUTPUT RELAY CONFIGURATION G1*
- *INPUTS CONFIGURATION G1* **(ABE)**
- *LEDS CONFIGURATION G1*

- *SETTING GROUP 2*

- *PROTECTION G2*

- *PHASE O/C G2 [50/51]*
- *SOTF [50/51] G2* **(ABE)**
- *E/GND FAULT G2 [50N/51N]*
- *NEGATIVE SEQUENCE O/C G2 [46]* **(E)**
- *BROKEN CONDUCTOR G2* **(E)**
- *THERMAL OVERLOAD G2 [49]* **(NABE)**
- *CB FAIL G2 [50BF]*
- *AUX TIMERS G2* **(ABE)**
- *LOGIC SELECTIVITY G2* **(E)**
- *AUTORECLOSE G2 [79]* **(E)**

- *OUTPUT RELAY CONFIGURATION G2*
- *INPUTS CONFIGURATION G2* **(ABE)**
- *LEDS CONFIGURATION G2*

- *GLOBAL SETTINGS*

- *LOC*
- *SETTING GROUP SELECT*
- *CT RATIO*
- *CIRCUIT BREAKER*
- *INRUSH BLOCKING* **(AE)**
- *O/C ADVANCED SETTINGS* **(NABE)**
- *[79] ADVANCED SETTINGS* **(E)**
- *COMMUNICATION ORDERS* **(AE)**
- *COMMUNICATION* **(L – ordering option)**
- *DISTURBANCE RECORDER* **(AE)**

- *COMMISSIONING*
- *SETTING CHANGE MODE*
- *OP PARAMETERS*

ST

- ***MEASUREMENTS***

2. SETTINGS

2.1 Protection Settings

2.1.1 Phase O/C [50/51]

The overcurrent protection included in the V11F relay provides non-directional three-phase overcurrent protection with independent time-delay characteristics. All overcurrent settings apply to all of the three phases but are independent for each of the three stages.

The first two overcurrent stages have time-delayed characteristics which are selectable between inverse definite minimum time (IDMT) and definite time (DMT). The third stage has definite time characteristics (DMT) only.

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
I> ?	Disabled	Disabled, Trip, Alarm, Trip-Inrush Bl (**AE**), Trip-Latch (**AE**), Trip-Phase A (**E**), Trip-Phase B (**E**), Trip-Phase C (**E**)		
Setting to disable or enable the protection element. The protection element can be set to trip the CB (Enable ***Trip***), only issue an Alarm signal (Enable ***Alarm***), trip the CB with Inrush Blocking logic (***Trip-Inrush Bl***) or trip the CB with latching until reset (***Trip-Latch***). If the protection element is set to ***'Trip'*** or ***'Trip-Inrush Bl'*** or ***'Trip-Latch'*** it means that it is linked to the ***Protection trip*** (see LED and Output configuration) and ***Trip Command*** (see Output configuration) functions. Additionally this protection element will trigger fault recording, disturbance recording, as well as the ***Trip*** LED on the front panel. If the protection element is set to ***'Alarm'*** it means that it is linked to the ***Alarm*** function (see LED and Output configuration) and ***'ALARM STATUS'*** indication..				
I> Threshold	1.2 x In	0.1 x In	40.0 x In	0.01 x In
Pick-up setting for the first stage of the overcurrent element. If IDMT is used the recommended value is up to 2.5 x In because of the 20-times dependency of IDMT characteristics (the dynamic measuring range is up to 50 x In).				
I> Delay Type	IEC SI	DMT, IEC SI, IEC VI, IEC EI, UK LTI, UK STI, UK RC, RI, IEEE MI, IEEE VI, IEEE EI, US CO2-P20, US CO8, RXIDG, BNP EDF, US CO2-P40		
Setting for the tripping characteristic for the first stage overcurrent element.				
tI>	1 s	0.05 s	200 s	0.01 s
Setting for the time-delay for the definite time setting if selected for first stage element.				
I> TMS	1	0.02	1.6	0.01
Setting for the time multiplier setting to adjust the operating time of the IEC, UK, and RI IDMT characteristics.				
I> Time Dial	1	0.02	100	0.01
Setting for the time multiplier setting to adjust the operating time of the IEEE/US IDMT curves.				
Reset Delay Type I>	DMT	DMT or IDMT		N/A
Setting to determine the type of reset/release characteristic of the IEEE/US curves.				
DMT tReset I>	0 s	0 s	600 s	0.01 s
Setting that determines the reset/release time for definite time reset characteristics.				
RTD/RTMS Reset I>	0.0 s	0.02 s	1.6 s	0.01 s
Setting that determines the reset/release time for IDMT time reset characteristics.				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
I>> ?	Disabled	Disabled, Trip, Alarm, Trip-Inrush Bl (**AE**), Trip-Latch (**AE**), Trip-Phase A (**E**), Trip-Phase B (**E**), Trip-Phase C (**E**)		
See I>?				
I>> Threshold	1.4 x In	0.1 x In	40.0 x In	0.01 x In
Pick-up setting for the second stage of the overcurrent element. If IDMT is used the recommended value is up to 3 x In because of the 20-times dependency of IDMT characteristics (the dynamic measuring range is up to 50 x In).				
Delay Type I>>	IEC SI	DMT, IEC SI, IEC VI, IEC EI, UK LTI, UK STI, UK RC, RI, IEEE MI, IEEE VI, IEEE EI, US CO2-P20, US CO8, RXIDG, BNP EDF, US CO2-P40		
Setting for the tripping characteristic for this stage overcurrent element.				
tI>>	1	0.05	200	0.01
Setting for the time-delay for the definite time setting if selected for this stage element.				
I>> TMS	1	0.02	1.6	0.01
Setting for the time multiplier setting to adjust the operating time of the IEC, UK, and RI IDMT characteristics.				
I>> Time Dial	1	0.02	200	0.01
Setting for the time multiplier setting to adjust the operating time of the IEEE/US IDMT curves.				
Reset Delay Type I>>	DMT	DMT or IDMT		N/A
Setting to determine the type of reset/release characteristic of the IEEE/US curves.				
DMT tReset I>>	0 s	0 s	600 s	0.01 s
Setting that determines the reset/release time for definite time reset characteristics.				
RTD/RTMS Reset I>>	0.02 s	0.02 s	1.6 s	0.01 s
Setting that determines the reset/release time for IDMT time reset characteristics				
I>>> ?	Disabled	Disabled, Trip, Alarm, Trip-Inrush Bl (**AE**), Trip-Latch (**AE**), Trip-Phase A (**E**), Trip-Phase B (**E**), Trip-Phase C (**E**)		
See I>?				
I>>> Threshold	4 x In	1 x In	40.0 x In	0.01 x In
Pick-up setting for the third stage of the overcurrent element.				
tI>>>	0.0 s	0 s	200 s	0.01 s
Setting for the time-delay for the definite time setting if selected for this stage element.				

IDMT tripping can be blocked if any DMT stage is started (**NABE**), settings: ***IDMT interlock by DMT*** (***GLOBAL SETTINGS/O/C ADVANCED*** column). This settings is common for ***E/Gnd Fault [50N/51N]*** and ***Phase O/C [50/51]***

Menu Text	Default Setting	Setting Range		Step Size
IDMT interlock by DMT	No	No	Yes	n/a

ST

2.1.2 SOTF (Switch On To Fault function) (**ABE**)

With the **Switch On To Fault** (SOTF) submenu, it is possible to shorten the time to trip when for example the relay has detected a fault that is still present on a feeder after energizing.

The SOTF overcurrent element is activated after the CB's state changes from open to closed. SOTF is blocked when the auto-recloser is running (**E**).

SOTF?	Disabled	Disabled, Trip, Alarm, Trip-Inrush Bl (**AE**), Trip-Latch (**AE**),		
Setting to disable or enable the protection element. The protection element can be set to trip the CB (Enable ***Trip***), only issue an Alarm signal (Enable ***Alarm***), trip the CB with Inrush Blocking logic (***Trip-Inrush Bl***) or trip the CB with latching until reset (***Trip-Latch***). If the protection element is set to ***'Trip'*** or ***'Trip-Inrush Bl'*** or ***'Trip-Latch'*** it means that it is linked to the ***Protection trip*** (see LED and Output configuration) and ***Trip Command*** (see Output configuration) functions. Additionally this protection element will trigger fault recording, disturbance recording, as well as the ***Trip*** LED on the front panel. If the protection element is set to ***'Alarm'*** it means that it is linked to the ***Alarm*** function (see LED and Output configuration) and ***'ALARM STATUS'*** indication.				
SOTF Threshold	4 x In	1 x In	40.0 x In	0.01 x In
Pick-up setting for the third stage of the overcurrent element.				
tSOTF	0.1 s	0 s	600 s	0.01 s
Setting for the time-delay for the definite time setting if selected for this stage element.				

2.1.3 E/Gnd Fault [50N/51N]

The earth fault element operates from earth fault current that is measured directly from the system; either by means of a separate CT located in a power system earth connection or via a residual connection of the three line CTs.

All overcurrent settings are independent for each of the two stages (**Model E**: three stages).

The first stage of e/f non-directional overcurrent protection has time-delayed characteristics which are selectable between inverse definite minimum time (IDMT) and definite time (DMT). The second stage and the third (**E**) have definite time characteristics only.

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
IN_1 stage ?	Disabled	Disabled, Trip IN>, Alarm IN>, Trip-Inrush Bl IN> (**AE**), Trip-Latch IN> (**AE**),		
Setting to disable or enable the protection element. The protection element can be set to trip the CB (Enable ***Trip***), only issue an Alarm signal (Enable ***Alarm***), trip the CB with Inrush Blocking logic (***Trip-Inrush Bl***) or trip the CB with latching until reset (***Trip-Latch***). If the protection element is set to ***'Trip'*** or ***'Trip-Inrush Bl'*** or ***'Trip-Latch'*** it means that it is linked to the ***Protection trip*** (see LED and Output configuration) and ***Trip Command*** (see Output configuration) functions. Additionally this protection element will trigger fault recording, disturbance recording, as well as the ***Trip*** on the front panel. If the protection element is set to ***'Alarm'*** it means that it is linked to the ***Alarm*** function (see LED and Output configuration) and ***'ALARM STATUS'*** indication				
IN_1 Threshold	0.2 x Ien	0.01 x Ien	2 x Ien	0.01 x Ien
Pick-up setting for the first stage e/f overcurrent element. If IDMT is used, the recommended value is up to 0.1 x Ien because of the 20-times dependency of IDMT characteristics (the dynamic measuring range is up to 2 x Ien). For dynamic range (ordering option): **0.01-2 Ien**, where Ien: nominal current for e/f input				
IN_1 Threshold	0.2 x Ien	0.05 x Ien	12 x Ien	0.01 x Ien
Pick-up setting for first stage overcurrent element. If IDMT is used, the recommended value is up to 0.6 x In because of 20-times dependency of IDMT characteristics (the dynamic measuring range is up to 12 x Ien). For dynamic range (ordering option): **0.05-12 Ien**, where Ien: nominal current for e/f input				
IN_1 Threshold	0.2 x Ien	0.01 x Ien	12 x Ien	0.01 x Ien
Pick-up setting for first stage overcurrent element. If IDMT is used, the recommended value is up to 0.6 x In because of 20-times dependency of IDMT characteristics (the dynamic measuring range is up to 12 x Ien). For dynamic range (ordering option in E): **0.01-12 Ien** (Ien: nominal current for e/f input)				
Delay Type IN_1	IEC SI	DMT, IEC SI, IEC VI, IEC EI, UK LTI, UK STI, UK RC, RI, IEEE MI, IEEE VI, IEEE EI, US CO2-P20, US CO8, RXIDG, BNP EDF, US CO2-P40		
Setting for the tripping characteristic for the first stage e/f overcurrent element.				
tIN_1	1 s	0.05 s	200 s	0.01 s
Setting for the time-delay for the definite time setting if selected for first e/f stage element.				
IN_1 TMS	1	0.02	1.6	0.01
Setting for the time multiplier setting to adjust the operating time of the IEC, UK, and RI IDMT characteristics.				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
IN_1 Time Dial	1	0.02	200	0.01
Setting for the time multiplier setting to adjust the operating time of the IEEE/US IDMT curves.				
Reset Delay Type IN_1	DMT	DMT or IDMT		N/A
Setting to determine the type of reset/release characteristic of the IEEE/US curves.				
RTD/RTMS Reset IN_1	0.02	0.02	1.6	0.01
Setting that determines the reset/release time for IDMT time reset characteristics.				
DMT tReset IN_1	0 s	0 s	200 s	0.01 s
Setting that determines the reset/release time for definite time reset characteristics.				
IN_2 stage ?	Disabled	Disabled, Trip IN>>, Alarm IN>>, Trip-Inrush Bl IN>> (**AE**), Trip-Latch IN>> (**AE**),		
See IN_1 stage?				
IN_2 Threshold	0.4 x Ien	0.05 x Ien	2.0 x Ien	0.01 x Ien
Pick-up setting for the second stage of the e/f overcurrent element. For dynamic range (ordering option**): 0.01-2 Ien**, where Ien: nominal current for e/f input				
IN_2 Threshold	0.4 x Ien	0.3 x Ien	12.0 x Ien	0.01 x Ien
Pick-up setting for the second stage of the overcurrent element. For dynamic range (ordering option): **0.05-12 Ien**, where Ien: nominal current for e/f input				
IN_2 Threshold	0.4 x Ien	0.01 x Ien	12.0 x Ien	0.01 x Ien
Pick-up setting for the second stage of the overcurrent element. For dynamic range (ordering option): **0.01-12 Ien**, where Ien: nominal current for e/f input				
tIN_2	0.0 s (Model E, 0.01-12Ien: 0.05)	0 s	200 s	0.01 s
Setting for the time-delay for the definite time setting if selected for this stage.				
IN_3 stage ? (**E**)	Disabled	Disabled (**E**), Trip IN>>> (**E**), Alarm IN>>> (**E**), Trip-Inrush Bl IN>>> (**E**), Trip-Latch IN>>> (**E**),		
See IN_1 stage ?				
IN_3 Threshold (**E**)	0.4 x Ien	0.05 x Ien	2.0 x Ien	0.001 x Ien
Pick-up setting for the third stage of the e/f overcurrent element. For dynamic range (ordering option): **0.01-2 Ien**, where Ien: nominal current for e/f input				
IN_3 Threshold (**E**)	0.4 x Ien	0.3 x Ien	12.0 x Ien	0.01 x Ien
Pick-up setting for the third stage of the overcurrent element. For dynamic range (ordering option): **0.05-12 Ien**, where Ien: nominal current for e/f input				
IN_3 Threshold (**E**)	0.4 x Ien	0.3 x Ien	12.0 x Ien	0.01 x Ien
Pick-up setting for the third stage of the overcurrent element. For dynamic range (ordering option): **0.01-12 Ien**, where Ien: nominal current for e/f input				
tIN_3 (**E**)	0.0 s	0 s	200 s	0.01 s
Setting for the time-delay for the definite time setting if selected for this stage.				

ST

IDMT tripping can be blocked if any DMT stage is started, settings: ***IDMT interlock by DMT*** (***GLOBAL SETTINGS/O/C ADVANCED*** column). This settings is common for ***E/Gnd Fault [50N/51N]*** and ***Phase O/C [50/51]***

Menu Text	Default Setting	Setting Range		Step Size
IDMT interlock by DMT	No	No	Yes	n/a

2.1.4 Negative Sequence O/C [46] (E)

ST

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
I2> ?	Disabled	Disabled, Trip, Alarm, Trip-Inrush Bl , Trip-Latch,		
Setting to disable or enable the protection element. The protection element can be set to trip the CB (Enable ***Trip***), only issue an Alarm signal (Enable ***Alarm***), trip the CB with Inrush Blocking logic (***Trip-Inrush Bl***) or trip the CB with latching until reset (***Trip-Latch***). If the protection element is set to ***'Trip'*** or ***'Trip-Inrush Bl'*** or ***'Trip-Latch'*** it means that it is linked to the ***Protection trip*** (see LED and Output configuration) and ***Trip Command*** (see Output configuration) functions. Additionally this protection element will trigger fault recording, disturbance recording, as well as the ***Trip*** LED on the front panel. If the protection element is set to ***'Alarm'*** it means that it is linked to the ***Alarm*** function (see LED and Output configuration) and ***'ALARM STATUS'*** indication.				
I2> Threshold	1.0x In	0.1 x In	4.0 x In	0.01 x In
Pick-up setting for the first stage of the overcurrent element. If IDMT is used recommended value is up to 3xIn because of 20 time dependence of IDMT characteristics. (dynamic measuring range is up to 50xIn)				
I2> Delay Type	IEC SI	DMT, IEC SI, IEC VI, IEC EI, UK LTI, UK STI, UK RC, RI, IEEE MI, IEEE VI, IEEE EI, US CO2-P20, US CO8, RXIDG, BNP EDF, US CO2-P40		
Setting for the tripping characteristic for the first stage overcurrent element.				
tI2>	1 s	0.05 s	200 s	0.01 s
Setting for the time-delay for the definite time setting if selected for first stage element.				
I2> TMS	1	0.02	1.6	0.01
Setting for the time multiplier setting to adjust the operating time of the IEC, UK, and RI IDMT characteristic				
I2> Time Dial	1	0.02	200	0.01
Setting for the time multiplier setting to adjust the operating time of the IEEE/US IDMT curves.				
Reset Delay Type I2>	DMT	DMT or IDMT		N/A
Setting to determine the type of reset/release characteristic of the IEEE/US curves.				
DMT tReset I2>	0 s	0 s	600 s	0.01 s
Setting that determines the reset/release time for definite time reset characteristics.				
RTD/RTMS Reset I2>	0.02	0.02	1.6	0.01

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Setting that determines the reset/release time for IDMT time reset characteristics.				

2.1.5 Broken Conductor (E)

Menu Text	Default Setting	Setting Range		Step Size
Broken Cond.?	Disabled	Disabled, Trip, Alarm, Trip-Inrush Bl , Trip-Latch		
Setting to disable or enable the protection element. The protection element can be set to trip the CB (Enable ***Trip***), only issue an Alarm signal (Enable ***Alarm***), trip the CB with Inrush Blocking logic (***Trip-Inrush Bl***) or trip the CB with latching until reset (***Trip-Latch***). If the protection element is set to ***'Trip'*** or ***'Trip-Inrush Bl'*** or ***'Trip-Latch'*** it means that it is linked to the ***Protection trip*** (see LED and Output configuration) and ***Trip Command*** (see Output configuration) functions. Additionally this protection element will trigger fault recording, disturbance recording, as well as the ***Trip*** LED on the front panel. If the protection element is set to ***'Alarm'*** it means that it is linked to the ***Alarm*** function (see LED and Output configuration) and ***'ALARM STATUS'*** indication.				
Ratio I2/I1	20%	20%	100%	1%
Pick-up setting for the third stage of the overcurrent element.				
tBCond	100 s	0.05 s	600 s	0.01 s
Setting for the time-delay for the definite time setting if selected for this stage element.				

ST

2.1.6 Thermal Overload [49] (**NABE**)

Menu Text	Default Setting	Setting Range		Step Size
Therm OL?	Disabled	Disabled, Enabled		
Setting to disable or enable the protection element.				
Itherm	1.0 x In	0.1 x In	3 x In	0.01 x In
Base current for Thermal Replica. The value should be set to: ***Itherm*** = k*I_{FLC}, where k: safety factor (typically: 1.05 or 1.1 or 1.2 depending on the application); I_{FLC}: full load current (maximum permissible current which can flow without risk of reducing the protected object's life).				
Te (heating)	40 mn	1 mn	200 mn	1 mn
Heating Time Constant of the protected object (see Application chapter of this Manual).				
Tr (cooling)	40 mn	1 mn	999 mn	1 mn
Cooling Time Constant of the protected object (see Application chapter of this Manual). Typically for protected objects with no moving parts (such as motors) this value should be equal to the Heating Time Constant (Tr = Te)				
Theta Trip	100%	50%	200%	1%
Thermal stage for tripping. If ***Itherm*** = k*I_{FLC}, typically this value is set to 100%, where k: safety factor (typically: 1.05 or 1.1 or 1.2 depending on the application); I_{FLC}: full load current If the ***Itherm*** = I_{FLC}, this value is set to: k^2x100% (for example for k=1.05: 1.05^2*100%=110%)				
Theta Trip/Reset Ratio:	90%	20%	99%	1%
Setting for ***Theta Trip*** Reset stage. The reset stage is equal to: (***Theta Trip***) * (***Theta Trip/Reset Ratio***).				
Theta Alarm	100%	20%	200%	1%
Thermal stage for signaling (***Alarm***).				

ST

2.1.7 CB Fail [50BF]

This function consists of a circuit breaker fail function that can be initiated by:

Current based protection elements

External protection element (**AE**): ***Strt tBF*** function (***SETTING GROUP x/INPUTS/*** column).

For current-based protection, the reset condition is based on undercurrent operation to determine whether the CB has opened.

It is common practice to use low set undercurrent elements in protection relays to indicate that circuit breaker poles have interrupted the fault or load current, as required.

If an external protection is set to trigger the ***CB Fail*** element, the trip input must also be mapped to the ***Strt tBF function*** *(**AE**)*. The resetting of the ***tBF*** timer is based on the ***I< Threshold CBF*** and ***IN< Threshold CBF*** criteria only. Therefore if an external protection issues a latched trip signal but currents fall below the undercurrent thresholds, ***CB Fail*** will not issue the CB Fail signal.

ST

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
CBF ?	Disabled	Disabled, Retrip, Alarm		
Setting to enable or disable the circuit breaker supervision function. ***Retrip*** setting – the CBF function retrips the local CB upon expiry of the ***tBF*** time-delay ***Alarm*** setting – the ***Alarm*** signal is issued upon expiry of the ***tBF*** time-delay				
CB Fail Time tBF	0.1 s	0 s	10 s	0.01 s
Setting for the circuit breaker fail timer stage for which the initiating condition must be valid.				
I< Threshold CBF	0.1 x In	0.1 x In	2 x In	0.01 x In
Setting that determines the circuit breaker fail timer reset current for overcurrent based protection circuit breaker fail initiation.				
IN< Threshold CBF	0.1 x Ien	0.1 x Ien	2 x Ien	0.01 x Ien
Setting that determines the circuit breaker fail timer reset current for earth fault current based protection circuit breaker fail initiation. For dynamic range (ordering option): 0.01-2 Ien, where Ien: nominal current for e/f input				
IN< Threshold CBF	0.1 x Ien	0.1 x Ien	2 x Ien	0.01 x Ien
Setting that determines the circuit breaker fail timer reset current for earth fault current based protection circuit breaker fail initiation. For dynamic range (ordering option): 0.05-12 Ien, where Ien: nominal current for e/f input				
IN< Threshold CBF	0.1 x Ien	0.1 x Ien	2 x Ien	0.01 x Ien
Setting that determines the circuit breaker fail timer reset current for earth fault current based protection circuit breaker fail initiation. For dynamic range (ordering option): 0.01-12 Ien, where Ien: nominal current for e/f input				
Block I> ? (**E**)	No	No or Yes		
Select the possibility to block the instantaneous signal I> in case of circuit breaker failure detection.				
Block IN> ? (**E**)	No	No or Yes		
Select the possibility to block the instantaneous signal IN> in case of circuit breaker failure detection.				

2.1.8 Auxiliary Timers (ABE)

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
AUX1 ?	0: Disabled	0: Disabled, 1: Trip, 2: Alarm, 3: Trip-Inrush Bl (AE), 4: Trip-Latch (AE), 5: Load Shedding (E), 6: AR after LS Hi (E), 7: AR after LS Lo (E)		N/A
Setting to disable or enable the AUX element. The element can be set to: - trip the CB (Enable ***Trip***), - signal only (***Alarm***), - trip the CB with Inrush Blocking logic (***Trip-Inrush Bl***) - trip the CB with latching until reset (***Trip-Latch***) - trip the CB when a binary input receives the information that the frequency of power system is too low (Load Shedding). This information is saved as long as the CB remains open or until the power system's frequency returns to its nominal value. The above information is based on the status of the binary input mapped to AUX (***SETTING GROUP x/INPUT CONFIGURATION Gx/AUX***) with AUX set to ***AR after LS Hi*** or to ***AR after LS Lo*** (tripping occurs upon expiry of the ***tAUX*** time-delay). The trip command is sent via the ***Trip CB order*** output (***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx/Trip CB order***). - reclose after Load Shedding triggered by a high state of the AUX function (***AR after LS Hi***). Load shedding information is based on the status of the binary input mapped to AUX (***SETTING GROUP x/INPUT CONFIGURATION Gx/AUX***) with AUX set to ***Load Shedding***. If the V11F has saved ***Load Shedding*** information and AUX indicates that the power system frequency has returned to its nominal value, the ***tAUX*** time-delay is started. At the end of ***tAUX*** the close command is issued. The close command is issued via the ***Close CB order*** output (***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx/Close CB order***). - reclose after Load Shedding triggered via a low state of the AUX function (***AR after LS Lo***). Load shedding information is based on the status of the binary input mapped to AUX (***SETTING GROUP x/INPUT CONFIGURATION Gx/AUX***) with AUX set to ***Load Shedding***. If the V11F has saved load shedding information and AUX indicates that the power system frequency has returned to its nominal value, the ***tAUX*** time-delay is started. At the end of ***tAUX*** the close command is issued. The close command is issued via the ***Close CB order*** output (***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx/Close CB order***). If the protection element is set to ***'Trip'*** or ***'Trip-Inrush Bl'*** or ***'Trip-Latch'*** it means that it is linked to the ***Protection trip*** (see LED and Output configuration) and ***Trip Command*** (see Output configuration) functions. Additionally this protection element will trigger fault recording, disturbance recording, as well as the ***Trip*** LED and the Flag indicator on the front panel. If the protection element is set to ***'Alarm'*** it means that it is linked to the ***Alarm*** function (see LED and Output configuration) and ***'ALARM STATUS'*** indication. Refer to V11F Operation chapter.				
tAUX1	0s	0 s	600 s	0.01 s
Setting for the operating time-delay of the ***AUX1*** function.				
AUX2 ?	0: Disabled	See AUX1?		N/A
Same as AUX1				

ST

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
tAUX2	0 s	0 s	600 s	0.01 s
Setting for the operating time-delay of the ***AUX2*** function.				
AUX3 ?	0: Disabled	See AUX1?		N/A
Same as AUX1				
tAUX3	0 s	0 s	600 s	0.01 s
Setting for the operating time-delay of the ***AUX3*** function.				
AUX4 ?	0: Disabled	See AUX1?		N/A
Same as AUX1				
tAUX4	0 s	0 s	600 s	0.01 s
Setting for the operating time-delay of the ***AUX4*** function.				

2.1.9 Logic Selectivity (**E**)

With Logic Select. 1 or Logic Select. 2, the user can assign each time-delay threshold to the ***Log Sel*** input (refer ***SETTING GROUP x/INPUTS CONFIGURATION/***) in the Inputs menu).

<table>
<tr><th rowspan="2">Menu Text</th><th rowspan="2">Default Setting</th><th colspan="2">Setting Range</th><th rowspan="2">Step Size</th></tr>
<tr><th>Min.</th><th>Max.</th></tr>
<tr><td>Sel1?</td><td>0: Disabled</td><td colspan="2">Disabled, Enabled</td><td>N/A</td></tr>
<tr><td colspan="5">Setting to Disable or Enable the Selective Logic 1 element.
This function changes the time-delay setting of the protection elements: tI>>, tI>>>, tIN_2 or tIN_3 (E) to the tSEL1 setting value. The time-delay's setting value is changed without resetting the timer.
In the SETTING GROUP x/INPUT CONFIGURATION Gx/ submenu it is possible to choose which protection element is linked to the Selective Logic 1 function:
Sel1 tI>> or/and Sel1 tI>>> or/and Sel1 tIN_2 or/and Sel1 tIN_3 (E)</td></tr>
<tr><td>tSel1</td><td>0.4s</td><td>0 s</td><td>600 s</td><td>0.01 s</td></tr>
<tr><td colspan="5">Setting for the operating time-delay of the Sel1 function.</td></tr>
<tr><td>Sel2?</td><td>Disabled</td><td colspan="2">Disabled, Enabled</td><td>N/A</td></tr>
<tr><td colspan="5">Same as Sel1?</td></tr>
<tr><td>tSel2</td><td>0.4 s</td><td>0 s</td><td>600 s</td><td>0.01 s</td></tr>
<tr><td colspan="5">Setting for the operating time-delay of the Sel2 function.</td></tr>
</table>

2.1.10 Cold Load Pick Up

The ***Cold Load PU*** (CLP) submenu allows the user to enable the cold load pick-up function. Selected threshold values can be raised temporarily.

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Cold Load PU ?	Disabled	Disabled, Current+Input, Input only		N/A
Setting to ***Disable*** or ***Current+Input*** or ***Input only*** the ***Cold Load PU*** element. This function increases or decreases the thresholds for ***Cold Load PU level*** via ***tCL pulse*** time. ***Input only:* *tCL*** is started by a binary input assigned to the ***Cold PU*** function. For example: Typically increasing of the threshold is applied when the CB changes position from 52b to 52a (closing CB), therefore the input mapped to ***CB status 52a*** should be assigned to the ***Cold PU*** function too. ***Current+Input: tCL*** is started by a binary input assigned to the ***Cold PU*** function (as above) or based on the current stages: 5%In and 10%In. If the current in all phases are below 5%In by over 10s, after increasing of current above 10%In at least in a one phase ***tCL*** is started.				
Cold Load PU Level	100%	20%	999%	1%
Displays the scaling value, in percentage, of the cold load pick up assigned to the selected thresholds. This value is the amount by which the selected threshold is increased or decreased.				
Cold Load PU tCL	1 s	0.0 s	6000 s	0.01 s
Displays the delay timer setting (***tCL***) for the Cold Load Pick-up function. The timer ***tCL*** controls the time during which the protection elements are altered. When ***tCL*** has elapsed, the settings revert back to their original values. ***tCL*** is initiated thanks to a dedicated input signal (refer to the ***SETTING GROUP x/INPUT CONFIGURATION Gx*** menu), generated by connecting an auxiliary contact from the CB (52a or 52b) or starting device to the relevant logic input.				
Cold Load PU I>	No	No, Yes		N/A
The Cold Load PU function increases or decreases the I> threshold: No or Yes				
Cold Load PU I>>	No	No, Yes		N/A
The Cold Load PU function increases or decreases the I>> threshold: No or Yes				
Cold Load PU I>>>	No	No, Yes		N/A
The Cold Load PU function increases or decreases the I>>> threshold: No or Yes				
Cold Load PU IN_1	No	No, Yes		N/A
The Cold Load PU function increases or decreases the IN> threshold: No or Yes				
Cold Load PU IN_2	No	No, Yes		N/A
The Cold Load PU function increases or decreases the IN>> threshold: No or Yes				
Cold Load PU IN_3 (**E**)	No	No, Yes		N/A
The Cold Load PU function increases or decreases the IN>>> threshold: No or Yes				
Cold Load PU Brkn.Cond (**E**)	No	No, Yes		N/A
The Cold Load PU function increases or decreases the Is2/Is1 threshold: No or Yes				
Cold Load PU Itherm (**NABE**)	No	No, Yes		N/A
The Cold Load PU function increases or decreases the Itherm threshold: No or Yes				

ST

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Cold Load PU I2> (**E**)	No	No, Yes		N/A
The Cold Load PU function increases or decreases the I2> threshold: No or Yes				

ST

2.1.11 Auto-reclose [79] (E)

The auto-reclose function provides the ability to automatically control the recloser, with one, two, three, or four shot cycles. Each cycle implements a dead time and a reclaim time.

During the auto-reclosing cycle, if the relay receives a command to switch setting groups, this command is kept in memory, and will be executed only after the timer elapses.

The auto-reclose function is available if:

- a logical input is assigned to the 52a state (if the ***CB trips*** option is set in submenu: ***GLOBAL SETTINGS/[79] ADVANCED SETTINGS/Start Dead t on***),
- and the trip output relay is not latched to the earth and/or phase protection element.

In addition to these settings, the user can fully link the auto-reclose function to the protection function using the menus ***PROTECTION G1 / Phase OC*** and ***PROTECTION G1/ E/Gnd***.

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Auto-reclose ?	Disabled	Disabled, Enabled		N/A
Setting to Disable or Enable the ***Auto-reclose*** element.				
Dead Time tD1	0.2 s	0.0 s	600 s	0.01 s
Sets the value for the Dead Time of the first shot (tD1). The Dead Time starts at the CB trip, when ***GLOBAL SETTINGS/[79] ADVANCED SETTINGS/***: - ***Start Dead t on: CB Trips*** is set: the 52a input is no longer energised. - ***Start Dead t on: Protect.Reset*** is set: none of the protection criteria (which trip) are started.				
Dead Time tD2	20 s	0 s	600 s	0.01 s
Sets the value for the Dead Time of the second shot (tD2).				
Dead Time tD3	1 s	0 s	600 s	0.01 s
Sets the value for the Dead Time of the third shot (tD3).				
Dead Time tD4	20 s	0 s	600 s	0.01 s
Sets the value for the Dead Time of the fourth shot (tD4).				
Reclaim Time tR	2 s	0.0 s	600 s	0.01 s
After the reclaim time has elapsed, if the circuit breaker does not trip again, the auto-reclose function resets; otherwise, the relay either advances to the next shot that is programmed in the auto-reclose cycle, or, if all the programmed reclose attempts have been accomplished, it locks out. If the protection element operates during the reclaim time following the final reclose attempt, the relay will lockout and the auto-reclose function is disabled until the lockout condition resets.				

ST

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Menu Text	**54321 trip shot**	**5,4,3,2,1 trip shot**		Step size
Fast O/C Trip	00000	0-1		1

This function allows faster tripping by phase overcurrent criteria when the auto-recloser is running.

The ***Fast Trip*** function increases the number of successful auto-reclosures.

The best result is obtained with fast tripping set to 0 s (instantaneous trip), but because of transient currents it is sometimes necessary to set a value greater than 0 s in order to avoid maloperation.

If bit “1” is set, the value for ***Fast O/C Trip Delay*** is used instead of the protection element's time-delay

Note: If the protection element's time-delay is shorter than the Fast Trip's time-delay, tripping occurs upon expiry of the protection element's time-delay (the shortest timer is used).

For example:

I> is configured for 4 shots auto-reclose (***SETTING GROUP x/PROTECTION Gx/ AUTORECLOSE [79] G1/I> Close Shot? 1111***)

tI> is set for 1 s (***SETTING GROUP x/PROTECTION Gx/PHASE O/C [50/51] G1/tI>=1.00 s***)

Delay for Ph O/C Fast Trip: 0.1 s (***SETTING GROUP x/PROTECTION Gx/ AUTORECLOSE [79] G1/ Fast O/C Trip Delay 0.1 s***)

For a permanent fault, the setting "00011" means that:

1. "1": the first trip occurs after the time-delay: 0.1 s (Fast Trip time-delay)
2. "1": the second trip occurs after the time-delay: 0.1 s (Fast Trip time-delay)
3. "0": the third trip occurs after the time-delay: 1 s (tI> time-delay)
4. "0": the fourth trip occurs after the time-delay: 1 s (tI> time-delay)
5. "0": the fifth trip occurs after the time-delay: 1 s (tI> time-delay)

Fast O/C Trip Delay	0 s	0 s	9.99s	0.01 s

Sets the value for the phase overcurrent **Fast Trip** time-delay

Menu Text	**54321 trip shot**	**5,4,3,2,1 trip shot**	Step size
Fast E/Gnd Trip	00000	0-1	1

This function allows faster tripping by earth fault overcurrent criteria when the auto-recloser is running.

The ***Fast Trip*** function increases the number of successful auto-reclosures.

If bit “1” is set, the value for ***Fast E/Gnd Trip Delay*** is used instead of the protection element's time-delay

Note: If the protection element's time-delay is shorter than the Fast Trip's time-delay, tripping occurs upon expiry of the protection element's DMT time-delay (the shortest timer is used).

ST

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Fast E/Gnd Trip Delay	0 s	0 s	9.99s	0.01 s
Sets the value for the phase overcurrent **Fast Trip** time-delay				
Menu Text	**4321 reclosing shot**	**4,3,2,1 reclosing shot**		Step size
Close Shot? tI>	0000	0-1		1
4321 are the cycles associated with the close command of the Auto-reclose function after tI> trip. "0011" are the actions (closing) to be executed after a tI> trip: 0 - no action by auto-recloser: final trip (the auto-recloser will switch to locked state), 1 - after tI> trip and dead time (fault clearance) the reclosing command will be executed.				
Menu Text	**4321 reclosing shot**	**4,3,2,1 reclosing shot**		Step size
Inhib.Trip tI>: Shot	0000	0-1		1
4321 are the cycles associated with the tI> trip 1101 are the actions to be executed after a reclosing shot and the tI> time-delay has elapsed: 0 = no inhibit 1 = no tI> trip: and this whatever the setting in the "SETTING GROUP x/PROTECTION Gx/PHASE O/C [50/51] Gx/I>? " menu.				
Close Shot? tI>>	0000	0-1		1
See ***Close Shot? tI>***				
Inhib.Trip tI>>: Shot	0000	0-1		1
See ***Close Shot? tI>***				
Close Shot? tI>>>	0000	0-1		1
See ***Close Shot? tI>***				
Inhib.Trip tI>>>: Shot	0000	0-1		1
See ***Close Shot? tI>***				
Close Shot? tIN_1	0000	0-1		1
See ***Close Shot? tI>***				

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Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Menu Text	**4321 Close Shot**	**4,3,2,1 reclosing shot**		Step size
Inhib.Trip tIN_1: Shot	0000	0-1		1
See ***Close Shot? tI>***				
Close Shot? tIN_2	0000	0-1		1
See ***Close Shot? tI>***				
Inhib.Trip tIN_2: Shot	0000	0-1		1
See ***Close Shot? tI>***				
Close Shot? tIN_3	0000	0-1		1
See ***Close Shot? tI>***				
Inhib.Trip tIN_3: Shot	0000	0-1		1
See ***Close Shot? tI>***				
Close Shot? tAUX1	0000	0-1		1
See ***Close Shot? tI>***				
Inhib.Trip tAUX1: Shot	0000	0-1		1
See ***Close Shot? tI>***				
Close Shot? tAUX2	0000	0-1		1
See ***Close Shot? tI>***				
Menu Text	**4321 Close Shot**	**4,3,2,1 reclosing shot**		Step size
Inhib.Trip tAUX2: Shot	0000	0-1		1
See ***Close Shot? tI>***				

Auto-reclose settings, common for Group 1 and Group 2, are available in column: ***GLOBAL SETTINGS / [79] Advanced Settings*** (see 3.6 ***[79] ADVANCED SETTINGS***).

2.2 Output Relay Configuration

Output settings define which signals are mapped to the V11F's outputs.
Matrix configuration allows free mapping of any one function to each output.

Note:

- Model L have RL1 to RL3 + WD outputs
- Model N have RL1 to RL5 + WD outputs
- Model B have RL1 to RL3 + WD outputs
- Model A have RL1 to RL7 + WD outputs
- Model E have RL1 to RL5 + WD outputs

<table>
<tr><th>Menu Text</th><th>Default Setting</th><th>Setting Range</th><th>Step Size</th></tr>
<tr><td>Description of bits:</td><td colspan="2">RL: 7,6,5,4,3,2,1</td><td></td></tr>
<tr><td>Latched Outputs</td><td>0000000</td><td>0-1</td><td>1</td></tr>
<tr><td colspan="4">Each output can be configured with or without latching.
Default Setting: “00000” means that:
RL7: “0” – output RL5 is not latched. The high state of the function mapped to the output determines the high state of RL7. The low state of this function determines the low state of RL7 (A).
RL6: “0” – see RL7 (A).
RL5: “0” – see RL7 (NEA).
RL4: “0” – see RL7 (NEA).
RL3: “0” – see RL7 (LBNEA).
RL2: “0” – see RL7 (LBNEA).
RL1: “0” – see RL7 (LBNEA).
The high state of the function mapped to the output determines the high state of the output relay. The low state of this function does not change the state of the output relay. For the low state of output relay, it is necessary to activate the Reset of Latched Output function (via a binary input, from the front panel or via a communication port)</td></tr>
<tr><td>Description of bits:</td><td colspan="2">RL: 7,6,5,4,3,2,1</td><td></td></tr>
<tr><td>Reverse outp.log.</td><td>0000000</td><td>0-1</td><td>1</td></tr>
<tr><td colspan="4">Reverse outp. logic gives more application flexibility. If reverse logic is chosen for the output, after the V11F is powered (current, auxiliary voltage) the output contacts close. Any high state function connected with this output will open the contacts of the output relay.</td></tr>
<tr><td>Description of bits:</td><td colspan="2">RL: 7,6,5,4,3,2,1</td><td></td></tr>
<tr><td>Protection Trip</td><td>0000000</td><td>0-1</td><td>1</td></tr>
<tr><td colspan="4">Protection Trip is high if any protection element configured to Trip is high (current-based protection elements and external protection elements: AUX1, AUX2, AUX3, AUX4, CBF re-trip).</td></tr>
<tr><td>Description of bits:</td><td>RL: 7,6,5,4,3,2,1</td><td>RL: 5,4,3,2,1</td><td></td></tr>
<tr><td>Prot.Trip pulse</td><td>0000000</td><td>0-1</td><td>1</td></tr>
<tr><td colspan="4">Protection Trip pulse is energized via Protection Trip (see above). This command has a pulse duration not less than tOpen time set at GLOBAL SETTINGS/CIRCUIT BREAKER/tOpen pulse min.</td></tr>
<tr><td>Description of bits:</td><td colspan="2">RL: 7,6,5,4,3,2,1</td><td></td></tr>
</table>

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Menu Text	Default Setting	Setting Range	Step Size
Trip CB Order	0000000	0-1	1
The **Trip CB Order** function is high during the set time if the manual trip command is executed (communication port, front panel, binary inputs) (the trip pulse is set at ***GLOBAL SETTINGS/CIRCUIT BREAKER/ tOpen pulse min***)			
Description of bits:	**RL: 7,6,5,4,3,2,1**		
Close CB Order	0000000	0-1	1
The ***Close CB Order*** function is high during the set time if the manual close command or Auto-reclose function are executed (Communication port, binary input, front pane). The close pulse is set at ***GLOBAL SETTINGS/CIRCUIT BREAKER/ tClose Pulse***.			
Description of bits:	**RL: W,7,6,5,4,3,2,1**		
Alarm	00000000	0-1	1
The ***Alarm*** function is high if any protection element configured to ***Alarm*** is high (current-based protection element and external protection elements: **AUX1**, **AUX2**, **AUX3**, **AUX4,**). Default Setting: “000000000” means that: W: “0” – watchdog (RL0/WD) contact is not assigned to the *Alarm* function RL7: “0” – see W RL6: “0” – see W RL5: “0” – see W RL4: “0” – see W RL3: “0” – see W RL2: “0” – see W RL1: “0” – see W			
Description of bits:	**RL: 7,6,5,4,3,2,1**		
Start I>	000000	0-1	1
Start I> is high if the I> protection element has started (current above the set I> threshold).			
Start I>>	000000	0-1	1
Start I>> is high if the I>> protection element has started (current above the set I>> threshold).			
Start I>>>	000000	0-1	1
Start I>>> is high if the I>>> protection element has started (current above the set I>>> threshold).			
Start SOTF (**BAE**)	000000	0-1	1
Start SOTF is high if the SOTF protection element has started (o/c current above the set SOTF threshold).			
Start IN_1	000000	0-1	1
Start IN_1 is high if the IN> protection element has started (e/f current is above the set IN_1 threshold).			
Start IN_2	000000	0-1	1
Start IN_2 is high if the IN>> protection element has started (e/f current above the set IN>> threshold).			
Start IN_3 (**E**)	00000	0-1	1
Start IN_3 is high if the IN>>> protection element has started (e/f current above the set IN>>> threshold).			
Start I2> (**E**)	00000	0-1	1

Menu Text	Default Setting	Setting Range	Step Size
Start I2> is high if the I2> protection element has started (current below the set I2> threshold).			
Start Brkn Cond (**E**)	00000	0-1	1
Start Brkn Cond is high if the Broken Conductor protection element has started (Is2/Is1 above the set ratio threshold).			
AUX1 (**BAE**)	0000000	0-1	1
AUX1 is high if the input assigned to AUX1 is set high.			
AUX2 (**BAE**)	0000000	0-1	1
AUX2 is high if the input assigned to AUX2 is set high.			
AUX3 (**BAE**)	0000000	0-1	1
AUX3 is high if the input assigned to AUX3 is set high.			
AUX4 (**BAE**)	0000000	0-1	1
AUX4 is high if the input assigned to AUX4 is set high.			
AUX5 (**BAE**)	0000000	0-1	1
AUX5 is high if the input assigned to AUX5 is set high.			
AUX6 (**BAE**)	0000000	0-1	1
AUX6 is high if the input assigned to AUX6 is set high.			
tI>	0000000	0-1	1
tI> is high if the set time-delay for the I> element has elapsed			
tI>>	0000000	0-1	1
tI>> is high if the set time-delay for the I>> element has elapsed			
tI>>>	0000000	0-1	1
tI>>> is high if the set time-delay for the I>>> element has elapsed			
tSOTF (**BAE**)	0000000	0-1	1
tSOTF is high if the set time-delay for the SOTF element has elapsed			
tIN_1	0000000	0-1	1
tIN_1 is high if the set time-delay for the IN> element has elapsed			
tIN_2	0000000	0-1	1
tIN_2 is high if the set time-delay for the IN>> element has elapsed			
tIN_3 (**E**)	00000	0-1	1
tIN_3 is high if the set time-delay for the IN>>> element has elapsed			
tI2> (**E**)	00000	0-1	1
tI2> is high if the set time-delay for the Is2> element has elapsed			
tBrkn Cond. (**E**)	00000	0-1	1
tBrknCond. is high if the set time-delay for the Is2/Is1 element has elapsed			
Thermal Trip (**NBAE**)	0000000	0-1	1
Thermal Trip is high if the trip thermal stage is greater than the set value			
Thermal Alarm (**NBAE**)	0000000	0-1	1

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Menu Text	Default Setting	Setting Range	Step Size
Thermal Alarm is high if the alarm thermal stage is greater than the set value			
CB Fail	0000000	0-1	1
CB Fail is high if the set time-delay for the CBF protection function is elapsed			
tAUX1 (**BAE**)	0000000	0-1	1
tAUX1 is high if the set time-delay for the AUX1 element has elapsed			
tAUX2 (**BAE**)	0000000	0-1	1
tAUX2 is high if the set time-delay for the AUX2 element has elapsed			
tAUX3 (**BAE**)	0000000	0-1	1
tAUX3 is high if the set time-delay for the AUX3 element has elapsed			
tAUX4 (**BAE**)	0000000	0-1	1
tAUX4 is high if the set time-delay for the AUX4 element has elapsed			
Comm. Order 1 (**AE**)	00000000	0-1	1
Comm.Order 1 is used for control of outputs via an RS485 command. The pulse duration is set at ***GLOBAL SETTING/COMMUNICATION ORDER/Pulse Time tCOM1***			
Comm. Order 2 (**AE**)	00000000	0-1	1
Comm.Order 2 is used for control of outputs via an RS485 command (if in ***GLOBAL SETTINGS/COMMUNICATION ORDERS/COM2 order Conf.*** "***0:RS485***" or "***1:RS485+Button_C***" is set) or via pressing "C" clear key on the front panel (if in ***GLOBAL SETTINGS/COMMUNICATION ORDERS/COM2 order Conf.*** "***2: Button_C***" or "***1:RS485+Button_C***" is set) The pulse duration set in ***GLOBAL SETTING/COMMUNICATION ORDER/Pulse Time tCOM2***			
[79] in Progress (**E**)	00000	0-1	1
[79] in Progress indicates that an auto-reclose cycle is running. The signal is present during the complete reclosing cycle from protection initiation to the end of the reclaim time or lockout			
[79] F.Trip (**E**)	00000	0-1	1
[79] F.Trip (Final Trip) indicates that the auto-recloser has issued a final trip (after the last reclosing shot the line is still faulty)			
[79] Lockout (**E**)	00000	0-1	1
[79] Lockout indicates that the relay is in a lockout state and that no further reclose attempts will be made: - the Reclaim time has elapsed but CB is still open - the Dead time has elapsed but CB remained open after the reclosing shot - the CB has failed to close - the protection element not assigned to the auto-reclose function is tripped. - Close or Trip command is executed in A/R time (when A/R is running) - a number of A/R rolling demand valid - A/R conflict - the CB is faulty - information based on an external Signal, assigned to an input is in high logic state longer than set in ***tCB FLT Ext.Sign (GLOBAL SETTINGS/CIRCUIT BREAKER)*** This alarm can be reset using one of these resetting methods: assigned input (***Reset Latchd Sign***), front panel (**C** clear key), reset command (***Reset Latchd Sign)*** via RS485 The lockout auto-reclose condition can reset by a manual closing after the ***Inhib Time tI***.			
[79] Blocked (**E**)	00000	0-1	1

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Menu Text	Default Setting	Setting Range	Step Size
[79] Blocked indicates that the auto-recloser is inhibited (blocked) due to one of the following reasons: - blocking from the front panel (blocking via Menu) - the auto-recloser is disabled by setting (disabled) - a binary input is assigned to the blocking function (blocking via Input) - remote blocking via RS485 (blocking via RS485) - ***Time Inhibit tI on Close*** (***GLOBAL SETTINGS/[79] ADVANCED SETTINGS***) is counted (after manually close execution by the operator, close command execution. A/R close command is excluded from this logic) Information about the reason of blocking is available in menu default window.			
[79] Success. (**E**)	00000	0-1	1
[79] Success. Indicates that an auto-reclose cycle has been successfully completed. A successful auto-reclose signal is given after the CB was tripped by a protection function and re-closed whereupon the fault was cleared and the reclaim time expired thus resetting the auto-reclose cycle. The successful auto-reclose output is reset This alarm can be reset using one of these resetting methods: assigned input (***Reset Latchd Sign***), front panel (**C** clear key), reset command (***Reset Latchd Sign)*** via RS485.			
TCS 52 Fail (**AE**)	0000000	0-1	1
TCS 52 Fail : Trip circuit supervision (TCS) failure function signal.			
Description of bits:	**RL: 7,6,5,4,3,2,1**	**RL: 5,4,3,2,1**	
CB Alarm (**AE**)	0000000	0-1	1
CB Alarm : Circuit Breaker Alarm function signal (***CB Open No.***, ***Sum Amps(n)***, ***TCS 52 Fail***, ***CB Open Time*** and ***CB Close Time, State of CB***)			
tCB FLT Ext.Sign (**AE**)	0000000	0-1	1
tCB FLT Ext.Sign is high if the ***tCB FLT ext.*** time-delay has elapsed. The counter is started if the function ***CB FLT Ext.Sign*** assigned to binary input is high. Binary input is used to indicate that there is sufficient energy in the CB operating mechanism to close and trip the CB. The ***tCB FLT ext.*** time-delay is set at ***GLOBAL SETTINGS/CIRCUIT BREAKER/ tCB FLT ext***. The binary input is set at SETTING GROUP x/INPUTS CONFIGURATION Gx/ CB FLT Ext.Sign.			
Setting Group 1	0000000	0-1	1
Setting Group 1 is active (switched via a binary input, the front panel, RS485 comms).			

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2.3 Input Configuration

Binary Input settings define which signals are mapped to the V11F's opto-isolated inputs. Matrix configuration allows free mapping of any one function to each input.

Note:

- Model L have no inputs
- Model N have no inputs
- Model B have 4 binary inputs (L1 to L4)
- Model A have 4 binary inputs (L1 to L4)
- Model E have 6 binary inputs programmable (L1 to L8).

Menu Text	Default Setting	Setting Range	Step Size
Description of bits:	L: 6,5,4,3,2,1		
Reverse Input Logic	000000	0-1	1
Reverse logic provides extra flexibility to the application. ***Reverse Input Logic*** means that the high state of a binary input causes the corresponding logic signal to be in low state. Default Setting: “000000” means that: L6: “0” – input L6 is without reverse logic. The state of L6 logic input is in line with the state of L6 binary input L5: “0” – see Input 6 L4: “0” – see Input 6 L3: “0” – see Input 6 L2: “0” – see Input 6 L1: “0” – see Input 6			
Description of bits:	L: 6,5,4,3,2,1		
Mainten. Mode (**AE**)	000000	0-1	1
Maintenance Mode ON/OFF change. The selection of the maintenance mode is possible via a logic input, using a control command (rear or front port), or from the front panel interface. The termination of the maintenance mode is done via a logic input, using a control command or by the front panel interface timing out (10 minutes) or turning the power supply off. This mode allows the user to verify the operation of the protection functions ***with*** or ***with*****out** actually sending any external command (tripping or signaling). If ***without*** option is selected, all the output contacts are blocked, and no command can be issued to these contacts, even if a protection threshold associated with one of these output contacts has been crossed.			
Reset Latchd Sign	000000	0-1	1
The high state of this logic input resets all latched LEDs, Alarm and Trip Information.			
Reset Latchd Outputs	000000	0-1	1
The high state of this logic input resets all latched contact outputs			
Block. tI>	000000	0-1	1
The high state of this logic input enables the blocking logic function of the I> protection element (resets its associated time-delay).			
Block. tI>>	000000	0-1	1

Menu Text	Default Setting	Setting Range	Step Size
The high state of this logic input enables the blocking logic function of the I>> protection element (resets its associated time-delay)			
Block. tI>>>	000000	0-1	1
The high state of this logic input enables the blocking logic function of the I>>> protection element (resets its associated time-delay)			
Block. tSOTF (**BAE**)	000000	0-1	1
The high state of this logic input enables the blocking logic function of the SOTF element (resets its associated time-delay)			
Block. tIN_1	000000	0-1	1
The high state of this logic input enables the blocking logic function of the IN> protection element (resets its associated time-delay)			
Block. tIN_2	000000	0-1	1
The high state of this logic input enables the blocking logic function of the IN>> protection element (resets its associated time-delay)			
Block. tIN_3 (**E**)	000000	0-1	1
The high state of this logic input enables the blocking logic function of the IN>>> protection element (resets its associated time-delay)			
Block. tI2> (**E**)	000000	0-1	1
The high state of this logic input enables the blocking logic function of the I2> element (resets its associated time-delay)			
Block. tBrkn Cond (**E**)	000000	0-1	1
The high state of this logic input enables the blocking logic function of the Broken Conductor element (resets its associated time–delay)			
Block. Itherm. (**NBE**)	000000	0-1	1
The high state of this logic input sets to zero the value at the thermal equivalent current used in the thermal algorithm. It means that for the low state of the input the thermal state does not increase the thermal value and the cooling time constant is applied. This function can be useful for emergency closing.			
Block. AUX1 (**BAE**)	000000	0-1	1
The high state of this logic input enables the blocking logic function of the AUX1 protection element (resets its associated time-delay and disables the AUX1 start logic signal)			
Block. AUX2 (**BAE**)	000000	0-1	1
The high state of this logic input enables the blocking logic function of the AUX2 protection element (resets its associated time-delay and disables the AUX2 start logic signal)			
Block. AUX3 (**BAE**)	000000	0-1	1
The high state of this logic input enables the blocking logic function of the AUX3 protection element (resets its associated time–delay and disables the AUX3 start logic signal)			
Block. tCB Fail	000000	0-1	1
The high state of this logic input enables the blocking logic function of the CB Fail protection function (resets its associated time–delay)			
Block. [79] (**E**)	000000	0-1	1
The high state of this logic input blocks (disables) the auto-reclose element with lockout if blocking occurs while it is running.			

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Menu Text	Default Setting	Setting Range	Step Size
SEL1 tI>> (**E**)	000000	0-1	1
The high state of this logic input changes the time-delay of the I>> protection element from tI>> (set in the ***SETTING GROUP x/PROTECTION Gx/Phase O/C [50/51]*** menu column) to the tSEL1 value (***SETTING GROUP x/PROTECTION Gx/LOGIC SELECT. Gx/tSEL1).*** The change is performed without resetting the elapsed time-delay. Typically the ***tSEL1*** value is greater than ***tI>>*** to ensure selectivity of the incomer (V11F) when the relay on the outgoing line detects a fault (the setting for ***tI>>*** is the same on the incoming feeder and the outgoing line).			
SEL1 tI>>> (**E**)	000000	0-1	1
See the description of the SEL1 tI>> function. The action is applied for the I>>> protection element and the tSEL1 time-delay			
SEL1 tIN>> (**E**)	000000	0-1	1
See the description of the SEL1 tI>> function. The action is applied for the IN>> protection element and the tSEL1 time-delay			
SEL1 tIN>>> (**E**)	000000	0-1	1
See the description of the SEL1 tI>>> function. The action is applied for the IN>>> protection element and the tSEL1 time-delay			
SEL2 tI>> (**E**)	000000	0-1	1
See the description of the SEL1 tI>> function. The action is applied for the I>>> protection element and the tSEL2 time-delay			
SEL2 tI>>> (**E**)	000000	0-1	1
See the description of the SEL1 tI>> function. The action is applied for the I>>> protection element and the tSEL2 time-delay			
SEL2 tIN>> (**E**)	000000	0-1	1
See the description of the SEL1 tI>> function. The action is applied for the IN>> protection element and the tSEL2 time-delay			
SEL2 tIN>>> (**E**)	000000	0-1	1
See the description of the SEL1 tI>> function. The action is applied for the IN>>> protection element and the tSEL2 time-delay			
AUX1 (**BAE**)	00000000	0-1	1
This logic input energizes the AUX1 function			
AUX2 (**BAE**)	00000000	0-1	1
This logic input energizes the AUX2 function			
AUX3 (**BAE**)	00000000	0-1	1
This logic input energizes the AUX3 function			
AUX4 (**BAE**)	00000000	0-1	1
This logic input energizes the AUX4 function			

Menu Text	Default Setting	Setting Range	Step Size
AUX5 (**BAE**)	00000000	0-1	1
This logic input energizes the AUX5 function. Note: 1. AUX5 has no timer therefore it is **not** included in the ***SETTING GROUP x/PROTECTION Gx/AUX TIMERS*** submenu. 2. AUX5 cannot be assigned directly to Protection Trip or Alarm functions. 3. AUX5 is used as a simple bridge between an input and the LEDs or an input and the outputs without any signaling (Alarm or Trip).			
AUX6 (**BAE**)	00000000	0-1	1
This logic input energizes the AUX6 function. Note: 1. AUX5 has no timer therefore it is **not** included in the ***SETTING GROUP x/PROTECTION Gx/AUX TIMERS*** submenu. 2. AUX5 cannot be assigned directly to Protection Trip or Alarm functions. 3. AUX5 is used as a simple bridge between an input and the LEDs or an input and the outputs without any signaling (Alarm or Trip).			
Cold Load PU (**AE**)	00000000	0-1	1
This function assigns chosen inputs to the cold load pick up logic. The protection elements connected to this logic are viewed and set in the ***SETTING GROUP x/PROTECTION Gx/COLD LOAD PU*** submenu. The Cold Load PU function is used to increase the current threshold (% Level) for a period of time (tCL) after CB closing.			
Start tBF (**AE**)	000000	0-1	1
This logic input launches the tBF Fail timer (***SETTING GROUP x/PROTECTION Gx/CB Fail [50BF]/CB Fail Time tBF*** submenu)			
CB Status 52A (**BAE**)	00000000	0-1	1
This logic input provides the V11F with information about the closed state of the CB. This information is used by the communication system, the auto-recloser and CB diagnostic function. Note: 1. If inputs are assigned to both: ***CB Status 52A*** and ***CB Status 52B***, the V11F uses a two-bit CB status logic. 2. If inputs are assigned to either ***CB Status 52A*** or ***CB Status 52B*** only, the V11F uses a one-bit CB status logic			

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Menu Text	Default Setting	Setting Range	Step Size
CB Status 52B (**BAE**)	00000000	0-1	1
This logic input provides the V11F with information about the open state of the CB. This information is used by the communication system, the auto-recloser and the CB diagnostic function. Note: see above.			
CB FLT Ext.Sign (**BAE**)	000000	0-1	1
After switching the logic input's state from low to high this function initiates the "tCB FLT ext" time-delay and blocks a close command. When this time-delay has elapsed the Alarm signal is issued. The binary Input is used to indicate that there is sufficient energy in the CB operating mechanism to close and trip the CB. The ***tCB FLT ext.*** time-delay is set at ***GLOBAL SETTINGS/CIRCUIT BREAKER/ tCB FLT ext***. The Alarm signal can be additionally assigned to ***output*** contacts using the ***CB FLT Ext.Sign*** output (***SETTING GROUP x/OUTPUTRELAYS CONFIGURATION Gx/ CB FLT Ext.Sign***). Depends on the configuration, this alarm can blocks auto-reclose function (***GLOBAL SETTINGS/[79] ADVANCED SETTINGS/CB FLT Monitor?***, the setting: ***Yes***)			
Setting group 2 (**BAE**)	000000	0-1	1
The high state of this logic input switches the active setting group to Setting Group 2. Setting Group 1 is active from the low state of Logic Input. Note: If two setting groups are switched via binary input, this input must be assigned to this function in both setting groups: Setting Group 1 and Setting Group 2. If it is not done there will be not changing of setting group via this input.			
Manual Close (**BAE**)	000000	0-1	1
Mapping of a control close function to the input. When activated, it is possible to control the output relays assigned to the ***Close CB*** function. This input will trigger the SOTF feature. Note: Manual Close command is blocked if: 1. The front panel LEDs are lit (LED resetting is required) 2. An input is assigned to the ***CB FLT Ext.Sign*** function and the state of this function is high			
Manual Trip (**BAE**)	000000	0-1	1
Mapping of a control trip function to the input. When activated, it is possible to control the output relay(s) assigned to the ***Trip CB*** function			
Trip Circ Supervis. (**AE**)	000000	0-1	1
Mapping of a TC Supervision function. The V11F continuously checks the trip circuit's continuity whether the CB status is CB open or CB closed. The function **TC Supervision** (***GLOBAL SETTINGS/CIRCUIT BREAKER/*** submenu) is enabled when the trip outputs (***Trip Command*** and ***Trip CB***) are not activated. When activated, it is possible to control the output relay(s) assigned to the ***CB ALARM*** function. Note: 1. The TC Supervision function has to be activated and the ***tSUP*** time-delay for ALARM signal should be set in the ***GLOBAL SETTINGS/CIRCUIT BREAKER/*** submenu.			
Reset Theta val. (**BAE**)	000000	0-1	1

Menu Text	Default Setting	Setting Range	Step Size
This logic input sets to zero the thermal state of the thermal replica. The zero thermal state value is written instead of the low value of this function.			
Start Distur. R. (**AE**)	000000	0-1	1
This logic input triggers the Disturbance Recorder.			
Local CTRL Mode (**AE**)	000000	0-1	1
Local mode condition (if enabled, any remote command to the output relays is forbidden).			
Time Synchr. (**BE**)	000000	0-1	1
Assigning of a time synchronization input (see Application chapter).			

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2.4 LED Configuration

LED configuration settings define which signals are mapped to the V11F's LEDs. Matrix configuration allows free mapping of any one function to each LED.

Menu Text	Default Setting	Setting Range	Step Size
Description of bits:	LED: 7,6,5,4,3,2	LED: 7,6,5,4,3,2	
Latched LEDs	000000	0–1,0-1, 0-1,0-1,0-1, 0-1	1
Each LED can be configured with or without latching. Default Setting: “000000” means that: LED8: “0” – LED 8 is latched until the LEDs are reset (Binary Input, Front panel, communication system) LED7: “0” – see LED8 LED6: “0” – see LED8 LED5: “0” – see LED8 LED4: “0” – see LED8 LED3: “0” – see LED8			
Protect. Trip	000000	0–1,0-1, 0-1,0-1,0-1, 0-1	1
This LED is lit if any protection element is configured: “Trip” is high (current-based protection elements and external protection elements: AUX1, AUX2, AUX3, AUX4, CBF re-trip). Default Setting: “000000” means that: LED8: “0” – LED 8 is not assigned to a Protection trip function LED7: “0” – see LED8 LED6: “0” – see LED8 LED5: “0” – see LED8 LED4: “0” – see LED8 LED3: “0” – see LED8			

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Menu Text	Default Setting	Setting Range	Step Size
Alarm	000001	0–1	1
This LED is lit if any protection element set to “Alarm” is high (current-based protection elements, Thermal Alarm and external protection elements: AUX1, AUX2, AUX3, AUX4, TC Supervision, CB FLT ext, CB Time Supervision, CB Current Diagnostic, CB Number Diagnostic, [79] Lockout, HW Warning function). Default Setting: “000001” means that: LED8: “0” – LED 8 is not assigned to an Alarm LED7: “0” – see LED8 LED6: “0” – see LED8 LED5: “0” – see LED8 LED4: “0” – see LED8 LED3: “1” – LED 3 is assigned to an Alarm			
Start Phase A	000000	0–1	1
This LED is lit if the phase overcurrent stage (set to trip) in phase A has started (phase A current above the phase current thresholds).			
Start Phase B	000000	0–1	1
This LED is lit if the phase overcurrent stage (set to trip) in phase B has started (phase B current above the phase current thresholds).			
Start Phase C	000000	0–1	1
This LED is lit if the phase overcurrent stage (set to trip) in phase C has started (phase C current above the phase current thresholds).			
Start I>	000000	0–1	1
This LED is lit if the phase current exceeds the I> stage.			
Start I>>	000000	0–1	1
This LED is lit if the phase current exceeds the I>> stage.			
Start I>>>	000000	0–1	1
This LED is lit if the phase current exceeds the I>>> stage.			
Start SOTF (**BAE**)	000000	0–1	1
This LED is lit if the phase current exceeds the SOTF stage.			
Start IN_1	000000	0–1	1
This LED is lit if the ground current exceeds the IN> stage.			
Start IN_2	000000	0–1	1
This LED is lit if the ground current exceeds the IN>> stage.			
Start IN_3 (**E**)	000000	0–1	1
This LED is lit if the ground current exceeds the IN>>> stage.			
AUX1 (**BAE**)	000000	0–1	1
This LED is lit if the input assigned to AUX1 sets this function to its high state.			
AUX2 (**BAE**)	000000	0–1	1
This LED is lit if the input assigned to AUX2 sets this function to its high state.			
AUX3 (**BAE**)	000000	0–1	1
This LED is lit if the input assigned to AUX3 sets this function to its high state.			

Menu Text	Default Setting	Setting Range	Step Size
AUX4 (**BAE**)	000000	0–1	1
This LED is lit if the input assigned to AUX4 sets this function to its high state.			
AUX5 (**BAE**)	000000	0–1	1
This LED is lit if the input assigned to AUX5 sets this function to its high state.			
AUX6 (**BAE**)	000000	0–1	1
This LED is lit if the input assigned to AUX6 sets this function to its high state.			
tI>	000000	0–1	1
This LED is lit if the set time-delay for the I> element has elapsed.			
tI>>	000000	0–1	1
This LED is lit if the set time-delay for the I>> element has elapsed.			
tI>>>	000000	0–1	1
This LED is lit if the set time-delay for the I>>> element has elapsed.			
tSOTF (**BAE**)	000000	0–1	1
This LED is lit if the set time-delay for the SOTF element has elapsed.			
tIN_1	000000	0–1	1
This LED is lit if the set time-delay for the IN> element has elapsed.			
tIN_2	000000	0–1	1
This LED is lit if the set time-delay for the IN>> element has elapsed.			
tIN_3 (**E**)	000000	0–1	1
This LED is lit if the set time-delay for the IN>>> element has elapsed.			
tI2> (**E**)	000000	0–1	1
This LED is lit if the set time-delay for the I2> element has elapsed.			
tBrkn Cond. (**E**)	000000	0–1	1
This LED is lit if the set time-delay for the Broken Conductor element has elapsed.			
Thermal Trip (**NBAE**)	000000	0–1	1
This LED is lit if the set time-delay for the Thermal state is above the Thermal Trip threshold, and after tripping it is above the Thermal Trip threshold multiplied by the Theta Trip/Reset Ratio.			
Thermal Alarm (**NBAE**)	000000	0–1	1
This LED is lit if the set time-delay for the Thermal state is above the Thermal Alarm threshold.			
CB Fail	000000	0–1	1
This LED is lit if the set time-delay for the CBF protection function has elapsed.			
tAUX1 (**BAE**)	000000	0–1	1
This LED is lit if the set time-delay for the AUX1 element has elapsed.			
tAUX2 (**BAE**)	000000	0–1	1
This LED is lit if the set time-delay for the AUX2 element has elapsed.			
tAUX3 (**BAE**)	000000	0–1	1

Menu Text	Default Setting	Setting Range	Step Size
This LED is lit if the set time-delay for the AUX3 element has elapsed.			
tAUX4 (**BAE**)	000000	0–1	1
This LED is lit if the set time-delay for the AUX4 element has elapsed.			
[79] in Progress (**E**)	000000	0–1	1
This LED is lit if auto-reclosing is in progress. [***79] in Progress*** indicates that an auto-reclose cycle is running. The signal is present during the complete reclosing cycle from protection initiation to the end of the reclaim time or lockout.			
[79] F.Trip (**E**)	000000	0–1	1
This LED is lit if the auto-recloser has issued the final trip signal. [***79] Final Trip*** indicates that the auto-recloser has issued a final trip (after the last reclosing shot the line is still faulty).			
[79] Lockout (**E**)	000000	0–1	1
This LED is lit if the auto-recloser is locked-out. ***[79] Lockout*** indicates that the relay is in a lockout state and that no further reclose attempts will be made: - the Reclaim time has elapsed but CB is still open - the Dead time has elapsed but CB remained open after the reclosing shot - the CB has failed to close - the protection element not assigned to the auto-reclose function is tripped. - a number of A/R rolling demand valid - A/R conflict - the CB is faulty - information based on an external Signal, assigned to an input is in high logic state longer than set in ***tCB FLT Ext.Sign (GLOBAL SETTINGS/CIRCUIT BREAKER)*** This alarm can be reset using one of these resetting methods: assigned input (***Reset Latchd Sign***), front panel (**C** clear key), reset command (***Reset Latchd Sign)*** via RS485 The lockout auto-reclose condition can reset by a manual closing after the ***Inhib Time tI***.			
[79] Blocked (**E**)	000000	0–1	1
This LED is lit if the auto-recloser is blocked (disabled). ***[79] Blocked*** indicates that the auto-recloser is inhibited (blocked) due to one of the following reasons: - blocking from the front panel (blocking via Menu) - the auto-recloser is disabled by setting (disabled) - a binary input is assigned to the blocking function (blocking via Input) - remote blocking via RS485 (blocking via RS485) - Close or Trip command is executed in A/R time (when A/R is running) - the CB is faulty – information based on an external Signal assigned to an input is in high logic state longer than set in ***tCB FLT Ext.Sign (GLOBAL SETTINGS/CIRCUIT BREAKER)*** - ***Time Inhibit tI on Close*** (***GLOBAL SETTINGS/[79] ADVANCED SETTINGS***) is counted (after manually close execution by the operator, close command execution. A/R close command is excluded from this logic) Information about the reason of blocking is available in menu default window.			
[79] Success. (**E**)	000000	0–1	1

Menu Text	Default Setting	Setting Range	Step Size
This LED is lit if the auto-recloser closes the CB and that no faults occur during the Reclaim Time (tR). ***[79] Success.*** Indicates that an auto-reclose cycle has been successfully completed. A successful auto-reclose signal is given after the CB was tripped by a protection function and re-closed whereupon the fault was cleared and the reclaim time expired thus resetting the auto-reclose cycle. The successful auto-reclose output is reset upon the next CB trip or from one of these resetting methods: input, front panel, remote command via RS485.			
Local CRTL Mode (**AE**)	000000	0–1	1
This LED is lit if CB control is in Local Mode.			
CB Alarm (**AE**)	000000	0–1	1
This LED is lit if a CB Alarm is detected. **CB Alarm:** Circuit Breaker Alarm function signal (CB Open No., **Sum Amps(n)**, **TCS 52 Fail**, **CB Open Time** and **CB Close Time**)			
Maintenance Mode (**AE**)	000000	0–1	1
This LED is lit if the V11F is in ***Maintenance Mode***.			
tCB FLT Ext.Sign (**BAE**)	000000	0-1,0-1,0-1, 0-1	1
This LED is lit if the CB is not ready for CB control after the set time-delay. The counter is started if the function ***CB FLT Ext.Sign*** assigned to a binary input is high. The binary input is used to indicate that there is sufficient energy in the CB operating mechanism to close and trip the CB. The ***tCB FLT ext.*** time-delay is set at ***GLOBAL SETTINGS/CIRCUIT BREAKER/ tCB FLT ext***. The binary input is set at ***SETTING GROUP x/INPUTS CONFIGURATION Gx/ CB FLT Ext.Sign***.			
Setting Group 1	000000	0–1	1
This LED is lit if the V11F is using the first setting group.			

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3. GLOBAL SETTINGS

3.1 LOC

Menu Text	Default Setting	Available Settings
Language	English	English Deutsch Francais Espanol Russian Turkish Regional (Polish)
This cell is used to change the language of the menu. The REGIONAL language is used if it is necessary to customize labels in the V11F's menu. For example: the ***CB Fail*** label instead of the ***AUX1*** label. To change the labels in the V11F menu, the ***Menu Creator Software*** is used. All available V11F language versions can be used as a template for a Regional menu.		
Default Display	Meas. In	Meas. In Meas.A CB Control **(BAE)** [79] CTRL **(E)** Control Mode **(AE)**
This cell is used to change the default display window: ***0: Measurements*** referred to In ***1: Measurements*** in Amps ***2: CB control*** window for CB control (close and trip command) **3: Auto-reclose** control window for blocking of auto-recloser and readout of auto-reclose status information ***4: Control Mode*** window for changing the CB control mode: Local/Remote and for presenting Control Mode state information		
LEDs Reset	Manual only	Manual only Protect.Start Close Command
This cell is used to change the resetting method of latched LEDs in the menu. ***0:Manual only*** – Resetting of latched LEDs via manual reset only (***C*** clear key, input, USB,RS485) ***1:Protect.Start*** – Resetting of latched LEDs upon any protection start (set for CB tripping) or via manual reset ***2:Close Command*** - Resetting of latched LEDs upon Close Command applied by V11F Note: It is also possible to configure the auto-recloser to reset the LEDs via ***[79] Close*** Command (see: ***GLOBAL SETTINGS/[79] Signalling Reset)***		
Ltchd Outp. Reset	Manual only	Manual only Protect.Start Close Command
This cell is used to change the resetting method of latched outputs in the menu. **0:Manual only** – Resetting of latched outputs via manual reset only (***C*** clear key, input, USB, RS485) ***1:Protect.Start*** – Resetting of latched outputs upon any protection start (set for CB tripping) or via manual reset ***2:Close Command*** - Resetting of latched LEDs upon Close Command applied by V11F		

<table>
<tr><th>Menu Text</th><th>Default Setting</th><th>Available Settings</th></tr>
<tr><td>Alarm Info</td><td>Self-Reset</td><td>Self-Reset
Manual Reset</td></tr>
<tr><td colspan="3">This cell is used to change the resetting method of Alarm indication windows (ALARM STATUS/)
0: Self-Reset – This option means that if an alarm signal has disappeared no information is available in the ALARM STATUS column
1:Manual Reset – this option means that if an alarm signal has disappeared information is still available in the ALARM STATUS column until it is reset in the ALARM STATUS/ Alarm Reset cell.</td></tr>
<tr><td>Nominal Frequency</td><td>50Hz</td><td>50Hz
60Hz</td></tr>
<tr><td colspan="3">This cell is used to set the nominal frequency of the power system.</td></tr>
<tr><td>Control Keys Confirm</td><td>No</td><td>No
Yes</td></tr>
<tr><td colspan="3">This cell is used to select the way of close/trip command execution from the front panel (CB Close key/CB Open key).
No: after pressing CB Close key or CB Open key the command is executed instantaneously
Yes: after pressing CB Close key or CB Open key the new window will be appeared to confirm or cancel the control command (Close or Trip). After pressing OK key the control command is executed or after pressing C clear key the control command is cancelled.</td></tr>
<tr><td>I>, I>>, I>>></td><td>1 harm.</td><td>1 harm.
True RMS</td></tr>
<tr><td colspan="3">Configuration of PHASE O/C [50/51] criteria:
0: 1 harm – I>, I>>, I>>> use fundamental harmonic criteria
1: True RMS – I>, I>>, I>>> use True RMS criteria</td></tr>
</table>

3.2 Setting Group Select

<table>
<tr><th>Menu Text</th><th>Default Setting</th><th>Available Settings</th></tr>
<tr><td>Number of Groups</td><td>Two Groups</td><td>One Group
Two Groups</td></tr>
<tr><td colspan="3">This cell is used to choose the number of setting groups available in the V11F.
By choosing One Group all settings related to Group 2 are hidden in the menu.</td></tr>
<tr><td>Setting Group</td><td>Group 1</td><td>Group 1
Group 2</td></tr>
<tr><td colspan="3">This cell is used to change the current setting group.</td></tr>
<tr><td>t Change Settings G1→G2 (BAE)</td><td>0.00 s</td><td>0.00 to 200 s, step 0.01 s</td></tr>
<tr><td colspan="3">This cell is used to set the time-delay changing between the setting Group 1 and Group 2.</td></tr>
<tr><td>Copy Settings</td><td>No Operation</td><td>No Operation
Copy G1-->G2
Copy G2→G1</td></tr>
<tr><td colspan="3">When:
- the G1→G2 command is issued, G1 will be copied to the G2 group,
- the G2→G1 command is issued, G2 will be copied to the G1 group.</td></tr>
</table>

3.3 CT Ratio

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Line CT Primary	1.000 A	1	30k	1
Sets the phase current transformer input's primary current rating.				
Line CT Sec	1.000 A	1	5	N/A
Sets the phase current transformer input's secondary current rating.				
E/Gnd CT Primary	1.000 A	1	30k	1
Sets the earth fault current transformer input's primary current rating.				
E/Gnd CT Sec	1.000 A	1	5	N/A
Sets the earth fault current transformer input's secondary current rating.				

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3.4 Circuit Breaker

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
tOpen Pulse min	0.1 s	0.1 s	10 s	0.01 s
Defines the duration of the trip pulse used by the Autorelose, **Trip Command** and **Trip CB *Order*** outputs.				
tClose Pulse	0.1 s	0.1 s	10 s	0.01 s
Defines the duration of the close pulse used by the ***Close CB Order*** output.				
Time Delay for Close (**BAE**)	0 s	0 s	200 s	0.01 s
Defines the time-delay for Manual or Remote CB close commands.				
tCB FLT ext (**BAE**)	16 s	1 s	200 s	1 s
A settable time-delay is included for manual closure with this circuit breaker check. If the circuit breaker does not indicate a healthy condition in this time period following a close command, then the relay will lockout and set off an alarm.				
Remote CTRL Mode (**AE**)	0: Remote only	Remote only Remote+LOC		
This cell is used to define Remote CB control mode. ***0: Remote only*** – If V11F is in Remote mode it is possible to apply a close and a trip command via RS485 only. ***1: Remote+LOC*** – In Remote mode it is possible to close and trip CB via RS485 or locally (Default window menu, Front panel keys, binary input).				
52 Unblock SOTF Time (**BAE**)	1 s	0 s	200 s	0.01 s
A settable pulse time is used to unblock SOTF with starting from a CB close command state up to end of pulse time.				
TC Supervision? (**AE**)	No	No Yes Yes-52		
Selection of the trip circuit supervision function. Yes – the monitoring is active all time Yes-52 – the monitoring is active if CB is the close state only. If ***Yes or Yes-52*** is selected, the ***TC Supervision*** menu is displayed (***ALARM*** signaling).				

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
TC Supervision tSUP (AE)	0.5 s	0.1 s	10 s	0.01 s
Displays the time-delay setting (tSUP) for TC supervision.				
CB Supervision? (AE)	No	Yes No		
Selection of the time monitoring function of CB open and close operations. If Yes is selected, the ***CB Open Time*** and ***CB Close Time*** menu are displayed. (***ALARM*** signaling)				
Max.CB Open Time (AE)	0.1 s	0.1 s	10 s	0.01 s
Displays the Alarm time threshold for a CB open operation.				
Max.CB Close Time (AE)	0.5 s	0.1 s	10 s	0.01 s
Displays the Alarm time threshold for a CB close operation.				
CB Diagnostic? (AE)	No	Yes No		
Selection of the CB monitoring function. If ***Yes*** is selected, the ***Max.CB Open No.*** and ***Sum AMPS^n*** menus are displayed. (***ALARM*** signaling).				
Max.CB Open Nb (AE)	0	0	50000	1
Displays the alarm threshold for the CB open count.				
Max Sum AMPS^n (AE)	0.1 MA^n	0.1 MA^n	6553.5MA^n	0.1MA^n
Displays the alarm threshold for the summation of the current (in Amps or square Amps) interrupted by the CB.				
AMPS's n= (AE)	1	1	2	1
Displays the exponent for the current summation: I or I^2.				

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3.5 Inrush Blocking (AE)

The 2nd Harmonic Blocking detects high inrush current flows that occur when transformers or machines are connected. The function will then block the following functions:

- ***PHASE O/C [50/51]***
- ***SOTF [50/51]*** **(BAE)**
- ***E/GND FAULT [50/51N]***
- ***NEGATIVE SEQ. O/C [46]*** **(E)**
- ***BROKEN CONDUCTOR*** **(E)**
- ***AUX TIMERS*** **(BAE)**

Blocking of a protection function is enabled if the main configuration of protection criteria is set to “Trip-Inrush Bl” (for example: “***SETTING GROUP x/PROTECTION Gx/PHASE O/C [50/51] Gx/I>? Trip-Inrush Bl”*** submenu)

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The 2nd Harmonic Blocking function identifies an inrush current by evaluating the ratio of the second harmonic current components to the fundamental wave. If this ratio exceeds the set thresholds, then the inrush stabilization function operates.

The minimum fundamental current value required for operation of the Inrush Blocking function is 0.2 In, and there is no upper limit to disable this feature.

2nd Harmonic Blocking operates across all phases.

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Inrush Blocking?	0: No	0: No 1: Yes 2: Closing		
Setting to Disable or Enable the ***Inrush Blocking*** element. Setting choice ***No***: The crossing of the 2nd Harmonic ratio threshold does not activate the Inrush Blocking logic function. Setting choice ***Yes***: The crossing of the 2nd Harmonic ratio threshold on any phase activates the Inrush Blocking Logic function instantaneously. Setting choice ***Closing***: The crossing of the 2nd Harmonic ratio threshold on any phase activates the Inrush Blocking Logic function after CB closing (Close CB order) when ***Unblock Inrush Time*** elapses.				
2nd Harmonic Ratio	20%	10%	50%	1%
Sets the value for the 2nd harmonic threshold ratio calculated as a percentage of the fundamental component from 10 to 50% (step 0.1%).				
Inrush Reset Time	0.0 s	0.0 s	200 s	0.01 s
Sets the value for the Inrush tReset time. This provides a reset delay of the Inrush Blocking signal (logic state=1) once the 2nd harmonic level falls below the set threshold. Note: Typically the Reset Time should be set to 0 ms, because second harmonic blocking can cause an additional tripping delay. If unwanted tripping can be caused by the inrush phenomena this value can be increased. This setting is available when Inrush Blocking? Is set to ***Yes*** or ***Closing***				
Unblock Inrush Time	1 s	0.0 s	200 s	0.01 s
A settable pulse time is used to enable Inrush Blocking from the moment the CB close state signal is issued until the end of the pulse time. This setting is available when Inrush Blocking? Is set to ***Closing***.				

3.6 O/C Advanced (NBAE)

Menu Text	Default Setting	Setting Range		Step Size
[46BC] Brkn.Cond I< Block (**E**)	0.1In	0.1 In	1.00 In	0.01 In
This setting allows to disable Broken Conductor protection element if the max current in three phases is lower than the setting value.				
IDMT interlock by DMT (**NABE**),	No	No	Yes	n/a
IDMT tripping can be blocked if any DMT stage is started settings: ***IDMT interlock by DMT*** (***GLOBAL SETTINGS/O/C ADVANCED*** column). This settings is common for ***E/Gnd Fault [50N/51N]*** and ***Phase O/C [50/51]***				

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3.7 [79] Advanced Settings (E)

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
CB FLT Montor.?	No	No Yes		
Allows the use of a dedicated input (***CB FLT Ext.Sign.***) to inform the auto-reclose function of the state of the CB (failed or operational). This signal has to be mapped to a digital input in the Automatic Control inputs submenu ***0: No***: ***CB FLT Montor.*** Function not activated. ***1: Yes***: The CB will be declared faulty and the auto-recloser will switch to locked-out state when the ***tCB FLT ext*** time (***GLOBAL SETTINGS/CIRCUIT BREAKER/*** submenu) has elapsed and ***tCB FLT Ext.Sign.*** remains active.				
Block.via Input?	No	No Block. [79] Block. [79] + tI/52a		
Allows the use of a dedicated input (***Block 79***) to block the auto-reclose function. If you set this item to **0: No:** Block function not activated. **1: Block. [79]:** in order to render it active you have to map the function ***Block [79]*** (***INPUTS CONFIGURATION*** submenu) to a digital input**.** With the ***Block 79*** function active, the auto-recloser will switch to locked-out state after a protection trip involved in the sequences matrix of the AR. **2: Block [79]+tI/52a:** The auto-reclose function is temporary blocked after closing of CB (from RS485, front panel or via configured Binary Input) during ***Inhibit Time tI on Close***. Temporary blocking feature is activated when breaker closes also (either 52a contact energises or 52b contact de-energises) and [79] - IN PROGRESS is inactive. In this way the temporary blocking feature will not be activated when the [79] function initiates the reclose, only when its manually done by an operator who turns a control switch.				
Start Dead t on	CB trips	Protect.Reset CB trips		
Setting that determines whether the dead time is started when the circuit breaker trips (CB is closed) or when the protection trip resets. Note: If no binary inputs are assigned to CB status the auto-reclose function uses the ***0: Protect.Reset*** option, even if it is set to ***1: CB trips***.				
Rolling Demand?	No	No Yes		
1: Yes: activates the trip activity supervision. When the first trip command is generated, the relay starts a time-delay during which, if the number of current-based trips reaches the programmed maximum trip number, the relay stops the current auto-reclose cycle (final trip).				
Max cycles No. Rol.Demand	10	2	100	1
Sets the programmed maximum [79] reclosing shot number to protect the CB against intermittent faults.				
Time period Rol. Demmand	10mn	1mn	1410 mn	1mn
Sets the time-delay for trip activity supervision.				
Inhibit Time tI on Close	1 s	0 s	600 s	0.01 s

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Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Set the value for the Inhibit Time (tI). The ***Inhib Time tI*** timer is used to block the auto-recloser from being initiated after the CB is manually closed onto a fault. The lockout condition can reset by a manual closing after the ***Inhib Time tI***.				
Signaling Reset	No	No Close via 79		
This cell is used to change the General resetting way of signaling (LEDs and Trip information). ***0: No*** – Closing of the CB by the auto-recloser does not reset signaling. ***1: Close via 79*** – Reset of signaling via an auto-reclose close command.				

3.8 Communication Orders (AE)

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Pulse Time tCOM1	1 s	0 s	200 s	0.01 s
Defines the duration of the trip pulse used by the ***Comm.Order 1*** output				
Pulse Time tCOM2	1 s	0 s	200 s	0.01 s
Defines the duration of the trip pulse used by the ***Comm.Order 2*** output				
COM2 Order Conf.	RS485	RS485 RS485+Button_C Button_C		
this configuration allows adding to ***Comm.Order 2***: pressing of the 'C' clear key located on the front panel of V11F Setting option: ***RS485+Button_C*** means that if command tCOM2 (Communication Order 2) via RS485 is executed or 'C' Clear key on the front panel is pressed, the output contact assigned to ***Comm.Order 2*** will be energized via set tCOM2 pulse time.				

3.9 Communication (in Model L optional)

<table>
<tr><th rowspan="2">Menu Text</th><th rowspan="2">Default Setting</th><th colspan="2">Setting Range</th><th rowspan="2">Step Size</th></tr>
<tr><th>Min.</th><th>Max.</th></tr>
<tr><td>Protocol</td><td>Modbus</td><td colspan="3">Modbus
IEC103</td></tr>
<tr><td colspan="5">This cell sets the type of protocol for RS485:
0: Modbus RTU protocol
1:IEC103 protocol
This setting parameter is applied for RS485 port only.
Note: USB port has fixed protocol: Modbus.</td></tr>
<tr><td>Relay Address</td><td>1</td><td>1</td><td>254</td><td>1</td></tr>
<tr><td colspan="5">This cell sets the unique address for the relay so that only one relay is accessed by the master station's software. This address is applied for RS485 port only.
Note: USB port has fixed address: 1.</td></tr>
<tr><td>Baud Rate</td><td>19200 bits/s</td><td colspan="3">4800 bits/s , 9600 bits/s, 19200 bits/s, 38400 bits/s</td></tr>
<tr><td colspan="5">This cell controls the communication speed between relay and master station. It is important that both the relay and the master station have the same speed setting.
This setting parameter is applied for RS485 port only.
Note: USB port has fixed Baud Rate: 115.2 kbits/s.</td></tr>
<tr><td>Parity</td><td>No parity</td><td colspan="3">No parity, Odd parity, Even parity</td></tr>
<tr><td colspan="5">This cell controls the parity format used in the data frames. It is important that both the relay and the master station have the same parity setting.
This setting parameter is applied for RS485 port only.
Note: USB port has fixed Parity: No parity.</td></tr>
<tr><td>Stop bits</td><td>1 stop bit</td><td colspan="3">1 stop bit, 2 stop bits</td></tr>
<tr><td colspan="5">This cell controls the stop bit format used in the data frames. It is important that both the relay and the master station have the same stop bits setting.
This setting parameter is applied for RS485 port only.
Note: USB port has fixed Stop bits: 1 stop bit.</td></tr>
</table>

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Note: The above parameters are relevant to the RS485 port only.

The USB port has the non-settable following parameters:
- Protocol: Modbus RTU
- Address: 1
- Baud Rate: 115.2 kbits/s
- Comms. Mode:
  - Data Bit: 8
  - Stop bit: 1
  - Parity: none

3.10 Disturbance Recorder (AE)

The Disturb Record submenu makes it possible to set and read out disturbance records. Up to 4 second's duration but not more than 5 disturbance records can be stored.

Total number of records available in disturbance recorder is:

- One - for set Max Record Time from in range: 2.01s – 4.00s
- Two – for set Max Record Time from in range: 1.51s – 2.00s
- Three – for set Max Record Time from in range: 1.01s – 1.33s
- Four – for set Max Record Time from in range: 0.81s – 1.00s
- Five - for set Max Record Time from in range: 0.10s – 0.8s

The beginning of the record can be adjusted with a selected pre-fault time. It is possible to limit the duration of a record.

<table>
<tr><th rowspan="2">Menu Text</th><th rowspan="2">Default Setting</th><th colspan="2">Setting Range</th><th rowspan="2">Step Size</th></tr>
<tr><th>Min.</th><th>Max.</th></tr>
<tr><td>Pre-Time</td><td>0.1 s</td><td>0.1 s</td><td>2 s</td><td>0.01 s</td></tr>
<tr><td colspan="5">Setting for the disturbance record pre-fault time. The pre-fault time sets the beginning of the disturbance record. In this example, the record starts 100 ms before the disturbance. Its length can be limited by setting.</td></tr>
<tr><td>Post-Time</td><td>0.1 s</td><td>0.1 s</td><td>1 s</td><td>0.01 s</td></tr>
<tr><td colspan="5">Setting for the disturbance record post-fault time. The total disturbance recording time is: pre-fault time + high state of triggering criteria (Start or Trip time)+ post-fault time.
The above total recording time is limited by setting.</td></tr>
<tr><td>Disturbance Rec.Trig.</td><td>on Inst.</td><td colspan="3">on Inst.
on Trip</td></tr>
<tr><td colspan="5">Setting for the trigger criteria:
0: on Inst. – the trigger is the disturbance indicated by the starting of a protection element set to trip the CB. If this option is chosen the total recording time is: pre-fault time + duration of protection start + post-fault time, but no longer than the value of Max Record Time.
1: on Trip. – the trigger is the disturbance indicated by a protection element trip. If this option is chosen the total recording time is: pre-fault time + duration of protection trip+ post-fault time, but no longer than the value of Max Record Time.</td></tr>
<tr><td>Max Record Time</td><td>4 s</td><td>0.1 s</td><td>4 s</td><td>0.01 s</td></tr>
<tr><td colspan="5">Setting for the maximum total recording time. If default value is kept (4 s) it means that 1 record will be recorded.</td></tr>
</table>

4. COMMISSIONING (AE)

This column contains menu cells which allow the status of the opto-isolated inputs, output relay contacts to be monitored. Additionally there are cells to test the operation of the output contacts, user-programmable LEDs.

<table>
<tr><th>Menu Text</th><th colspan="3">Default Setting</th><th>Available Settings</th></tr>
<tr><td>Description of bits:</td><td colspan="3">L: 8,7,6,5,4,3,2,1</td><td></td></tr>
<tr><td>Opto I/P Status</td><td colspan="4">00000000</td></tr>
<tr><td colspan="5">This menu cell displays the status of the relay's opto-isolated inputs as a binary string, a '1' indicating an energized opto-isolated input and a '0' a de-energized one</td></tr>
<tr><td>Description of bits:</td><td colspan="3">RL: 8,7,6,5,4,3,2,1</td><td></td></tr>
<tr><td>Relay O/P Status</td><td colspan="4">00000000</td></tr>
<tr><td colspan="5">This menu cell displays the status of the digital signals used to energize the output relays as a binary string, a '1' indicating an operated state and '0' a non-operated state.</td></tr>
<tr><td>Maintenance Mode</td><td colspan="3">No</td><td>No
Yes,outp.trips
Yes,outp.block</td></tr>
<tr><td colspan="5">Choose whether you want to activate the MAINTENANCE MODE of the relay.
MAINTENANCE MODE allows to test contact outputs and functional tests.
For changing this value Control password have to be entered.
If "No" is selected, all menu cells below are hidden.
If "Yes,outp.trips" or "Yes,outp.block" – ALARM LED is lit and 10 minutes timer is started for returning to "No" option. In this time P16 is in SETTING MODE. Changing of test values and execution of command are allowed.
If "Yes,outp.block" is selected, output relays are disconnected from the protection and automation functions.</td></tr>
<tr><td>Description of bits:</td><td colspan="3">RL: 8,7,6,5,4,3,2,1</td><td></td></tr>
<tr><td>Test Pattern</td><td colspan="4">00000000</td></tr>
<tr><td colspan="5">This menu cell is used to set outputs for the test. The digit: 1 set in this cell means that this output will be energized after the test command is applied.
If the test is applied (COMMISSIONING/Test outputs cell) outputs set in this cell will be energized for the duration of Contact Test Time.</td></tr>
<tr><td>Contact Test Time</td><td>0.1 s</td><td>0 s</td><td>200 s</td><td>0.01 s</td></tr>
<tr><td colspan="5">Set the time pulse of contact closing during the tests.</td></tr>
<tr><td>Test outputs</td><td colspan="3">no operation</td><td>no operation
Apply test</td></tr>
<tr><td colspan="5">This menu cell is used to apply a test to the outputs set in the Test Pattern cell.
To apply the output test: Press OK, change a setting option from 0 to 1 (1: Apply test), confirm this action by pressing the OK key. After this, outputs (set in Test Pattern cell) are energized for the duration of Contact Test Time.
Note: If the Test control password is not equal to 0 before changing of option (from 0 to 1) at least Test control password should be entered (as for every other V11F setting).</td></tr>
</table>

ST

<table>
<tr><th>Menu Text</th><th colspan="3">Default Setting</th><th>Available Settings</th></tr>
<tr><td>Functional Test</td><td colspan="3">I></td><td>I>
I>>
I>>>
SOTF
IN_1
IN_2
IN_3 (E)
I2> (E)
Brkn Cond (E)
Therm Trip (NBAE)
Therm Alarm (NBAE)
CBF</td></tr>
<tr><td colspan="5">This menu cell is used to set a protection element for Functional tests.</td></tr>
<tr><td>Functional Test End</td><td colspan="3">Time</td><td>CB trip
Time</td></tr>
<tr><td colspan="5">This menu cell is used to choose the method of ending the test procedure.
0: CB trip – the test is applied until Trip signal
1: Time – the test is ended after the Functional Test Time set value.</td></tr>
<tr><td>Functional Test Time</td><td>0.1 s</td><td>0.1 s</td><td>200 s</td><td>0.01 s</td></tr>
<tr><td colspan="5">Setting for the time pulse of contact closing during Functional tests.</td></tr>
<tr><td>Functional Test CTRL</td><td colspan="3">no operat.</td><td>no operat.
Operate</td></tr>
<tr><td colspan="5">This menu cell is used to apply test of outputs which were set in Functional Test pattern cell.
To apply output test: Press enter, change a setting option from no operat. to Operate, confirm this action by pressing OK key. After that outputs (set in Functional Test pattern cell) are energized via Functional Test Time.
Note: if Test control password is not equal 0 before changing of option (from no operat. to Operat) at least Test control password should be entered (like for every V11F setting).</td></tr>
</table>

ST

5. SETTING CHANGE MODE

This column contains menu cells which allow the settings and configuration to be changed.

Before any change to the settings it is necessary to set a V11F's ***Edit Setting Mode*** to ***Without limits*** or ***Protection only***. If changing of parameters is allowed, the LEDs light up one by one until the ***Setting Change status*** cell is in the ***Protected*** state.

In the ***Without limits*** state, it is possible to change all of the settings.

In the ***Protection only*** state, it is only possible to change protection settings (***PROTECTION*** columns)

In the ***Control*** state, it is possible to control the CB in the default window and apply ***MAINTENANCE MODE*** for outputs and functional tests . If the password is set to 0, no password is necessary to control the CB.

In the ***Protected*** state, settings are password-protected.

ST

Menu Text	Default Setting	Available Settings
Edit Settings?	Enter PSWD	0000 – 9999
This cell is used to switch the V11F to Edit Settings in order to allow changing the settings.		
Setting Change	Protected	Protected/Without limits/Protection only/Test Control
This cell displays the level of rights to change settings.		
Change Password		0000 – 9999
This cell is displayed if the password is entered. To change the password it is necessary to press the OK key and enter the new password. After that it is necessary to press enter to save the new password.		

To access the ***Edit Setting*** Menu window faster, press the left and up keys at the same time.

This action makes the menu jump to the ***Edit Setting*** cell.

Then press the OK key, a password will be requested.

Enter the password (the default factory password is “0000” for every password level)

In the ***Without limits*** or the ***Protection only*** state, all the LEDs will then light up, in rapid sequence. This indicates that the V11F is operating in Edit Mode: the parameters can be changed in this state.

In the ***Control*** state there is no any LED signaling (no lighting up in rapid sequence as above).

After having set all the required parameters, press simultaneously the 4 and 8 keys, then press the OK key once

6. OP PARAMETERS

This column contains menu cells to show some of the V11F's parameters.

Menu Text	Default Setting	Available Settings
Description	V11F Model x (L, N, B, E)	Read only
This cell is used to show the type of relay.		
Serial Nb	000000	Read only
This cell is used to show the serial number of the relay.		
Reference	SE VAMP	Read only
This cell is used to show the relay's manufacturer.		
Software Version	1.D	Read only
This cell is used to show the software version (firmware)		
Hardware Version	00	Read only
This cell is used to show the hardware version ordered		
Active Set Group	Group 1	Read only
This cell is used to show the active setting group		
Date	01/01/08	00/00/00 – 99/99/99
This cell is used to set the date of the internal clock		
Time	00:00:00	00:00:00 – 23/59/59
This cell is used to set the time of the internal clock Note: 1. A back-up clock capacitor is charged from an auxiliary voltage supply (terminals 11-12) only. The capacitor's energy allows storage of real time information for up to 2 days. When the back-up capacitor is completely discharged, it takes less than 10 minutes to recharge it completely 2. If the clock has no real time information (the back-up capacitor is recharged) and the current exceeds the minimum current required for operation, the real time is set to 01/01/2008 00:00:00. Therefore events are dated with reference to this start time value.		
Nominal Frequency:	50Hz or 60Hz	Read only
This cell is used to show the nominal frequency setting.		

ST

ST

OP

OPERATION

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

OP

CONTENTS

FIGURES

OP

1. OPERATION OF INDIVIDUAL PROTECTION FUNCTIONS

The following sections detail the individual protection functions.

1.1 Overcurrent Protection

The overcurrent protection included in the V11F relays provides three-stage non-directional three-phase overcurrent protection with independent time-delay characteristics. All overcurrent settings apply to all three phases but are independent for each of the three stages.

Each protection stage can be selected to Trip the CB or to issue a signal (Alarm) only.

If an overcurrent protection stage (I***>?***, I***>>?*** or I***>>>?*** menu) is set to ***Trip***, ***Trip-Inrush Bl***, ***Trip-Latch***, ***Trip-Phase A*** (**E**), ***Trip-Phase B*** (**E**) or ***Trip-Phase C*** (**E**) it means that that stage is linked to the ***Protect.Trip*** and ***Prot.Trip pulse*** functions (see LED and Output configuration).

If an overcurrent protection stage (I***>?***, I***>>?*** or I***>>>?*** menu) is set to ***Alarm***, it means that that stage is linked to the ***Alarm*** function (see LED and Output configuration).

If ***Trip-Inrush Bl*** is selected, the overcurrent stage is blocked via the ***Inrush Blocking*** function (refer to Inrush Blocking section).

If ***Trip-Latch*** is selected, the overcurrent stage will remain high after a trip, until it is reset via a binary input, the HMI or a remote RESET command.

If ***Trip-Phase A*** is selected, the overcurrent stage is compared with the current in phase A only (tripping is based on phase A measurement only; the rest phases: B and C are ignored).

If ***Trip-Phase B*** is selected, the overcurrent stage is compared with the current in phase B only (tripping is based on phase B measurement only, the rest phases: A and C are ignored).

If ***Trip-Phase C*** is selected, the overcurrent stage is compared with the current in phase C only (tripping is based on phase C measurement only, the rest phases: A and B are ignored).

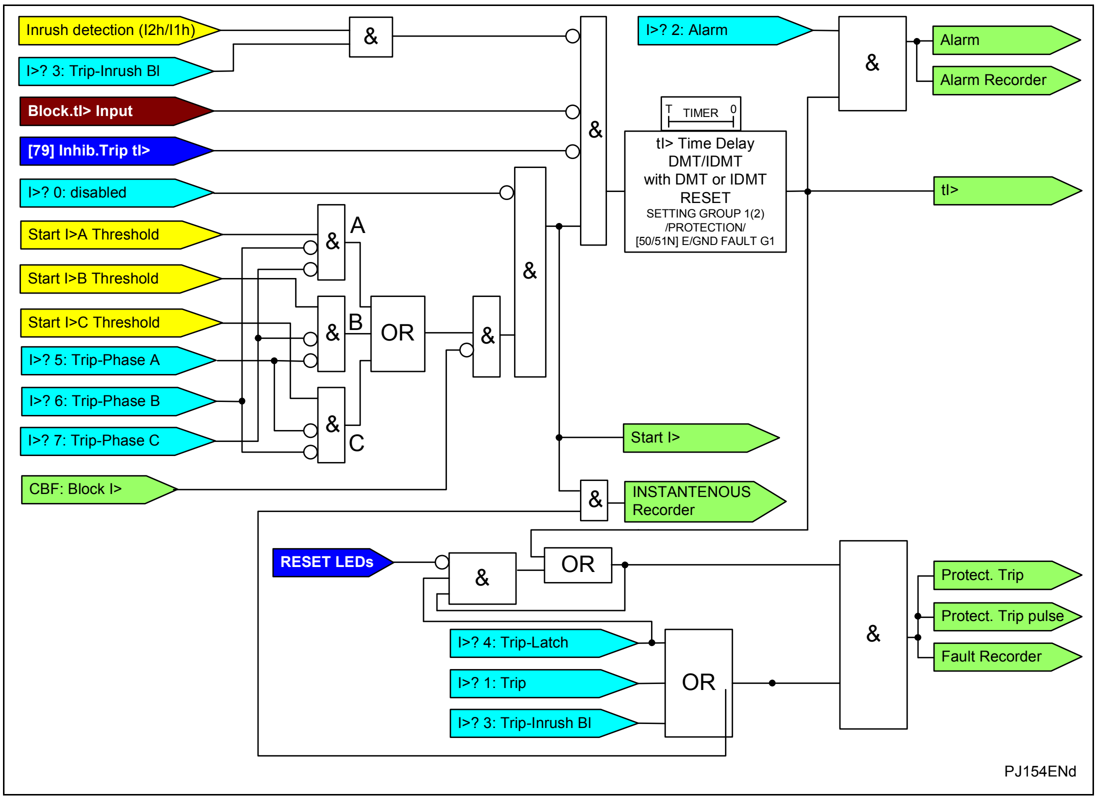


Figure 1: Overcurrent protection logic diagram

1.1.1 Operation Time-Delay

The first (I>) and second (I>>) stages of overcurrent protection have time-delayed characteristics which are selectable between inverse definite minimum time (IDMT) and definite time (DMT). The third (I>>>) stage has a definite time characteristic only.

Various methods are available to achieve correct relay co-ordination on a system; by means of time alone, current alone or a combination of both time and current. Grading by means of current is only possible where there is an appreciable difference in fault level between the two relay locations. Grading by time is used by some utilities but can often lead to excessive fault clearance times at or near source substations where the fault level is highest. For these reasons the most commonly applied characteristic in coordinating overcurrent relays is the IDMT type.

The inverse time-delayed characteristics indicated above comply with the following formulae:

IEC/UK/FR curves: $$t = TMS \cdot \left(\frac{k}{\left(\frac{G}{Gs}\right)^{\alpha} - P} + c\right);$$

IEEE/US curves: $$t = TD \cdot \left(\frac{k}{\left(\frac{G}{Gs}\right)^{\alpha} - P} + c\right);$$

where:

t = Operating time in [s]

k, P, c = Constant

G = Measured current in [A]

TMS = Time multiplier setting for IEC curves

TD = Time dial setting for IEEE curves

Gs = Current threshold setting [A]

α = Constant

Type of Curve according to IEC60255-151 std definition	**Standard**	**k**	**c**	**α**	**P**
IEC Standard Inverse Time (SI)	IEC/A	0.14	0	0.02	1
IEC Very Inverse Time (VI)	IEC/B	13.5	0	1	1
IEC Extremely Inverse Time (EI)	IEC/C	80	0	2	1
IEC Long Time Inverse (LTI)	IEC	120	0	1	1
FR Short Time Inverse (STI)	FR	0.05	0	0.04	1
UK Rectifier (Rect)	UK	45900	0	5.6	1
IEEE Moderately Inverse Time (MI)	IEEE (IEC/D)	0.0515	0.114	0.02	1
IEEE Very Inverse Time (VI)	IEEE (IEC/E)	19.61	0.491	2	1
IEEE Extremely Inverse Time (EI)	IEEE (IEC/F)	28.2	0.1217	2	1
US Short Time Inverse (CO2 P20)	US	0.02394	0.01694	0.02	1
US Short Time Inverse (CO2 P40)	US	0.16758	0.11858	0.02	1

US Long Time (CO5)	US	4.842	1.967	1.1	1
US Definite Minimum Time (CO6)	US	0.3164	0.1934	1.4	1
US Moderately Inverse Time (CO7)	US	0.0094	0.0366	0.02	1
US Time Inverse (CO8)	US	5.95	0.18	2	1
US Very Inverse Time (CO9)	US	4.120	0.0958	2	1
US Extreme Inverse Time (CO11)	US	5.570	0.028	2	1
BNP (EDF)	EDF	1000	0.655	2	1
RI		-4.2373	0	-1	1.43644

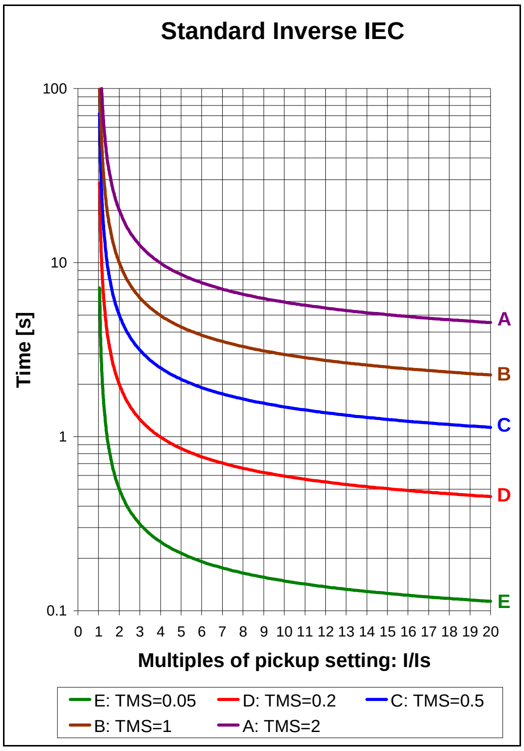
A time multiplier setting TMS is used to adjust the operating time of IEC & UK IDMT curves.

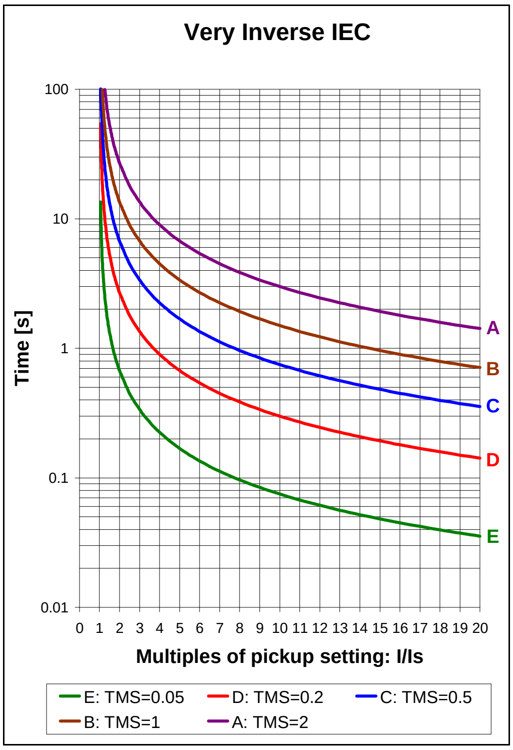
A time multiplier setting TD is used to adjust the operating time of IEEE or US IDMT curves.

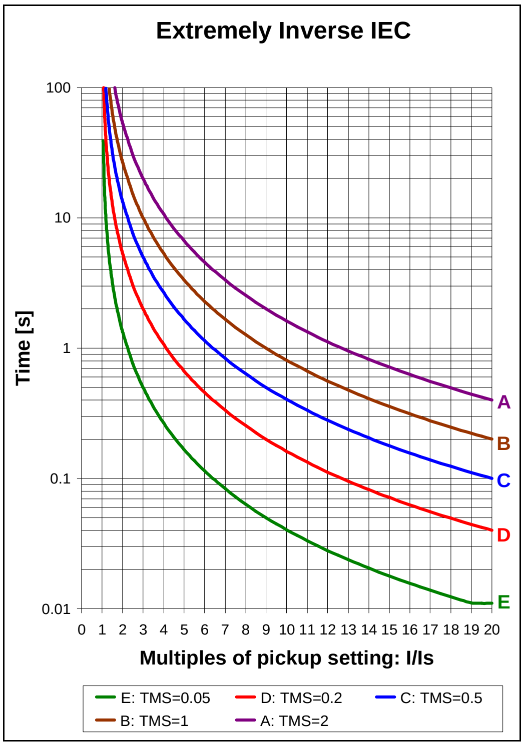
Note:

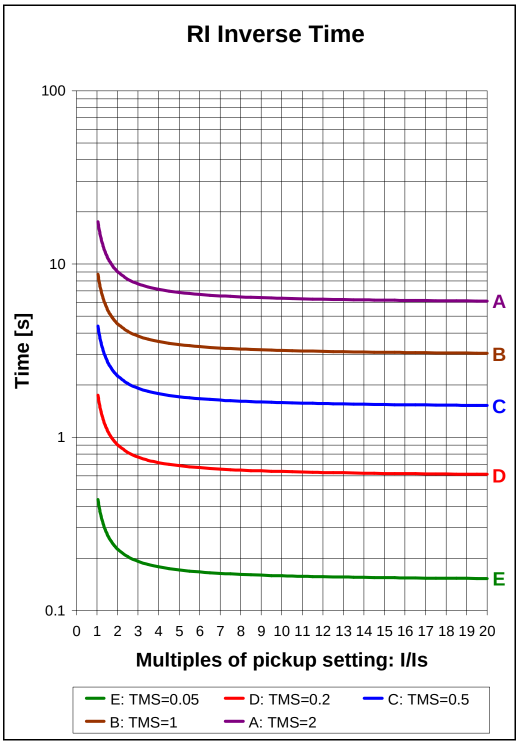
1. For (CO2 P20), TD is defined like in MiCOM P20 series
2. For (CO2 P40), TD is defined like in MiCOM P40 series

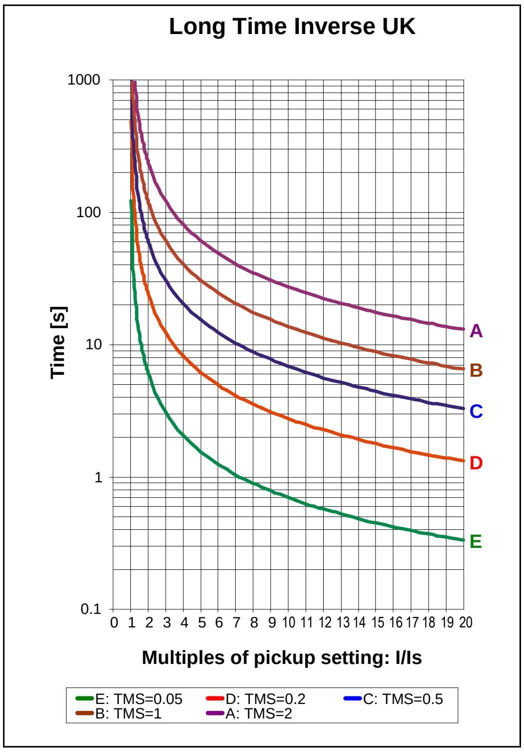
The difference between above two characteristics is in definition of TD setting value only.

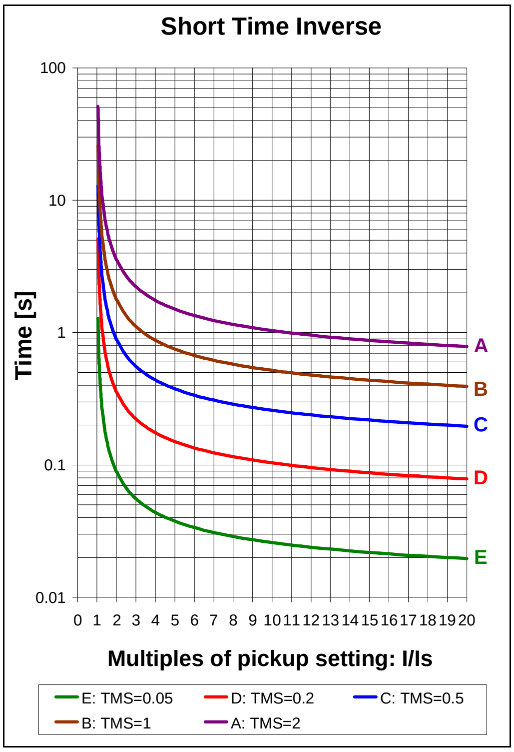




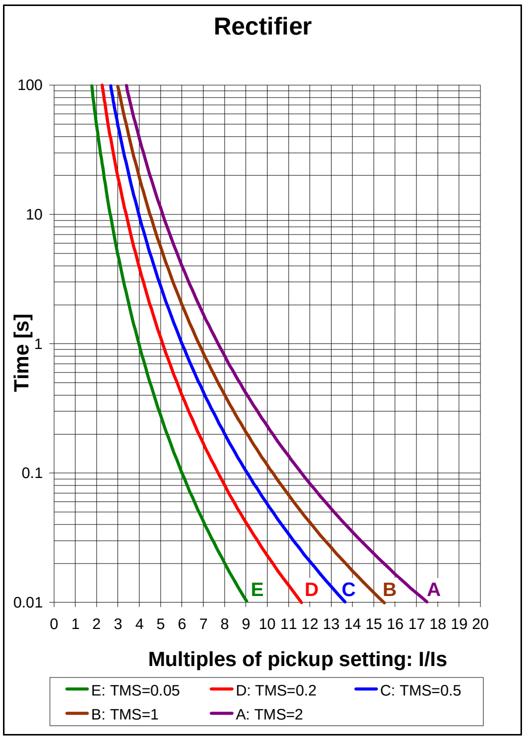

Extremely Inverse IEC
Time [s]
100
10
1
0.1
0.01
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TMS=0.05
D: TMS=0.2
C: TMS=0.5
B: TMS=1
A: TMS=2

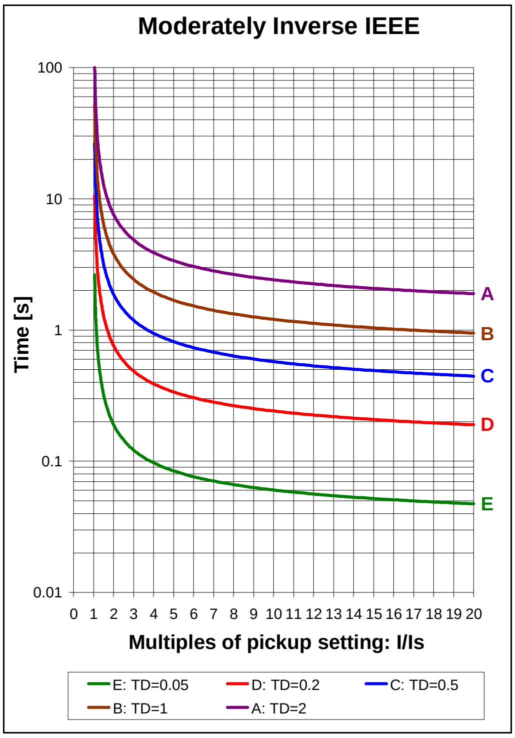

RI Inverse Time
Time [s]
100
10
1
0.1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TMS=0.05
D: TMS=0.2
C: TMS=0.5
B: TMS=1
A: TMS=2

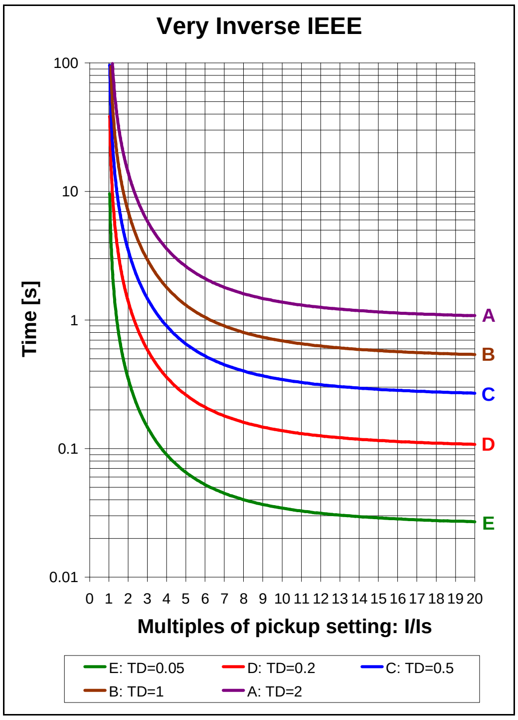

Long Time Inverse UK
Time [s]
1000
100
10
1
0.1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TMS=0.05
D: TMS=0.2
C: TMS=0.5
B: TMS=1
A: TMS=2

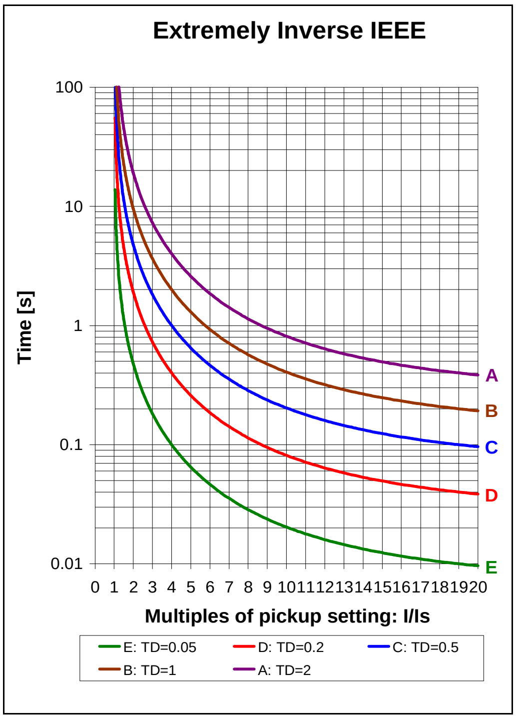

Short Time Inverse
Time [s]
100
10
1
0.1
0.01
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TMS=0.05
D: TMS=0.2
C: TMS=0.5
B: TMS=1
A: TMS=2

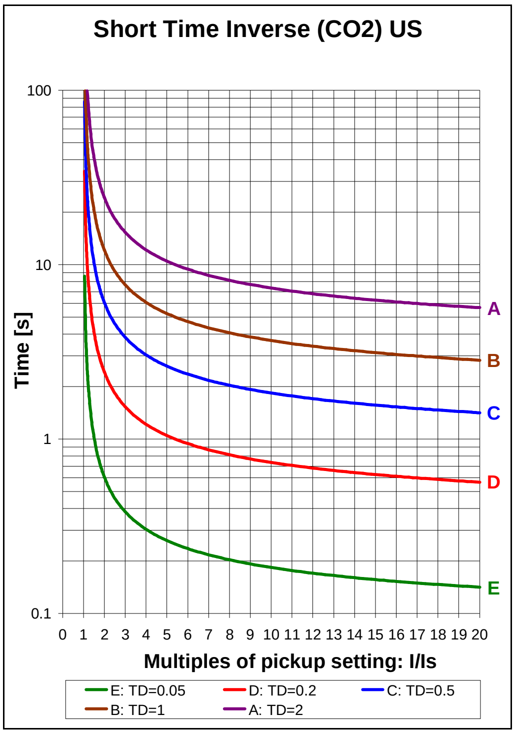
OP

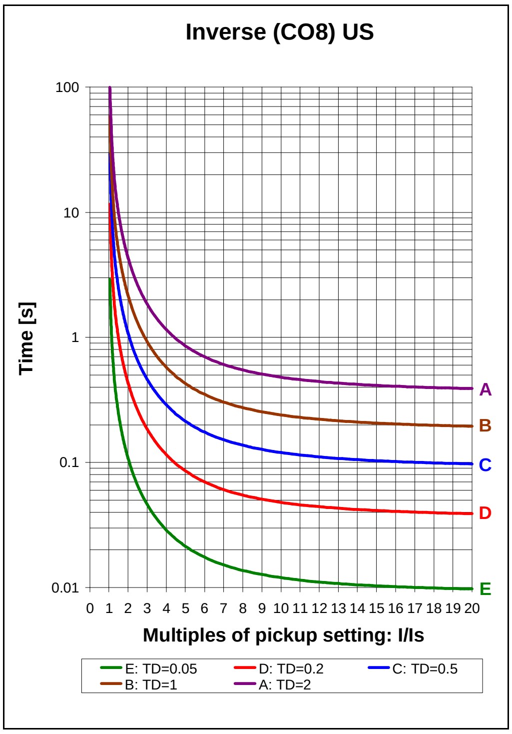

Rectifier
100
10
1
0.1
0.01
Time [s]
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
E D C B A
Multiples of pickup setting: I/Is
E: TMS=0.05
D: TMS=0.2
C: TMS=0.5
B: TMS=1
A: TMS=2

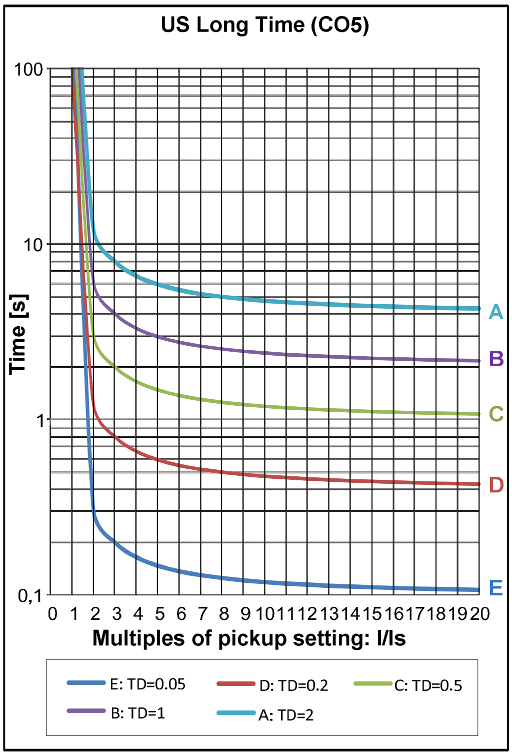

Moderately Inverse IEEE
100
10
1
0.1
0.01
Time [s]
A
B
C
D
E
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Multiples of pickup setting: I/Is
E: TD=0.05
D: TD=0.2
C: TD=0.5
B: TD=1
A: TD=2

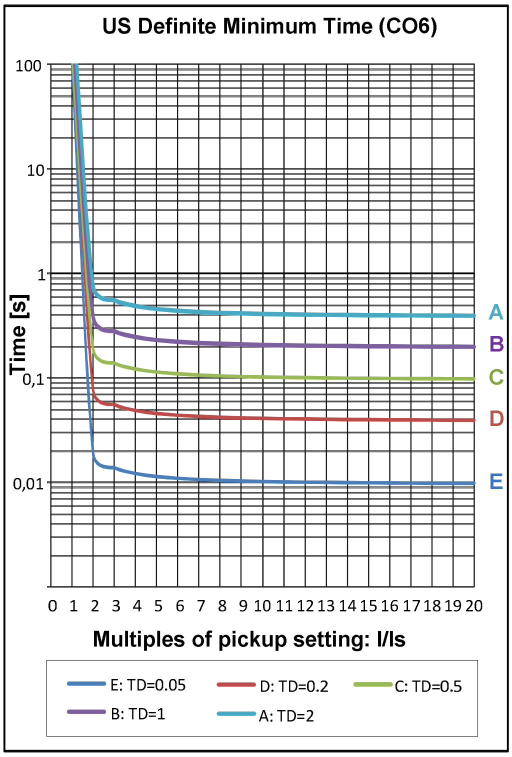

Very Inverse IEEE
100
10
1
0.1
0.01
Time [s]
A
B
C
D
E
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Multiples of pickup setting: I/Is
E: TD=0.05
D: TD=0.2
C: TD=0.5
B: TD=1
A: TD=2

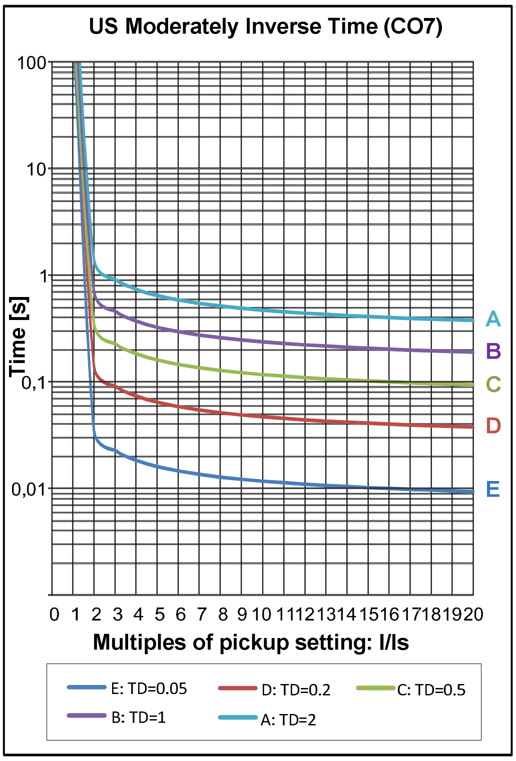

Extremely Inverse IEEE
100
10
1
0.1
0.01
Time [s]
A
B
C
D
E
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Multiples of pickup setting: I/Is
E: TD=0.05
D: TD=0.2
C: TD=0.5
B: TD=1
A: TD=2

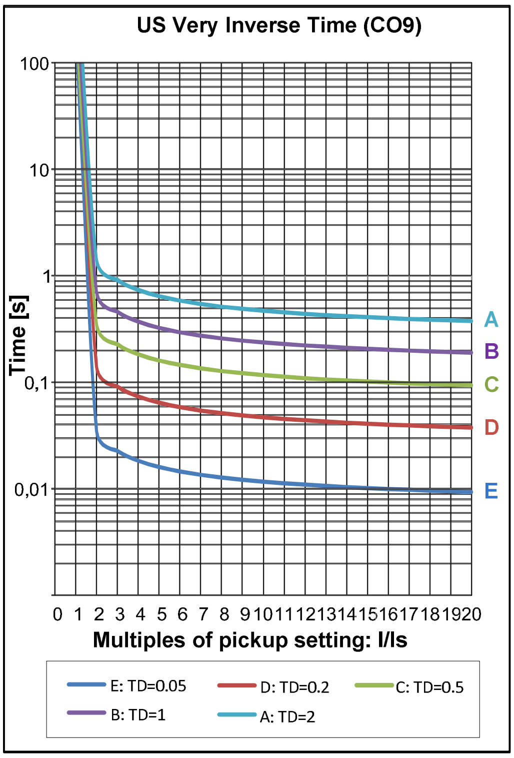

Short Time Inverse (CO2) US
Time [s]
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TD=0.05
D: TD=0.2
C: TD=0.5
B: TD=1
A: TD=2

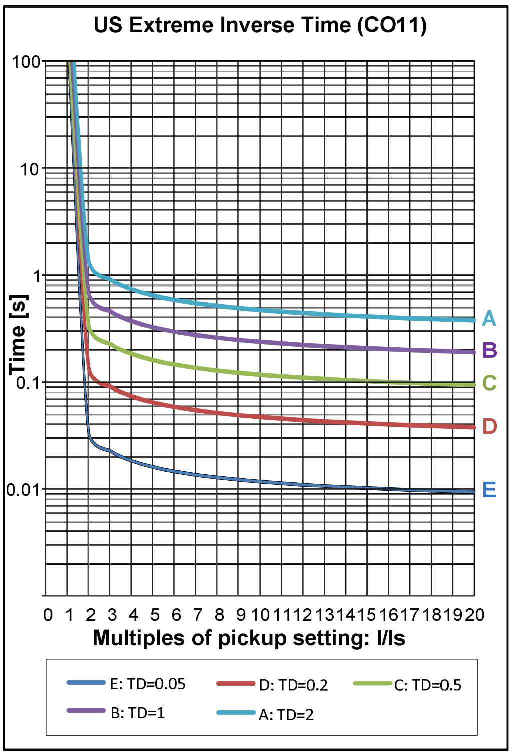

Inverse (CO8) US
Time [s]
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TD=0.05
D: TD=0.2
C: TD=0.5
B: TD=1
A: TD=2


US Long Time (CO5)
Time [s]
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TD=0.05
D: TD=0.2
C: TD=0.5
B: TD=1
A: TD=2


US Definite Minimum Time (CO6)
Time [s]
Multiples of pickup setting: I/Is
A
B
C
D
E
E: TD=0.05
D: TD=0.2
C: TD=0.5
B: TD=1
A: TD=2







RXIDG Curves

RXIDG curves can be selected on V11F with medium earth current sensitivity (corresponding to Cortec model number V11FExxx4xxxxxxxxxx)

The first earth thresholds can be selected with dedicated RXIDG curves.

The curves available follow the formula:

t = 5.8 – 1.35 * ln (1/ (k * Is/I))

Where:

t = tripping time

k = coefficient (from 0.3 to 1, by steps of 0.01)

Is = value of the programmed threshold (Pick-up value)

I = value of measured current

In order to be compliant with the Netmanagement specifications the relay must be used with:

- An earth current range 0.01 Ion to 12 Ion
- A rated current wiring 1A
- A core balanced CT with a ratio 25/1.

1.1.2 Timer Hold Facility

The first two stages of overcurrent protection in the V11F relay are provided with a timer hold facility, which may either be set to zero or to a definite time value. Setting of the timer to zero means that the overcurrent timer for that stage will reset instantaneously once the current falls below 95% of the current setting. Setting of the hold timer to a value other than zero, delays the resetting of the protection element timers for this period. When the reset time of the overcurrent relay is instantaneous, the relay will be repeatedly reset and not be able to trip until the fault becomes permanent. By using the Timer Hold facility the relay will integrate the fault current pulses, thereby reducing fault clearance time.

The timer hold facility can be found for the first and second overcurrent stages as settings ***I> DMT tRESET"*** and "***I>> DMT tRESET***", respectively. Note that this cell is not visible for the IEC/IEEE/US curves if an inverse time reset characteristic has been selected (***SETTING GROUP x/PROTECTION Gx/ PHASE O/C G1(G2)/ I> (I>>) Reset Delay Type 1:IDMT*** setting), as the reset time is then determined by the programmed time dial setting.

Reset IDMT Characteristic

IEEE/US/IEC

The IEEE/US/IEC curves may have an inverse time reset characteristic (***I> (I>>) Reset Delay Type 1: IDMT*** setting) or instantaneous reset ***(I> (I>>) Reset Delay Type 0:DMT*** setting). If IDMT reset is selected (***I> (I>>) Reset Delay Type 1: IDMT*** setting) then the following menu will be available: ***I> (I>>) RTD/RTMS RESET***. The following equation can be used to calculate the inverse reset time for IEEE/US/IEC curves:

IEC and UK and FR: $$reset\ time = RTMS \cdot \frac{tr}{1-(\frac{G}{Gs})^p}$$

IEEE and US: $$reset\ time = RTD \cdot \frac{tr}{1-(\frac{G}{Gs})^p}$$

where:

RTD = Time dial setting for IEEE/US curves

RTMS = A time multiplier setting for IEC curves

tr = Constant (see table below)

α = Constant (see table below)

M = I/Is

Note: To be in line with IEEE/US/IEC the RTMS (RTD) value should be equal to the TMS (TD) value. The setting for RTMS or RTD is given to adjust the reset characteristic to specific applications. Typically RTMS = TMS and RTD = TD.

Type of Curve	Standard	tr	P
IEC Standard Inverse Time (SI)	IEC/A	8.2	6.45
IEC Very Inverse Time (VI)	IEC/B	50.92	2.4
IEC Extremely Inverse Time (EI)	IEC/C	44.1	3.03
IEC Long Time Inverse (LTI)	IEC	40.62	0.4
FR Short Time Inverse (STI)	FR	0	0
UK Rectifier (Rect)	UK	0	0

OP

IEEE Moderately Inverse Time (MI)	IEEE (IEC/D)	4.850	2
IEEE Very Inverse Time (VI)	IEEE (IEC/E)	21.600	2
IEEE Extremely Inverse Time (EI)	IEEE (IEC/F)	29.100	2
Long Time (CO5)	US	0	2
Definite Minimum Time (CO6)	US	0	2
Moderately Inverse Time (CO7)	US	0	2
Time Inverse (CO8)	US	5.950	2
Very Inverse Time (CO9)	US	0	2
Extreme Inverse Time (CO11)	US	0	2
Short Time Inverse (CO2_P20)	US	0.323	2
Short Time Inverse (CO2_P40)	US	2.261	2
BNP EDF	BNP EDF	0	2
RXIDG	RXIDG	0	2

Note:

1. For CO2_P20, RTD is defined like in MiCOM P20 series
2. For CO2_P40, RTD is defined like in MiCOM P40 series

The difference between above two characteristics is in definition of TD setting value only.

1.2 SOTF: Switch On To Fault (Model A, B, E)

1.2.1 General

In some feeder applications, fast tripping may be required if a fault is still present on the feeder after the reclosure of the circuit breaker (Close on to fault).

In the case of a CB being manually closed, a switch on to an existing fault may occur. This situation is particularly critical because the overcurrent protection element would not clear the fault until the set time-delay has elapsed. It is then desirable to clear the fault as fast as possible.

Enabling and setting the SOTF (Switch On To Fault) function can be done under the ***SETTING GROUP x/PROTECTION Gx/SOTF?*** submenu.

Crossing the SOTF Threshold will initiate the SOTF function. The tSOTF time-delay will then be started.

If the ***SOTF*** element is set to ***Trip***, **Trip-Inrush Bl** (**AE**) or ***Trip-Latch*** (**AE**), it means that it is linked to the ***Protect.Trip*** and ***Prot.Trip pulse*** functions (see LED and Output configuration).

If the ***SOTF*** element is set to ***Alarm***, it means that it is linked to the ***Alarm*** function (see LED and Output configuration).

If **Trip-Inrush Bl** (**AE**) is selected, the SOTF element is blocked via the ***Inrush Blocking*** function (refer to Inrush Blocking section).

If ***Trip-Latch*** (**AE**) is selected, the SOTF element will remain high after a trip, until it is reset via a binary input, the HMI or a remote RESET command.

1.2.2 SOTF Description

The following signals can activate the SOTF function:

- manual closing ordered using the HMI (menu or function Close key)

- command generated by a digital input labelled ***Manual Close***,
- front communication Closing command,
- rear communication Closing command,

The diagram below illustrates this functionality.

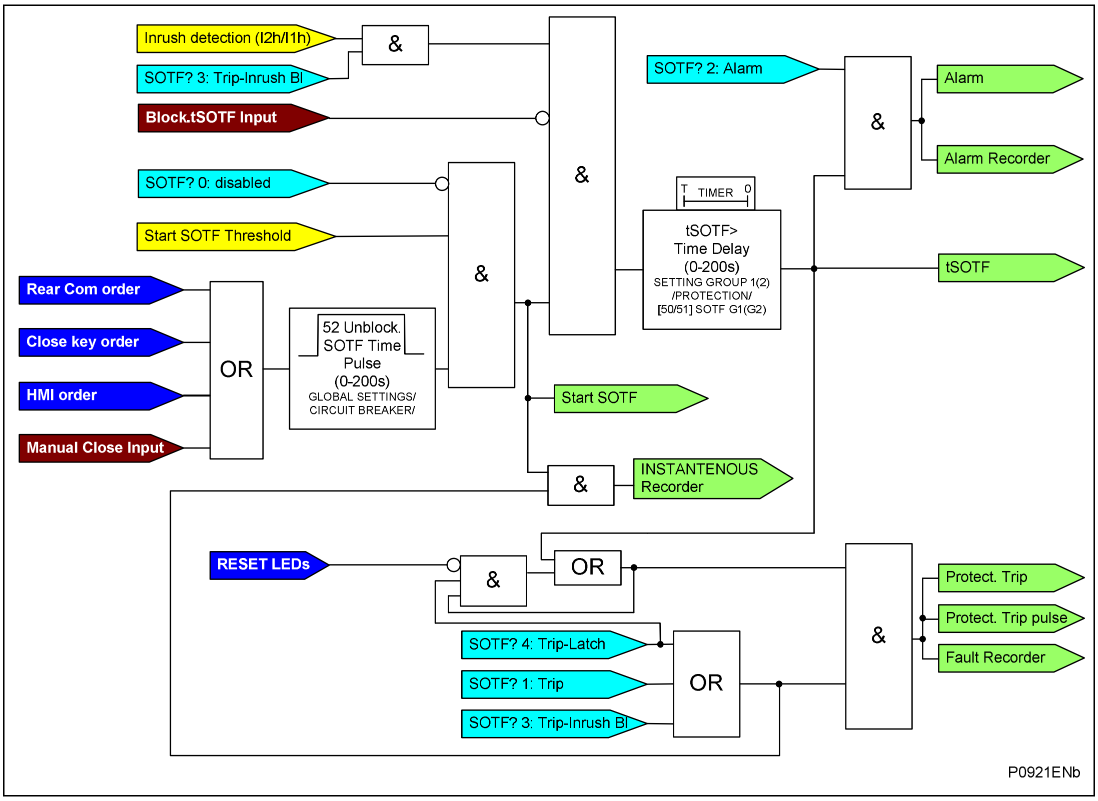


Figure 2: Switch on to fault logic diagram

When at least one of the signals listed above has been detected, a timer starts and lasts until ***52 Unblock.SOTF Time (GLOBAL SETTINGS/CIRCUIT BREAKER*** submenu) elapses.

Once the above timer has elapsed and the SOTF thresholds have been crossed, the ***tSOTF*** settable time-delay starts. This settable time-delay is particularly useful in applications where fault selectivity is required.

This time-delay is also useful in cases where serious transients may be present, where the three poles of the CB do not all close at the same time and in cases where the CB may not close instantaneously.

“tSOTF” can also be considered as a trip time-delay that substitutes itself to the trip time-delay associated with the crossed threshold so that the tripping time is accelerated.

If the SOTF stage is reset before the settable time-delay ***tSOTF*** elapses, the SOTF function is reset.

1.3 Earth Fault Protection

The Earth fault element operates from a measured earth fault current quantity.

The first earth fault stage has time-delayed characteristics which are selectable between inverse definite minimum time (IDMT) and definite time (DMT). The second stage has a definite time characteristic only.

If an earth fault stage (***IN_1 stage?***, ***IN_2 stage?*** or ***IN_3 stage?*** (**E**) menu) is set to ***Trip***, **Trip-Inrush BI (AE)** or ***Trip-Latch*** it means that that stage is linked to the ***Protect.Trip*** and ***Prot.Trip pulse*** functions (see LED and Output configuration).

If an earth fault stage (***IN_1 stage?***, ***IN_2 stage?*** or ***IN_3 stage?*** (**E**) menu) is set to ***Alarm***, it means that that stage is linked to the ***Alarm*** function (see LED and Output configuration).

If **Trip-Inrush BI** (**AE**) is selected, the earth fault stage is blocked via the ***Inrush Blocking*** function (refer to Inrush Blocking chapter).

If ***Trip-Latch*** (**AE**) is selected, the earth fault stage will remain after a trip, until it is reset via a binary input, the HMI or a remote RESET command.

OP

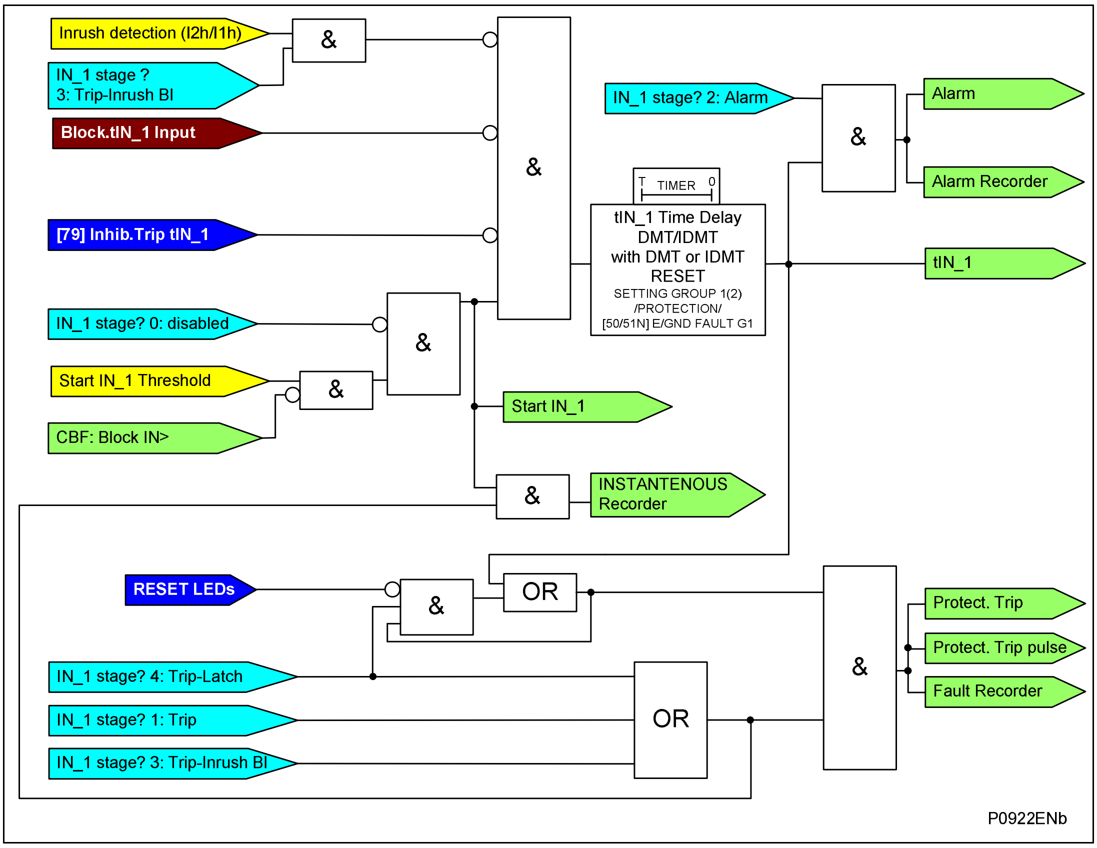


Figure 3: Earth Fault protection logic diagram for IN_1. For IN_2, the logic diagram is the same but without the IDMT characteristics

The types of characteristics are the same as for phase protection elements:

- IEC Standard Inverse Time (SI)
- IEC Very Inverse Time (VI)
- IEC Extremely Inverse Time (EI)
- IEC Long Time Inverse (LTI)
- FR Short Time Inverse (STI)
- UK Rectifier (Rect)

- RI: Electromechanical Inverse
- IEEE Moderately Inverse Time (MI)
- IEEE Very Inverse Time (VI)
- IEEE Extremely Inverse Time (EI)
- US Short Time Inverse; TD setting in line with MiCOM P20 (CO2_P20)
- US Short Time Inverse; TD setting in line with MiCOM P40 (CO2_P40)
- US CO8: Time Inverse
- BNP EDF
- RXIDG

The mathematical formulae and curves for the twelve Inverse Time characteristics available with the V11F are presented in section 2.1 of this chapter .

The IEEE/US/IEC curves may have an inverse time reset characteristic, DMT delayed or instantaneous reset (refer to section 2.1 of this chapter)

1.4 Negative Sequence Overcurrent Protection (Model E)

In traditional phase overcurrent protection schemes, overcurrent thresholds must be set above the maximum load current levels. This limits the sensitivity of the relay. Most protection schemes also use an earth fault element based on residual current, which improves sensitivity for earth faults. However, it can happen that some faults occur and stay undetected by such schemes.

Any unbalanced fault condition will produce negative sequence current. Thus, a negative phase sequence overcurrent element can detect both phase-to-phase and phase-to-earth faults.

The negative phase sequence overcurrent element included in the V11F relays provides one stage non-directional overcurrent protection with independent time-delay characteristics. These characteristics are selectable between inverse definite minimum time (IDMT) and definite time (DT). The inverse time-delayed characteristics support both IEC and IEEE curves. Please refer to section 2.1 for a detailed description.

If the **I2>** protection element is set to ***Trip***, **Trip-Inrush BI** or ***Trip-Latch***, it means that that element is linked to the ***Protect.Trip*** and ***Prot.Trip pulse*** functions (see LED and Output configuration).

If the **I2>** protection element is set to ***Alarm***, it means that that element is linked to the ***Alarm*** function (see LED and Output configuration).

If **Trip-Inrush BI** is selected, the negative sequence overcurrent element is blocked via the ***Inrush Blocking*** function (refer to Inrush Blocking section).

If ***Trip-Latch*** is selected, the negative sequence overcurrent element will remain high after a trip, until it is reset via a binary input, the HMI or a remote RESET command.

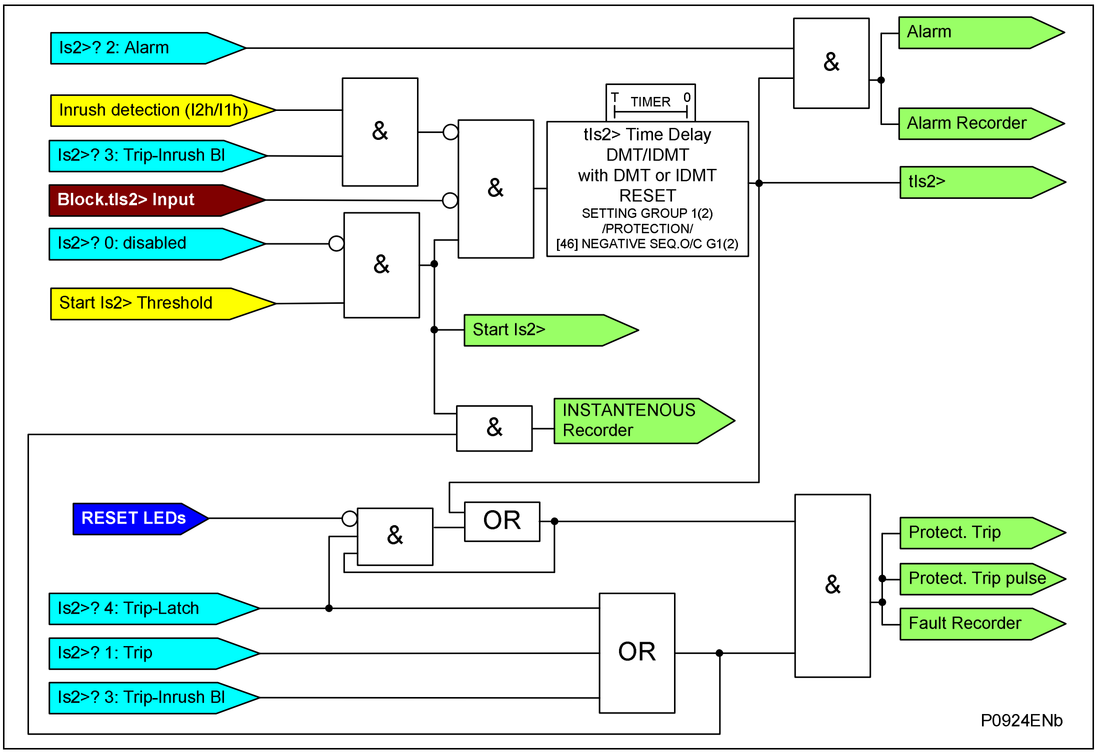


Figure 4: Negative sequence overcurrent protection logic

1.5 Broken Conductor Detection (Model E)

The relay incorporates an element that measures the ratio of negative to positive phase sequence current (I_2/I_1). This will be affected to a lesser extent than the measurement of negative sequence current alone, since the ratio is approximately constant with variations in load current. Hence, a more sensitive setting may be achieved. The logic diagram is as shown below. The ratio of I_2/I_1 is calculated and compared with the ***Ratio I2/I1*** threshold. If it exceeds the threshold then the time-delay ***tBCond*** is initiated. The ***Brkn Cond I< block*** signal is used to disable Broken Conductor function if the max current value from three phases is too low. The ***Brkn Cond I< block*** undercurrent threshold is settable (***GLOBAL SETTINGS/O/C ADVANCED/[46BC] Brkn.Cond I< Block.***). Factory setting value is 0.1 In.

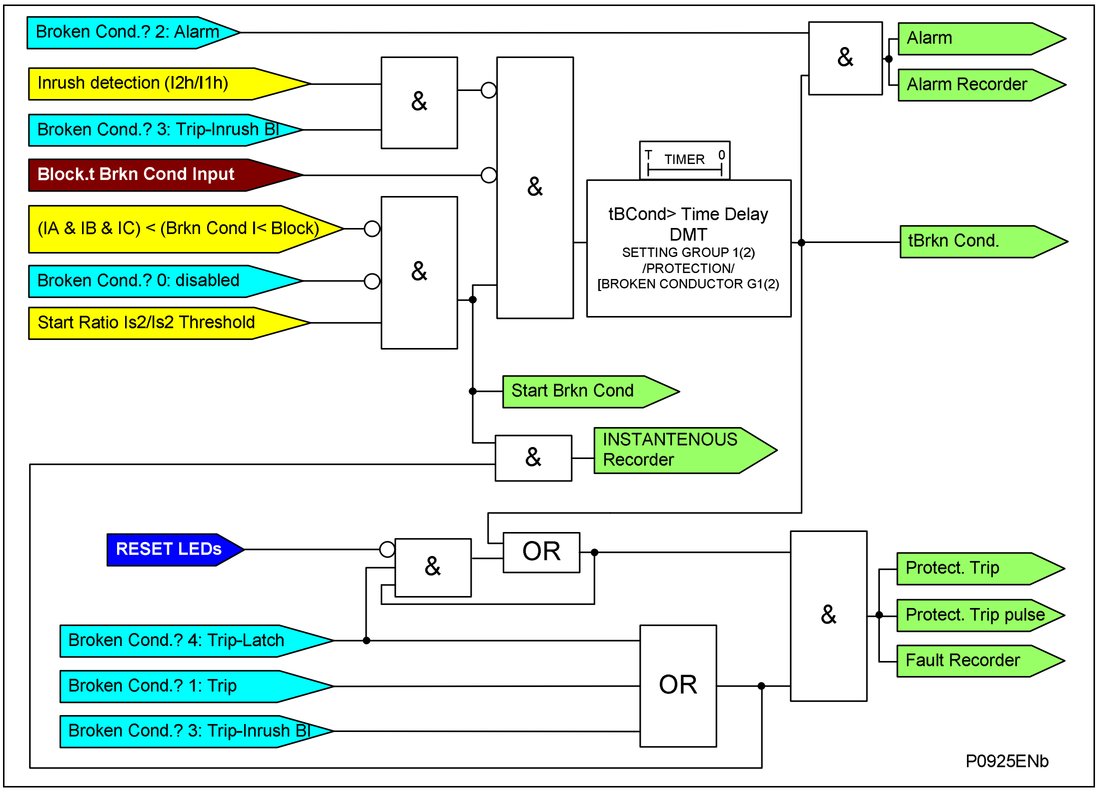


Figure 5: Broken conductor protection logic

The Broken Conductor function can be set to: ***Trip***, **Trip-Inrush Bl**, ***Trip-Latch*** or ***Alarm***.

If the ***Broken Conductor*** element is set to ***Trip***, **Trip-Inrush Bl** or ***Trip-Latch***, it means that it is linked to the ***Protect.Trip*** and ***Prot.Trip pulse*** functions (see LED and Output configuration).

If the ***Broken Conductor*** element is set to ***Alarm***, it means that it is linked to the ***Alarm*** function (see LED and Output configuration).

If **Trip-Inrush Bl** is selected, the I2/I1 threshold is blocked via the ***Inrush Blocking*** function (refer to Inrush Blocking section).

If ***Trip-Latch*** is selected, the Broken Conductor element will remain high after a trip, until it is reset via a binary input, the HMI or a remote RESET command.

1.6 Thermal Overload Protection (Model N, A, B, E)

The relay incorporates a current-based thermal replica, using r.m.s. load current to model heating and cooling of the protected plant. The element can be set with both alarm and trip stages.

The heat generated within an item of plant, such as a cable or a transformer, is the resistive loss (I^2R x t). Thus, heating is directly proportional to current squared. The thermal time characteristic used in the relay is therefore based on current squared, integrated over time. The relay automatically uses the largest phase current for input to the thermal model.

The equipment is designed to operate continuously at a temperature corresponding to its full load rating, where the generated heat is balanced by heat dissipated through radiation, etc.

Over-temperature conditions therefore occur when currents in excess of the rating are allowed to flow for a period of time. It can be shown that temperatures during heating follow exponential time constants and a similar exponential decrease of temperature occurs during cooling.

This characteristic is used to protect cables, dry type transformers (e.g. type AN), and capacitor banks.

The thermal time characteristic is given by:

$$\text{t Trip} = \text{Te In}\left(\frac{\left|\text{K}^2 - \theta_p\right|}{\left|K^2 - \theta_{t\,rip}\right|}\right)$$

Where:

t Trip = Tripping time (in seconds)

T_e = Thermal time constant of the equipment to be protected (in seconds)

K = Thermal overload equal to $\frac{I_{eq}}{1.05 \cdot I_{therm}}$

I_{eq} = Equivalent current corresponding to the R.M.S. value of the largest phase current

I_P = Steady state pre-loading current before application of the overload

I_{therm} = Setting value. It is full load current rating

θ_P = Steady state pre-loading thermal state before application of the overload

θ_{alarm} = Initial thermal state. If the initial thermal state = 30% then θ =0.3

θ_{trip} = Trip thermal state. If the trip thermal state is set at 100%, then θ trip = 1

The tripping time varies according to the load current carried before application of the overload, i.e. whether the overload was applied from '**hot**" or "**cold**".

The parameter settings are available in the various menus. The calculation of the thermal state is given by the following formula:

$$\Theta_{\tau+1} = \left(\frac{I_{eq}}{1.05 \cdot I_{therm}}\right)^2 \left[1 - e^{\left(\frac{-t}{Te}\right)}\right] + \Theta_\tau e^{\left(\frac{-t}{Te}\right)}$$

θ is calculated every 10 ms.

If all the phase currents are above 0.1 x I_{therm} the value of Tr (time constant for cooling) is used instead of Te (time constant for heating):

$$\Theta_{\tau+1} = \left(\frac{I_{eq}}{1.05 \cdot I_{therm}}\right)^2 \left[1 - e^{\left(\frac{-t}{Tr}\right)}\right] + \Theta_\tau e^{\left(\frac{-t}{Tr}\right)}$$

In a typical application (transformer, cable, ...) Tr should be equal to Te. Different setting values of Te and Tr are only used in motor applications.

Where θ is the thermal state and is θp the pre-fault thermal state.

Note: A current of 105% Is (kI_{FLC}) has to be applied for several time constants to cause a thermal state measurement of 100%.

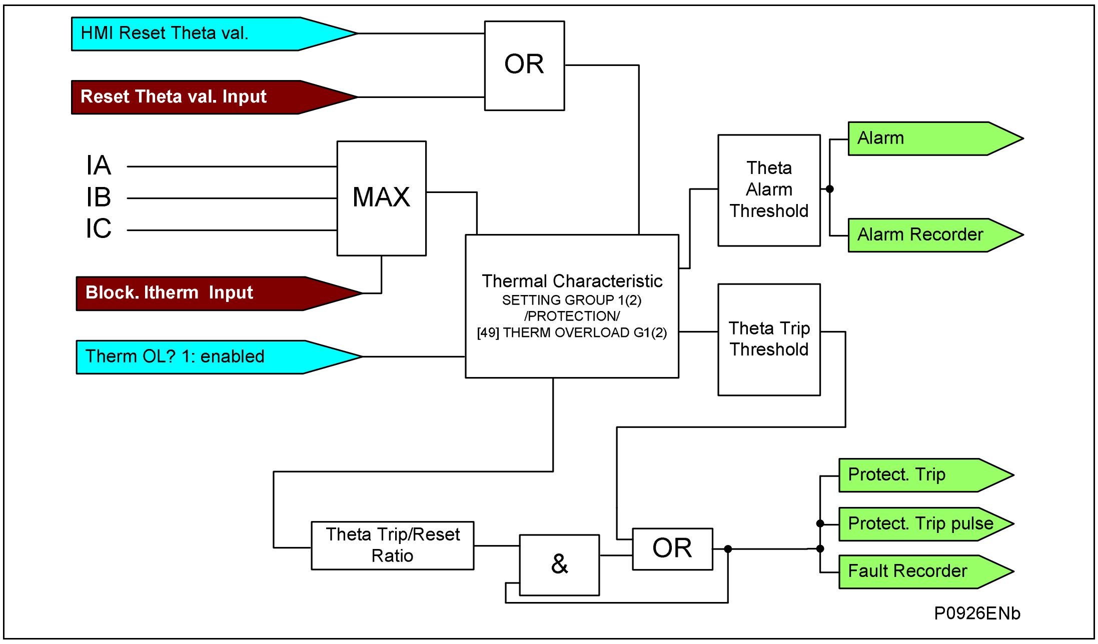


Figure 6: Thermal overload protection logic

The functional block diagram for the thermal overload protection is shown in Figure 7

The magnitudes of the three phase currents are compared and the largest magnitude selected as the input to the thermal overload function. If this current exceeds the thermal trip threshold setting a start condition is asserted.

The Thermal Trip signal remains high until the thermal state drops below the thermal reset threshold.

The thermal reset threshold is settable using the ***Theta Trip/Reset Ratio*** value.

The Thermal Reset Ratio is calculated:

Thermal Reset Threshold = ***Theta Trip/Reset Ratio*** x ***Theta Trip***

For ***Theta Trip/Reset Ratio*** = 90% (0.9) and ***Theta Trip***=120%:

Thermal Reset Threshold = 0.9 x 120%=108%

If the Thermal State is above the ***Theta Trip*** threshold and then drops, the Thermal Trip signal will reset when the Thermal State drops below the ***Thermal Reset Threshold*** (see above).

If ***Blocking Ithermal Input*** (ABE) is in high state, for calculation Thermal Characteristic uses current value 0xIn instead of measured value.

Thermal protection also provides an indication of the thermal state in the ***MEASUREMENTS*** column of the relay. The thermal state can be reset by either an opto-input (if assigned to this function using the programmable scheme logic) or the relay menu.

The reset function in the menu is also found in the ***MEASUREMENTS*** column with the thermal state menu.

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1.7 Circuit Breaker Failure Function: CB Fail

The circuit breaker failure protection function incorporates one timer allowing configuration for the following scenario: upon any protection trip, ***CB Fail Timer tBF*** is started, and normally reset when the circuit breaker opens to isolate the fault. If breaker opening is not detected, ***CB Fail Timer tBF*** times out and closes an output contact assigned to ***tCBF***. This contact is used to backtrip upstream switchgear, generally tripping all infeeds connected to the same busbar section.

The complete breaker fail logic is illustrated in Figure 8.

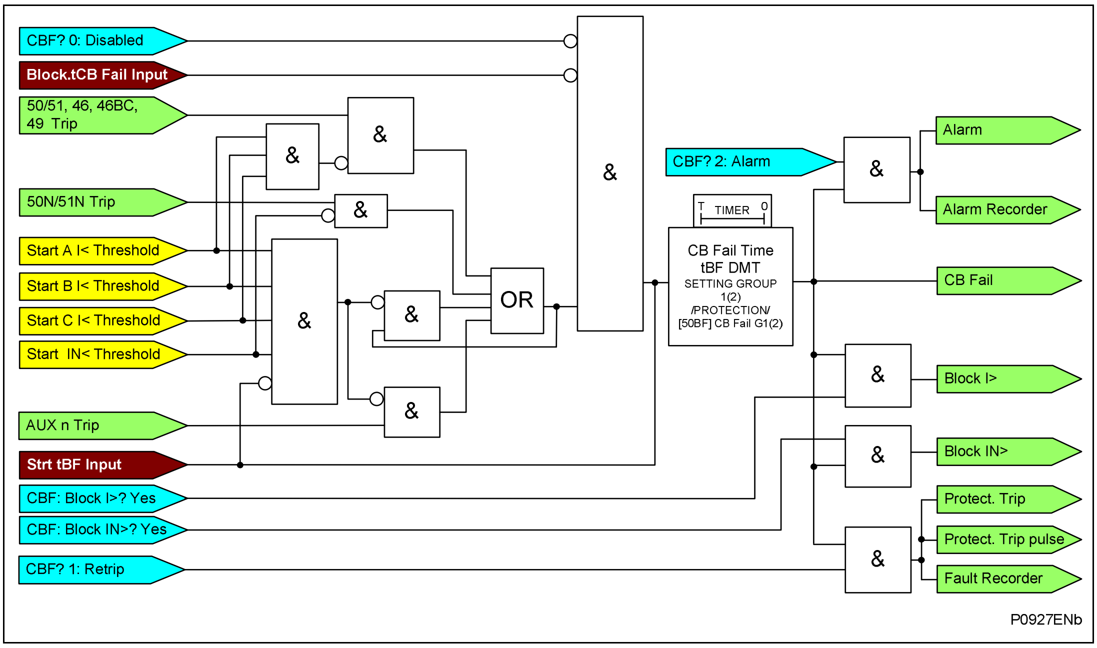

Figure 7: Circuit Breaker Failure protection logic

The CBF element ***CB Fail Timer tBF*** operates for trips triggered by protection elements within the relay or via an external protection device (binary input). The latter is achieved by assigning one of the relay opto-isolated inputs to ***AUX n*** (**ABE**) set for tripping or ***Strt tBF*** (**ABE**) (depends on the application).

When CBF is triggered by a current-based protection element included in the V11F, it is reset by an undercurrent element (***I<Threshold CBF*** or ***IN< Threshold CBF***) only.

When it is triggered via the ***AUX n*** (**ABE**) input, CBF is reset by an undercurrent element.

When it is triggered via the ***Strt tBF*** input (**ABE**), CBF is reset by the low state of this input only.

The ***Block I>?*** (**E**) and ***Block IN>?*** (**E**) settings are used to cancel starts issued by the overcurrent and earth fault elements, respectively, following a breaker fail time out. The start is cancelled when the cell is set to ***Yes.***

If the ***Retrip*** option is selected for the ***CB Fail*** function, it means that it is linked to the ***Protect.Trip*** and ***Prot.Trip pulse*** functions (see LED and Output configuration).

If ***CB Fail*** is set to ***Alarm***, any outputs and LEDs assigned to the ***Alarm*** or ***tCBF*** function are energized.

If ***CB Fail*** is not set to ***Disabled***, any outputs and LEDs assigned to the ***tCBF*** function are energized.

1.8 Auxiliary Timers (available in B, A and E)

Four auxiliary timers, tAux1, tAux2, tAux3 and tAux4, are available and associated with logic inputs Aux1, Aux2, Aux3 and Aux4 (refer to the ***SETTING GROUP x/INPUTS CONFIGURATION*** menu). When these inputs are energized, the associated timers start and, when the set time has elapsed, the associated LEDs (***SETTING GROUP 1(2)/LEDs CONFIGURATION*** menu) are lit or/and the associated output relays close (refer to the ***SETTING GROUP 1(2)/OUTPUT RELAYS CONFIGURATION*** menu). Time-delays can be independently set from 0 ms to 600 s.

Each auxiliary timer can be set independently to:

- ***Alarm:*** Alarm signal
- ***Trip***: Protection Trip signal
- ***Trip-Inrush Bl*** (**AE**): Protection Trip signal with inrush blocking
- ***Trip-Latch***(**AE**)***:*** Protection Trip signal latched until it is reset via a binary input (***Reset Ltch Sign***), the HMI or a remote reset command
- ***Load Shedding*** (**E**): The high state of an AUX logic input starts the corresponding tAUX timer at the expiry of which it is associated with the ***Trip CB Order*** and ***tAUX*** outputs (refer to the ***SETTING GROUP 1(2)/OUTPUT RELAYS CONFIGURATION*** menu). Additionally this state (***Load Shedding state***) is stored in memory. The stored value is reset by any protection trip, a close signal or the CB closed status (**CB status 52A** logic input) (refer to chapter V11F/EN AP – Application).
- ***AR after LS Hi*** (**E**)***:*** If the ***Load Shedding*** state is stored, *the high state of the logic input triggers the* ***tAUX*** timer. When the set value has elapsed the close command is executed ***(Close CB order*** output) (refer to chapter V11F/EN AP – Application).
- **AR after LS Lo** (**E**)**:** If the ***Load Shedding*** state is stored, *the low state of the logic input triggers the* ***tAUX*** timer. When the set value has elapsed the close command is executed ***(Close CB order*** output) (refer to chapter V11F/EN AP – Application).

In the ***SETTING GROUP x/INPUTS CONFIGURATION*** (**ABE**) menu ***AUX5*** (**ABE**) and/or ***AUX6*** (**ABE**) can be mapped to inputs. These input functions have no timers (instantaneous action). They can be used as bridges between inputs and LEDs or inputs and outputs. It is not possible to link this input function to a ***Trip*** or ***Alarm*** signal.

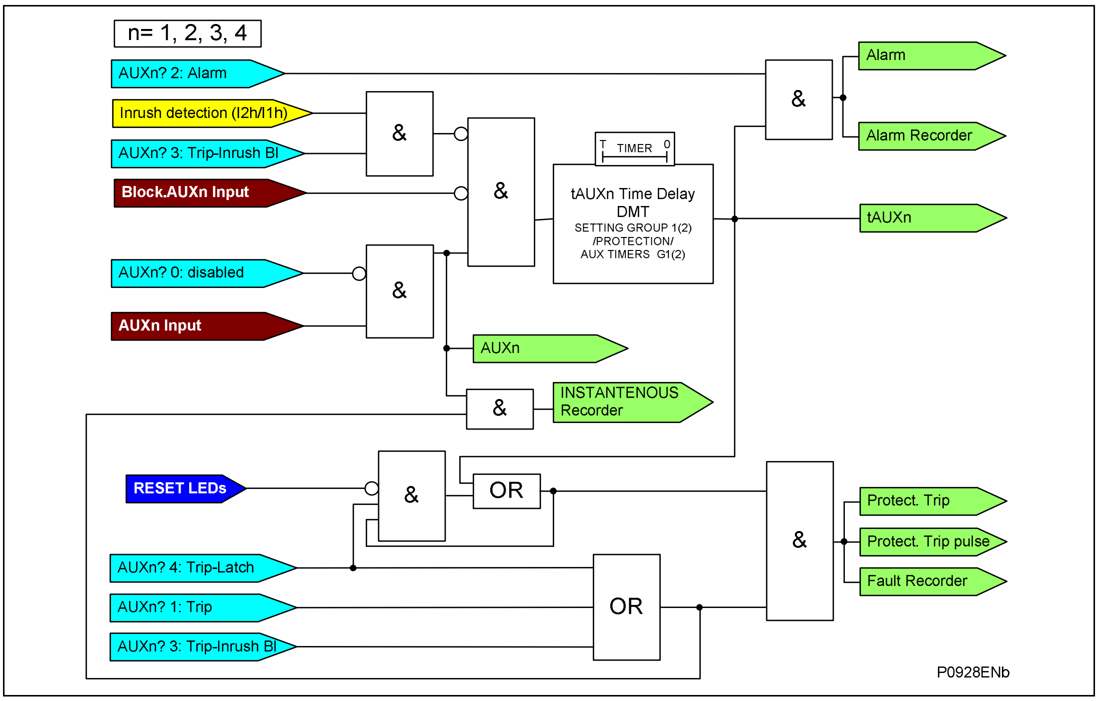

Figure 8: AUX Timer Logic (AUX1-AUX4) (for Alarm, Trip, Trip-Inrush BL, Trip-Latch options)

1.9 Logic Selectivity (Model E)

Section 1.9 describes the use of non-cascade protection schemes that make use of start contacts from downstream relays connected to block operation of upstream relays. In the case of ***Logic Selectivity*** (Sel), the start contacts are used to raise the time-delays of upstream relays, instead of blocking them. This provides an alternative approach to achieving non-cascade types of overcurrent scheme. This may be more familiar to some utilities than the blocked overcurrent arrangement. The ***Logic Selectivity*** function provides the ability to temporarily increase the time-delay settings of the second and third stages of phase overcurrent and measured earth fault protection elements.

Two independent Logic Selectivity functions are available: ***Sel1*** and/or ***Sel2***.

This logic is initiated by energization of the appropriate binary input assigned to Sel1 (Sel2)

To allow time for a start contact to initiate a change of setting, the time settings of the second and third stages should include a nominal delay.

This function acts upon the following protection functions:

- Phase overcurrent (2nd and/or 3rd stages)
- Earth fault (2nd and/or 3rd stages)

The logic diagram for the selective overcurrent function is shown for phase A of the third overcurrent stage. The principle of operation is identical for the 3-phase phase overcurrent element, stages 2 and 3, and the earth fault element, stages 2 and 3. When the selective logic function is enabled, the action of the blocking input is as follows:

1. No block applied
In the event of a fault condition that continuously asserts the start output, the function will assert a trip signal after the normal time-delay tI>>> has elapsed.

2. Logic input block applied
In the event of a fault condition that continuously asserts the start output, the function will assert a trip signal after the selective logic time-delay tSelx has elapsed.

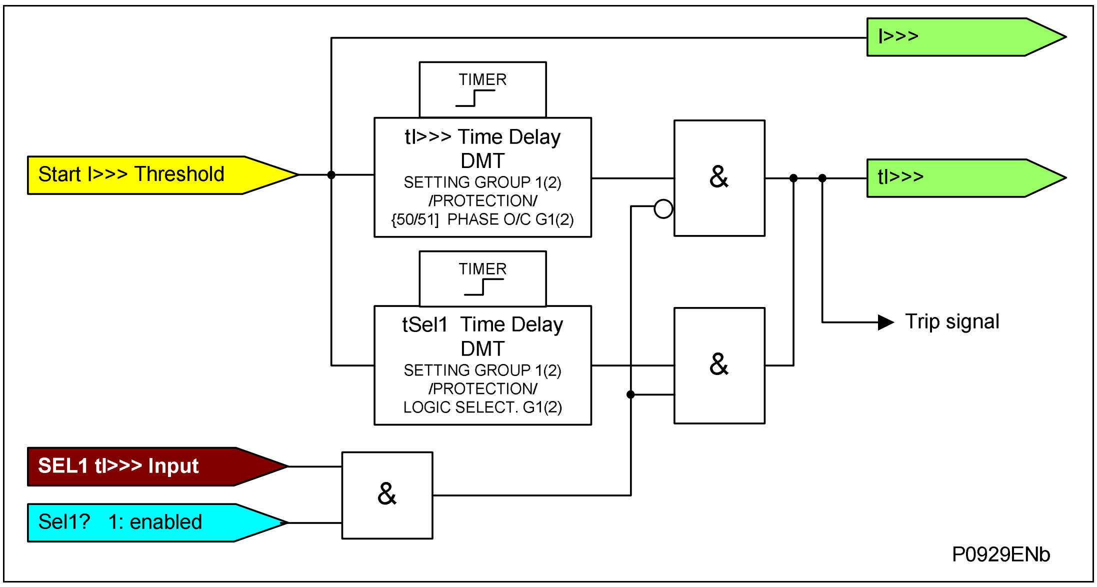

Figure 9: Selective Logic scheme for the I>>> protection element

1.10 Cold Load Pick Up

The Cold Load Pick-up feature allows selected settings of VAMP 11F relays to be changed to react to temporary overload conditions that may occur during cold starts. This condition may happen by switching on large heating loads after a sufficient cooling period, or loads that draw high initial starting currents.

When a feeder is energized, the current levels that flow for a period of time following energizing may differ greatly from the normal load levels. Consequently, overcurrent settings that have been applied to give short circuit protection may not be suitable during this period.

This function acts upon the following protection functions:

- Phase overcurrent (1st, 2nd and 3rd stages)
- Earth fault (1st, 2nd and 3rd stages (**E**))
- Broken Conductor I2/I1 element (**E**)
- Thermal Overload I_{therm} setting (**NABE**)
- Negative sequence overcurrent (**E**)

The Cold Load Pick-up (CLP) logic raises (x Level%) the settings of selected stages for a set duration (tCL). This allows the protection settings to be set closer to the load profile. Cold load pick-up cannot restart until the end of tCL duration. The CLP logic provides stability, without compromising protection performance during starting.

CLP is started by a digital logic Cold Load PU binary input or/and by current stage. It depends on the configuration (see Fig.11):

- ***Cold Load PU?: 1: Cur.+Input*** - CLP is started from both: current criteria (stages ***I<5%In*** and ***I>10%In***) and binary input criteria (***Cold Load PU*** Binary Input). If ***Cold Load PU*** function is not assigned to any inputs, CLP is started from current criteria only,
- ***Cold Load PU?: 1: Input*** - CLP is started from binary input criteria (***Cold Load PU*** Binary Input). If ***Cold Load PU*** function is not assigned to any inputs, CLP is disabled.

Typically ***Cold Load PU*** Binary Input is wired to 52A CB status.

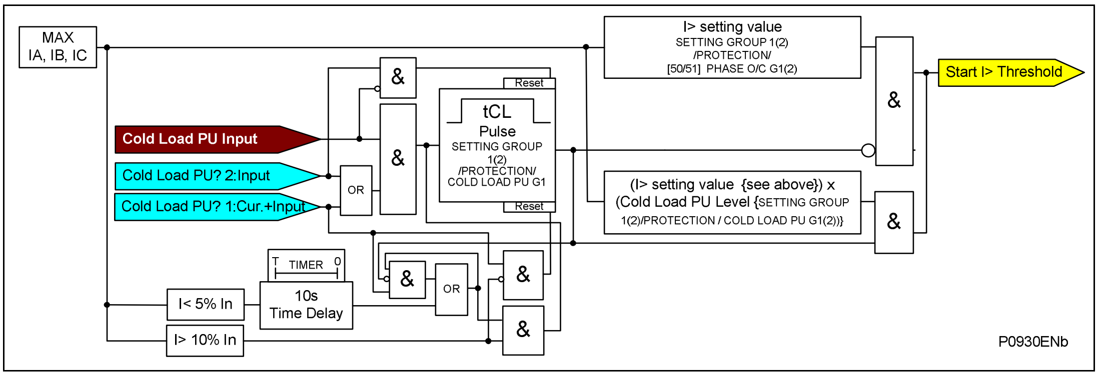

Figure 10: Cold Load Pick Up scheme for the I> protection element

1.11 Auto-reclose (Model E)

1.11.1 Auto-reclose Enabling

The auto-reclose function is enabled in the ***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE Gx*** menu. The current state of the auto-reclose function is shown in the default Autoreclose cell of the menu:

[79]: Ready CTRL: no operation

The first line informs about the current state of the auto-reclose function. The following can be displayed:

- ***[79] Ready*** – The auto-reclose function is unblocked and ready to operate.
- ***[79] In progress*** – An auto-reclose cycle is in progress.
- ***[79] Tempor.Block***. – The auto-reclose function is temporary blocked after Closing of CB (from RS485, Front Panel or via configured Binary Input) during ***Inhibit Time tI on Close*** (***GLOBAL SETTINGS/[79] ADVANCED SETTINGS/Inhibit Time tI on Close***). Also temporary blocking feature is activated when breaker closes (either 52a contact energises or 52b contact de-energises) and [79] - IN PROGRESS is inactive. In this way the temporary blocking feature will not be activated when the [79] function initiates the reclose, only when its manually done by an operator who turns a control switch (the relay doesn't close in on a fault when the operator is near the switchgear).
- ***[79]: Lockout*** – The auto-reclose function is internally blocked up to reset signalling (Input assigned to ***Reset Latched Signals***, ***C*** clear key on the front panel, ***Reset Latched Signals*** via RS485, closing of CB command via V11F or ***Unlockout*** command in CTRL line).
- ***[79] Block:CTRL***. – The auto-reclose function is blocked via the communication port or from V11F menu via the Auto-reclose default cell (CTRL line)
- ***[79] Block:Input*** – The auto-reclose function is blocked via a binary input assigned to this effect.
- ***[79] Disabled*** – The auto-reclose function is disabled in the ***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE Gx*** submenu.

There are two menu columns in which the Auto-reclose function can be configured:

- ***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE G1(2)*** – separate settings for each setting group,
- ***GLOBAL SETTINGS/ [79] ADVANCED SETTING*** – common settings for all setting groups.

The Auto-reclose function of the VAMP 11F is available only if the following conditions are verified:

- The auxiliary contact of the CB status, 52a or 52b, must be connected to the relay. Refer to the ***SETTING GROUP x/PROTECTION Gx/INPUT CONFIGURATION*** menu.
- The auto-recloser is ready for operation (not disabled nor blocked). The Autoreclose default cell should display: ***[79]: Ready***.
- The trip output relay must be set to ***Prot.Trip pulse*** (recommended if an output contact is used) or/and ***Protect Trip*** (if an energy trip output is used) and not latched in the protection element's settings (for example ***I>? Trip-Latch***). The trip output must not be latched either.
- The ***Close CB Order*** command must be assigned to the close CB output. The close contact output must not be latched.

- In the ***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE Gx*** menu all settings are properly configured.

  Note: If the auxiliary supply is lost during an auto-reclose cycle, the auto-reclose function is totally disabled.

In addition to ***[79] AUTORECLOSE Gx*** settings, the user will be able to fully link the auto-reclose function to the protection function using the menus:

- ***SETTING GROUPS x/PROTECTION Gx/[50/51] PHASE O/C G1***,
- ***SETTING GROUPS x/PROTECTION Gx/[50/51N] E/GND FAULT G1,***
- ***SETTING GROUPS x/PROTECTION Gx/AUX TIMERS Gx.***

1.11.2 Logic Inputs

The auto-reclose function has four inputs that can be assigned to the auto-reclose logic. These inputs can be mapped to opto-isolated inputs in the ***SETTING GROUP x/PROTECTION Gx/INPUT CONFIGURATION*** menu. External contacts can then be wired to these inputs and influence the auto-recloser scheme. These four logic inputs are:

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- one external ***CB FLT Ext Sign***. – external information that CB is not ready to close (a spring not charged, too low level of CB gas, etc),
- ***AUX 1*** or ***AUX 2*** assigned to trip and [79] shots - the external starting commands,
- ***Block [79]*** – the external blocking command (for example: an external switch).

The following table gives the “SETTING GROUP 1(2)/INPUT CONFIGURATION 1(2)” menu assigned to the auto-reclose logic input.

	***INPUT CONFIGURATION Gx* submenu:**	***AUTORECLOSE Gx submenu* enabled with:**	***[79] ADVANCED SETTING submenu* enabled with:**
External CB Fail	***CB FLT Ext.Sign.***		***CB FLT Monitor.? 1:Yes***
External starting commands	**AUX1** (Note: ***AUX1*** timer should be set to ***Trip***)	***Close Shot ? 4321*** ***TAUX 1111*** (‘1’ – means enabled)	
External starting commands	**AUX2** (Note: ***AUX2*** timer should be set to ***Trip***)	***Close Shot ? 4321*** ***tAUX2 1111*** (‘1’ – means enabled)	
External blocking command	***Block [79]***		***Block.via Input? 1: Yes***

1.11.2.1 External CB faulty signal

Most circuit breakers provide one trip-close-trip cycle. A time-delay is necessary for the CB to return to its nominal state (for example, the spring that allows the circuit breaker to close should be fully charged). The state of the CB can be checked using an input assigned to the ***CB FLT Ext.Sign.*** function. If the ***CB FLT Ext.Sign.*** signal is detected during Closing time, the Auto-reclose Close Command is interrupted and blocked and the CB remains open. In this case the Autorecloser will be Lockout by not successful close command monitored by ***Auto-reclose CB Supervision*** logic (it’s separate function to ***CB Supervision*** in ***GLOBAL SETTINGS/CIRCUIT BREAKER*** column). If, on completion of the ***tCB FLT ext*** time (***GLOBAL SETTINGS/CIRCUIT BREAKER*** submenu), the **CB FLT ext** (Alarm) indicates a failed state of the CB, a lockout occurs and the CB remains open.

1.11.2.2 External Starting Commands

Two independent and programmable inputs (AUX1 and AUX2) can be used to initiate the auto-reclose function from an external device (such as an existing overcurrent relay). These logic inputs may be used both independently and in parallel with the overcurrent elements.

Note:

1. The input must be assigned to an AUXx function (***SETTING GROUPx/INPUT CONFIGURATION Gx***),
2. AUXx must be set to ***Trip*** (***SETTING GROUP x/PROTECTION Gx/AUX TIMERS Gx/AUXx?***) and time-delay tAUXx must be configured (instantaneous: ***tAUXx*** set to 0 s),
3. The ***tAUXx Close Shot*** cell must be set for every cycle (Close shot).

1.11.2.3 Internal and External Blocking Commands

The auto-recloser can be blocked by an internal or an external control. It can be used when protection is needed without requiring the use of the auto-reclose function.

The external block is executed by the ***Block [79]*** input, Blocking via RS485, [79] default cell in CTRL line, or temporary blocked after a close command made by an operator until ***Time Inhibit tI on Close*** set in ***GLOBAL SETTINGS/ [79] ADVANCED SETTINGS*** column.

The internal block can be executed by a final trip, a number of valid A/R rolling demands or an A/R conflict.

A typical example is on a transformer feeder, where the auto-recloser may be initiated from the feeder protection device but needs to be blocked on the transformer protection side.

1.11.3 Auto-reclose Output Information

The following output signals can be mapped to an LED (see ***SETTING GROUP x /LEDS CONFIGURATION Gx*** menu) or to output relays (see ***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx*** menu) in order to provide information about the status of the auto-reclose cycle:

- Auto-reclose cycle in progress
- Final Trip
- Internal block
- External block
- Auto-reclose successful

The following table gives the ***SETTING GROUP x /LEDS CONFIGURATION Gx*** and the ***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx*** menus used to assign the auto-reclose output signal.

	LEDs menu	Output relays menu
Auto-reclose in progress	***[79] in Progress***	***[79] in Progress***
Final Trip	***[79] Trip Final***	***[79] F.Trip Final***
Internal block	***[79] Lockout***	***[79] Lockout***
External block	***[79] Blocked***	***[79] Blocked***
Auto-reclose successful	***[79] Success.***	***[79] Success.***

1.11.3.1 Auto-reclose in Progress

The “Auto-reclose in progress” signal is present during the complete reclosing cycles from protection initiation to the end of the reclaim time or lockout.

1.11.3.2 Final Trip

The "Final trip" signal indicates that a complete auto-reclose cycle has been performed and that the fault has not been cleared.

The "Final trip" signal can be reset after a manual closing of the CB after the settable ***Inhibit Time tI on Close*** (***GLOBAL SETTINGS/ [79] ADVANCED SETTING***) time-delay or reset via a Reset Command (assigned Binary Input, RS485 Reset Latched Signaling command , C clear key).

1.11.4 Auto-reclose Logic Description

The auto-reclose function makes it possible to automatically control the the CB's reclosing cycles (two, three or four shot cycle, settable using the ***Close Shot ?*** parameter – separate for each protection element (***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE G1(2)*** menu).

Dead times for all the shots (reclose attempts) can be independently adjusted.

The number of shots is directly related to the types of fault likely to occur on the system and the voltage level of the system (for instance medium voltage networks).

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The Dead Time (tD1, tD2, tD3 and tD4) and the minimum drop-off time start when the CB has tripped (when the 52a input has dropped off – ***Start Dead t on 1: CB trips*** or the protection element has reset - ***Start Dead t on 0: Protect.Reset*** configuration option). The Dead Time is set to initiate the auto-recloser when the circuit breaker is opened.

At the end of the relevant dead time the close command (***Close CB Order***) is executed and the CB supervision timer is started. The length of this timer is equal to: ***tClose Pulse*** (***GLOBAL SETTINGS/CIRCUIT BREAKER***) + 150 ms (***Auto-reclose CB Supervision*** logic). If the CB is not closed after this time-delay, the auto-recloser is locked out (***[79] Lockout***) and the Alarm is issued (***Alarm CB Time Monitor***).

The reclaim time (***Reclaim Time tR***) starts when the CB has closed. If the circuit breaker does not trip again, the auto-reclose function resets at the end of the reclaim time.

If a protection element operates during the reclaim time, the relay either advances to the next shot programmed in the auto-reclose cycle, or it locks out (see ***Inhib.Trip*** function description).

The total number of reclosures is displayed in the ***RECORDS /COUNTERS/ AUTORECLOSE COUNTER*** menu cell.

1.11.5 Auto-reclose Inhibit Trip

Freely settable the inhibit of the trip after closing command issued via the [79], set separately for each protection element:

tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3, tAUX1, tAUX2

The trip inhibit is used for following cases:

- e/f protection in neutral-insulated or compensated systems. The [79] can clear a non-permanent fault in the first cycles. If it will be permanent fault, there will be no the final trip up to reset of the protection trip.
  For 4-cycle [79]: ***Inhibit Trip 1000*** setting. In the first three cycles (***000***) the trip is executed to allow fault clearance, but the last one (1) is with inhibition, so no trip is executed in case of permanent fault).
- application where for example the setting for the I> stage covers more than the protected zone, so that the [79] can clear faults downstream too, but the final trip will be executed by the downstream relay or a fuse, therefore in the upstream relay, tI> should be inhibited – waiting for tI>> trip of the downstream relay).
  Note: for this case ***Fast Trip O/C*** function can be used too (see below).

Inhibit Trip setting:

- ***0***: means that after close via the [79], the protection element trip will be not inhibited (function is disabled).
- ***1***: means that after close via the [79], the protection element trip will be inhibited.

It is recommended to set another protection stage with setting for Alarm only, to inform that this fault was not cleared by autorecloser so it's still present (tripping from this protection element is inhibited). For above case when the auto-reclose is successful, the reset of inhibition is applied after reset of protection stage (current below the stage value). For another case when during inhibition of protection element, another protection element (set to run [79]) makes a trip after going to the next cycle (the next [79] close command is executed) the inhibition is reset and the further action depends on the configuration:

if in the next cycle this protection element is still set with inhibition, the protection element is still inhibited

if in the next cycle this protection element is not set with inhibition, but the fault is still not cleared, this protection element will trip CB (If another protection element moves auto-reclose to the next cycle, the inhibition is removed automatically and [79] logic checks configuration for the next [79] shot).

1.11.6 Auto-reclose Fast Trip

On circuits using time-graded protection, the auto-recloser allows the use of instantaneous (fast) protection (***Fast O/C Trip*** function in ***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE Gx*** menu) to issue a high speed first trip. With fast tripping, the duration of the power arc resulting from an overhead line fault is reduced to a minimum, thus lessening the chance of damage and of the transient fault developing into a permanent fault. To avoid maloperation because of transients, it is possible to assign a short time-delay to the fast trip: ***Fast O/C Trip Delay*** setting (***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE Gx*** menu column) above the typical transient time value. The fast trip can be associated with phase-to-phase faults (***Fast O/C Trip***) and/or earth faults (***Fast E/Gnd Trip***), separately for every shot in the auto-reclose sequence. If in ***Fast O/C Trip*** configuration the setting for chosen trip shot is ' ***0*** ', the trip is executed after the time-delay of the protection element. If it is set to ' ***1*** ', the time-delay set in the ***Fast O/C Trip Delay*** menu cell is applied. In some regions the typical setting of the fast trip for a 2-shot AR is set:

- ***Fast O/C Trip*** (trip shots): ***00011*** (The first and second trips with ***Fast O/C Trip Delay*** to reduce to minimum the resulting power arc; The third – final – trip after the time-delay of the protection element to ensure the grading in the power system – trip selectivity)
- ***Fast E/GND Trip*** (trip shots): 00000 (alls trips re executed after the time-delays of the protection elements).

Fast O/C Trip – refers to all O/C stages in the PHASE O/C menu column: I>, I>>, I>>>.

Fast E/GND Trip – refers to all E/GND stages in the ***PHASE E/GND*** menu column: ***IN_1***, ***IN_2***, ***IN_3***.

Fast O/C (E/GND) Trip Delay is associated with a DMT characteristic even if the protection element is set to an IDMT characteristic. For the fast trip the reset time-delay of the protection element is not applied.

1.11.7 Auto-reclose Inhibit after Manual Closing

The ***Inhibit Time tI on Close*** timer (***GLOBAL SETTINGS/ [79] ADVANCED SETTING)*** can be used to block the auto-reclose cycle being initiated after the CB has been manually closed onto a fault. The auto-recloser is blocked for the duration of ***Inhibit Time tI on Close*** after a manual CB Closure.

1.11.8 Recloser Lockout

If a protection element operates during the reclaim time, following the final reclose attempt, the relay will lockout and the auto-reclose function will be disabled until the lockout condition is reset.

The lockout condition is reset by a manual closing after the ***Inhibit Time tI on Close*** timer elapses.

Additionally the lockout condition is reset by a reset signalling command (via Inputs, HMI 0 key, Remote Reset command),

The auto-recloser can also be locked out using a ***CB FLT Ext.Sign.*** input. This information can be issued from the "not charged" or "Low gas pressure" indications of CB springs.

Note that the auto-recloser can also be locked out by:

- The fact that the CB does not open after the tBF delay (CB Fail) elapses,
- An operating time longer than the set thresholds,
- Local or remote manual Close or Open command when the auto-reclose is in progress,
- The Rolling Demand function detects too many auto-reclose shots.
- CB monitoring logic detects abnormal CB position (opened and closed, or not opened and not closed) for longer than set: ***Max CB Close*** or ***Max CB Open*** time.

In the lockout condition the ALARM with the cause: ***ALARM [79] Lockout*** is displayed up to reset of the lockout condition.

1.11.9 Setting Group Change when the auto-reclose is in progress

During the auto-reclose cycle, if the relay receives a command to switch setting groups, it is executed after the end of auto-reclose action (if auto-reclose is not in progress).

1.11.10 Rolling Demand

This specific counter avoids frequent operations of a CB in case of intermittent faults. The numbers of shots can be set from 2 to 100 in the cell ***Max cycles No. Rol.Demand***, settable over a time period (***GLOBAL SETTINGS/ [79] ADVANCED SETTING /Time period Rol.Demand***) from 1 min to 24 hours.

The rolling demand is used when a defined number of successful recloses are performed over a defined time. If it is happened auto-reclose function is Lockout and he ALARM with the cause: ***ALARM [79] Roll.Demand*** is displayed up to reset the lockout condition.

If after ***Alarm [79] Rolling Demand*** signaling, the lockout condition reset is applied, the recorded number of rolling demand shots are cleared.

1.11.11 Signalling Reset after Close via 79

In the ***GLOBAL SETTINGS/ [79] ADVANCED SETTING*** menu it is possible to set the signalling reset after a close command executed by the auto-recloser. If ***Signalling Reset*** is set to **1: Close via 79**, after the auto-recloser's close shot (confirmed by the 52a CB status), signalling (LEDs, display) of the last trip before the close shot is reset:

- Latched LEDs
- Trip information on the V11F's front panel
- Electromagnetic Flag Indicators on the Front Panel
- Latched outputs

This function signals the final trip only and clears signalling if the CB remains closed (Auto-reclose is successful). This function is recommended if the V11F is integrated into a SCADA system or if the substation is rarely supervised by maintenance personnel. In this case it is not necessary to clear signalling if the fault has disappeared and the line is healthy.

Note: Reset of signalling and of latched outputs can be done using the General resetting function.

This configuration can be set in the ***GLOBAL SETTINGS/LOC*** submenu:

- LEDs Reset:
  - ***0: Manual only*** (via Inputs, HMI 0 key, Remote Reset command)
  - ***1: Start protect.*** (Start of the protection element set to Trip)
- Ltchd Outp. Reset:
  - ***0: Manual only*** (via Inputs, HMI 0 key, Remote Reset command)
  - ***1: Start protect.*** (Start of the protection element set to Trip)

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The ***Manual only*** option prevents a close command from being issued without readout of the cause of trip by maintenance personnel. It reduces the risk to switch on to fault.

The ***Start protect*** option allows signalling of the latest trip only.

1.12 External Trip via a Binary Input (Model A, B and E)

For some applications it is necessary to issue a CB trip via a binary input. Any input assigned to AUXn (n = 1-4) can be used to that effect. The **AUX** function must be set to ***Trip***.

Tripping is executed after a set time-delay: tAUXn (n = 1-4).

Auxiliary voltage connected to such a configured Input energizes output relays assigned to ***Protect.Trip***, ***Prot.Trip pulse*** or ***tAUX*** AUXn (n = 1-4).

The Low Energy Trip Coil output and/or Flag Indicator output are activated if they are assigned to ***Protect.Trip*** or ***tAUX*** AUXn (n = 1-4) (refer to **Figure 9 - AUX timers logic)**

1.13 Blocking Logic Function and Blocked Overcurrent Scheme Logic (Model ABE)

Each stage of the phase protection element can be blocked via an appropriately configured binary input. Binary inputs can be assigned to the following functions (***SETTING GROUPx/INPUT CONFIGURATION Gx***):

- Block.tI> (**ABE**)
- Block.tI>> (**ABE**)
- Block.tI>>> (**ABE**)
- Block.tSOTF (**ABE**)
- Block.tIN_1 (**ABE**)
- Block.tIN_2 (**ABE**)
- Block.tIN_3 (**E**)
- Block.tI2> (**E**)
- Block.tBrkn Cond (**E**)
- Block.Itherm (**ABE**)
- Block.AUX1 (**ABE**)
- Block.AUX2 (**ABE**)
- Block.AUX3 (**ABE**)
- Block.tCB Fail (**ABE**)
- Block. [79] (**E**)

Such a configured input can be used by the blocking logic function or by a protection element disabling function (Auto-reclose (**E**), CB Fail or AUX (**ABE**)).

The blocking logic function can be applied to radial feeder circuits where there is little or no back feed. For parallel feeders, ring circuits or where there can be a back feed from generators, directional relays should be considered.

The blocking logic function allows the upstream IDMT relay to be blocked by the start output of a downstream relay that has detected the presence of a fault current above its threshold. Thus both upstream and downstream relays can have the same current and time settings, and the blocking feature will automatically provide grading.

If in ***SETTING GROUPS x/PROTECTION Gx/[[50BF] CB Fail*** the function: ***Block I> (IN>)?*** (**E**) is set to ***0: Yes*** and the Circuit Breaker Fail protection is enabled, the blocking command on the upstream relay will be removed if the downstream circuit breaker fails to trip.

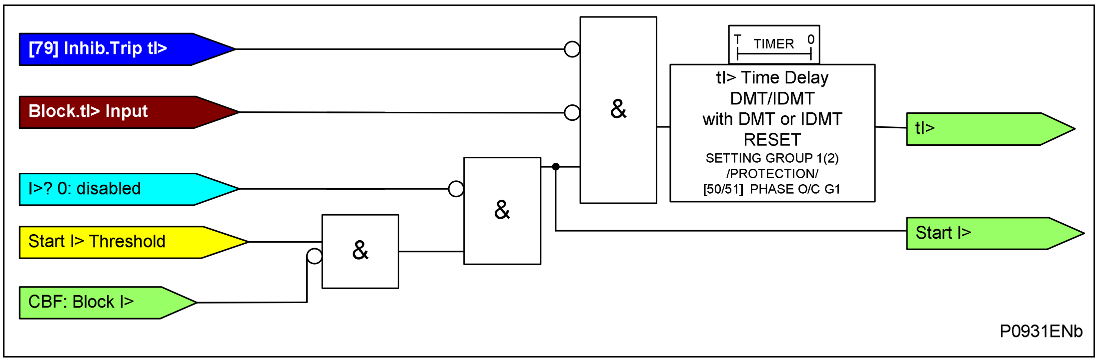

Figure 11: Blocking logic function diagram for the I> protection element

1.14 Inrush Blocking (Model A and E)

The Inrush Blocking function measures the ratio of second to fundamental harmonic currents. It can be used as a “blocking logic” of I>, I>>, I>>>, IN_1, IN_2, IN_3 (**E**), I2 > (**E**), SOTF, Broken Cond (**E**), CB Fail, and AUXn in cases where the 2nd harmonic ratio is higher than the settable threshold. Indeed, inrush blocking functions will reset the selected protection function starts.

Blocked by the second harmonic ratio of a protection element is set in the main setting cell for that element (for example***: I>? 3: Trip-Inrush Bl***). Each protection element set to ***3: Trip-Inrush Bl*** will be blocked by the Inrush current function.

The minimum duration of an overcurrent threshold inhibition (tReset) can be also set. This value depends on the transformer power transient inrush duration: between 0.1 second (for a 100 kVA transformer) to 1.0 second (for a large unit). It is used to avoid any maloperation during a fixed time period in case of too sensitive a setting.

1.14.1 Operation

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For each of the three phases currents (IA, IB, IC), the harmonic restraint function compares the ratio of 2nd harmonic to the fundamental with the set ratio (Harmonic 2 / Fundamental settable from 10 % up to 50 % in steps of 1%).

The minimum fundamental current value required for operation of the Inrush Blocking function is 0.2 In, and there is no upper limit to disable this feature. However, in transformer protection, the high set overcurrent stage shall not be controlled by this Inrush Blocking feature; this enables detection of all high current faults without inrush blocking.

It is possible to set two options for Inrush Current logic in the ***GLOBAL SETTINGS/INRUSH BLOCKING/Inrush Blocking?*** menu:

- ***1: Yes*** – monitoring is permanent. The Inrush Blocking function will block the selected protection stages every time inrush conditions are present on the line (Ratio of 2nd Harmonics measured greater than Inrush H2 set ratio), and will be active at least for the duration of ***Inrush Reset Time***. This timer defines the minimum duration of overcurrent threshold inhibition (0-200 s, settable). This timer starts as soon as operating inrush current threshold picks up:
    - If the inrush condition lasts less than the set value for ***Inrush Reset Time***, the selected overcurrent function will be inhibited for the duration of ***Inrush Reset Time***.
    - If the inrush condition lasts longer than the set value for ***Inrush Reset Time***, the selected overcurrent function will remain inhibited as long as the inrush condition is present.
- ***2: Closing*** – monitoring is based on the ***Close CB order*** output. The Inrush Blocking function will block the selected protection stages every time a close command is executed and the Ratio of measured 2nd Harmonics is greater than the set Inrush h2 ratio, and will be active at least for the duration of ***Unblock Inrush Time***.

Note: Inrush Blocking in V11F relays is not phase-selective. If an inrush condition occurs on any phase, the selected protection stages will be blocked in all 3 phases.

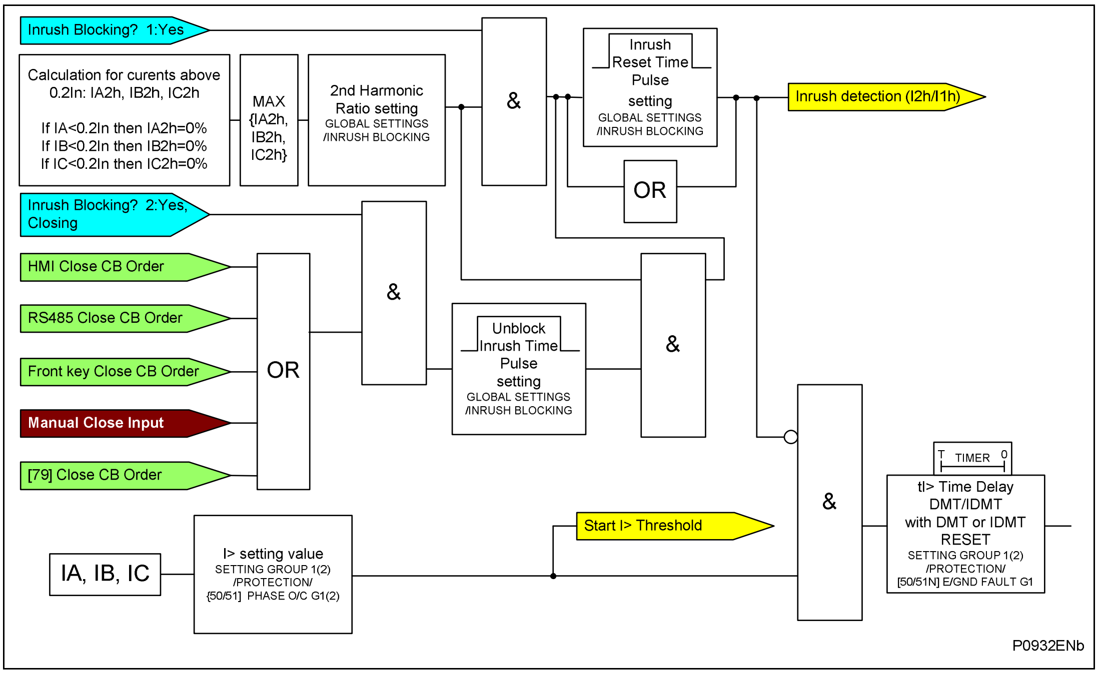


Figure 12: Second harmonic blocking diagram for the I> protection element

2. OPERATION OF NON PROTECTION FUNCTIONS

2.1 Circuit Breaker State Monitoring (Model A and E)

An operator at a remote location requires a reliable indication of the state of the switchgear. Without an indication that each circuit breaker is either open or closed, the operator has insufficient information to decide on switching operations. The VAMP 11F relays incorporate circuit breaker state monitoring, giving an indication of the position of the circuit breaker.

This indication is available either on the relay front panel or via the communication network.

The CB positions can be selected at ***SETTING GROUPx/INPUT CONFIGURATION Gx***):

- CB status 52A
- CB status 52B

If two inputs are assigned to both the above inputs, CB status is based on both indications.

If only one function is used, CB status is based on a single-bit information only (the second is derived from the first one).

If CB Supervision function is activated (***GLOBAL SETTINGS/CIRCUIT BREAKER/CB Supervision?: 1:Yes***), CB monitoring logic detects abnormal CB's position (opened and closed, or not opened and not closed) in the monitoring window: the max value from settings: ***Max CB Close Time*** or ***Max CB Open Time*** (***GLOBAL SETTINGS/CIRCUIT BREAKER*** column). CB monitoring logic checks CB position permanently, if an abnormal CB status is detected by the time longer than the monitoring window, the Alarm is issued (***Alarm State of CB***).

The CB's status can be displayed on the V11F front panel using programmable LEDs. To assign an input to the CB status, an AUX function must be used.

For example:

L1 is assigned to CB status 52a and AUX5

L2 is assigned to CB status 52a and AUX6

LED 7 is assigned to AUX5

LED 8 is assigned to AUX6

In the above configuration LED7 indicates the CB closed position and LED8 indicates the CB open position.

If the Control menu cell is selected as the default display, the CB status is indicated on the LCD display:

CB status: Opened CTRL: no operat.

2.2 Circuit Breaker Condition Monitoring (Model A and E)

Periodic maintenance of circuit breakers is generally based on a fixed time interval, or a fixed number of fault current interruptions.

The relays record the following controls and statistics related to each circuit breaker trip or close operation:

- monitoring time for CB opening (triggered by the ***Trip CB order*** and ***Protect.Trip*** outputs). Operations based on the setting:
  - time-delay setting for tripping (***GLOBAL SETTINGS/CIRCUIT BREAKER/Max CB Open Time***)

  If CB opening time is longer than ***Max CB Open Time*** the Alarm is issued (***Alarm CB Time Monit.***). This function can be activated in the menu: ***GLOBAL SETTINGS/CIRCUIT BREAKER/ CB Supervision? 1: Yes***,
- monitoring time for CB closing (triggered by the ***Close CB order*** output). Operations based on the setting:
  - time-delay setting for closing (***GLOBAL SETTINGS/CIRCUIT BREAKER/Max CB Close Time***)

  If CB closing time is longer than ***Max CB Close Time*** the Alarm is issued (***Alarm CB Time Monit.***). This function can be activated in the menu: ***GLOBAL SETTINGS/CIRCUIT BREAKER/ CB Supervision: 1: Yes***,
- CB open operations counter (triggered by ***Trip CB order:*** HMI, Manual Trip Logic Input, HMI '***Trip***' key, rear communication trip command, USB port (NABE) trip command)
  - Number of open operations (***RECORDS/COUNTERS/CONTROLCOUNTER/Open No.***)
- CB close operations counter (triggered by ***Close CB order***: HMI, Manual Close Logic Input, HMI 'Close' key, rear communication close command, USB port (NABE) close command)
  - Number of close operations (***RECORDS/COUNTERS/CONTROL COUNTER/Close No.***)
- protection CB open operations counter (triggered by ***Protect.Trip*** output)
  - Number of CB open operations (***RECORDS/COUNTERS/FAULT COUNTER/Fault Trips No.***)
- CB open operations counter monitoring (triggered by the ***Trip CB order*** and ***Protect.Trip*** output function)
  - setting threshold (***GLOBAL SETTINGS/CIRCUIT BREAKER/MAX CB Open No.***)
  - current value (***RECORDS/COUNTERS/CB MONITORING COUNTER/ CB Open Mon.No.***). This value is editable, so it is possible to change this value or set the value when the relay was replaced by another one,

  This function can be activated in menu: ***GLOBAL SETTINGS/CIRCUIT BREAKER/ CB Diagnostic? 1: Yes***,
- summation of the current interrupted by the CB (triggered by the ***Protect.Trip*** output function):
  - setting threshold (***GLOBAL SETTINGS/CIRCUIT BREAKER/MAX SUM AMPS^n)***
  - current value (***RECORDS/COUNTERS/CB monitoring/CB AMPS Value***). This value is editable, so it is possible to change this value or set the value when the relay was replaced by another one,

OP

- exponent for the summation (***GLOBAL SETTINGS/CIRCUIT BREAKER/AMPS's n=***),

This function can be activated in menu: ***GLOBAL SETTINGS/CIRCUIT BREAKER/ CB Diagnostic: 1: Yes***.

Note: summation of the current interrupted by CB is phase selective, but the max value from three phases is displayed in menu only. If the new value is entered, it is applied for all phases.

CB Alarm output function and ***CB Alarm*** LEDs function signal is generated if ***CB Supervision*** or ***CB Diagnostic*** function detects any problem.

Additionally ***CB Diagnostic*** function triggers TCS 52 Fail output function.

Cause of Alarm	Alarm function	Key setting	Alarm Label	Output	LED
The monitoring time for CB opening	***CB Supervision***	***Max CB Open Time***	***CB Time Monit.***	***CB Alarm***	***CB Alarm***
The monitoring time for CB closing	***CB Supervision***	***Max CB Close Time***	***CB Time Monit.***	***CB Alarm***	***CB Alarm***
The abnormal CB's position for two bits CB's connection (00 or 11)	***CB Supervision***	***Max value:*** ***Max CB Close Time*** ***or*** ***Max CB Open Time***	***State of CB***	***CB Alarm***	***CB Alarm***
CB open operations counter monitoring	***CB Diagnostic***	***MAX CB Open No.***	***CB Nb Diagn.***	***CB Alarm***, ***TCS 52 Fail***	***CB Alarm***
Summation of the current interrupted by the CB	***CB Diagnostic***	***Max Sum AMPS^n***	***CB Curr, Diagn.***	***CB Alarm***, ***TCS 52 Fail***	***CB Alarm***

For the proper collaboration with CB coils, in menu it is possible to set:

- trip pulse time (***GLOBAL SETTINGS/CIRCUIT BREAKER/tOpen pulse***)
- close pulse time (***GLOBAL SETTINGS/CIRCUIT BREAKER/tClose pulse***)

The trip pulse time is used by: ***Protect.Trip pulse*** and ***Trip CB Order*** output functions.

The close pulse time is used by: ***Close CB Order*** output functions.

In cases where the breaker is tripped by an external protection device it is also possible to update the CB condition monitoring. This is achieved by setting one of the ***AUX*** protection element (***Protect.Trip)*** or ***Manual Trip*** logic inputs or via the communications to accept a trigger from an external device.

OP

2.3 Local / Remote Mode (Model A and E)

The goal of this feature is to make it possible to block commands sent remotely through communication networks (such as setting parameters, control commands, etc.), so as to prevent any accidents or maloperations during maintenance work performed on site.

Local Mode can be achieved by:

- Control Mode default cell in the menu (**E**):

LR Status:L+R
CRL: no operat.

- A digital input labelled: ***Local CTRL Mode***

When the ***Local CTRL Mode*** input is energized, all remote commands are blocked. When the ***Local CTRL Mode*** input is de-energized, remote control commands can be issued. In Local mode, only the synchronizing time signal is allowed.

The Remote mode is set at ***GLOBAL SETTINGS/CIRCUIT BREAKER/Remote CTRL Mode:***

OP

- ***0: Remote only*** – Only Remote control is permitted. All manual controls (HMI, Close/Trip function keys, Binary Inputs assigned to Manual Close or Trip) are blocked.
- ***1: Remote + LOC -*** Remote and Local controls are permitted.

Control Mode default cell (**E**):

The first line of CTRL Mode cell allows monitoring of the Local/Remote Mode status:

- ***Status: Local*** - Local mode
- ***Stat:Remote*** – Remote Mode. ***GLOBAL SETTINGS/CIRCUIT BREAKER/Remote CTRL Mode*** is set to ***0: Remote only***.
- ***Status: L+R*** – Remote Mode. ***GLOBAL SETTINGS/CIRCUIT BREAKER/Remote CTRL Mode*** is set to ***1: Remote + Loc***.

The second line is used to change Local/Remote Mode in the menu:

- ***CTRL: no operat***. – No operation
- ***CTRL: Local*** – Local Mode command
- ***CTRL: Remote*** – Remote Mode command

To change from ***Remote*** to ***Local*** mode it is necessary to press the OK key, enter Control Password (if it is set), press the OK key twice (confirm password and select changing). Press down or up key to choose ***Local*** confirm by Enter. LR Status indicates: LR Status: Local.

To change from ***Local*** to ***Remote*** mode it is necessary to press the OK key, enter Control Password (if it is set), press the OK key twice (confirm the password and select the change). Press the 2 or 8 key to select ***Remote*** then confirm by pressing the OK key. LR Status indicates: ***LR Status L+R*** (option ***Remote CTRL Mode 1: Remote + Local***) or ***LR Status Remote*** (option ***Remote CTRL Mode 0: Remote***) .

Note: if the Control Password is set to zero: no asking about password will appear – the Control Password is disabled.

It is possible to map the Local Mode state to a LED by assigning the LED to the ***Local CTRL Mode*** function (***SETTING GROUP x/LEDs CONFIGURATION Gx***).

2.4 Setting Group Selection

VAMP 11F relays have two protection setting groups called ***PROTECTION G1*** and ***PROTECTION G2***. Only one group is active at any time.

If a group is used in an application it is possible to remove the other group from the menu in order to simplify the setting procedure. If one group only is chosen the relay uses Group 1 even if the other parameters are set to Group 2 (Inputs(**ABE**), Menu, Remote Group Setting).

The selection of the number of groups is done at ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Number of Groups: 1: One Group*** or ***2: Two Groups.***

If ***1: One Group*** is selected, the ***SETTING GROUP 2*** column and the setting group cell are hidden in the menu.

Switching between groups can be done via:

- a selected binary input (**ABE**) assigned to the **Setting Group 2** logic input (***SETTING GROUP x/INPUTS CONFIGURATION Gx*** submenu),
- the relay front panel interface (***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group: 1: Group1*** or ***2: Group2***),
- through the communications port (refer to the Mapping Database for detailed information).

OP

Switching between setting groups can be done even while a protection function is active, but it resets all timers, LEDs or flag's on V11F front panel).

The user can check which one of the setting groups is active in the ***OP PARAMETERS*** menu: ***Active Set Group*** cell.

The user can also assign the active group (***Setting Group x*** function) to an output relay (***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx***) or to an LED (***SETTING GROUP x/LEDs CONFIGURATION G1***).

Setting group change via a digital input

It is possible to change the setting group by energizing a digital input (**ABE**) (operates on level: logic input is low – setting group 1, logic input is high – setting group 2).

If the setting group switchover is done via a binary input (**ABE**), the change from Group 1 to Group 2 is executed after the set time-delay: ***t Change Setting G1->G2*** (***GLOBAL SETTINGS/SETTING GROUP SELECT***) (**ABE**). The switch from Group 2 back to Group 1 is instantaneous.

Warning: If the digital input that has been assigned to the setting group change operates on level (low or high), it is not possible to change the setting group via remote communications.

Switch between Active Groups via a Binary Input (ABE)

When powering up the relay, the selected group (Group 1 or Group 2) corresponds to the state of the logic input assigned to ***Setting Group 2***. This means:

A – ***Reverse Inp.Logic*** = 0 and ***Setting Group 2*** = 1
(***SETTING GROUP x/INPUTS CONFIGURATION Gx*** submenu),

If the programmed logic input starts being supplied with +V, then after the ***t Change Setting G1->G2*** time-delay the active group will be G2.
If the programmed logic input is not supplied with +V , then the active group will be G1.

B – ***Reverse Inp.Logic*** = 1 and ***Setting Group 2*** = 1
(***SETTING GROUP x/INPUTS CONFIGURATION Gx*** submenu),

If the programmed logic input is supplied with +V, then the active group will be G1.
If the programmed logic input stops being supplied with +V , then after the ***t Change Setting G1->G2*** time-delay the active group will be G2.

Notes:

1. Binary Input configuration is associated with both Setting Groups, so that if in a Setting Group the selected binary input is assigned to ***Setting Group 2***, in the other group it must be set to ***Setting Group 2*** as well, otherwise no switch will occur.

2. If the V11F is powering up (from the currents or the auxiliary voltage) and Group 2 is selected via a binary input, the ***t Change Setting G1->G2*** time-delay is ignored (changing to setting group 2 is instantaneous – without time-delay).

3. The setting group switch is based on the level of the binary input. So as long as Setting Group 2's logic signal is high, the V11F uses Setting Group 2.

Switch between Active Groups via the Menu or a Remote Command (RS485, USB)

By using the relay front panel interface it is possible to change the active setting group: ***1: Group1*** or ***2: Group2*** (menu cell: ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group***).

This menu cell is commonly used for switching groups from the front panel interface and via a remote command (RS485 or USB).

It means that if the ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** menu cell is set to ***1: Group1*** and the remote setting group 2 command is executed, the value of menu cell: ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** will be changed to ***2: Group2*** (Active group: 2).

Setting group 1 will be applied if:

- ***1: Group1*** is set in the ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** menu cell from the relay's front panel interface,

- the remote setting group 1 command is executed. The value of the ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** menu cell will then be changed to ***1: Group1***.

Priority

Warning: If the digital input that has been assigned to the setting group change operates on level (low or high), it is not possible to change the setting group via neither remote communications nor the front panel.

The detailed logic table for setting group selection is shown below:

Binary Input Setting Group 2 (ABE)	Front Panel and Remote Setting	Active Group
Not configured	G1	G1
Not configured	G2	G2
G1	G1	G1
G1	G2	G1
G2	G1	G2
G2	G2	G2

Note: If a setting group change initiated by a remote command has not been effected due to priority settings, that command is ignored (not recorded in the V11F's logic for the future, when priority settings allow changing).

It is possible to assign an Active Group state to an output contact by setting the output contact to the ***Setting Group x*** output (***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx***.

If Active Group signaling is required, some LEDs should be assigned to the ***Setting Group x*** function (***SETTING GROUP x/LEDs CONFIGURATION Gx***).

2.5 Trip Circuit Supervision (Model A and E)

The trip circuit extends beyond the relay's enclosure and passes through more components, such as fuses, wires, relay contacts, auxiliary switch contacts and so on.

These complications, coupled with the importance of the circuit, have directed attention to its supervision.

The simplest arrangement for trip circuit supervision contains a healthy trip lamp in series with a resistance placed in parallel with the trip output relay contacts of the protection device.

2.5.1 Trip Circuit Supervision Mechanism

The Trip Circuit Supervision function included in the **VAMP 11F** relays is described below:

OP

A logic input is programmed to the ***GLOBAL CONFIGURATION/CIRCUIT BREAKER/TC Supervision*** function. The logic input is associated to the label ***Trip Circ Supervis..*** within the ***SETTING GROUPx/INPUT CONFIGURATION Gx*** menu. Then, this logic input is wired in the trip circuit according to one of the typical application diagrams shown in the following example.

When the ***TC Supervision*** function is set to ***Yes*** under the ***CIRCUIT BREAKER*** sub-menu, the relay checks continuously on trip circuit continuity whether the CB's status is open or closed.

When the ***TC Supervision*** function is set to ***Yes-52A*** under the ***CIRCUIT BREAKER*** sub-menu, the relay checks continuously on trip circuit continuity in case when the CB's status is closed only.

The ***TC Supervision*** function is enabled when the ***Protect.trip*** or ***Trip CB order*** output is not energized. The ***TC Supervision*** function is not enabled when the ***Protect.trip*** or ***Trip CB*** is energized.

A ***TCS 52 Fail*** and ***CB Alarm*** output function, ***TCS Supervision Alarm*** and ***CB Alarm*** LEDs function signal is generated if the logic input detects no voltage signal during a time longer than the settable timer ***tSUP*** (in ***GLOBAL CONFIGURATION/CIRCUIT BREAKER*** menu). See Chapter V11F/EN TD (Technical Data) for the settings.

As this function is disabled when the ***Protect.trip*** or ***Trip CB order*** output is energized, this function is suitable for use with the enabled relay latching logic.

The ***tSUP*** timer can be set according to the following table:

MENU TEXT	SETTING RANGE		STEP SIZE
	MIN	MAX	
TC Supervision ?	Yes	No	
tSUP	100ms	10s	10ms

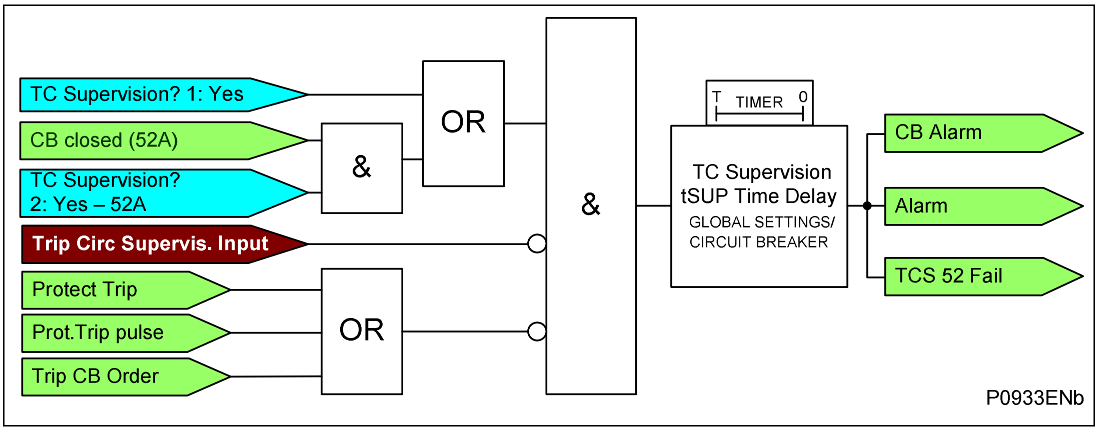


Figure 13: Trip Circuit Supervision Principle

For more details refer to the Application Chapter (V11F/EN AP)

2.6 Commissioning

2.6.1 Maintenance Mode (Model A and E)

This menu allows the user to check the operation of the protection functions.

It is possible to set following ***Maintenance mode*** options (settings):

- "***No***" - ***Maintenance mode*** is disabled. All window cells below are hidden (***Maintenance mode*** is the latest cell in ***COMMISIONING*** column)
- "***Yes,outp.trips***" - ***Maintenance mode*** is enabled. In this mode all test cells in ***COMMISIONING*** column are shown. During tests outputs are energized.
- "Yes,outp.block" - ***Maintenance mode*** is enabled and all test cells in ***COMMISIONING*** column are shown. In this mode, the high state of output functions are ignored (control of outputs are blocked).

  This option allows the user to check the operation of the protection functions without actually sending any external command (Tripping or signalling).

Depends on the rear protocol selected in menu, transmission of information to SCADA is blocked (Modbus RTU) or sent (IEC 103) with additional information to know that V11F is in Maintenance mode (refer to Communication chapter and EN 60870-5-103 standard).

Changing of setting from "***No***" to "***Yes,….***" from the front panel activate this mode for **10 minutes only**. After this time the option is automatically switched to "***No***".

The selection of the maintenance mode is possible by logic input (the level), control command (rear or front port), or by front panel interface. The maintenance mode is terminated by:

- Low state of logic input assigned to ***Maintenance mode*** function,
- Control command which activate this mode (rear command or setting: "***Yes,….***") and by turning off the power supply.

Note: Maintenance rear command is available in Modbus protocol only

Maintenance Mode
1: Yes,outp.trips

It is possible to assign the state of ***Maintenance Mode*** to programmable LEDs.

In "***Yes,outp.block***" case, all the output contacts are blocked, and no command can be issued to these contacts, even if a protection threshold associated with one of these output contacts has been crossed. (If a protection threshold is crossed, all associated LEDs will be ON, even the TRIP LED, if protection element is set to ***Trip***).

If the Maintenance Mode is set in menu ("***Yes,outp.trips***" or "***Yes,outp.block***") after 10 minutes this function returns automatically to ***Maintenance mode*** "***No***" (function disabled).

If the input assigned ***to Maintenance Mode*** is logical high the Maintenance Mode is active (without any time limitation) up to low state of the logical input.

2.6.2 Outputs test

This function is available after activation of ***Maintenance mode***

The commissioning cells allow the user to check the external wiring to the relay's output contacts. To do this, the user has only to set to 1 the desired output contact's corresponding bit, and this will close the contact and allow the continuity of the wiring to be checked.

Test	7654321
Pattern	0000000

In the cell below, the contact test time can be set:

Contact Test	
Time	1.00s

If the outputs for test are selected and Time for output closing is set, the closing command can be executed in this cell:

Test output
0: no operation

To execute the test, press OK key, press the 2 or 8 key to select ***1: Apply test*** and confirm action by OK. The contact will be closed for the duration of the ***Contact Test Time*** pulse.

2.6.3 Functional test

This function is available after activation of ***Maintenance mode***

The next commissioning cells allow the user to check the functional output configuration of the V11F. To do this, the user has only to select which protection element will be triggered, and this will close the contact assigned to this protection element and allow the continuity of the wiring to be checked. If the protection element is disabled there will be no action.

OP

Functional Test
0: I>

In the cell below the end of the functional test can be configured:

Functional Test
End 0: CB trip

The following options are possible:

- ***0: CB trip*** – after triggering the functional test, the test is interrupted after trip command.
- ***1: Time*** – the protection element will be triggered for the duration of the pulse time.

If the ***1: Time*** option is selected it is necessary to set the pulse length:

Contact Test	
Time	001.00s

The next cell is used for functional test execution:

Functional Test
CTRL: no operation

To execute this test, press the OK key, press the 2 or 8 key to select ***1: Operate*** and confirm action by pressing OK. The contact will be closed for the duration of the ***Contact Test Time*** pulse.

NOTE: In ***Maintenance Mode*** V11F works with full functionality (ready to trip in a fault condition, even during functional test). During functional test of selected stage (for example tI>), V11F measures currents so the rest active stages (for example tI>>, tIN>, etc) work on the measured current from the field. Only the tested stage (for example tI>) sees test current: two times greater than tI> current setting value in all phases. After functional test of Thermal replica, the thermal value is set to 0%. After test, in the fault record all recorded current values are based on the currents measured in the field.

If Functional Test will be applied for protection element which is disabled there will be no any action done.

2.7 Circuit Breaker Control

The relay includes the following options for control of a single circuit breaker:

- Local tripping and closing, via the relay menu or function keys
- Local tripping and closing, via relay binary inputs
- Remote tripping and closing, using the relay communications

If a local/remote external selector switch is to be used, it is recommended that separate relay output contacts are assigned to remote circuit breaker control and protection trip. This enables the control outputs to be selected via a local/remote selector switch as shown in Figure 14.

Where this feature is not required or is connected to a V11F's binary input, the same output contact(s) can be used for both protection (***Protect.Trip*** output) and remote tripping (***Trip CB order*** output).

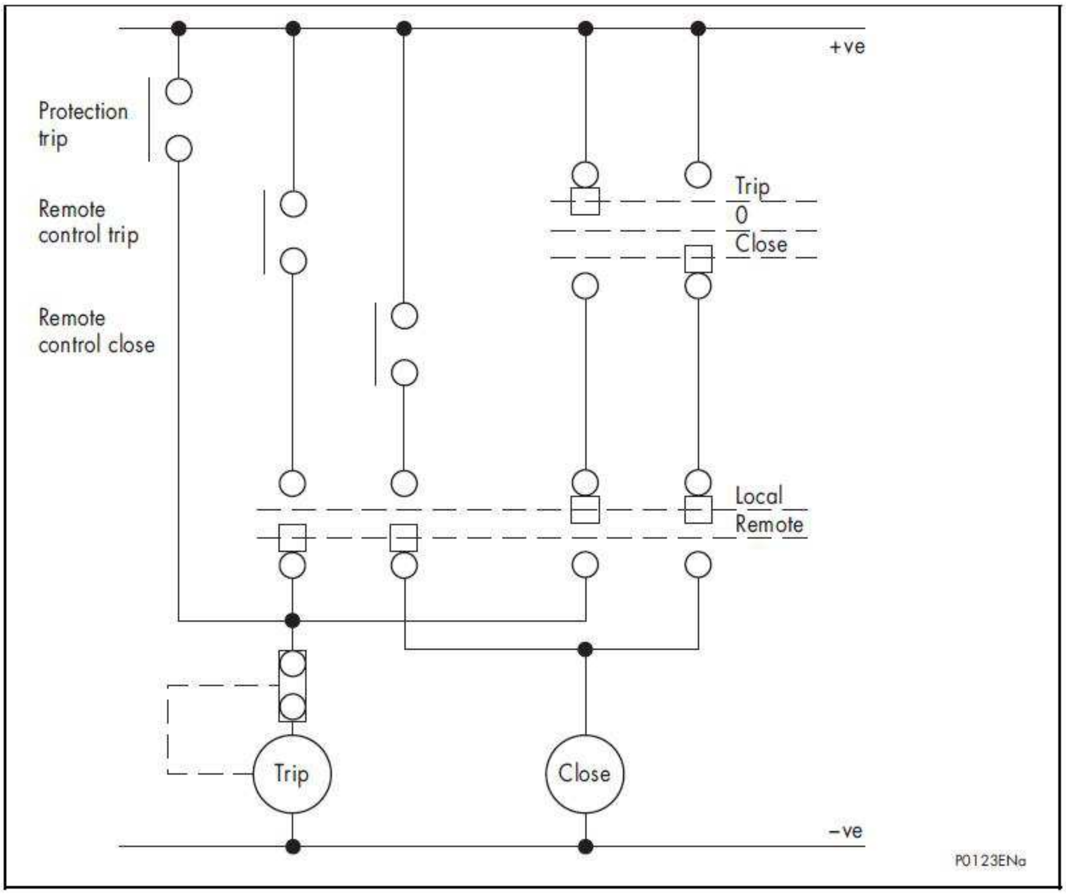


Figure 14: Remote Control of Circuit Breaker

A manual trip will be permitted provided that the circuit breaker is initially closed. Likewise, a close command can only be issued if the CB is initially open. To confirm these states it will be necessary to use the breaker 52A (assigned to ***CB status 52A*** input(**ABE**)) and/or 52B (assigned to ***CB status 52B*** input (**ABE**)) contacts. Under these circumstances manual CB control will be possible, but the Auto-reclose function will not be available. Additionally, it will be not possible to see the CB status in the Control default cell.

Once a CB Close command is initiated the output contact (***Close CB order)*** can be set to operate following a user-defined time-delay (***Time-delay for Close*** setting in ***GLOBAL SETTINGS/CIRCUIT BREAKER*** menu). This would give personnel time to move safely away from the circuit breaker following the close command. This time-delay will apply to all manual CB Close commands.

The length of the trip or close control pulse can be set via the ***tOPen pulse min*** and ***tClose Pulse*** settings respectively (***GLOBAL SETTINGS/CIRCUIT BREAKER*** menu). These should be set long enough to ensure the breaker has completed its open or close cycle before the pulse has elapsed.

Note: The manual trip and close commands are found in the default Control cell and the Close/Trip keys on the front panel.

If an attempt to close the breaker is being made, and a protection trip signal is generated, the protection trip command overrides the close command.

If ***CB FLT Ext.Sign*** (**ABE**) is assigned to a binary input this signal is checked before manual closing of the CB. This function uses the signal received at the relay's binary input to confirm whether the breaker is capable of closing (sufficient circuit breaker energy for example). A user-settable time-delay, ***tCB FLT ext*** (**ABE**), is included for manual closure. If, following a close command, the CB does not signal a healthy condition before that timer elapses, then the relay will lockout and issue an alarm.

2.8 Real Time Clock Synchronization via Opto-Inputs (Model E)

In modern protective schemes it is often desirable to synchronize the relay's real time clock so that events from different relays can be placed in chronological order. This can be done using the communication interface connected to the substation control system or via a binary input. Any of the available binary inputs on the V11F relay can be selected for synchronization. Pulsing this input will result in the real time clock snapping to the nearest minute. The recommended pulse duration is 20 ms to be repeated no more than once per minute. An example of the time synchronization function is shown.

Time of "Sync. Pulse"	Corrected Time
19:47:00.000 to 19:47:29.999	19:47:00.000
19:47:30.000 to 19:47:59.999	19:48:00.000

Note: The above assumes a time format of hh:mm:ss

The input is configured in the ***SETTING GROUPx/INPUT CONFIGURATION Gx*** menu. The input must be assigned to the ***Time Synchr.*** Input (Model A and E).

2.9 Resetting of Latched LEDs and Outputs

How latched LEDs and outputs are reset is determined by the inputs assigned to the resetting of latched LED. Outputs can be reset via external inputs, by pressing the 0 clear key on the V11F's front panel if the LCD shows the default display or via the communication port.

The resetting configuration can be entered in the ***GLOBAL SETTINGS/LOC*** menu:

- LEDs Reset:
    - ***0: Manual only*** (via Inputs, HMI 0 key, Remote Reset command)
    - ***1: Start protect.*** (Start of a protection element set to Trip)
- Ltchd Outp. Reset:
    - ***0: Manual only*** (via Inputs, HMI 0 key, Remote Reset command)
    - ***1: Start protect.*** (Start of a protection element set to Trip)

The ***Manual only*** option prevents a close command from being issued without readout of the cause of trip by maintenance personnel. It reduces the risk to switch on to fault.

The ***Start protect*** option allows to signal the latest trip only: Start of any protection element set to trip the CB, reset all latched LEDs and show the default display.

2.10 Records

2.10.1 Fault Recorder

Each time any of the set thresholds are crossed, an instantaneous record is created and displayed in the ***RECORDS/INSTANTANEOUS RECORD*** menu (**E**). Information on the last five starts is available, with the duration of the signal.

The following information is displayed in the ***RECORDS/INSTANTANEOUS RECORD*** menu (**E**): time, date, origin (crossing of a current threshold or start of a protection element's time-delay), and current values.

Each time any of the set protection elements trips (***Protect.Trip*** output), a fault record is created and stored in memory. The fault record tags up to 20 faults and stores them in a non-volatile (FRAM) memory. This allows the operator to identify and analyze system failures. When the available memory space is exhausted, the new fault automatically overwrites the oldest fault.

The user can view the latest fault record in the ***RECORD/FAULT RECORDS*** menu, where the user can choose to display up to 20 stored records. These records are the fault flags, the fault measurements, etc. Also note that the time stamp displayed in the fault record itself will be more accurate than the corresponding time stamp given in the event record. This is due to the fact that events are logged some time after the actual fault is recorded.

OP

The user can view event records either via the front panel interface, via the USB port (**NABE**), or remotely, via the rear EIA(RS)485 port (**L – optional**).

2.10.2 Alarm Recorder

Each time any of the set protection element issues an ALARM signal (***Alarm*** output), an Alarm record is created and stored in memory. The fault record tags up to 5 faults and stores them in a non-volatile (FRAM) memory. This allows the operator to identify and analyze system failures. When the available memory space is exhausted, the new alarm automatically overwrites the oldest alarm.

The user can view the latest Alarm record in the ***RECORD/ALARM RECORDS*** menu, where he or she can choose to display up to 5 stored records. These records are the alarm flags, the alarm measurements, etc. Also note that the time stamp displayed in the Alarm record itself will be more accurate than the corresponding time stamp given in the event record..

2.10.3 Instantaneous Recorder (Model E)

Each time any of set thresholds are crossed, an instantaneous record is created and displayed in the ***RECORDS/INSTANTANEOUS RECORD*** menu. The last five starting records are available, with the duration of the signal.

The following information is displayed in the ***RECORDS/INSTANTANEOUS RECORD*** menu: number of starts, time, date, origin (crossing of a current threshold or start of a protection element's time-delay), current values.

NOTE: Instantaneous Records is active if V11F is powered from the auxiliary voltage Vx.

2.11 Disturbance Recorder (Model A and E)

The integral disturbance recorder has a memory space specifically dedicated to the storage of disturbance records. Up to 4 seconds of disturbance recording can be stored. When the available memory space is exhausted, the new record automatically overwrites the oldest record.

The recorder stores actual samples that are taken at a rate of 16 samples per cycle.

Each disturbance record consists of analogue and digital channels. (Note that the relevant CT ratios for the analogue channels are also extracted to enable scaling to primary quantities).

The disturbance recorder is set in the ***GLOBAL SETTINGS/DISTURBANCE RECORDER*** menu.

The total disturbance recording time is 4 s but not more than 5 records are available.

Total number of records available in disturbance recorder is:

- One **-** for set Max Record Time from in range: 2.01s – 4.00s
- Two – for set Max Record Time from in range: 1.51s – 2.00s
- Three – for set Max Record Time from in range: 1.01s – 1.33s
- Four – for set Max Record Time from in range: 0.81s – 1.00s
- Five **-** for set Max Record Time from in range: 0.10s – 0.8s

Triggering of disturbance recording depends on the ***Disturb.Rec.Trig.*** configuration:

- ***0: on Inst.*** – Start of a protection element set to ***Trip***,
- ***1: on Trip*** – Trip by a protection element followed by the ***Protect.Trip*** output.

If the ***0: on Inst***. option is selected the record consists of: Pre-fault time + duration of the "any Start" signal presence + Post-fault time.

If the ***1: on Trip*** option is selected the record consists of: Pre-fault time + duration of the Trip signal presence (***Protect.Trip*** function active) + Post-fault time.

The pre-fault time can be set in the cell: ***GLOBAL SETTINGS/DISTURBANCE RECORDER/Pre-Time***. If the pre-fault time is set to 100 ms, recording starts 100 ms before the disturbance.

The post-fault time can be set in the cell: ***GLOBAL SETTINGS/DISTURBANCE RECORDER/Post Trip Time***. If the post trip time is set to 100 ms, recording stops 100 ms after the trip signal.

2.12 Event Records (Model N, B, A and E)

The relay records and time-tags up to 200 events and stores them in a non-volatile (Fram) memory. This allows the system operator to analyze the sequence of events that has occurred within the relay after a particular power system condition, or switching sequence, etc. When the available space is exhausted, the new fault automatically overwrites the oldest fault.

The real time clock within the relay time-tags each event, with a resolution of 1 ms.

The user can view the event records either locally via the USB port (**NABE**), or remotely, via the rear EIA(RS)485 port (**L – optional**).

AP

APPLICATION NOTES

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

AP

CONTENTS

AP

FIGURES

AP

1. INTRODUCTION

1.1 Protection of Underground and Overhead Lines

The secure and reliable transmission and distribution of power within a network is heavily dependent upon the integrity of underground cables and overhead lines, which link the various sections of the network together. Therefore the associated protection system must also provide both secure and reliable operation.

The most common fault conditions on underground cables and overhead lines are short circuit faults. These faults may occur between the phase conductors but will most often involve one or more phase conductors being short-circuited to the earth.

Faults caused by short circuits require the fastest clearance times but these should still allow for suitable co-ordination with other downstream protection devices.

Fault sensitivity is an issue common to all voltage levels. For transmission systems, tower-footing resistance can be high. Also, high resistance faults might be prevalent where lines pass over sandy or rocky terrain. Fast and discriminative fault clearance is required in these conditions.

The effect of fault resistance is more pronounced on lower voltage systems, resulting in potentially lower fault currents, which in turn increases the difficulty in the detection of high resistance faults. In addition, many distribution systems use earthing arrangements designed to limit the passage of earth fault current.

Earthing methods as such as resistance, Petersen coil or neutral-insulation make the detection of earth faults arduous. Special protection equipment is often used to overcome these problems.

Nowadays, the supply continuity of power distribution is of paramount importance.

On overhead lines, most faults are transient or semi-permanent in nature.

In order to increase system availability, multi-shot auto-reclose cycles are commonly used in conjunction with instantaneous tripping elements. For permanent faults it is essential that only the faulted section of the system is isolated. High-speed, discriminative fault clearance is therefore a fundamental requirement of any protection scheme on a distribution system.

Power transformers are installed at all voltage levels and have their own specific requirements with regard to protection. In order to limit the damage incurred by a transformer under fault conditions, fast clearance of phase to phase and phase to earth faults on the windings is a primary requirement.

Damage to electrical plant equipment such as transformers, cables and lines may also be incurred by excessive loading conditions, which lead directly to overheating of the equipment and subsequent damage to insulation. To protect against such fault conditions, protective devices must also provide thermal protection.

Uncleared faults, arising either from the failure of the associated protection system or of the switchgear itself, must also be considered. The protection devices concerned should be fitted with logic dealing with breaker failure and the upstream relays must be able to provide adequate back-up protection for such fault conditions.

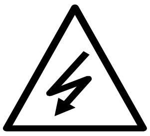
Other situations may arise on overhead lines, such as broken phase conductors. Traditionally, series faults have been difficult to detect.

With today's numerical technology, it is now possible to design elements that are responsive to such unbalanced system conditions and to subsequently issue alarm and trip signals.

On large networks, time co-ordination of the overcurrent and earth fault protection relays can often lead to problematic grading situations or, as is often the case, excessive fault clearance times. Such problems can be overcome by relays operating in blocked overcurrent schemes.

Due to its dual powering featuer, the V11F can be used as back-up protection of HV/MV transformers.

Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety Guide, SFTY/4L M/E11 or later issue, or the safety and technical data section of the technical manual and also the ratings on the equipment rating label.



For safety reasons, no work must be carried out on the V11F until all power sources to the unit have been disconnected.

2. APPLICATION OF INDIVIDUAL PROTECTION FUNCTIONS

The following sections detail individual protection functions in addition to where and how they may be applied. Each section provides some worked examples on how the settings are applied to the relay.

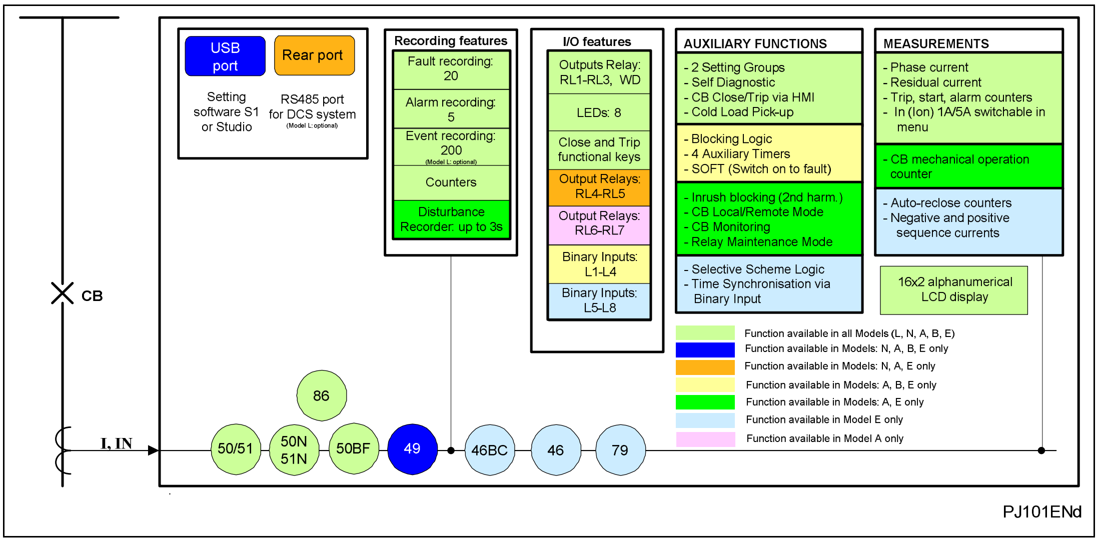


Figure 1: V11F single-line functional diagram (all options included)

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2.1 Earth and Phase Overcurrent Functions

VAMP 11F relays provide definite and independent time-delayed overcurrent protection.

Each phase current and earth current input is associated with three stages.

The first and second timer stages can be set to definite time-delay or inverse time-delay using the IEC, IEEE, CO, RXIDG, BPN, RI and RECT curves. Their parameters are shown in the Technical Data chapter of this Technical Guide.

The third stages can be set as definite time-delay only.

Similarly, the earth fault elements has three different stages, that also can be set independently of the settings chosen for the phases.

The instantaneous stages are labeled “I>” for the first stage, “I>>” and “I>>>” for the second and third instantaneous stages respectively (“IN_1”, “IN_2” and “IN_3” (**E**) for earth fault elements).

The time-delayed stages are labeled “tI>” for the first stage, “tI>>” and “tI>>>” for the second and third time-delayed stages respectively (“tIN_1”, “tIN_2” and “tIN_3” (**E**) for the time-delayed earth fault stages).

The protection elements trip when the following conditions are realized:

- A phase current exceeds the set overcurrent threshold
- The relevant time-delay has elapsed
- The blocking logic (if used) is not activated.

The following diagrams show the functionality for each stage.

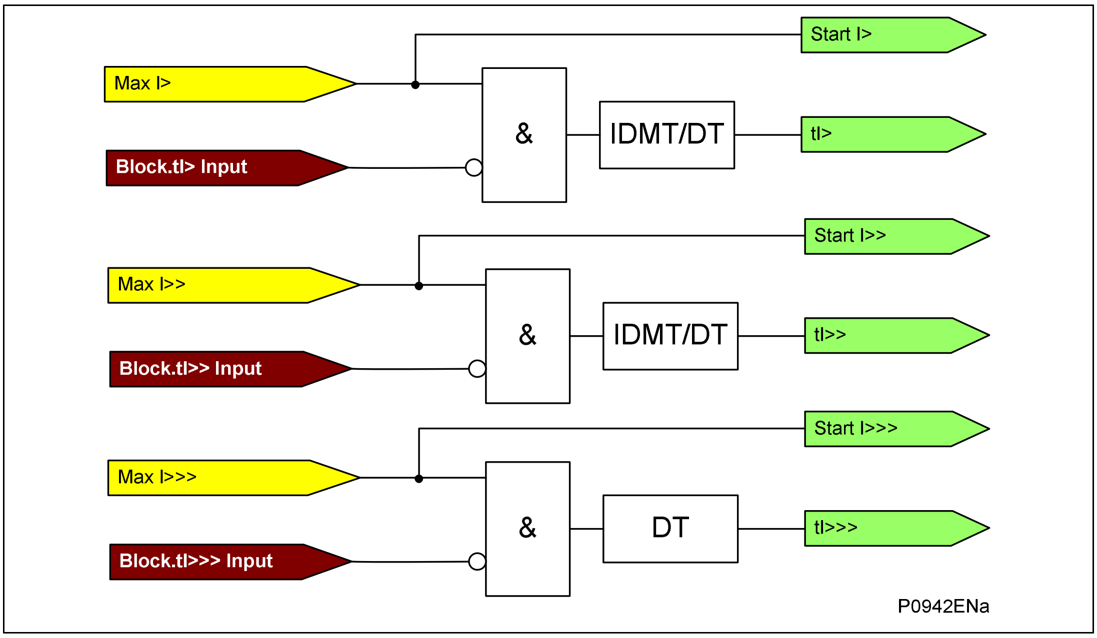

Figure 2: Logic diagram for the phase stages I>, I>> and I>>>

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With: Max I> = [IA>] OR [IB>] OR [IC>]

Max I>> = [IA>>] OR [IB>>] OR [IC>>]

Max I>>> = [IA>>>] OR [IB>>>] OR [IC>>>]

Note: Model E has possibility to set **50/51** protection element for a one phase only (for example for phase A or phase B or phase C), so if this protection element is assigned to one phase only, MAX value is equal the current value in selected phase (for example: I> is configured ***Trip-Phase A*** (**E**) so Max I> = [IA>])

The logic associated with the earth fault stage is identical to the logic described above. The stages I> & tI>, I>> & tI>> and I>>> & tI>>> are respectively replaced by the stages IN_1 & tIN_1, IN_2 & tIN_2, IN_3 & tIN_3(**E**).

Thanks to the "Blocking Logic" function, it is possible to freeze the timer as long as the "Block Logic" signal is active.

As soon as the blocking “Block Logic" signal drops, if the overcurrent value is still over the set threshold, the time-delay resumes using the value prior to the activation of the blocking function as its new initial value. This allows faster clearance of the fault after resetting of the “Block Logic" signal.

2.1.1 Instantaneous function

As soon as a phase (or earth) timer stage starts running, the instantaneous output associated with that stage is activated. This output indicates that the protection element has detected a phase (or earth) fault and that the corresponding time-delay has started. This time-delay can be blocked via the associated "Block Logic" logic input. If this blocking input is activated by an output contact of a downstream relay, the logic that will lead to the trip command is then blocked only if the relay that is the closest to the fault can see and therefore eliminate the fault. This principle is known as «Blocking logic» or «Blocking». It is described in more detail in this document.

2.1.2 DMT timer stages

The three phase (earth) overcurrent stages can be assigned definite time-delays. The time to operate is equal to the set time-delay plus the time for the output contact to operate (typically about 30 ms, 20 ms for a current exceeding or equal to twice the threshold) and the time required to detect the overcurrent condition (maximum 20 ms at 50 Hz).

For DMT stages, a definite-time "tReset" reset timer is associated with the first phase o/c stage, and with the first and second earth fault stages.

2.1.3 IDMT timer stages

The first and the second phase (I>, I>>) and e/f (IN_1) overcurrent stages can be selected with an inverse maximum time (IDMT) characteristic.

The time-delay in relay operation is calculated with a mathematical formula that depends on the relay current and TMS (IEC and UK) or TD (IEEE and US) values.

There are twelve inverse time characteristics available:

- SI: Standard Inverse Time Characteristic (IEC/A)
- VI: Very Inverse Time Characteristic (IEC/B)
- EI: Extremely Inverse Time Characteristic (EC/C)
- LTI: Long Time Inverse Characteristic (IEC)
- STI: Short Time Inverse Characteristic (FR)
- RC: Rectifier Characteristic (UK)
- MI: Medium Inverse Time Characteristic (IEEE, IEC/D)
- VI: Very Inverse Time Characteristic (IEEE, IEC/E)
- EI: Extremely Inverse Time Characteristic (IEEE, IEC/F)
- CO2 P20: Short Time Inverse Characteristic (US)
- CO2 P40: Short Time Inverse Characteristic (US)
- CO5: Long Time (US)
- CO6: Definite Minimum Time (US)
- CO7: Moderately Inverse Time (US)
- CO8: Inverse Characteristic (US)
- CO9: Very Inverse Time (US)
- CO11: Extreme Inverse Time (US)
- RI: Electromechanical Inverse Characteristic
- BNP Time Charactristic (EDF)
- RXIDG Time Charactristic

The mathematical formulae and curves for the twelve Inverse Time characteristics available with the V11F are presented in chapter OP (“Operation”).

2.1.4 Reset timer

The first two phase overcurrent stages [I>/tI>, I>>/tI>>] and the first earth fault stage ([IN_1/tIN_2] have a reset timer.

The value that is set for this reset timer corresponds to the minimum time during which the current value needs to be lower than 95% of the phase (or earth) threshold before the corresponding phase (or earth) time-delay is reset.

Note: This rule does not apply when the protection element is triggered. When the protection element is triggered, the time-delay tI> (or tIN>) is immediately reset.

DMT stages have DMT reset timers only.

IDMT characteristics can be associated with either a DMT or an IDMT reset timer. This selection is made in the menu:

AP

- phase current: ***SETTING GROUP x/PROTECTION Gx /[50/51] PHASE OC Gx /Reset Delay Type***: ***0:DMT or 1: IDMT***
- earth current: ***SETTING GROUP x/PROTECTION Gx /50/51N] E/GND FAULT Gx/Reset Delay Type***: ***0:DMT or 1: IDMT***

DMT Reset Timer

Type of timer associated with the first & second phase (50/51 only) stages	DMT Reset Timer
DMT (see note below)	0 ms to 600 s
IDMT	0 ms to 600 s

For the first phase and earth overcurrent stages, the VAMP 11F has a timer hold facility, ***DMT tReset***, which can be set to a definite time value or to an inverse time characteristic. This may be useful in some applications, for example when grading with upstream electromechanical overcurrent relays which have inherent reset time-delays.

This timer hold facility is used to reduce fault clearance times and is also useful in situations where intermittent faults may be experienced. This can for example be the case on a plastic-insulated cable. In that case, the fault energy may cause the cable insulation to melt and reseal, thereby extinguishing the fault. This process repeats itself a couple of times giving a succession of fault current pulses, each of increasing duration with reducing intervals between the pulses, until the fault becomes permanent.

When the reset time of the overcurrent relay is instantaneous the relay will be repeatedly reset and unable to trip until the fault becomes permanent. By using the Timer Hold facility, the relay will integrate the fault current pulses, thereby reducing fault clearance time.

The VAMP 11F reset timer ***DMT tReset*** can be found in the following menu cells:

- ***SETTING GROUP x/PROTECTION Gx /[50/51] PHASE OC Gx /DMT tReset*** for the phase.
- ***SETTING GROUP x/PROTECTION Gx /[50/51N] E/GND FAULT Gx /DMT tReset*** for the earth.

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IDMT Reset Timer (IDMT Reset Characteristic)

This feature may be useful in certain applications, for example when grading with upstream electromechanical overcurrent relays, which have inherent reset time-delays. Setting the hold timer to a value other than zero, delays the resetting of the protection element timers for this period, thus allowing the element to behave similarly to an electromechanical relay.

Another possible situation where the timer hold facility may be used to reduce fault clearance times is where intermittent faults may be experienced. An example of this may occur in a plastic-insulated cable. In this application it is possible that the fault energy melts and reseals the cable insulation, thereby extinguishing the fault. This process repeats to give a succession of fault current pulses, each of increasing duration with reducing intervals between the pulses, until the fault becomes permanent.

When the reset time of the overcurrent relay is instantaneous, the relay will be repeatedly reset and unable to trip until the fault becomes permanent. By using the Timer Hold facility for IDMT characteristics the relay will integrate the fault current pulses, thereby reducing fault clearance time.

For IDMT it is possible to set the timer hold facility based on the following formulae:

IEC: $$t = RTMS \times \left(\frac{tr}{1 - \left(\frac{G}{Gs} \right)^{p}} \right)$$

IEEE and US: $$t = RTD \times \left(\frac{tr}{1 - \left(\frac{G}{Gs} \right)^{p}} \right)$$

where:

t Reset time

tr, p Constant (see table)

G Value of the measured current

Gs Value of the programmed threshold (pick-up value)

RTMS Reset time multiplier setting between 0.02 and 1.5.

RTD Reset time multiplier setting between 0.02 and 100.

Type of curve	Standard	tr	p
US Short time inverse	C02_P40	2.261	2
US Short time inverse	C02_P20	0.323	2
US Long Time	C05	0	2
US Definite Minimum Time	C06	0	2
US Moderately Inverse Time	C07	0	2
US Long time inverse	C08	5.950	2
US Very Inverse Time	C09	0	2
US Extreme Inverse Time	C11	0	2
IEEE Moderately inverse (MI)	IEEE	4.850	2
IEEE Very inverse (VI)	ANSI/IEEE	21.600	2
IEEE Extremely Inverse (EI)	ANSI/IEEE	29.100	2
IEC Standard Inverse Time (SI)	IEC/A	8.2	6.45
IEC Very Inverse Time (VI)	IEC/B	50.92	2.4
IEC Extremely Inverse Time (EI)	IEC/C	44.1	3.03
IEC Long Time Inverse (LTI)	IEC	40.62	0.4
FR Short Time Inverse (STI)	FR	0	2
UK Rectifier (Rect)	UK	0	2
BNP EDF	BNP EDF	0	2
RXIDG	RXIDG	0	2
RI	RI	0	2

Table 1: The value of “tr” for IDMT characteristics

Notes: 1. According to the IEEE and US standards, RTD should be equal to TD. By separately setting the values for RTD and TD it is possible to adapt the reset time to a specific application.
2. Typically for IEC characteristic RTMS can be set equal to TMS.

2.1.5 Time-graded protection

Inverse definite minimum time relays are time graded in such a way that the relay closer to the fault operates faster than the upstream relays. This is referred to as relay co-ordination because if the relay nearest to the fault does not operate, the next relay will trip in a slightly longer time. The time grading steps are typically 400 ms, the operation times becoming progressively longer with each stage.

When difficulty is experienced in arranging the required time grading steps, the use of a blocked overcurrent scheme should be considered (described in § 2.14 of the Operation chapter, V11F/EN OP).

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Note**:** The dynamic measurement range is typically 600 times the minimum setting.

2.1.6 Earth fault protection

Earth fault (E/F) current is measured on the e/f input.

Three stages are available: IN_1, IN_2 and IN_3 (E). The first stage has IDMT or DT characteristics. The types of characteristics are the same as for I> (refer to section 2.1.3).

2.1.7 Setting guidelines

When applying the overcurrent protection provided in the V11F relays, standard principles should be applied in calculating the necessary current and time settings for co-ordination The Network Protection and Automation Guide (NPAG) textbook offers further assistance. The example detailed below shows a typical setting calculation and describes how the settings are applied to the relay.

Assume the following parameters for a relay feeding an LV switchboard:

CT Ratio	=	500 A/1 A
Full load current of circuit	=	440 A
Slowest downstream protection	=	100 A Fuse

The current setting employed on the V11F relay must account for both the maximum load current and the reset ratio of the relay itself:

I> must be greater than: (440 A/0.95)/500 A = 0.9263 In

I> must be greater than: 0.9263 In

For setting range 0.2-4 In step is 0.01 In, so the closest I> set value = 0.93 In.

A suitable time-delay characteristic can now be chosen. When coordinating with downstream fuses, the applied relay characteristic should be closely matched to the fuse characteristic. Therefore, assuming IDMT co-ordination is to be used, an IEC Extremely Inverse (EI) time characteristic would normally be chosen.

Finally, a suitable time multiplier setting (TMS) must be calculated and entered. .

MV/LV transformer application

Example:

Transformer:

Snom = 1000 kVA

Unom = 6 kV

CT ratio: 100 A/1 A

$$I_{nom} = \frac{S_{nom}}{\sqrt{3} \cdot U_{nom}} = \frac{1000kVA}{\sqrt{3} \cdot 6kV} = 96A$$

Where:

I_{nom} - nominal current of the transformer

S_{nom} - nominal power of the transformer

U_{nom} - nominal phase-phase voltage

Short circuit I>>

Primary value setting: 1.5kA

I>> current stage: $I_{>>} = 1500A/100A = 15[In]$

$I_{>>}\_set\_value$: 15In

Where:

$I_{>>}\_set\_value$: setting value of the short-circuit overcurrent stage

Overcurrent I>

Overcurrent stage I> should be set above the normal load current

If the primary setting value of I> is equal to 172 A, the set value is calculated as follows:

$$I_{>} = 172A/100A = 1.72 \cdot In$$

Calculation of the required E/F settings
The setting value of E/F overcurrent protection should be greater (with safety margin) than the charging currents flowing in the protected line to prevent an earth fault in other parts of the system tripping the relay. The value of the safety coefficient depends on the application and accuracy of obtained earth fault current value (typically: 1.5 to 2.5).

2.2 Transformer Magnetizing Inrush (Inrush Blocking) (Model A and E)

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The inrush blocking function ensures protection stability during transformer energizing based on the presence of harmonic 2.

Either I>>/IN_2 or I>>>/IN_3 (**E**) can be used as high-set instantaneous elements. Their design is such that they do not respond to the DC transient component of the fault current. The principle of operation allows the current settings to be set down to 35% of the prospective peak inrush current that will be absorbed by a transformer when it is energized. As a first approximation, the peak inrush current is given by the converse of the per unit series reactance of the transformer.

As an alternative, inrush blocking can be applied. This is discussed in the next section.

In applications where the sensitivity of overcurrent thresholds need to be set below the prospective peak inrush current, the inrush blocking function can be used to block the overcurrent, earth fault and negative sequence overcurrent stages. During transformer inrush conditions, the second harmonic component of the inrush current may be as high as 70%. In practice, the second harmonic level may not be the same for all phases during an inrush and therefore the relay will issue an Inrush Blocking signal for any phase above the set threshold. A setting of 15% to 20% for the Inrush harmonic 2 ratio can be applied in most cases. Care must be taken that it is not set too high, as inrush blocking may not operate for low levels of second harmonic current which may result in the O/C element tripping during transformer energization. Similarly if it is set too low, inrush blocking may prevent tripping for some internal transformer faults with significant second harmonic current

2.2.1 Overview

The Inrush Blocking function measures the ratio of second to fundamental harmonic currents. It can be used as “blocking logic” for I>, I>>, I>>>, SOTF(**ABE**), IN_1, IN_2, IN_3 (**E**), I2> (**E**), Broken Conduct (**E**), in cases where the harmonic 2 ratio is higher than the set threshold. Indeed, inrush blocking functions will reset selected protection starts.

Two options are available (***GLOBAL SETTINGS/INRUSH BLOCKING*** menu):

- ***1: Yes***
- ***2: Closing***

If ***1: Yes*** is selected, the minimum duration of the overcurrent stage inhibition (***T Inrush Reset***) can be also set. This value depends on the transformer power transient inrush duration: between 0.1 second (for a 100 kVA transformer) to 1.0 second (for a larger unit). It is used to avoid any maloperation during a fixed time period in case of too sensitive a setting. For example, this option is recommended for incoming feeders where the inrush current is caused by a transformer connected to an outgoing line. However, using the second harmonic can increase the tripping time in case of a fault, especially with DC component included. This option can also be used if the CB contacts are not assigned to any VAMP 11F inputs (no information about CB closing).

If ***2: Closing*** is selected, the protection element block is active after the CB closes until ***Unblock Inrush Time*** elapses (this can be also set in the ***GLOBAL SETTINGS/INRUSH BLOCKING*** menu column). If ***1: Closing*** is selected, the minimum duration of the overcurrent stage inhibition (***T Inrush Reset***) can be also set (see above: ***1: Yes***). This option can increase protection reliability, because inrush blocking is limited to cases where inrush current can appear (closing of CB). Therefore it can be used on outgoing lines with transformers. Note that for incoming feeders the inrush current can be also present when CB is closed and an outgoing line with a transformer is closing. In such a case the CB status of the incoming feeder is not changed but Inrush current can trip protection element. The ***2: Closing*** option is not recommended for such an application.

2.2.2 Operation

For each of the three phases currents (IA, IB, IC), the harmonic restraint function compares the ratio of harmonic 2 to the fundamental with the set ratio (Harmonic 2 / Fundamental settable from 10 % to 50 % in steps of 1%).

The minimum fundamental current value required for operation of the Inrush Blocking function is 0.2 In, and there is no upper limit to disable this feature. However, in transformer protection, this Inrush Blocking feature shall not control the high set overcurrent stage; this enables detection of all high current faults without inrush blocking.

Inrush blocking configuration offers two options:

- ***1: Yes -*** The Inrush Blocking function will block the selected protection stages every time inrush conditions occur on the line (Ratio of measured 2nd Harmonics > Inrush H2 set ratio), and will remain active at least for the duration of ***T Inrush Reset***. The tReset timer defines the minimum duration of overcurrent protection inhibition (0-200 s, settable). This timer starts as soon as an inrush current threshold picks up:
    - If the inrush condition lasts less than the set value for ***T Inrush Reset***., the selected overcurrent function will remain inhibited for the duration of tReset.
    - If the inrush condition lasts longer than the set value for ***T Inrush Reset***., the selected overcurrent function will remain inhibited as long as the inrush condition is present.
- ***2: Closing -*** The Inrush Blocking function will block the selected protection stages every time the CB closes (V11F closing command) until ***Unblock Inrush Time*** has elapsed and as long as the inrush conditions are present on the line (Ratio of measured 2nd Harmonics > Inrush H2 set ratio). If ***1: Closing*** is selected, the minimum duration of the overcurrent stage inhibition (***T Inrush Reset***) can be also set (see above: ***1: Yes***).

The operating Inrush current (2^{nd} Harmonic Ratio) is settable from 10% to 50% of the fundamental current.

Under inrush conditions, the following selectable protection stages can be blocked: I>, I>>, I>>>, SOTF (**ABE**), IN_1, IN_2, IN_3 (**E**), I2>(**E**), Broken Conduct (**E**), if they are set to ***3: Trip-Inrush Bl***.

Note: Inrush Blocking in V11F relays is not phase-selective. If an inrush condition occurs on any phase, the selected protection stages will be blocked in all 3 phases.

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2.2.3 Principle (example for the I> protection element only)

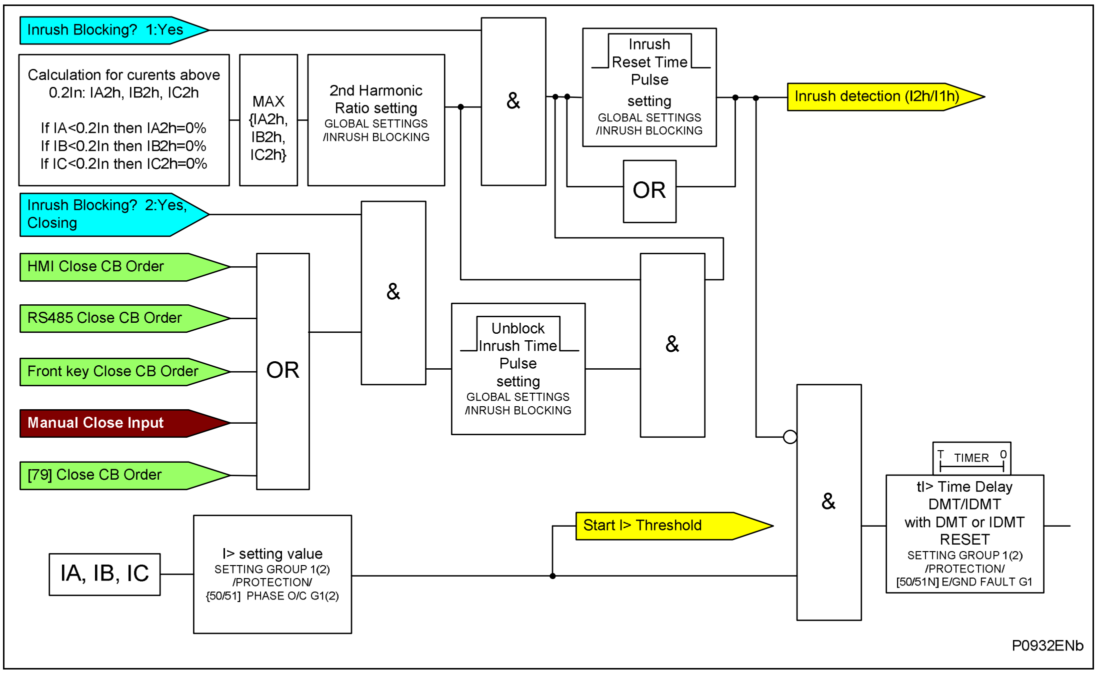

Figure 3: Inrush Blocking Logic

2.3 Busbar Protection on Radial Systems

The use of non-directional overcurrent relays to protect a busbar is based on the following hypotheses:

- The network is a radial system,
- The incoming and outgoing feeders are clearly defined, the incoming feeders always being considered as suppliers of energy and outgoing feeders as loads.

Under these circumstances, the busbar is effectively protected using the interlocking principle (Figure 4).

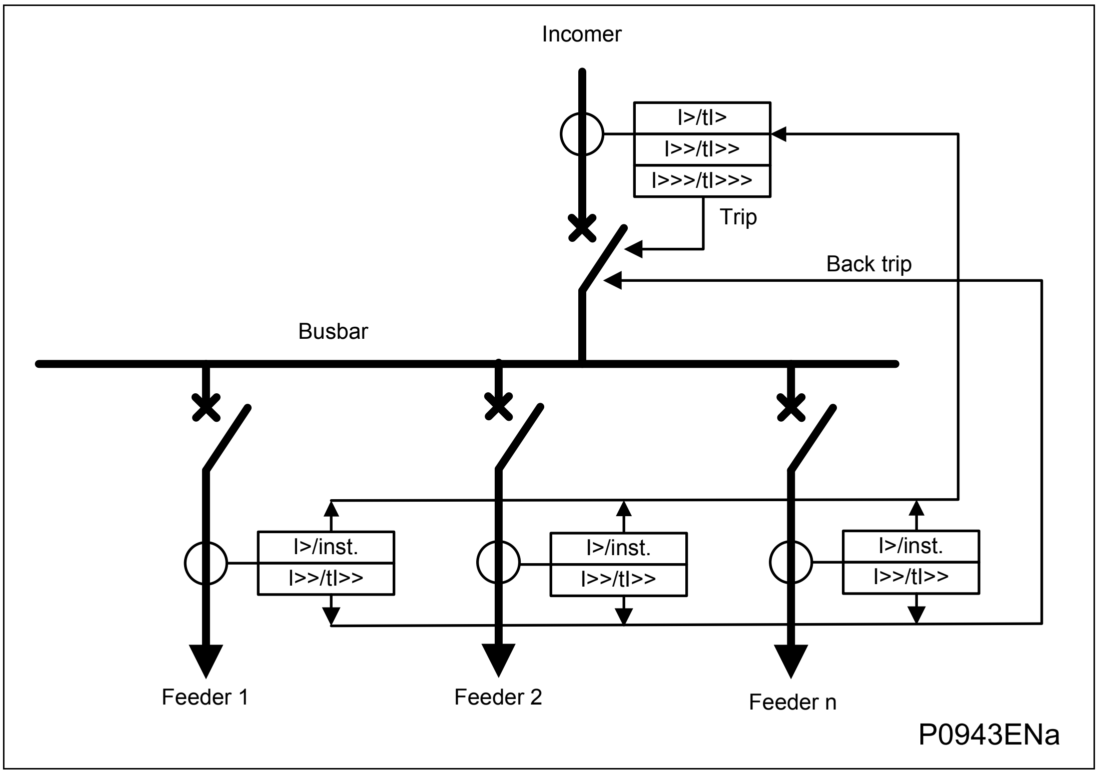

Figure 4: Blocked Overcurrent for Busbar Protection

The instantaneous overcurrent signals of the protection relays on the feeders are grouped together and wired to the "Blocking logic" logic input of the relay protecting the incoming feeder. The blocking function is programmed to inhibit either the first or first two stages. The third I>>> stage will operate at a high value (> 10 In) with a short time-delay (< 60 ms).

If a fault appears on the system, the relay protecting the associated feeder will immediately (in less than 30 ms) send a blocking command to the relay protecting the incoming feeder. After the fault has been cleared (by opening the circuit breaker), the blocking command is withdrawn and the relay protecting the incoming feeder is unblocked. As the fault current is no longer present, the timer is reset.

If a fault appears on the busbar, the fault current exceeds by far the value of the third threshold (I>>>). As this third stage is not blocked by the blocking logic of the relays protecting the incoming feeders, the trip command is sent in less than 60 ms and the busbar is isolated.

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2.4 Blocking Logic Function (Blocked Overcurrent Protection) (Model A, B and E)

This type of protection can be applied to radial feeder circuits where there is little or no back feed. For parallel feeders, ring circuits or where there can be a back feed from generators, directional relays should be considered.

The blocking logic function allows the upstream IDMT relay to be blocked by the start output of a downstream relay that has detected the presence of a fault current above its threshold. Thus both upstream and downstream relays can have the same current and time settings, and the blocking feature will automatically provide grading. If the CB failure protection is active, the blocking command on the upstream relay will be removed if the down-stream circuit breaker fails to trip.

Thus for a fault downstream from relay C, the start output from relay C will prevent relay B from operating and the start output of relay B will prevent relay A from operating. Therefore all 3 relays could have the same timer and current settings and grading would be obtained by the blocking signal received from a relay closer to the fault. This gives a constant, close time grading, but there will be no back-up protection in the event of pilot wires being short-circuited.

In practice it is recommended to set the upstream relay to a value that is 10% higher than the downstream relay setting. This ensures that the downstream relay successfully blocks the upstream relay when required.

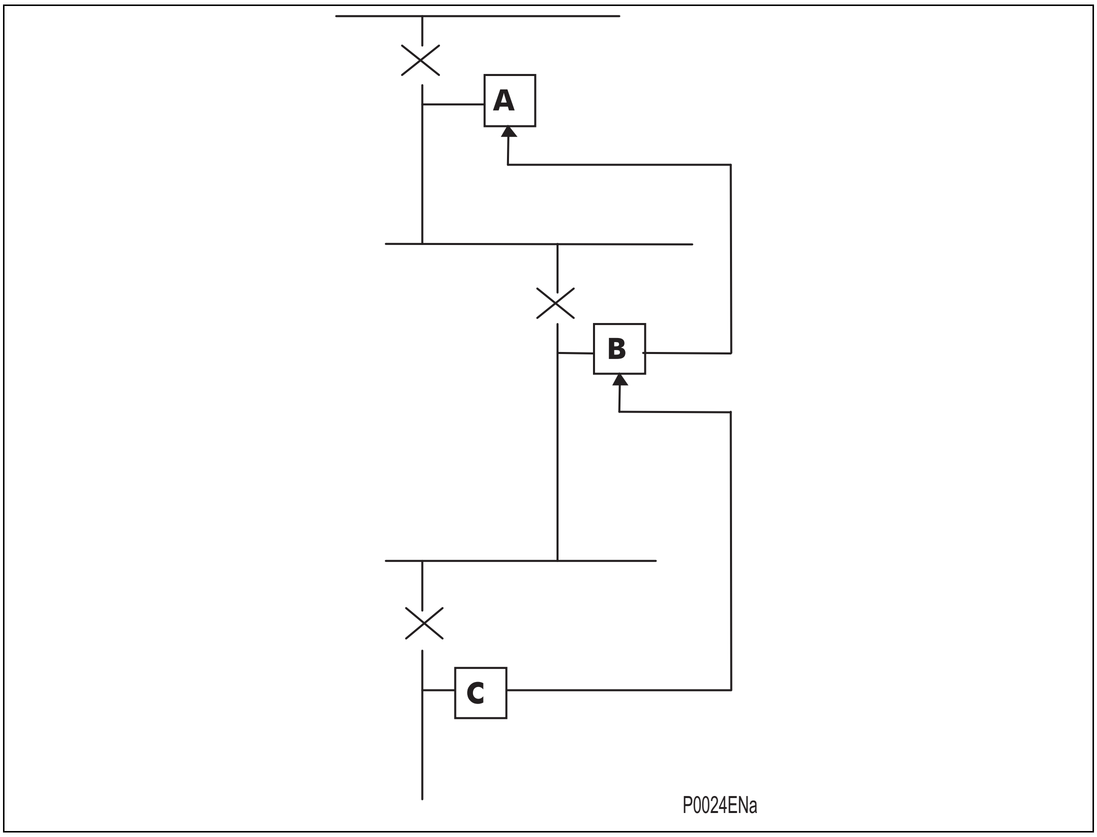

Figure 5: Blocking Logic

The "Blocking Logic" functions are assigned in the ***SETTING GROUP x/ INPUT CONFIGURATION Gx/*** menu. Every protection element can be assigned a blocking function: ***Block.tI>***, ***Block.tI>>***, ***Block.tI>>>***, ***Block.tSOTF***, ***Block.tIN_1***, ***Block.tIN_2***, ***Block.tIN_3*** (**E**), ***Block.tI2>***(**E**), **Block.tBrkn Cond** (**E**), ***Block.Itherm*** (**NABE**), ***Block.AUX1*** (**NABE**), **Block.AUX2** (**NABE**), ***Block.AUX3*** (**NABE**), ***Block.tCB Fail***, ***Block.[79]*** (**E**).

VAMP 11F relays have separate blocking functions, which can be used to block every protection element, for example: Earth fault and phase overcurrent stages.

2.5 Protection of Silicon Rectifiers

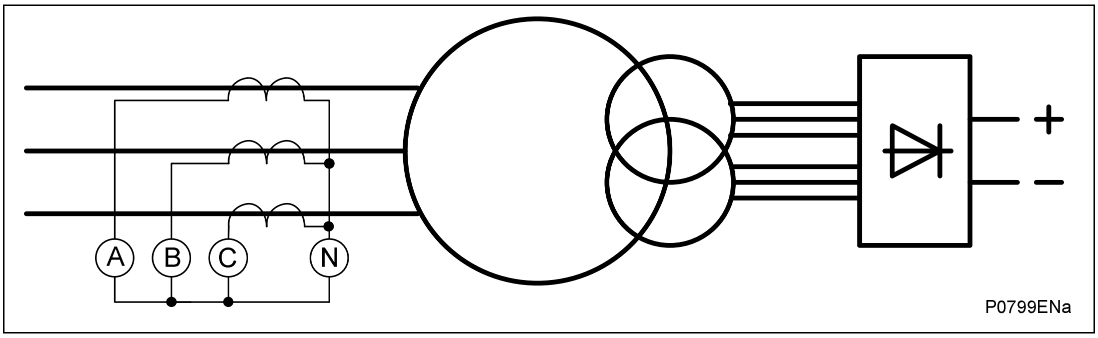

Figure 6: Protection of silicon rectifiers

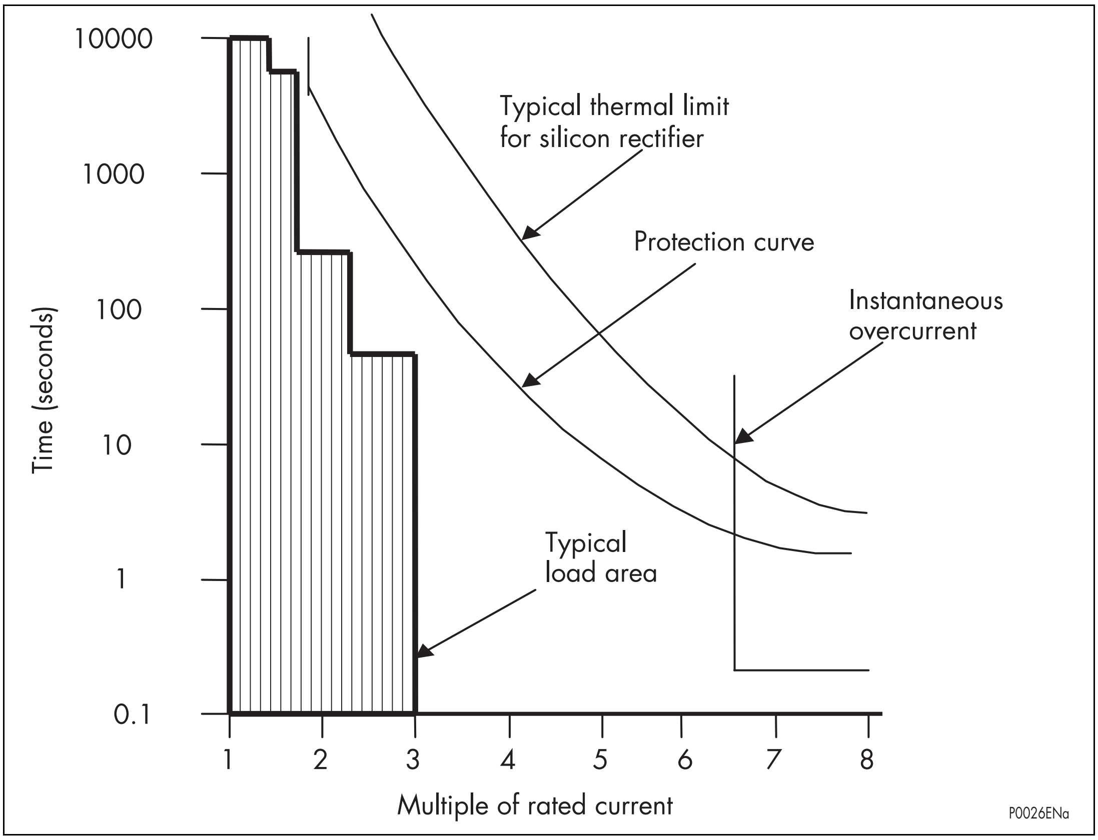

Figure 7: Matching curve to load and thermal limit of rectifier

The rectifier protection feature is based upon the inverse time/current characteristic as used in the MCTD01 (Silicon Rectifier Protection Relay) and the above diagrams show a typical application.

Rectifier protection differs from the more traditional overcurrent applications in that many rectifiers can withstand relatively long overload periods without damage, typically 150% for 2 hours and 300% for 1 min.

The threshold I> should typically be set to 110% of the maximum allowable continuous load of the rectifier. The relay issues start indications when the setting of I> has been exceeded, but this is of no consequence, as this function is not used in this application. The rectifier curve should be selected as it allows for relatively long overloads even with I> set to 110%.

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Typical settings for the TMS factor are:

Light industrial service TMS = 0.02

Medium duty service TMS = 0.1

Heavy duty traction TMS = 0.8

The high set threshold is typically set to 8 times the rated current as this ensures that HV AC protection will discriminate with faults covered by LV protection. However, it has been known for the high set threshold to be set to 4 or 5 times the rated current where there is more confidence in the AC protection device. Use of the thermal element to provide protection between 70% and 160% of the rated current could enhance protection. It is also common practice to provide restricted earth fault protection for the transformer feeding the rectifier.

2.6 Back-up Scheme using "Selective Transfer Tripping"

In this application, the relay protecting the incoming feeder can trip the circuit breaker of the faulty feeder via the watchdog contact of the relay protecting the faulty feeder.

Figure 8 illustrates this example:

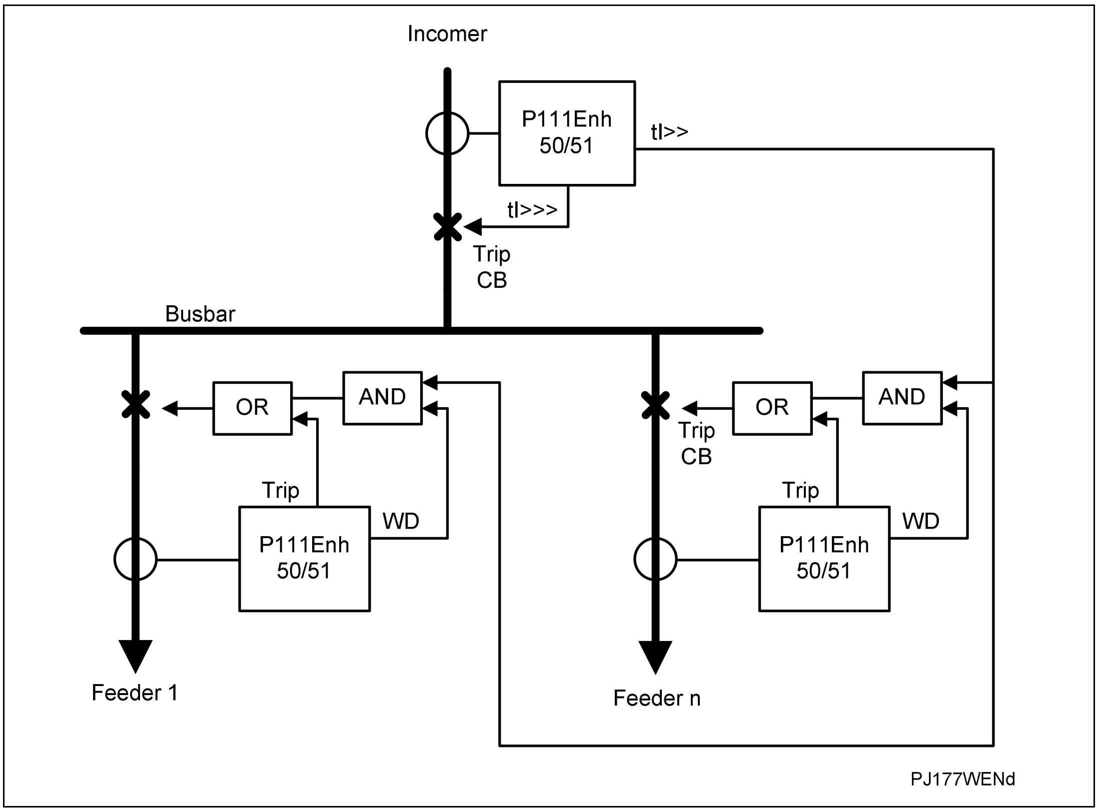

Figure 8: Example of a back-up scheme using "selective transfer tripping"

Thus, a fault occurring on a feeder can be cleared by tripping the circuit breaker of the faulty feeder even if the relay protecting this feeder has failed to operate. Without this function, the fault would normally be cleared by the opening of the circuit breaker of the incoming feeder. This would lead to total disconnection of the affected busbar.

The relay protecting the incoming feeder has two time-delayed outputs available (among others):

- 3rd stage: tI>>> time-delay, at 60 ms (active stage for the high phase current faults).
- 2nd stage: tI>> time-delay, selectively longer than the third stage, i.e. 360 ms.

The output contact associated with the 2nd stage is wired in series with the watchdog contact of the downstream relays, so that it can activate the trip coil of the circuit breakers of the feeders. Regarding the output contact associated with the 2nd and 3rd stages, this contact is directly wired to the trip coil of the incoming feeder's circuit breaker.

Case n°1 → all relays operate normally:

In this case, the watchdog contacts of all the relays are open.

Thus, for a phase fault on the busbar, stage tI>> or tI>>> of the V11F located on the incoming feeder will clear the fault.

For a phase fault on one of the feeder, the stages tI>> and tI>>> of the relay located on the incoming feeder being selectively set to higher values than the ones set for the phase o/c stages of downstream relays, the fault shall be cleared selectively by the relay of the faulty feeder (selectivity between the relay of the incoming feeder and relays of the outgoing feeders is ensured thanks to intervals of selectivity correctly chosen, or thanks to a suitable blocking scheme).

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Case n°2 → the relay supervising one of the feeders is faulty:

In this case, the watchdog contact of that relay is closed.

Thus, for a phase fault on the busbar, stages tI>> and tI>>> activate their associated output contacts. However, stage tI>> will clear the fault as its threshold has been set to a lower value than that of stage tI>>>.

For a phase fault on one of the ‘healthy’ feeders, stages tI>> and tI>>> of the relay located on the incoming feeder being selectively set to higher threshold values than the ones set for the phase o/c stages of the downstream relays, the fault shall be cleared selectively by the relay of the faulty feeder (selectivity between the relay of the incoming feeder and relays of the outgoing feeders is ensured thanks to intervals of selectivity correctly chosen or to a suitable blocking scheme).

For a phase fault on the feeder of the failed relay, the stage tI>> of the relay located on the incoming feeder operates via the watchdog contact of the faulty relay on the trip coil of the circuit breaker of the faulty feeder. This stage being selectively set to a value lower than the stage tI>>> (which operates directly on the coil of the incoming feeder circuit breaker), the fault is therefore selectively cleared.

2.7 Remote Stand-By Protection Scheme

VAMP 11F relays can be used as back-up for HV distance protection devices (Figure 9). Depending on the type of selectivity required, the V11F 51/51N element needs to be time-delayed either as definite time or as inverse time. The time-delay tI>/tIN> is set to a value that is compatible with stages Z2 or Z3 (2nd and 3rd distance protection zones).

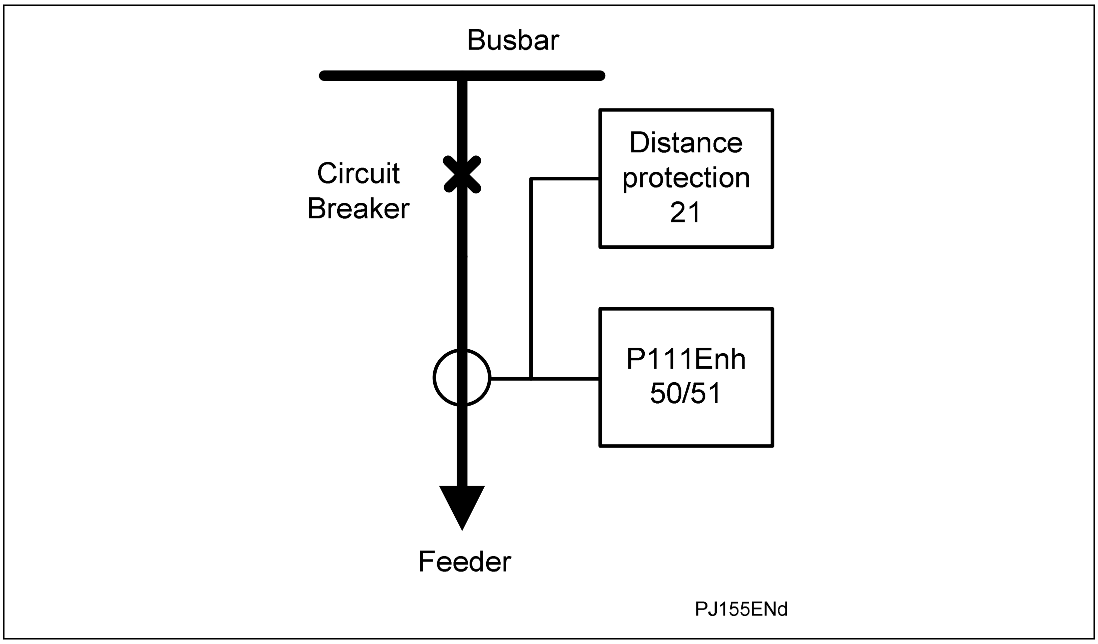

Figure 9: VAMP 11F relay used as back-up for a distance protection device

The Watchdog contact of the distance protection (on a numerical protection unit) can be wired to a VAMP 11F relay to optimize the trip time.

2.8 1 ½ Breaker Scheme

For HV/EHV substations with 1½ circuit breaker arrangements (Figure 10), the zone between the two circuit breakers and the switch section must be protected with a standard ANSI 50 protection device.

The tripping time is an essential criterion to be considered when choosing this protection device. VAMP 11F relays are perfectly suited for this application. The time-delay of the first stage (tI>) is set to a low value (typically 100 ms above the circuit breaker failure time). This will allow the relay to be blocked by the close contact of the associated switch.

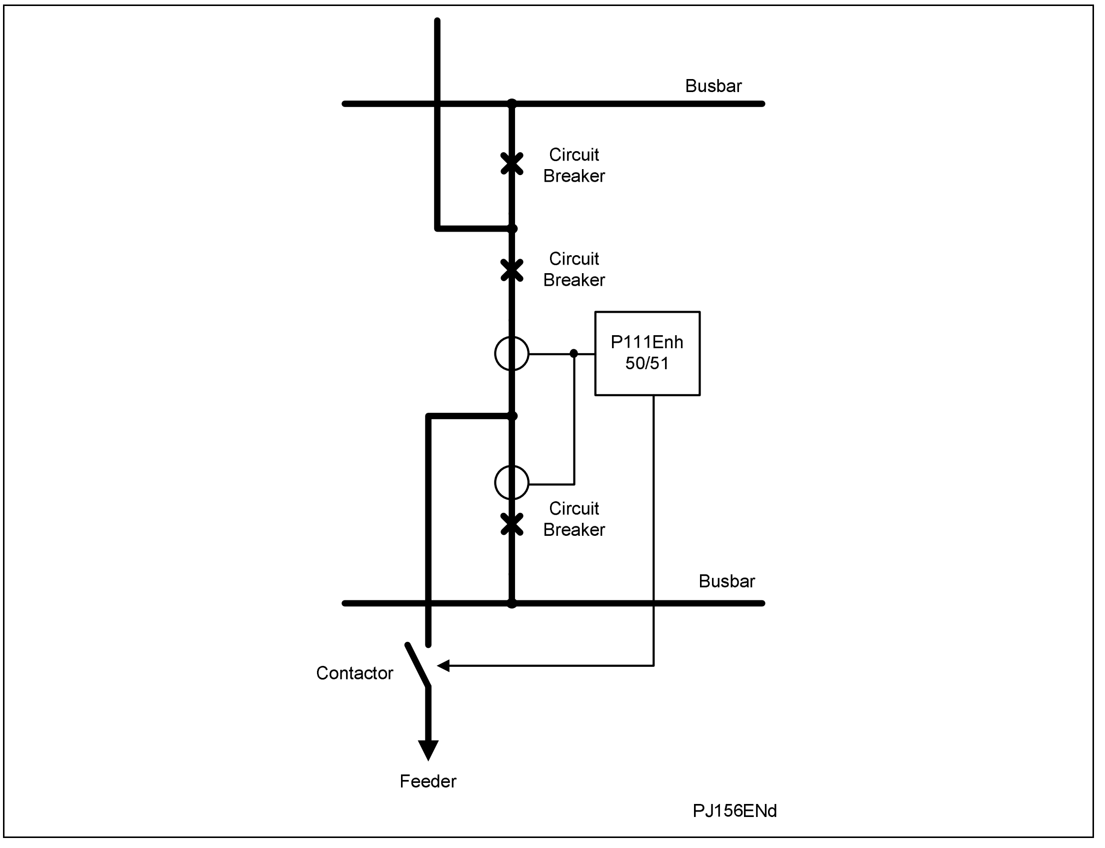

Figure 10: 1 ½ Breaker Scheme

2.9 Thermal Overload Protection (Model N, A, B, E)

Thermal overload protection can be applied to prevent damages to the equipment of the electrical plant when operating at temperatures that are above the values designed for maximum withstand. A prolonged overloading causes excessive heating, which may result in premature deterioration of the insulation, or in extreme cases, insulation failure.

VAMP 11F relays incorporate a current-based thermal replica, using load current to reproduce the heating and cooling of the equipment to be protected. The thermal overload protection element can be set with both alarm and trip stages.

Heating within any plant equipment, such as cables or transformers, is of resistive type ($I^2R \times t$). Thus, the quantity of heat generated is directly proportional to the current squared (I^2). The thermal time characteristic used in the relay is based on current squared, integrated over time.

VAMP 11F relays automatically use the highest phase current as input information for the thermal model.

The equipment is designed to operate continuously at a temperature corresponding to its full load rating, where the generated heat is balanced by the heat dissipated through radiation etc. Over-temperature conditions therefore occur when currents in excess of the rating are allowed to flow for a certain period of time. It can be shown that temperatures during heating follow exponential time constants and a similar exponential decrease of temperature occurs during cooling.

In order to apply this protection element, the thermal time constant (Te) of the plant equipment to be protected is therefore required.

A thermal time constant for cooling (Tr) is available for motor protection applications.

The following sections will show that different plant items possess different thermal characteristics, due to the nature of their construction.

2.9.1 Time Constant Characteristic

This characteristic is used to protect cables, dry type transformers (e.g. type AN), and capacitor banks.

The thermal time characteristic is given by:

$$\boxed{e^{\left(\frac{-t}{\tau}\right)} = \frac{\left(I^2 - (k \times I_{FLC})^2\right)}{\left(I^2 - I_p^2\right)}}$$

Where:

t	=	Tripping time, following application of the overload current, I
τ	=	Heating and cooling time constant of the protected plant equipment
I	=	Largest phase current
I_{FLC}	=	Full load current rating (relay setting ‘Thermal Trip’)
k	=	1.05 constant, allows continuous operation up to < 1.05 I_{FLC}
I_P	=	Steady state pre-loading current before application of the overload

The tripping time varies depending on the load current carried before application of the overload, i.e. whether the overload was applied from “hot” or “cold”.

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Mathematical formula applicable to VAMP Relays:

The calculation of the tripping time is given by:

$$t_{trip} = \text{Te In}\left(\frac{\left|K^2 - \theta\right|}{\left|K^2 - \theta trip\right|}\right)$$

Where:

t_{trip} = Tripping time (in seconds)

Te = Thermal time constant of the protected element (in seconds)

K = Thermal overload equal to $I_{eq}/(k^*I\theta >)$

I_{eq} = Equivalent current corresponding to the R.M.S. value of the largest phase current.

$I\theta >$ = Full load current rating given by the national standard or by the supplier.

k = Constant associated with the thermal state formula (1.05).

θ = Initial thermal state. If the initial thermal state = 30% then $\theta = 0.3$

θ_{trip} = Trip thermal state. If the trip thermal state is set at 100%, then θ trip = 1

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The settings of these parameters are available in the menus:

PROTECTION G1/ [49] Therm OL

PROTECTION G2/ [49] Therm OL

The calculation of the thermal state is given by the following formula:

$$\Theta_{\tau+1} = \left(\frac{I_{eq}}{k \times I\Theta >}\right)^2 \left[1 - e^{\left(\frac{-t}{T_e}\right)}\right] + \Theta_\tau e^{\left(\frac{-t}{T_e}\right)}$$

θ being calculated every 20ms.

2.9.2 Setting Guidelines

The current setting is calculated as:

Thermal Trip (θ_{trip}) = permissible continuous loading of the plant equipment / CT ratio. Typical time constant values are given in the following tables. The ‘Time Constant’ parameter is given in minutes.

Paper-insulated lead sheathed cables or polyethylene insulated cables are placed above the ground or in conduits. The table shows τ in minutes, for different cable rated voltages and conductor cross-sections (CSA):

CSA mm^2	**6 - 11 kV**	**22 kV**	**33 kV**	**66 kV**
25 - 50	10	15	40	-
70 - 120	15	25	40	60
150	25	40	40	60
185	25	40	60	60
240	40	40	60	60
300	40	60	60	90
	Time constant τ (minutes)			

<u>Other plant items:</u>

	Time constant Te (minutes)	**Limits**
Dry-type transformers	40 60 - 90	Rating < 400 kVA Rating 400 - 800 kVA
Air-core reactors	40	
Capacitor banks	10	
Overhead lines	10	Cross section ≥ 100 mm^2 Cu or 150mm^2 Al
Busbars	60	

An alarm can be raised when reaching a thermal state corresponding to a percentage of the trip threshold. A typical setting might be ‘Thermal Trip’ = 70% of thermal capacity.

2.10 Cold Load Pick-Up

The Cold Load Pick-up feature allows selected settings of VAMP 11F relays to be changed to react to temporary overload conditions that may occur during cold starts. This condition may happen by switching on large heating loads after a sufficient cooling period, or loads that draw high initial starting currents.

When a feeder is energized, the current levels that flow for a period of time following energizing may differ greatly from the normal load levels. Consequently, overcurrent settings that have been applied to give short circuit protection may not be suitable during this period.

The Cold Load Pick-up (CLPU) logic raises the settings of selected stages for a set duration (tCL). This allows the protection settings to be set closer to the load profile. Cold load pick-up cannot restart until the end of tCL duration. The CLPU logic provides stability, without compromising protection performance during starting.

The CLP can be started by a digital logic Input Cold Load PU (***Cold Load PU? 1: Cur+Input*** or ***Cold Load PU? 2: Input*** (**ABE**)) which can be assigned to 52a CB status or by current stages logic (***Cold Load PU? 1: Cur+Input***). If the Cold Load PU logic has to be triggered by current criteria only, ***Cold Load PU Input*** (**ABE**) function must not be configured to any digital input. Typically ***Cold Load PU*** (**ABE**) binary Input is wired to 52A CB status. If this function is configured to selected input, both criteria will work in parallel way.

The following diagram shows the logic start for CLPU:

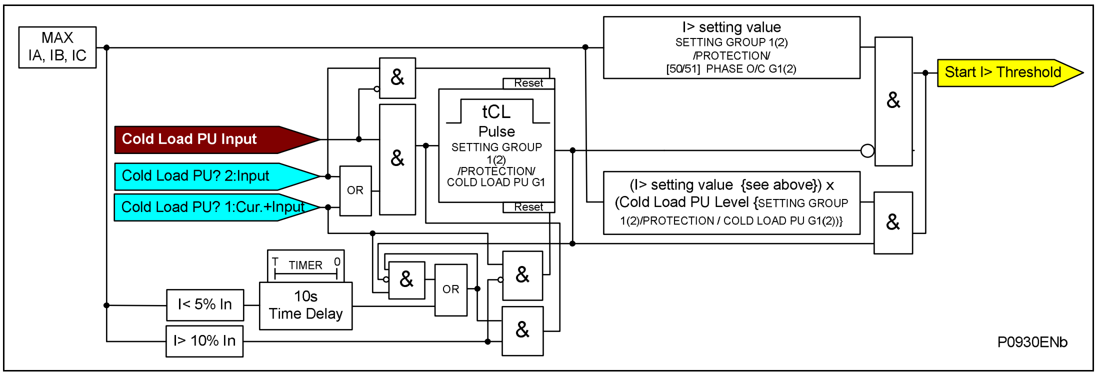

Figure 11: Cold Load Pick-Up Logic

2.10.1 Example of Application for Earth Fault Protection Applied to Transformers

Where an earth fault relay is residually connected on the primary side of a delta-star transformer, no time-delay is required for co-ordination purposes, due to the presence of the delta winding. However, a nominal time-delay or stabilizing resistor is recommended, to ensure transient stability during transformer energizing.

The CLPU logic may be used in a similar manner to that previously described for the motor application.

This method will not provide stability in the event of asymmetric CT saturation (as a result of an unbalanced fault condition). In this case, use a stabilizing resistor.

2.11 Switch On To Fault / Trip On Reclose Protection (Model A, B, E)

2.11.1 General

In some feeder applications, fast tripping may be required if a fault is still present on the feeder after the reclosure of the circuit breaker (Close on to fault).

Some faults may not be cleared after a reclose due to the fact that the conditions that led to the fault have not been removed from the feeder after a reclosing cycle or a manual trip, or due to earthing clamps left on after a maintenance visit. In these cases, it may be desirable to clear the fault more quickly, rather than wait for the DMT or IDMT trip time-delay associated with the involved protection to elapse.

In the case of a CB being manually closed, a switch on to an existing fault may occur. This situation is particularly critical because the overcurrent protection element would not clear the fault until the set time-delay has elapsed. It is then desirable to clear the fault as fast as possible.

Enabling and setting the SOTF (Switch On To Fault) function can be done under the ***SETTING GROUP x/PROTECTION Gx/SOTF*** submenu.

Crossing of SOTF threshold will initiate the SOTF function.

2.11.2 SOTF description

The following signals can activate the SOTF function:

- closing by Input ***(Manual Close Input)***,
- manual closing controlled by the HMI, (***Close key order***),
- front panel communication control (***HMI order***),
- rear communication control (***Rear Com order***),

The diagram below illustrates this functionality.

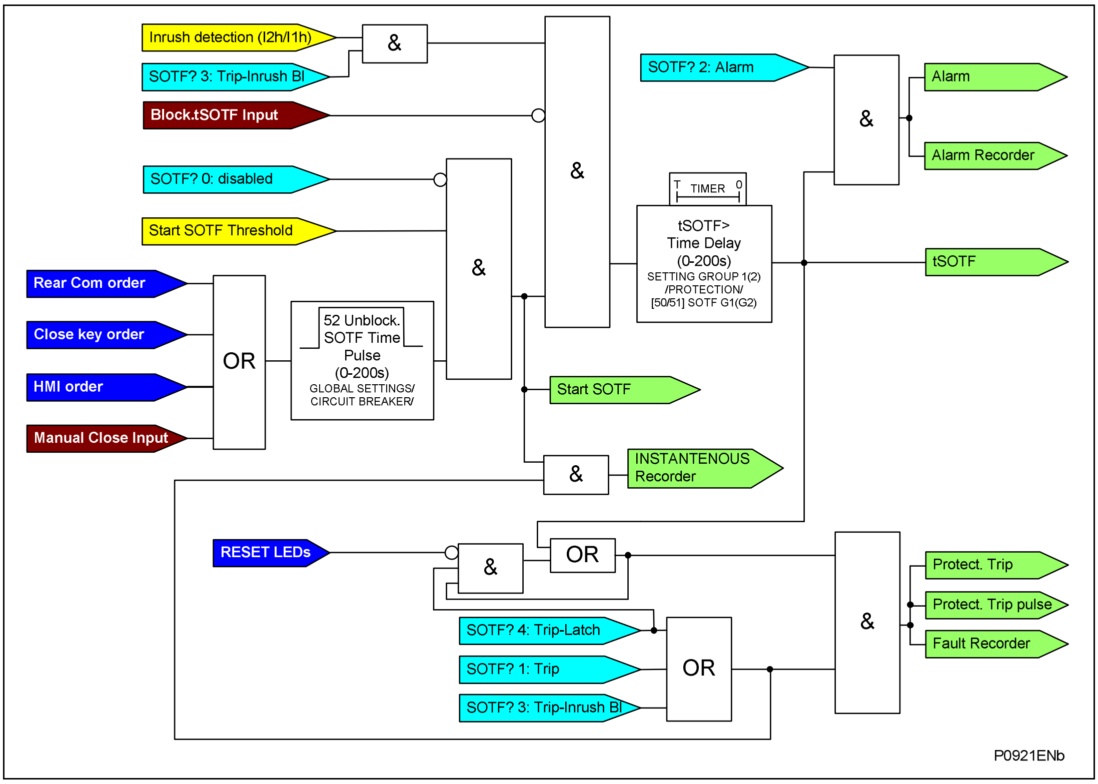

Figure 12: SOTF Logic Diagram

When at least one of the selected signals has been detected, a ***52 Ublock.SOTF Time*** (***GLOBAL SETTINGS/ CIRCUIT BREAKER/ 52 Unblock.SOTF Time*** submenu) timer starts to activates SOTF protection element.

Once this timer (***52 Ublock.SOTF Time***) is active and SOTF thresholds have been crossed, the ***tSOTF*** settable time-delay starts. This settable time-delay is particularly useful in applications where fault selectivity in stages two or three is required.

This time-delay (***tSOTF***) is also useful in cases where serious transients may be present, where the three poles of the CB do not all close at the same time and in cases where the CB may not close instantaneously.

tSOTF can also be considered as a trip time-delay that substitutes itself to the trip time-delay associated with the crossed threshold so that the tripping time is accelerated.

If a trip due to switch on to fault occurs during the reclaim time of the ARC, the trip will be final and the ARC will be locked.

If the SOTF stage is reset before the settable time-delay ***tSOTF*** elapses, the SOTF function is reset.

2.12 LOCAL / REMOTE MODE (Model A and E)

2.12.1 General

The goal of this feature is to make it possible to block commands sent remotely through communication networks (such as setting parameters, control commands, etc.), so as to prevent any accidents or maloperation during maintenance work performed on site.

A digital input labeled "***Local CTRL mode***" is assigned to this feature. In Local mode, only the synchronizing time signal is allowed.

The local mode can also be set in default CTRL mode cell. The Local/Remote mode state is displayed in this cell.

2.12.2 Setting

The Remote Mode state can be set in the ***GLOBAL SETTINGS/CIRCUIT BREAKER/ Remote CTRL Mode*** cell:

- ***0: Remote only*** – Local control via an input or/and the HMI or/and the Close/Trip key are blocked.
- ***1: Remote + LOC*** – Local and Remote control are permitted.

Note: The auto-recloser is not blocked via the Local/Remote Mode.

When the "Local" input is energized, all remote commands are blocked. When the "Local" input is de-energized, remote control commands are accepted.

If local/remote switching has to be done outside of the V11F, the output configuration can be as follows (Figure 13):

- the protection trip is assigned to the ***Prot.Trip pulse*** output,
- the remote close command is assigned to the ***Close CB Order*** output,
- the remote trip command is assigned to the ***Trip CB Order*** output.

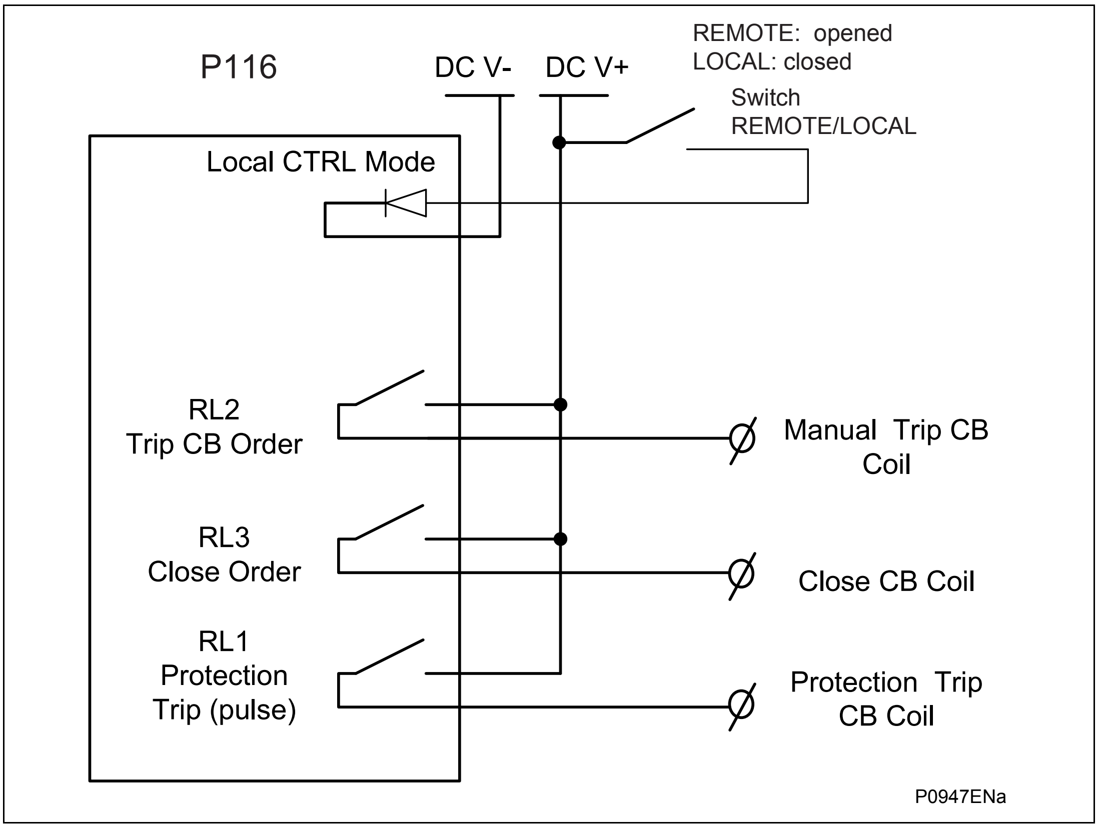

Figure 13: Example of Local/Remote Application

If separate output contacts for remote and local commands are required because external Local/Remote switching is used, commands sent remotely should be assigned to:

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- ***Comm.Order1*** for a remote trip command,

- ***Comm.Order2*** for a remote close command,

The protection trip is assigned to the ***Prot.Trip pulse*** output.

The Local Trip (HMI, Input, Trip key) is assigned to the ***Trip CB Order*** output.

The Local Close (HMI, Input, Trip key) and the Auto-reclose function are assigned to the ***Close CB Order*** output.

Example for the above application:

In the following scheme (Figure 14), the user may assign the different signals to different relays: "TRIP" signal may be assigned to the trip relay (***Prot.Trip pulse*** and ***Trip CB Order)***, the ***Comm.Order1*** (remote trip) signal to the auxiliary relay number 2, the ***Close CB Order*** signal to the auxiliary relay number 3 and the ***Comm.Order2*** (remote close) to the auxiliary relay number 4.

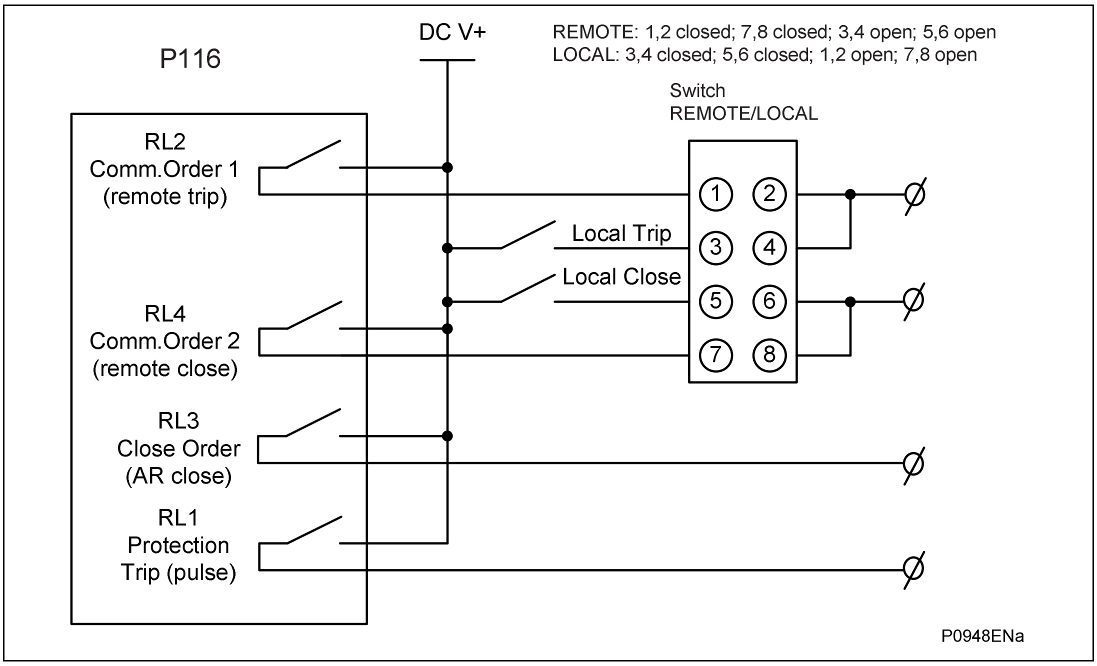

Figure 14: Example of Local/Remote Application

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2.13 Selective scheme logic (Model E)

The following figure describes the use of non-cascade protection schemes using the start contacts from downstream relays to block operation of upstream relays.

In the case of Selective Overcurrent Logic (SOL), the start contacts are used to increase the time-delays of upstream relays, instead of blocking them. This provides an alternative approach to achieving a non-cascade type of overcurrent scheme. It may be more familiar to some utilities than the blocked overcurrent arrangement.

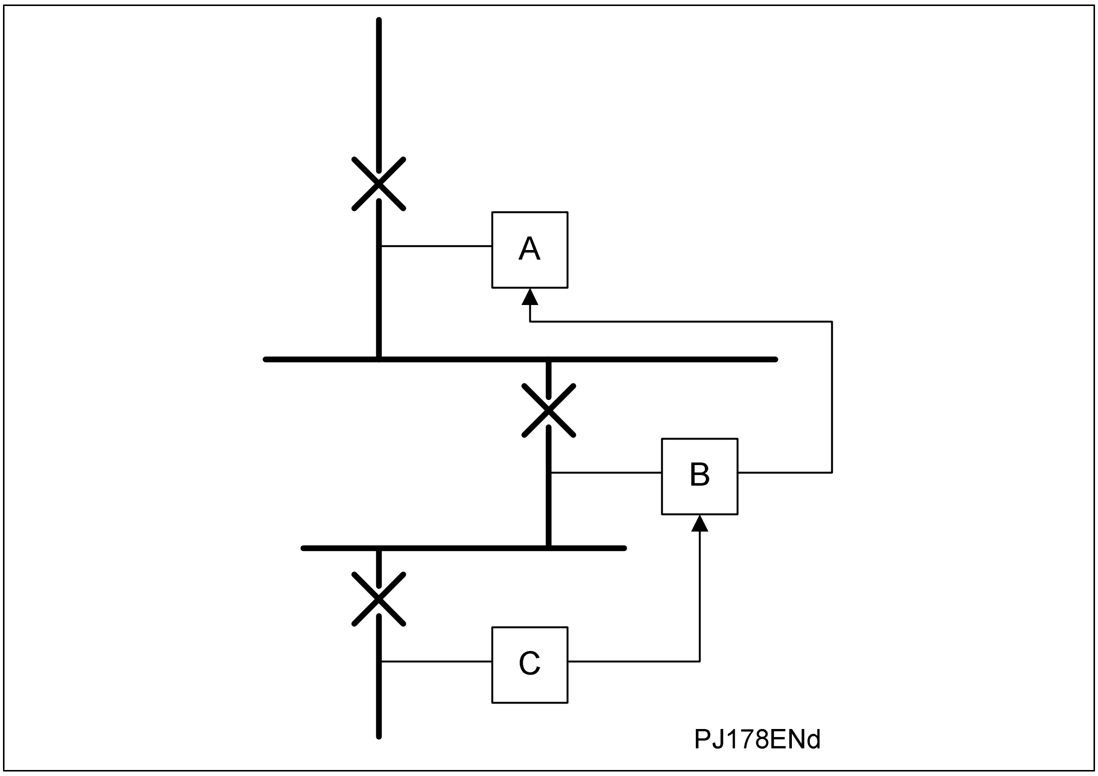

Figure 15: TYPICAL SCHEME LOGIC

The SOL function temporarily increases the time-delay settings of the second and third stages of phase overcurrent, derived and measured earth fault and sensitive earth fault protection elements. This logic is initiated by energizing the appropriate logic input (***SEL1*** or ***SEL2***) as selected in ***SETTING GROUP x/INPUTS CONFIGURATION Gx*** menu.

To allow time for a start contact to initiate a change of setting, the time settings of the second and third stages should include a nominal delay. Guidelines for minimum time settings are identical to those given for blocked overcurrent schemes.

The tSel1 and tSel2 timers can be independently set from 0 to 200 s (***SETTING GROUP x/PROTECTION Gx/LOGIC SELECT. Gx*** menu).

2.14 Auxiliary timers (available in B, A and E)

Four auxiliary timers tAux1, tAux2, tAux3, tAux4 are available and associated with Aux1, Aux2, Aux3, Aux4 logic inputs (refer to ***SETTING GROUP x/INPUTS CONFIGURATION Gx*** menu). When these inputs are energized, the associated timers start and, when the set time has elapsed, the associated output relays close (refer to ***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx*** menu). Time-delays can be independently set from 0 ms to 600 s (***SETTING GROUP x/PROTECTION Gx/AUX TIMERS Gx*** menu).

AUX function can be configured to:

- Trip CB (***Protect.Trip***, ***Prot.Trip pulse***, Disturbance and Fault Recorder, **TRIP** LED and FLAG)
- Alarm signal (***Alarm***, ***Alarm*** LED),
- Trip CB with Inrush blocking (***Protect.Trip***, ***Prot.Trip pulse***, Disturbance and Fault Recorder, **TRIP** LED and FLAG)
- Trip CB with latching up to signaling reset (***Protect.Trip***, ***Prot.Trip pulse***, Disturbance and Fault Recorder, **TRIP** LED and FLAG)
- Load Shedding triggered via AUX input (***Trip CB Order),*** tAUX is time-delay for trip,
- Auto-reclose after Load Shedding triggered via AUX input (high level); tAUX is time-delay for close ***(Close CB Order)***,
- Auto-reclose after Load Shedding triggered via AUX input (low level); tAUX is time-delay for close ***(Close CB Order)***,

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For more details about: Trip CB, Alarm signal, Trip with Inrush blocking, Trip CB with latching refer to the Operation Chapter (V11F/EN OP)

AUX and ***tAUX*** signal can be assigned to LEDs or outputs.

AUX1, ***AUX2*** and ***AUX3*** can be blocked via binary input assigned to the ***Block.AUXn*** output.

Binary Inputs can be configured to AUX5 and AUX6. These AUX functions have no timers and can be used as logic bridge between inputs and: LEDs and/or outputs.

An example of Load Shedding and Auto-reclose after Load Shedding logic is shown: Figure 16.

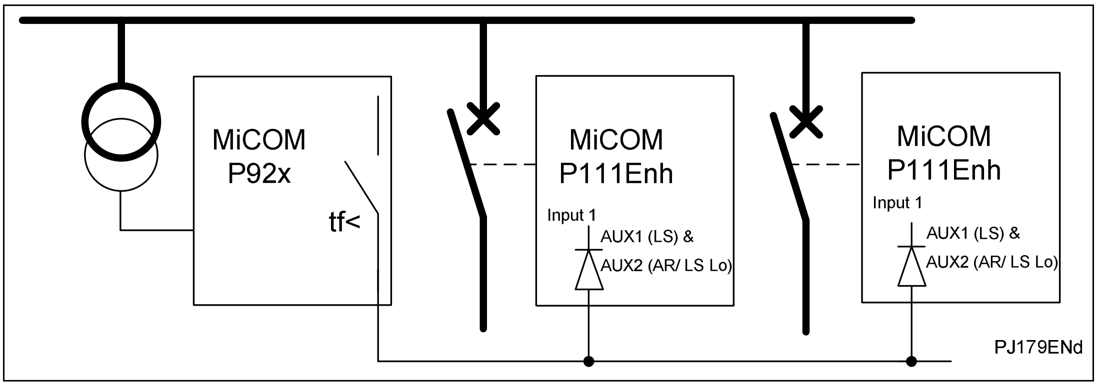

Figure 16: An example: Load Shedding and Auto-reclose after Load Shedding logic. Separate inputs for: LS (AUX1) and AR after LS (AUX2)

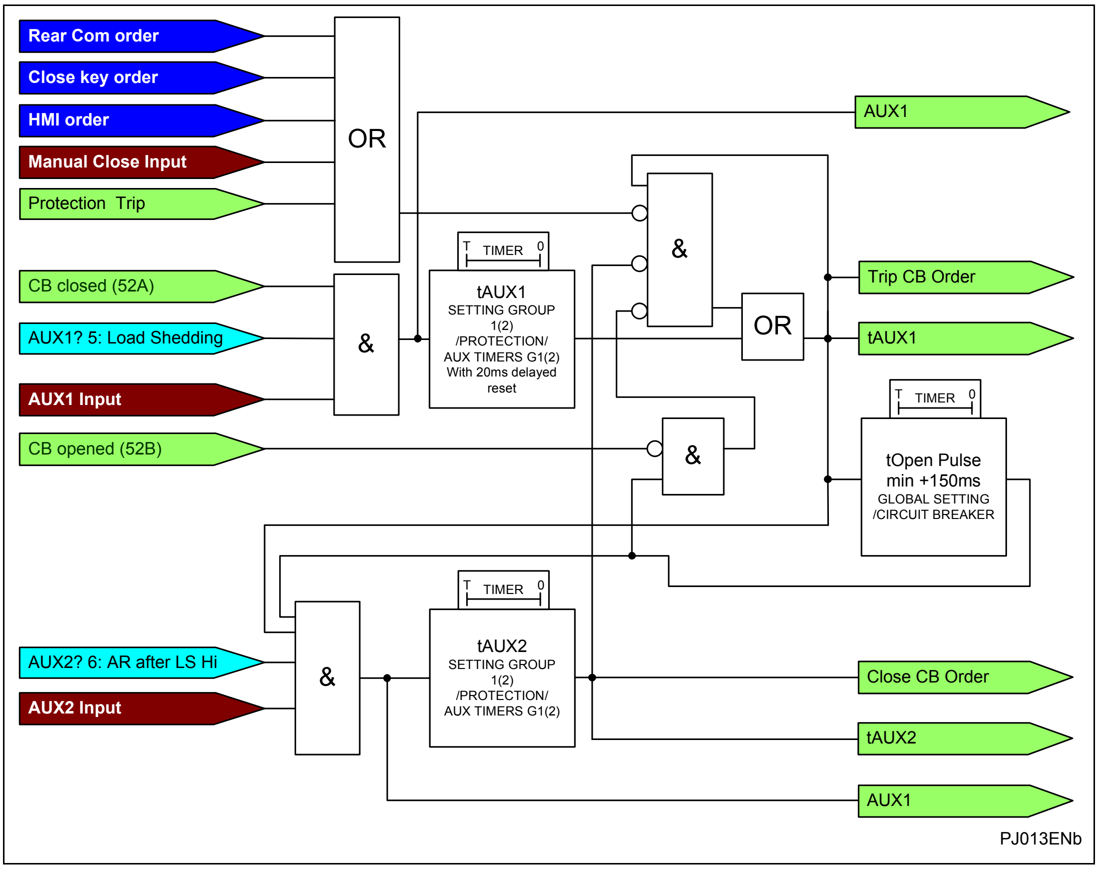

Figure 17: Load Shedding and Auto-reclose after Load Shedding logic. Separate inputs for: LS (AUX1) and auto-reclose after LS (AUX2) (for example: Input 1 configured to AUX1, Input 2 to AUX2) – see Figure 16

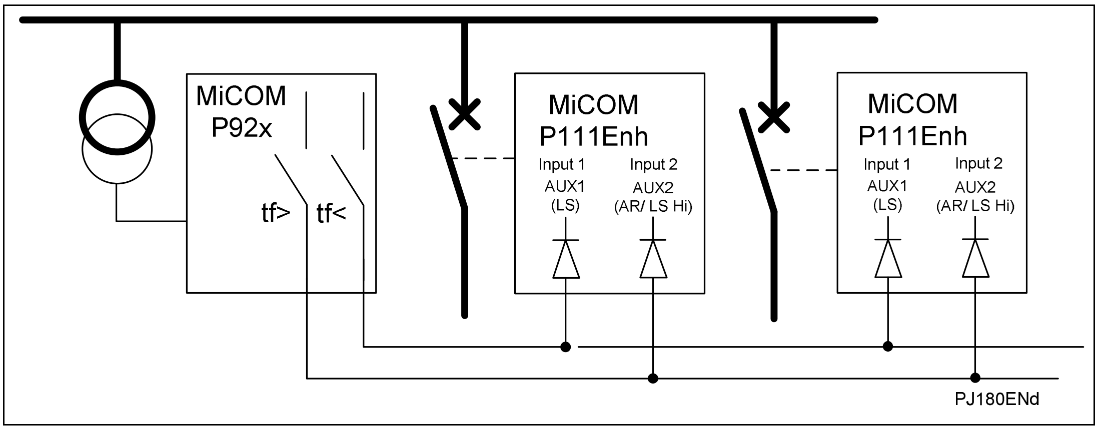

Figure 18: An example: Load Shedding and Auto-reclose after Load Shedding logic. Separate inputs for: LS (AUX1) and auto-reclose after LS (AUX2)

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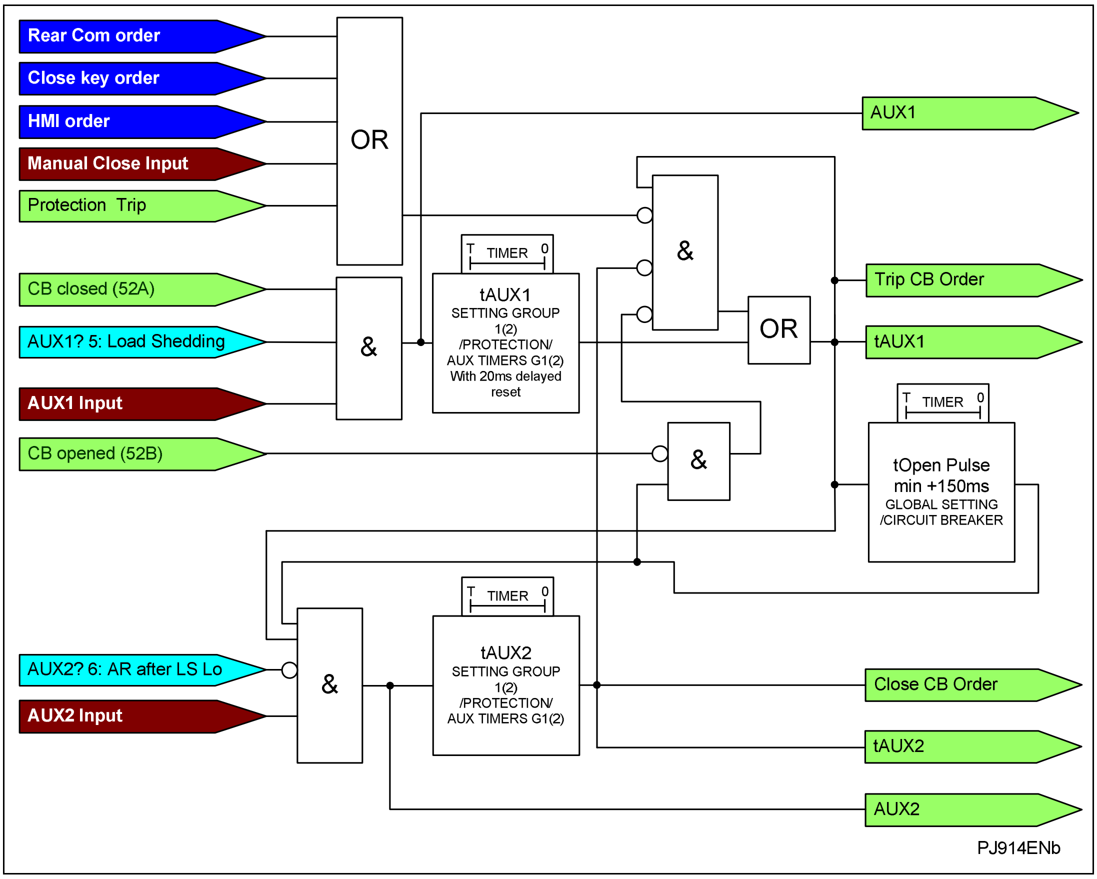

Figure 19: Load Shedding and Auto-reclose after Load Shedding logic. The same input for: LS (AUX1) and AR after LS (AUX2) (for example: Input 1 configured to AUX1 and AUX2) - see Figure 18

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2.15 Setting Group Selection

VAMP 11F relays have two protection setting groups called PROTECTION G1 and PROTECTION G2. Only a one group is active at any time.

If a group is used in an application it is possible to remove the other group from the menu in order to simplify the setting procedure. If one group only is chosen the relay uses Group 1 even if the other parameters are set to Group 2 (Inputs, Menu, Remote Group Setting).

The selection of the number of groups is done at ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Number of Groups: 1: One Group*** or ***2: Two Groups.***

If ***1: One Group*** is selected, the ***SETTING GROUP 2*** column and the setting group cell are hidden in menu.

Switching between the groups can be done via:

- a selected binary input (**ABE**) assigned to the **Setting Group 2** logic input (***SETTING GROUP x/INPUTS CONFIGURATION Gx*** submenu),
- the relay front panel interface (***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group: 1: Group1*** or ***2: Group2***),
- through the communications port (refer to Mapping Database for detailed information).

Switching between setting groups can be done even while a protection function is active (no timers are resetting).

The user can check which one of the setting groups is active looking in the ***OP PARAMETERS*** menu: ***Active Set Group*** cell.

The user can also assign the active group (***Setting Group x*** function) to an output relay (***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx***) or to an LED (***SETTING GROUP x/LEDs CONFIGURATION G1***).

Setting group change via a digital input

It is possible to change the setting group by energizing a digital input (**ABE**) (on level).

If the setting group switchover is done via a binary input (**ABE**), the change from Group 1 to Group 2 is executed after the set time-delay: ***t Change Setting G1->G2*** (***GLOBAL SETTINGS/SETTING GROUP SELECT***) (**ABE**). The switch from Group 2 back to Group 1 is instantaneous.

Switch between Active Groups via a Binary Input (ABE**)**

When powering up the relay, the selected group (Group 1 or Group 2) corresponds to the state of the logic input assigned to ***Setting Group 2***. This means:

A – ***Reverse Inp.Logic*** = 0 and ***Setting Group 2*** = 1
(***SETTING GROUP x/INPUTS CONFIGURATION Gx*** submenu),

If the programmed logic input starts being supplied with +V, then after the ***t Change Setting G1->G2*** time-delay the active group will be G2.
If the programmed logic input is not supplied with +V, then the active group will be G1.

B – ***Reverse Inp.Logic*** = 1 and ***Setting Group 2*** = 1
(***SETTING GROUP x/INPUTS CONFIGURATION Gx*** submenu),

If the programmed logic input is supplied with +V, then the active group will be G1.
If the programmed logic input stops being supplied with +V, then after the ***t Change Setting G1->G2*** time-delay the active group will be G2.

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Notes: 1. Binary Input configuration is associated with both Setting Groups, so that if in a Setting Group the selected binary input is assigned to ***Setting Group 2***, in the other group it must be set to ***Setting Group 2*** as well, otherwise no switch will occur.

2. If the V11F is powering up (from the currents or the auxiliary voltage) and Group 2 is selected via a binary input, the ***t Change Setting G1->G2*** time-delay is ignored (changing to setting group 2 is instantaneous – without time-delay).

3. The setting group switch is based on the level of the binary input. So as long as Setting Group 2's logic signal is high, the V11F uses Setting Group 2.

Switch between Active Groups via the Menu or a Remote Command (RS485, USB)

By using the relay front panel interface it is possible to change the active setting group: ***1: Group1*** or ***2: Group2*** (menu cell: ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group***).

Above menu cell is common for changing from panel interface and via remote command (RS485 or USB).

It means that if the ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** menu cell is set to ***1: Group1*** and the remote setting group 2 command is executed, the value of menu cell: ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** will be changed to ***2: Group2*** value (Active group: 2).

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Setting group 1 will be applied if:

- ***1: Group1*** is set in the ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** menu cell from the relay's front panel interface,

  or

- the remote setting group 1 command is executed. The value of the ***GLOBAL SETTINGS/SETTING GROUP SELECT/ Setting Group*** menu cell will then be changed to ***1: Group1***.

WARNING: If the digital input has been assigned to the setting group change, it is not possible to change the setting group via remote communications. If changing via Menu or RS485 is required ensure that no input is assigned to ***Setting Group 2***.

Priority

The detailed logic table for setting group selection is shown below:

Binary Input *Setting Group 2* (ABE)	Front Panel and Remote Setting	Active Group
Not configured	G1	G1
Not configured	G2	G2
G1	G1	G1
G1	G2	G1
G2	G1	G2
G2	G2	G2

Note: If a setting group change initiated by a remote command has not been effected due of priority settings, that command is ignored (not recorded in the V11F logic for the future, when priority settings allow changing).

It is possible to assign an Active Group state to an output contact by setting the output contact to the ***Setting Group x*** output (***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx***).

If Active Group signaling is required, some LEDs should be assigned to the ***Setting Group x*** function (***SETTING GROUP x/LEDs CONFIGURATION Gx***).

2.16 Maintenance Mode (Model A and E)

This menu allows the user to check the operation of the protection functions.

It is possible to set following ***Maintenance mode*** options (settings):

- "***No***" - ***Maintenance mode*** is disabled. All window cells below are hidden (***Maintenance mode*** is the latest cell in ***COMMISIONING*** column)
- "***Yes,outp.trips***" - ***Maintenance mode*** is enabled. In this mode all test cells in ***COMMISIONING*** column are shown. During tests outputs are energized.
- "***Yes,outp.block***" - ***Maintenance mode*** is enabled and all test cells in ***COMMISIONING*** column are shown. In this mode, the high state of output functions are ignored (control of outputs are blocked).

  This option allows the user to check the operation of the protection functions without actually sending any external command (Tripping or signalling).

Depends on the rear protocol selected in menu, transmission of information to SCADA is blocked (Modbus RTU) or sent (IEC 103) with additional information to know that V11F is in Maintenance mode (refer to Communication chapter and EN 60870-5-103 standard).

Changing of setting from "***No***" to "***Yes,….***" from the front panel activate this mode for 5 minutes only. After this time the option is automatically switched to "***No***".

The selection of the maintenance mode is possible by logic input (the level), control command (rear or front port), or by front panel interface. The maintenance mode is terminated by:

- Low state of logic input assigned to ***Maintenance mode*** function,
- Control command which activate this mode (rear command or setting: "***Yes,….***") and by turning off the power supply.

Note: Maintenance rear command is available in Modbus protocol only

When this menu is activated (set to: "***Yes,outp.trips***" or "***Yes,outp.block***"), the Alarm led is lit. Additionally it is possible to configure Maintenance Mode to programmable LED.

In "***Yes,outp.block***" case, all the output contacts are blocked, and no command can be issued to these contacts, even if a protection threshold associated with one of these output contacts has been crossed. (If a protection threshold is crossed, all associated LEDs will be ON, even the TRIP LED, if protection element is set to ***Trip***).

2.17 Negative Sequence Overcurrent Protection (Model E)

In traditional phase overcurrent protection schemes, overcurrent thresholds must be set above the maximum load current levels. This limits sensitivity of the relay. Most protection schemes also use an earth fault element based on residual current, which improves sensitivity for earth faults. However, it can happen that some faults occur and stay undetected by such schemes.

Any unbalanced fault condition will produce negative sequence current. Thus, a negative phase sequence overcurrent element can detect both phase-to-phase and phase-to-earth faults.

This section describes how negative phase sequence overcurrent protection may be applied in conjunction with standard overcurrent and earth fault protection in order to solve some application problems.

- Negative phase sequence overcurrent protection is more sensitive to resistive phase-to-phase faults than phase overcurrent elements, which may not operate.
- In some applications, an earth fault relay may not be able to detect a residual current because of the configuration of the network. For example, an earth fault relay connected on the delta side of a delta-star transformer is unable to detect earth faults on the star side. However, negative sequence current will be present on both sides of the transformer in any fault condition, independently of the transformer configuration. Therefore, negative phase sequence overcurrent element may be used to provide time-delayed back-up protection for any uncleared asymmetrical faults.
- Where fuses are used to protect motors on rotating machines, a blown fuse produces a large amount of negative sequence current. This is a dangerous condition for the machine because negative phase sequence current generates overheating. Then, a negative phase sequence overcurrent element may be used to back-up motor protection relays.
- It may also be required to trigger an alarm to announce the presence of negative phase sequence currents in the system. Operators are then prompted to investigate the cause of the unbalance.

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The negative phase sequence overcurrent elements have a current pick up setting, I2>, and can be time-delayed using configurable timer tI2>.

I2> stages can be set under the ***SETTING GROUP x/PROTECTION G1 (2)/[46] NEGATIVE SEQ. O/C*** menu column.

The current pick-up stage I2> must be set to a value that is higher than the normal negative phase sequence current because of the normal unbalance conditions on the network. This can be done practically during the commissioning, using the ***MEASUREMENTS*** menu of the relay to display the negative phase sequence current value. Then, this value has to be increased by 20%.

Where negative phase sequence element is used to clear particular cases of uncleared asymmetric faults, the stage setting have to be calculated based on a fault analysis of that particular system, due to the complexities involved. However, to ensure that the protection element will operate, the current pick-up value has to be set to approximately 20% below the lowest calculated negative phase sequence fault current for a specific remote fault.

It is essential to set correctly the time-delay associated with this function. It should also be noted that this element is used primarily as a back-up protection to other protective devices or to provide an alarm. Therefore, this function is usually set with a long time-delay.

Care must be made to ensure that the time-delay is set above the operating time of any other protection device (at minimum fault level) present on the system and that may react to unbalanced faults, such as:

- Phase overcurrent elements
- Earth fault elements
- Broken conductor elements

- Negative phase sequence influenced thermal protection elements

The tI2> time-delay associated with the I2> stage can be set under the menu ***SETTING GROUP x/PROTECTION G1 (2)/[46] NEGATIVE SEQ. O/C***.

2.18 Broken Conductor Detection (Model E)

Most of the faults that affect a power system occur between one phase and the earth or between two phases and the earth. These faults are shunt faults and are caused by lightning discharges and other overvoltages generating flashovers. They may also arise from birds on overhead lines or mechanical damage on underground cables, etc.

Such faults lead the current to increase appreciably and therefore they can easily be detected in most applications. Open circuit faults are a different type of faults that can happen in electrical networks. These faults can be caused by broken conductors, blown fuses or maloperation of a pole of a circuit-breaker.

Series faults will not lead to an increase in phase current and therefore they cannot easily be detected by common overcurrent relays. However, this type of fault produces an unbalance that creates negative phase sequence current, which can be detected.

The use of negative phase sequence overcurrent is then recommended to detect such faulty conditions. However, on lightly loaded lines, the value of the negative sequence current caused by a faulty condition may be very close to, or even inferior, to the full load steady state unbalance generated by CT errors, load unbalances, etc. As a consequence, a negative sequence protection element would not work for low level of loads.

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As a solution, the VAMP 11F have a protection element that measures the ratio between the negative and the positive phase sequence current (I2/I1). By using this ratio rather than only the measured I2, the relay will be able to detect a fault condition independently of the load level on the power system, since the ratio remains approximately constant whatever the variations in load current. It is then possible to have a more sensitive setting.

Note: The Broken Conductor function is inhibited if the value of the current flowing in each of the three phases is below ***Brkn Cond I< block*** undercurrent threshold (factory setting: 10% of the nominal current).

Setting Guidelines

On single point earthed power systems, there is a low zero sequence current flow and the ratio Is2/Is1 that flows is close to 100%. On power systems with multiple earthing, (assuming that the impedances in each sequence system are equals), the ratio I2/I1 will be equal to 50%.

It is possible to calculate the ratio I2/I1 corresponding to various system impedances, according to the following equations:

$$I_{1F} = \frac{E_g(Z_2+Z_0)}{Z_1Z_2+Z_1Z_0+Z_2Z_0}$$

$$I_{2F} = \frac{-E_gZ_0}{Z_1Z_2+Z_1Z_0+Z_2Z_0}$$

Where:

E_g = Power System Voltage
Z_0 = Zero sequence impedance
Z_1 = Positive sequence impedance
Z_2 = Negative sequence impedance

Therefore:

$$\frac{I_{2F}}{I_{1F}} = \frac{Z_0}{Z_0+Z_2}$$

As a consequence, for an open circuit in a particular part of the system, I2/I1 can be determined from the ratio between the zero sequence and the negative sequence impedance. It must be noted however that this ratio may vary depending on the location of the fault. It is therefore desirable to apply a setting that is as sensitive as possible. Practically, the levels of standing negative phase sequence current present on the system guide the choice of this minimum setting. A system study or the use of the relay's measurement data during commissioning are two ways to determine this minimum setting. If the latter method is chosen, it is important to record measurements during maximum load conditions, to ensure that all single-phase loads are taken into account.

A time-delay (tBCond) is necessary to ensure co-ordination with other protective devices.

2.18.1 Setting Example

The following information comes from a the relay commissioning report;

I_{FLC} = 500 A

I2= 50 A

Then:

I2/I1 = 50/500 = 0.1

To include some margin and tolerate load variations, it is typical to set this value 200% above this result: Therefore, RATIO I2/I1 = 20%

Set tBCond to 60 s to allow short circuits to be cleared by time-delayed protection elements.

2.19 Description and Setting Guide of the Auto-Reclose Function (Model E)

2.19.1 Introduction

An analysis of faults on overhead line network has shown that:

- 80-90% of faults are transient in nature,
- the remaining 10-20% of faults are either non-permanent (arcing faults) or permanent.

A transient fault is a self-clearing 'non-damage' fault. This type of fault can be isolated and cleared by the immediate tripping of one or more circuit breakers, and does not reappear when the line is re-energized. The most common causes of transient faults are lightning, insulator flashover, clashing conductors and debris blown by the wind.

The initial trip might not clear a non-permanent or permanent fault, and the use of the reclosing sequence could be necessary in order to clear it. A small tree branch falling on the line could cause a non-permanent fault. Permanent faults could be caused by broken conductors, transformer faults, cable faults or machine faults, which must be located and repaired before the supply can be restored.

Most of the time, if the faulty line is immediately opened, and the fault arc is allowed sufficient time to de-ionize, reclosing the circuit breakers will result in the line being successfully re-energized. Auto-reclosing schemes are used to automatically reclose a switching device once a time-delay started after the CB has opened has elapsed.

On HV/MV distribution networks, the Auto-reclose function is used mainly for radial feeders where system stability problems do not generally arise. Using the auto-recloser minimizes outage time and reduces operating costs.

Automatic reclosing allows a substation to operate unattended: the number of visits to manually reclose a circuit breaker is substantially reduced. This feature constitutes therefore an important advantage for substations supervised remotely.

On circuits using time-graded protection, the auto-recloser allows the use of instantaneous (fast) protection (***Fast O/C Trip*** function in ***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE Gx*** menu) to issue a high speed first trip. With fast tripping, the duration of the power arc resulting from an overhead line fault is reduced to a minimum, thus lessening the chance of damage and of the transient fault developing into a permanent fault. To avoid maloperation because of transients, it is possible to assign a short time-delay to the fast trip: **Fast O/C Trip Delay** setting (***SETTING GROUP x/PROTECTION Gx/[79] AUTORECLOSE Gx*** menu column) above the typical transient time value. The fast trip can be associated with phase-to-phase faults (***Fast O/C Trip)*** and/or earth faults (***Fast E/Gnd Trip***), separately for every shot in the auto-reclose sequence. If in ***Fast O/C Trip*** configuration the setting for chosen trip shot is ***' 0 '***, the trip is executed after the time-delay of the protection element. If it is set to ***' 1 '***, the time-delay set in the **Fast O/C Trip Delay** menu cell is applied. In some regions the typical setting of the fast trip for a 2-shot AR is set:

- ***Fast O/C Trip*** (trip shots): 00011 (The first and second trips with **Fast O/C Trip Delay** to reduce to minimum the resulting power arc; The third – final – trip after the time-delay of the protection element to ensure the grading in the power system – trip selectivity)
- ***Fast E/GND Trip*** (trip shots): 00000 (alls trips re executed after the time-delays of the protection elements).

Fast O/C Trip – refers to all O/C stages in the ***PHASE O/C*** menu column: ***I>, I>>, I>>>.***

Fast E/GND Trip – refers to all E/GND stages in the ***PHASE E/GND*** menu column: ***IN_1, IN_2, IN_3***.

Fast O/C (E/GND) Trip Delay is associated with a DMT characteristic even if the protection element is set to an IDMT characteristic. For the fast trip the reset time-delay of the protection element is not applied.

Using a short time-delay prevents the blowing of fuses and reduces circuit breaker maintenance by eliminating pre-arc heating when clearing transient faults.

The figure below shows an example of 4 auto-reclose cycles (maximum numbers of allowed cycles) until the final trip (tD1, tD2, tD3, tD4 = dead times 1, 2, 3 and 4, tR = Reclaim time).

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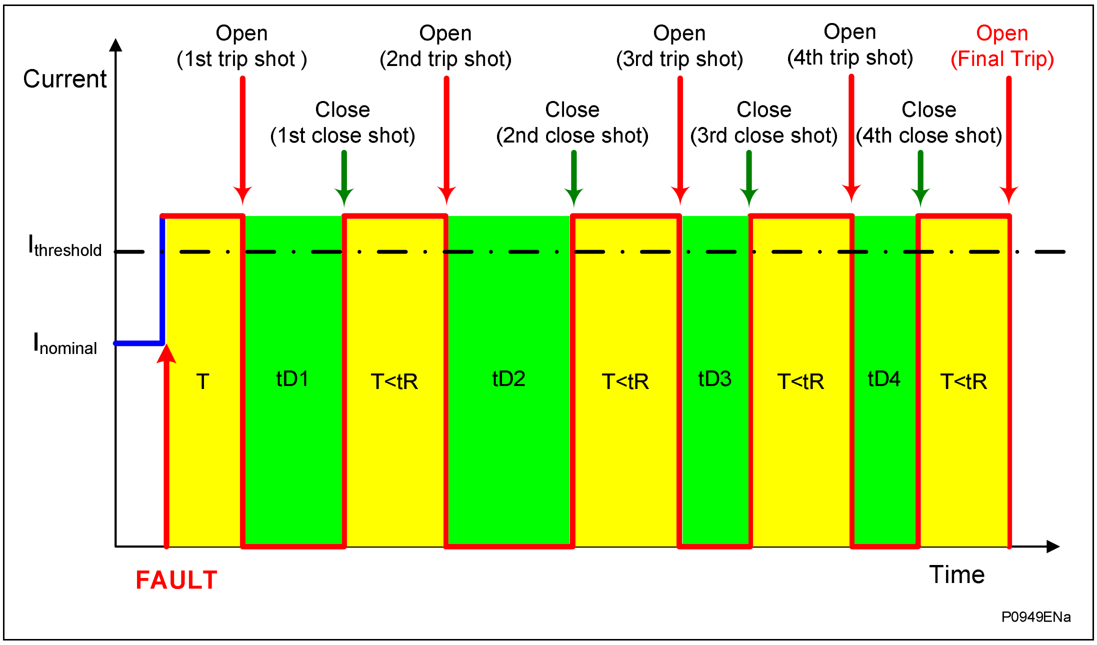

Figure 20: Typical Auto-Reclose Sequence

When short time-delay protection is used with auto-reclosing, the scheme can be arranged to block the instantaneous element after the first trip. Therefore, if the fault persists after re-closing, time-graded protection will issue discriminative tripping with fuses or other protection devices, resulting in the isolation of the faulted section. However, for certain applications, where the majority of the faults are likely to be transient, it is not uncommon to allow more than one instantaneous trip before instantaneous protection stops being applied or the time-delay for fast trip is set.

Some schemes allow a number of re-closings and time-graded trips after the first instantaneous trip, which may result in the burning out and clearance of non-permanent faults. Such an approach may also be used to allow fuses to operate in teed feeders where the fault current is low.

Any decision to apply the Auto-reclose function would be influenced by all known data about the frequency of transient faults (for instance feeders which consist partly of overhead lines and partly of underground cables). When a significant proportion of the faults are permanent, the advantages of auto-reclosing are small, particularly since re-closing on to a faulty cable is likely to compound the damage.

The auto-reclose function has four inputs that can be assigned to the auto-reclosing logic. These inputs can be mapped to opto-isolated inputs in the ***SETTING GROUP x/PROTECTION Gx/INPUT CONFIGURATION*** menu. External contacts can then be wired to these inputs and influence the auto-recloser scheme. These four logic inputs are:

- one external CB Faulty signaling,
- two external starting commands,
- one external blocking command.

The following table gives the “AUTOMAT.CTRL/Inputs” menu assigned to the auto-reclose logic input.

	***INPUT CONFIGURATION Gx* submenu:**	***AUTO-RECLOSE Gx* submenu enabled with:**	***[79] ADVANCED SETTING* submenu enabled with:**
External CB faulty signaling	***CB FLT Ext.Sign.***		***CB FLT Monitor.? 1:Yes***
External starting commands	**AUX1** (Note: ***AUX1*** timer should be set to ***Trip***)	***Close Shot ? 4321*** ***tAUX1 1111*** (‘1’ – means that closing is enabled)	
External starting commands	**AUX2** (Note: ***AUX2*** timer should be set to ***Trip***)	***Close Shot ? 4321*** ***tAUX2 1111*** (‘1’ – means that closing is enabled)	
External blocking command	***Block 79***		***Block.via Input? 1: Yes***

2.19.1.1 External CB Fail signaling

Most of circuit breakers provide one trip-close-trip cycle. A time-delay is necessary for the CT to return to its nominal state (for example, the spring that allows the circuit breaker to close should be fully charged). The state of the CB can be checked using an input assigned to the ***CB FLT Ext.Sign.*** function. If, on completion of the **tCB FLT ext** time (***GLOBAL SETTINGS/CIRCUIT BREAKER*** submenu), the **CB FLT ext** (Alarm) indicates a failed state of the CB, a lockout occurs and the CB remains open.

2.19.1.2 External Starting Commands

Two independent and programmable inputs (AUX1 and AUX2) can be used to initiate the auto-reclose function from an external device (such as an existing overcurrent relay). These logic inputs may be used both independently and in parallel with the overcurrent elements.

Notes:

1. The input must be assigned to an AUXx function (***SETTING GROUPx/INPUT CONFIGURATION Gx***),
2. AUXx must be set to ***Trip*** (***SETTING GROUP x/PROTECTION Gx/AUX TIMERS Gx/AUXx?***) and time-delay tAUXx must be configured (instantaneous: ***tAUXx*** set to 0 s),
3. The ***tAUXx Close Shot*** cell must be set for every cycle (Close shot).

2.19.1.3 Internal and External Blocking Commands

The auto-recloser can be blocked by an internal or an external control. It can be used when a protection is needed without requiring the use of the auto-recloser function.

The external block is the ***Block [79]*** input.

The internal block can be a final trip, a number of [79] rolling demand valid or an [79] conflict.

A typical example is on a transformer feeder, where the Auto-reclose may be initiated from the feeder protection but need to be blocked from the transformer protection side.

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2.19.2 Auto-reclose Output Information

The following output signals can be mapped to an LED (see ***SETTING GROUP x /LEDS CONFIGURATION Gx*** menu) or to output relays (see ***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx*** menu) in order to provide information about the status of the auto-reclose cycle:

- Auto-reclose cycle in progress
- Final Trip
- Internal block
- External block
- Auto-reclose successful

The following table gives the ***SETTING GROUP x /LEDS CONFIGURATION Gx*** and the ***SETTING GROUP x/OUTPUT RELAYS CONFIGURATION Gx*** menus used to assign the auto-reclose output signal.

	LEDs menu	Output relays menu
Auto-reclose in progress	***79 in Progress***	***79 in Progress***
Final Trip	***79 Trip Final***	***79 Trip Final***
Internal block	***79 Lockout***	***79 Lockout***
External block	***79 Blocked***	***79 Blocked***
Auto-reclose successful	***79 Success.***	***79 Success.***

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2.19.2.1 Auto-reclose in progress

The “Auto-reclose in progress” signal is present during the complete reclosing cycles from protection initiation to the end of the reclaim time or lockout.

2.19.2.2 Final trip

The "Final trip" signal indicates that a complete auto-reclose cycle has been performed and that the fault has been cleared.

The "Final trip" signal can be reset after a manual closing of the CB after the settable ***Inhibit Time tI on Close*** (***GLOBAL SETTINGS/ [79] ADVANCED SETTING***) time-delay or reset via a Reset Command

2.19.3 Auto-reclose Logic Description

The auto-reclose function makes it possible to automatically control the CB's reclosing cycles (two, three or four shot cycle, settable using the ***Close Shot ?*** parameter – separate for each O/C and E/GND protection element (***SETTING GROUP x/PROTECTION Gx/[79] AUTO-RECLOSE Gx*** menu).

Dead times for all the shots (reclose attempts) can be independently adjusted.

The number of shots is directly related to the type of faults likely to occur on the system and the voltage level of the system (for instance medium voltage networks).

The Dead Time (tD1, tD2, tD3 and tD4) and the minimum drop-off time start when the CB has tripped (when the 52a input has dropped off – ***Start Dead t on 1: CB trips*** or the protection element has reset – ***Start Dead t on 0: Protect.Reset*** configuration option). The Dead Time is set to initiate the auto-recloser when the circuit breaker is opened.

At the end of the relevant dead time the close command (***Close CB Order***) is executed and the CB supervision timer is started. The length of this timer is equal to: ***tClose Pulse*** (***GLOBAL SETTINGS/CIRCUIT BREAKER***) + 150 ms. If the CB is not closed after this time-delay, the auto-recloser is locked out and Alarm is issued (***Alarm CB Time Monitor***).

The reclaim time (***Reclaim Time tR***) starts when the CB has closed. If the circuit breaker does not trip again, the Auto-reclose function resets at the end of the reclaim time.

If a protection element operates during the reclaim time, the relay either advances to the next shot programmed in the auto-reclose cycle, or it locks out (see ***Inhib.Trip*** function description).

The total number of reclosures is displayed in the ***RECORDS/ COUNTERS/ AUTORECLOSE COUNTER*** menu cell.

2.19.4 Auto-reclose ***Inhibit Trip***

The trip inhibit is used for following cases:

- e/f protection in neutral-insulated or compensated systems. The A/R can clear a non-permanent fault in the first cycles. If it will be permanent fault, there will be no the final trip up to reset of the protection trip.
- application where for example the setting for the I> stage covers more than the protected zone, so that the [79] can clear faults downstream too, but the final trip will be executed by the downstream relay or a fuse, therefore in the upstream relay, tI> should be inhibited – waiting for tI>> trip of the downstream relay).
  Note: for this case ***Fast Trip O/C*** function can be used too (see below).

It is recommended to set another protection stage with setting for Alarm only, to inform that this fault was not cleared by autorecloser so it's still present (tripping from this protection element is inhibited). For above case when the auto-reclose is successful, the reset of inhibition is applied after reset of protection stage (current below the stage value).
For another case when during inhibition of protection element, another protection element (set to run [79]) makes a trip after going to the next cycle (the next A/R close command is executed) the inhibition is reset and the further action depends on the configuration:

- if in the next cycle this protection element is still set with inhibition, the protection element is still inhibited
- if in the next cycle this protection element is not set with inhibition, but the fault is still not cleared, this protection element will trip CB (If another protection element moves auto-reclose to the next cycle, the inhibition is removed automatically and [79]logic checks configuration for the next [79] shot).

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2.19.5 Auto-reclose Inhibit after Manual Closing

The ***Inhibit Time tI on Close*** timer (***GLOBAL SETTINGS/ [79] ADVANCED SETTING)*** can be used to block the auto-reclose cycle being initiated after the CB has been manually closed onto a fault. The Auto-reclose is blocked for the duration of ***Inhibit Time tI on Close*** after a manual CB Closure (The blocking indication: ***[79] blocked***, the reason of blocking: ***[79] Tempor.Block***).

2.19.6 Recloser lockout

If a protection element operates during the reclaim time, following the final reclose attempt, the relay will lockout and the auto-reclose function will be disabled until the lockout condition is reset.

The lockout condition can be reset by a manual closure after the ***Inhibit Time tI on Close*** timer elapses.

The auto-recloser can also be locked out using a ***CB FLT Ext.Sign.*** input. This information can be issued from the "not charged" or "Low gas pressure" indications of CB springs.

Note that the auto-recloser can also be locked out by:

- The fact that the CB does not open after the tBF delay (CB Fail) elapses,
- An operating time longer than the set thresholds,
- Local or remote manual Close or Open command when the auto-reclose is in progress,
- The Rolling Demand function detects too many auto-reclose shots.

In the lockout condition the ALARM with the cause: ***ALARM [79] Lockout*** is displayed up to reset of the lockout condition.

2.19.7 CB monitoring logic detects abnormal CB position (opened and closed, or not opened and not closed) for longer than set: ***Max CB Close*** or ***Max CB Open*** time.

2.19.8 Setting Group Change

During the auto-reclose cycle, if the relay receives a command to switch setting groups, it is executed immediately upon the end of the current A/R cycle.

2.19.9 Rolling demand

This specific counter avoids frequent operations of a CB in case of intermittent faults. The number of shots can be set from 2 to 100 in the cell ***Max cycles Nb Rol.Demand***, settable over a time period (***GLOBAL SETTINGS/ [79] ADVANCED SETTING /Time period Rol.Demand***) from 1 min to 24 hours.

The rolling demand is used when a defined number of successful recloses are performed over a defined time. If it is happened auto-reclose function is Lockout and he ALARM with the cause: ***ALARM [79] Roll.Demand*** is displayed up to reset the lockout condition.

If after ***Alarm [79] Rolling Demand*** signaling, the lockout condition reset is applied, the recorded number of rolling demand shots are cleared

2.19.10 Signaling Reset after Close via 79

In the ***GLOBAL SETTINGS/ [79] ADVANCED SETTING*** menu it is possible to set the signaling reset after a close command executed by the auto-recloser. If ***Signaling Reset*** is set to **1: Close via 79**, after the auto-recloser's close shot (confirmed by the 52a CB status), signaling (LEDs, display) of the last trip before the close shot is reset:

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- Latched LEDs
- Trip information on the V11F front panel
- Electromagnetic Flag Indicators on the Front Panel
- Latched outputs

This function signals the final trip only and clears signaling if the CB remains closed (Auto-reclose is successful). This function is recommended if the V11F is integrated into a SCADA system or if the substation is rarely supervised by maintenance personnel. In this case it is not necessary to clear signaling if the fault has disappeared and the line is healthy.

Note: Reset of signaling and of latched outputs can be done using the General resetting function.

This configuration can be set in the ***GLOBAL SETTINGS/LOC*** submenu:

- LEDs Reset:
    - ***0: Manual only*** (via Inputs, HMI 0 key, Remote Reset command)
    - ***1: Start protect.*** (Start of the protection element set to Trip)
- Ltchd Outp. Reset:
    - ***0: Manual only*** (via Inputs, HMI 0 key, Remote Reset command)
    - ***1: Start protect.*** (Start of the protection element set to Trip)

The ***Manual only*** option prevents a close command from being issued without readout of the cause of trip by maintenance personnel. It reduces the risk to switch on to fault.

The ***Start protect*** option allows signaling of the latest trip only.

2.19.11 Setting Guidelines

2.19.11.1 Number Of Shots

There is no perfect rule to define the number of shots for a particular application.

In medium voltage systems it is common to use two or three auto-reclose shots, and, for specific applications, four shots. Using four shots, the final dead time can be set to a time long enough to allow thunderstorms to end before the final reclosure. This scheme prevents unnecessary lockout caused by consecutive transient faults.

Typically, the first trip, and sometimes the second, are caused by the instantaneous protection element. Since 80% of faults are transient, further trips will be time-delayed, and all will have increasing dead times so as to clear non-permanent faults.

In order to determine the required number of shots, the first factor is the ability for the circuit breaker to perform several trip-close operations in a short time and the effect of these operations on the maintenance period.

If a moderate percentage of non-permanent faults are present in a system, two or more shots are justified. If fused ‘tees’ are used and the fault level is low, the timer of the fuses may not discriminate with the main IDMT relay: several shots are useful. This would not warm up the fuse to such an extent that it would eventually blow before the main protection element operated.

2.19.11.2 Dead Time Setting

Load, circuit breaker, fault de-ionizing time and protection reset are taken into consideration when setting the dead time.

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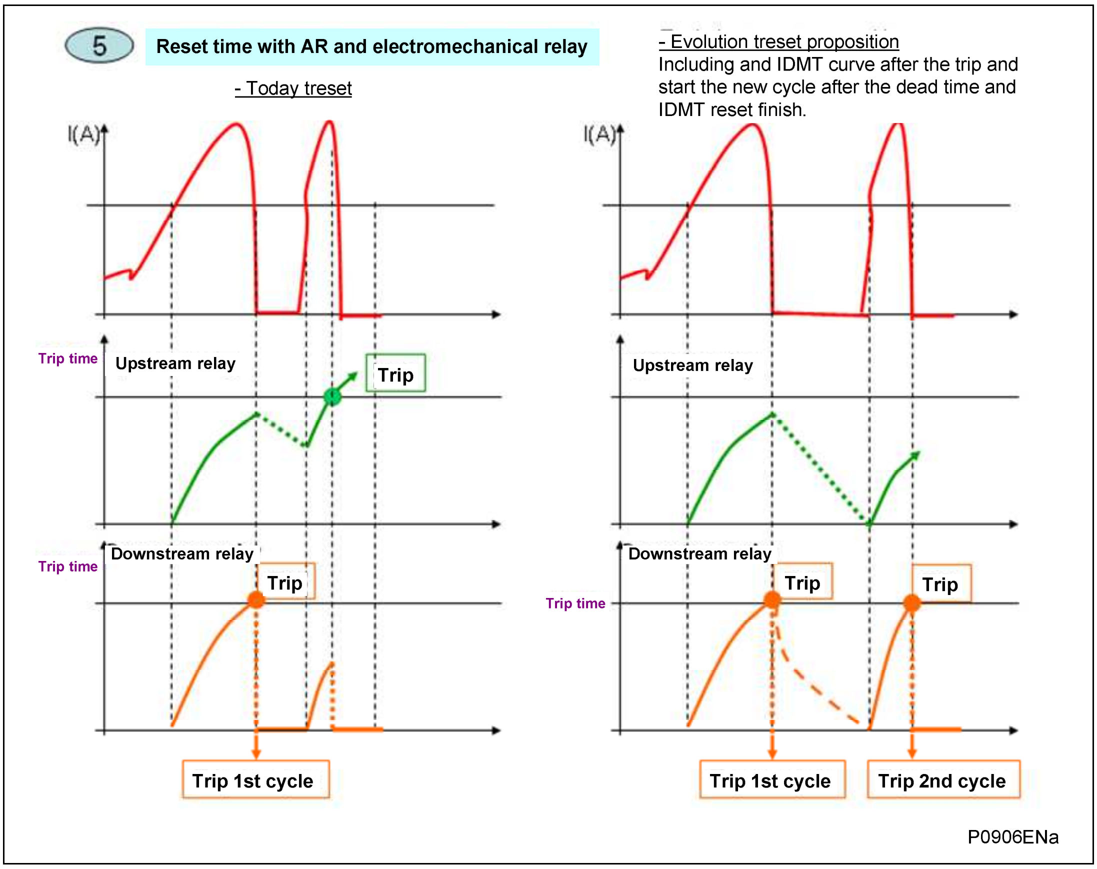
2.19.11.3 Minimum Drop-Off Time Setting

If an electromagnetic relay is used (working on the principle of disc in the electromagnetic field due to eddy current generated in the disc), an additional dead time (Min Drop-off Time), depending of the trip cause, is settable.

This function includes the choice to select an IDMT curve on the relay's reset time, setting the drop-off time on phase and neutral auto-reclose cycles.

This drop-off time blocks the next cycle if the current one has not elapsed.

A new cycle can start if both the dead time and tReset have elapsed.



Note: This function is currently used with an IDMT curve.
If dead time > drop-off time, the relay will close the CB at the end of the dead time.
If dead time < drop-off time, the relay will close the CB at the end of the drop-off time.

2.19.11.3.1 Load

It is very difficult to optimize the dead time due to the great diversity of loads on a system. However, it is possible to study each type of load separately and thereby be able to define a typical dead time.

The most common types of loads are synchronous or induction motors and lighting circuits.

Synchronous motors tolerate only extremely short interruptions of supply without loss of synchronism. In practice, the dead time should be sufficient to allow the motor no-volt device to operate. Typically, a minimum dead time of 0.2-0.3 second is recommended.

Induction motors, on the other hand, can withstand supply interruptions, up to a maximum of 0.5 second and re-accelerate successfully. In general dead times of 3-10 seconds are normally satisfactory, but there may be special cases for which additional time is required to allow the reset of manual controls and safety devices.

Loss of supply of lighting circuits, such as street lighting, can lead to important safety problems (car circulation). Regarding domestic customers, the main consideration is linked to the inconvenience caused.

The number of minutes lost per year to customers will be reduced on feeders using the auto-recloser and will also be affected by the dead time settings used.

2.19.11.3.2 Circuit Breaker

For high speed reclosing, the minimum dead time of the power system depends on the minimum time-delay imposed by the circuit breaker during a trip and reclose operation.

Since a circuit breaker is a mechanical device, it has an inherent contact separation time. This operating time for a modern circuit breaker is usually within the 50-100 ms range, but could be longer with older designs.

After a trip, the mechanism needs some time to reset before applying a close pulse. This reset time varies depending on the circuit breaker, but lasts typically 0.1 second.

Once the circuit breaker has reset, the breaker can start to close. The period of time between the energization of the closing mechanism and the making of the contacts is called closing time. Because of the time constant of a solenoid closing mechanism and the inertia of the plunger, a solenoid closing mechanism may take 0.3 s. A spring-operated breaker, on the other hand, can close in less than 0.2 second.

Where high speed reclosing is required, for the majority of medium voltage applications, the circuit breaker mechanism dictates itself the minimum dead time. However, the fault de-ionizing time may also have to be considered.

High speed reclosing may be required to maintain stability on a network that has two or more power sources. For high speed reclosing, the system disturbance time should be minimized using fast protection, <50 ms, such as distance or feeder differential protection and fast circuit breakers < 100 ms. Fast fault clearance can reduce the time for the fault arc to de-ionize.

To ensure stability between two sources, a dead time of less than 300 ms is typically required. Considering only the CB, this minimum time corresponds to the reset time of the mechanism plus the CB closing time. Thus, a solenoid mechanism is not adapted for high speed reclosing due to the fact that the closing time is generally too long.

2.19.11.3.3 Fault De-ionizing Time

For high speed reclosing, the time to de-ionize faults may be the most important factor when considering the dead time. This is the time required for the ionized air to disperse around the fault location so that the insulation level of the air is restored. This time may be around the following value:

De-ionizing time = (10.5 + ((system voltage in kV)/34.5)) / frequency

For 66 kV = 0.25 s (50 Hz)

For 132 kV = 0.29 s (50 Hz)

2.19.11.3.4 Protection Reset

It is essential that the protection device fully resets during the dead time, so that correct time discrimination is maintained after reclosing on to a fault. For high speed reclosing, instantaneous protection reset is required.

Typical 11/33 kV dead time settings in the UK are as follow:

1st dead time = 5 - 10 seconds

2nd dead time = 30 seconds

3rd dead time = 60 - 100 seconds

4th dead time (uncommon in the UK, however used in South Africa) = 60 - 100 seconds

2.19.11.4 Reclaim Time Setting

The following factors influence the choice of the reclaim time:

- Supply continuity - Large reclaim times can result in unnecessary lockout for transient faults.
- Fault incidence/Past experience - Small reclaim times may be required where there is a high incidence of lightning strikes to prevent unnecessary lockout for transient faults.
- Charging time of the spring or resetting of electromagnetical induction disk relay - For high speed reclosing, the reclaim time may be set longer than the spring charging time to ensure that there is sufficient energy in the circuit breaker to perform a trip-close-trip cycle. For delayed reclosing, this setting is of no need as the dead time can be extended by an extra CB healthy check window time if there is insufficient energy in the CB. If there is insufficient energy after the check window time the relay will lockout.
- Switchgear Maintenance - Excessive operation resulting from short reclaim times can mean shorter maintenance periods. A minimum reclaim time of 5 s may be needed to give sufficient time to the CB to recover after a trip and close before it can perform another trip-close-trip cycle.

The reclaim time must be long enough to allow any time-delayed protection leading the auto-recloser to operate. Failure to do so can cause the auto-recloser to reset too soon and the reactivation of the instantaneous protection.

If that were the case, a permanent fault would look like a sequence of transient faults caused by repeated auto-recloses. Applying protection against excessive fault frequency lockout is an additional precaution that can solve this problem.

It is possible to obtain short reclaim times to reduce the number of CB lockouts by blocking the reclaim time from the protection start signals. If short reclaim times are to be used, then the switchgear rating may dictate the minimum reclaim time.

Sensitive earth fault protection is used to detect high resistance earth faults. The time-delay of such protections is usually a long time-delay, typically about 10-15 s. If auto-reclosing is caused by SEF protection, this timer must be taken into account when deciding the value of the reclaim time, if the reclaim time is not blocked by an SEF protection start signal. Sensitive earth faults, caused by a broken overhead conductor in contact with dry ground or a wood fence are rarely transient faults and may be dangerous to people.

It is therefore common practice to block the auto-recloser using the sensitive earth fault protection element and to lockout the circuit breaker.

Where motor-wound spring closed circuit breakers are used, the reclaim time must be at least as long as the spring winding time for high speed reclosing to ensure that the breaker can perform a trip-close-trip cycle.

A typical 11/33 kV reclaim time is 3-10 seconds, this prevents unnecessary lockout during thunderstorms. However, times up to 60-180 seconds may be used.

2.19.11.5 Auto-reclose Setting Guideline

2.19.11.5.1 General Setting

SETTING CONDITION FOR THE A/R FUNCTIONALITY

SETTING GROUP x/PROTECTION Gx / [79] AUTO-RECLOSE Gx		
Autoreclose?	***1: Enabled***	Enabling the Auto-reclose function
Dead Time tDx, where x – number of cycle after a trip during A/R	See 2.22.2	The time-delay between CB opening via the trip command and reclose command via the A/R. These values must be set according to the application.
Reclaim Time tR	See 2.22.4	The time between CB closure via the reclose command and reset of the Auto-reclose function (ready to the next fault from the first cycle). This value must be set according to application.
Fast O/C Trip for every trip when the A/R is activated.	54321 00000	' 0 ' - means that the overcurrent trip before the A/R reclosing shot will occur according to the time-delay set in the protection element submenu (Fast Trip function is not applied) ' 1 ' - means that the overcurrent trip before the reclosing shot will occur according to the DMT time-delay and ***Fast E/Gnd Trip Delay*** – not according to the time-delay set in the protection element submenu (Fast Trip function is applied). The default value is ***00000***.
Fast O/C Trip Delay	0s	Time-delay for Fast Trip function. The time-delay set to avoid transients impacting on selectivity. The fast tripping reduces de-ionization time. The default value is 0 s.
Fast E/Gnd Trip for every trip when the A/R is activated.	54321 00000	' 0 ' - means that the e/f trip before the A/R reclosing shot will occur according to the time-delay set in the protection element submenu (Fast Trip function is not applied) ' 1 ' - means that the e/f trip before the reclosing shot will occur according to DMT time-delay and ***Fast E/Gnd Trip Delay*** – not according to the time-delay set in the protection element submenu (***Fast Trip*** function is applied). The default value is ***00000***.
Fast E/Gnd Trip Delay	0s	Time-delay for ***Fast Trip*** function. The time-delay is set to avoid transients impacting on selectivity. Fast tripping reduces de-ionization time. The default value is 0 s.

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SETTING GROUP x/PROTECTION Gx / [79] AUTO-RECLOSE Gx		
Close Shot ? Freely settable the number of Auto-reclose cycles (closing shots), set separately for each protection element: tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3, tAUX1, tAUX2	4321 0111	Max number cycle: 4 cycles. ' ***0*** ' - means that after a trip issued by a protection element, the A/R will be blocked – no reclose command will be executed. ' ***1*** ' - means that after a trip issued by a protection element the A/R will close CB (closing shot will be executed). If the protection element is set: ***1111*** – it means that 4 cycles are set. If ***0011*** – it means that 2 cycles are set. The default value is ***00000***. This value must be set according to the application.
Inhibit Trip Freely settable the inhibit of the trip after closing command issued via the A/R, set separately for each protection element: tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3, tAUX1, tAUX2	4321 0000	Freely settable the inhibit of the trip after closing command issued via the A/R, set separately for each protection element: tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3, tAUX1, tAUX2 ***Inhibit Trip*** setting: - ***0:*** means that after close via the A/R, the protection element trip will be not inhibited (function is disabled). - ***1***: means that after close via the A/R, the protection element trip will be inhibited. An example: For 4-cycle [79]: ***Inhibit Trip 1000*** setting. In the first three cycles (000) the trip is executed to allow fault clearance, but the last one (1) is with inhibition, so no trip is executed in case of permanent fault). (see ***V11F Operation*** chapter) The default value is: ***0000***

GLOBAL SETTINGS / [79] ADVANCED SETTINGS		
CB FLT Monitor. ?	***No*** or ***Yes***	Disable or enable: CB faulty monitoring via binary input. See 2.19.1.1, 2.20, 2.21 Typically the auto-recloser uses this function. Default value is ***Yes.***
Block.via Input?	No, Block. [79] Block.[79]+tI/52a	Disable or enable: blocking of the Auto-reclose function via a binary input. See section 2.19.6. Typically the auto-recloser uses this function. Default value is ***No***.
Start Dead t on	Protection reset or CB trips	Definition of Dead time start: - ***Protect.Reset***: no protection elements are energized. - ***CB trips***: the CB is open (information from inputs) Typically auto-reclosing occurs based on CB status. The default value is ***CB trips***.
Rolling Demand?	***No*** or ***Yes***	Enable of Rolling Demand function. This function protects the CB against mechanical wear in case of intermittent faults (for example a fault caused by a tree branch).
Max cycles No.	***100***	Number of accepted cycles in settable time period. If the number in the sliding window is greater than the set value for ***Max cycles Nb*** the auto-recloser is blocked. If ***Rolling Demand? = Yes,*** these values must be set according to the application. See section 2.19.8.
Time period Rol.Demand	***0010 mn***	Sliding window period ***Max cycles No.*** calculation.
Inhibit Time tI on Close	***1.00 s***	Inhibit of auto-reclosing time after manual closure of the CB (via a binary input, the front panel, RS485 or USB port). The default value: 1s. If 0 s is applied, inhibition of A/R on closing is disabled. See section 2.19.5.
Signaling Reset	***No*** or ***Close via 79***	This function resets the latched LEDs and outputs via the auto-reclose Close command. If ***Close via 79*** is selected, in case of a successful A/R there will be no signaling (reset not needed). Only the last fault will be displayed. See section 2.19.9.

SETTING GROUP x/INPUTS CONFIGURATION Gx		
CB status	***CB status 52A***	*At least a one* of the digital inputs have

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SETTING GROUP x/INPUTS CONFIGURATION Gx		
Input or inputs assigned to CB state (contact position)	or/and ***CB status 52B*** Inputs: 654321 000000	to be assigned to the CB's contact position. - ***CB status 52A:*** This input must correspond to the CB state: HIGH for CB close, LOW for CB open. - ***CB status 52B:*** This input must correspond to the CB state: LOW for CB close, HIGH for CB open. If a one input is used the CB status is based on a one-bit monitoring. If two inputs are used, the CB status is based on two-bit monitoring. By default no inputs are assigned to CB contact position. These values must be set according to the application.
CB FLT Ext.Sign. CB failure external signaling mapped to an input.	Inputs: 654321 000000	See section 2.19.1. By default no inputs are assigned to CB failure monitoring. This value can be set according to application.
Block.79 Blocking of the auto-recloser via a binary input.	Inputs: 654321 000000	See section 2.19.1.3. By default no inputs are assigned to blocking of the auto-reclose function. This value can be set according to the application.

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SETTING GROUP x/ OUTPUT RELAYS CONFIGURATION Gx		
Prot.Trip pulse CB Open via protection elements and the auto-reclose function.	Outputs: 54321 00000	Output relays 1 to 5. An output relay must be assigned to this function to CB trip.
Close CB order CB Close by the A/R or a manual close command.	Outputs: 54321 00000	Output relays 1 to 5. An output relay must be assigned to this function to CB close.
[79] in Progress Auto-reclose in progress (running)	Outputs: 54321 00000	An output relay can be assigned to this function.
[79] F.Trip Auto-recloser lockout after final trip.	Outputs: 54321 00000	An output relay can be assigned to this function.
[79] Lockout Auto-recloser lockout.	Outputs: 54321 00000	An output relay can be assigned to this function.
[79] Blocked Auto-recloser blocked or disabled	Outputs: 54321 00000	An output relay can be assigned to this function.
[79] Success. The Reclaim Time is elapsed and no trip has occurred.	Outputs: 54321 00000	An output relay can be assigned to this function.

2.19.11.5.2 Trip and reclose (normal operation)

The auto-recloser starts only if a trip command (***Prot.Trip pulse*** output) has been issued.

The red Trip LED will illuminate whenever the auto-recloser starts. It can however be reset by a close command (***Signalling Reset*** setting).

PROTECTION Gx / [79] AUTORECLOSE		
"Autoreclose"	Yes	
Cycles tI>, tI>>, tI>>>, tIN_1, tIN_2, tIN_3	1234 0111	Maximum number of shots: Max. 4 shots for each protection element selected separately.

SETTING GROUP x/ OUTPUT RELAYS CONFIGURATION Gx		
Trip and Close Commands	At least one trip and close command	Overcurrent and/or earth fault overcurrent trip stages (One is enough).

2.20 Circuit Breaker State Monitoring (Model A and E)

An operator at a remote location requires a reliable indication of the state of the switchgear. Without an indication that each circuit breaker is either open or closed, the operator has insufficient information to decide on switching operations. The VAMP 11F relays incorporate a circuit breaker state monitoring feature, giving an indication of the position of the circuit breaker.

This indication is available either on the relay's front panel or via the communication network.

The positions of the CB contacts can be selected under the ***SETTING GROUP x/INPUTS CONFIGURATION Gx*** and ***SETTING GROUP x/LEDs CONFIGURATION Gx*** menus using **AUX5** (in parallel with **CB Status 52A**) and **AUX6** (in parallel with **CB Status 52B**).

AUX5 (CB closed) and AUX6 (CB opened) must be assigned to LEDs in ***SETTING GROUP x/LEDs CONFIGURATION Gx*** menu.

Furthermore, the VAMP 11F relays can inform the operator that the CB has not opened following a remote trip command (refer to section “CB FAIL protection”).

2.21 Circuit Breaker Condition Monitoring

Periodic maintenance of circuit breakers is generally based on a fixed time interval, or a fixed number of fault current interruptions.

The relays record the following controls and statistics related to each circuit breaker trip operation:

- time-delay setting,
- monitoring time for CB open and close operations,
- CB open count,
- summation of the current interrupted by the CB,
- exponent for the summation,
- tripping and closing pulse time

2.22 Circuit Breaker Condition Monitoring Features

For each circuit breaker trip operation the relay records statistics as shown in the following table taken from the relay menu. The **RECORDS/COUNTERS/CB Monitoring** menu cells shown are counter values only.

The circuit breaker condition monitoring counter increases when it receives:

- a protection trip command (***Prot.Trip pulse***),
- an HMI (or MiCOM S1 Studio 5.1.0 or higher) opening command (**Trip CB Order**),
- a rear com opening command (**Trip CB Order**),
- a digital input opening command (**Trip CB Order**).

In cases where the breaker is tripped by an external protection device it is also possible to update the CB condition monitoring. This is achieved by assigning one of the logic inputs or via the communication to accept a trigger from an external device.

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2.23 Setting guidelines

2.23.1 Setting the $\Sigma\, I^n$ Threshold

Where overhead lines are prone to frequent faults and are protected by oil circuit breakers (OCB's), oil changes account for a large proportion of the life cycle cost of the switchgear. Generally, oil changes are performed at a fixed interval of circuit breaker fault operations. However, this may result in premature maintenance where fault currents tend to be low, and hence oil degradation is slower than expected.

The $\Sigma\, I^n$ counter monitors the cumulative severity of the duty placed on the interrupter allowing a more accurate assessment of the circuit breaker condition.

For OCB's, the dielectric withstand of the oil generally decreases as a function of $\Sigma\, I^2t$. This is where 'I' is the fault current broken, and 't' is the arcing time within the interrupter tank (not the interrupting time). As the arcing time cannot be determined accurately, the relay would normally be set to monitor the sum of the broken current squared, by setting ***n*** = 2.

For other types of circuit breaker, especially those operating on higher voltage systems, practical evidence suggests that the value of ***n*** = 2 may be inappropriate. In such applications ***n'*** may be set to 1.

An alarm in this instance may be indicative of the need for gas/vacuum interrupter HV pressure testing, for example.

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It is imperative that any maintenance program must be fully compliant with the switchgear manufacturer's instructions.

2.23.2 Setting the Number of Operations Threshold

Every operation of a circuit breaker results in some degree of wear for its components. Thus, routine maintenance, such as oiling of mechanisms, may be based upon the number of operations. Suitable setting of the maintenance threshold will allow an alarm to be raised, indicating when preventative maintenance is due.

Should maintenance not be carried out, the relay can be set to lockout the auto-reclose function upon reaching a number of operations. This prevents further reclosure when the circuit breaker has not been maintained to the standard required by the switchgear manufacturer's maintenance instructions.

Certain circuit breakers, such as oil circuit breakers (OCB's) can only perform a certain number of fault interruptions before requiring maintenance attention. This is because each fault interruption causes carbonizing of the oil, degrading its dielectric properties.

2.23.3 Setting the Operating Time Threshold

Slow CB operation is also indicative of the need for mechanism maintenance. Therefore, an alarm is provided and is settable in the range of 100 ms to 5 s. This time is set in relation to the specified interrupting time of the circuit breaker.

2.24 Circuit Breaker Failure Protection: CB Fail

When a fault is detected, one or more main protection elements will issue a trip command to the associated circuit breaker(s). To isolate the fault, and prevent (further) damage to the power system it is essential that the circuit breaker operates correctly.

A fault that is not cleared quickly enough threatens the stability of the system. It is therefore common practice to install circuit breaker failure protection devices/elements that check that the circuit breaker has opened within a reasonable period of time. If the fault current has not been eliminated after the set time-delay, breaker failure protection (CB Fail) will send a signal.

The CB Fail protection element can be used to back-trip upstream circuit breakers to ensure that the fault is correctly isolated. The CB Fail protection element can also clear all blocking commands associated with logic selectivity.

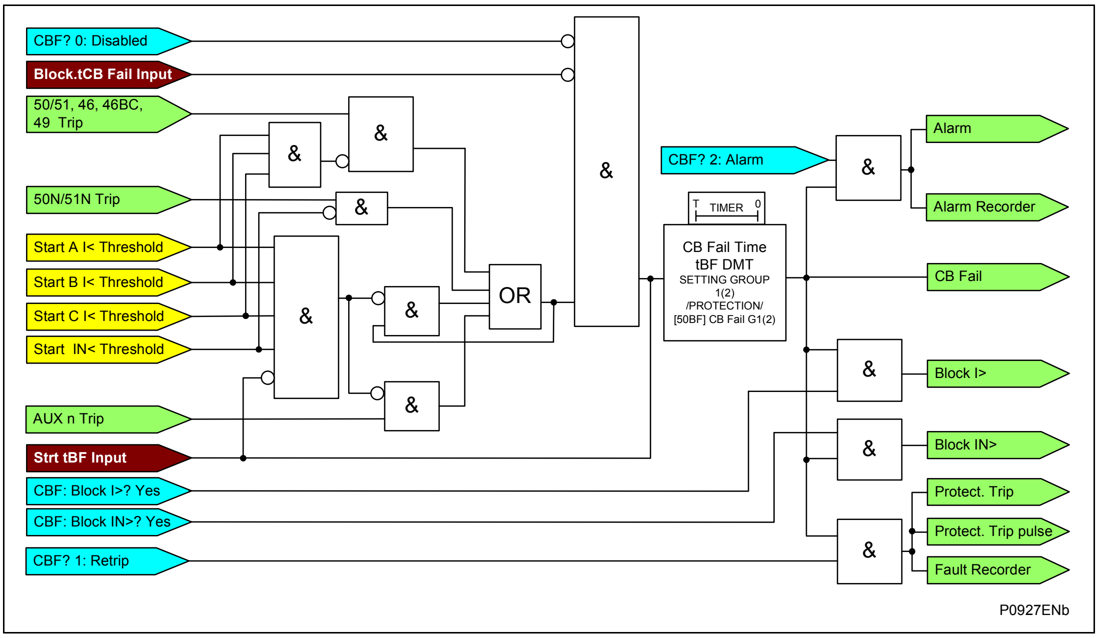

Figure 21: CB Fail Principle

The ***tBF*** timer is initiated when a trip command is issued by a protection element. Note that the trip command can be issued either by a protection element, or by a logic input (**ABE**) assigned to an AUX counter. Then the relay monitors the current signal of each phase and compares each phase current signal with the bandzone made by the undercurrent I< threshold. This value can be set under the ***SETTING GROUP x/PROTECTION Gx / [50BF] CB FAIL Gx*** menu.

The selection in the relay menu is grouped as follows:

MENU TEXT	SETTING RANGE		STEP SIZE
	MIN	MAX	
CB Fail ?	Disabled, Retrip, Alarm,		
tBF	0.01 s	10 s	10 ms
I< Threshold CBF	0.1 In	2 In	0.01 In
IN< Threshold CBF	0.1 In	2 In	0.01 In
Block I>?	No, Yes		
Block IN>?	No, Yes		

One of these options:

- ***Retrip***: a retrip signal is issued concurrently with the ***tCBF*** output (***Protect.Trip*** and ***Prot.Trip pulse*** output). The TRIP LED and FLAG are activated,

- ***Alarm***: typical setting. In case of CB Failure, an alarm is issued concurrently with the ***tCBF*** output. The ***Alarm*** LED is lit,

must be set in order to enable CB Fail protection.

2.24.1 Typical settings

2.24.1.1 Breaker Fail Timer Settings

The typical timer settings to use are as follows:

CB fail reset mechanism	tBF time-delay	Typical delay for 2 cycle circuit breaker
Initiating element reset	CB interrupting time + element reset time (max.) + error in tBF timer + safety margin	50 + 50 + 10 + 50 = 160 ms
CB open	CB auxiliary contacts opening/ closing time (max.) + error in tBF timer + safety margin	50 + 10 + 50 = 110 ms
Undercurrent elements	CB interrupting time + undercurrent element (max.) + safety margin operating time	50 + 25 + 50 = 125 ms

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Note that all the CB Fail resetting methods involve the operation of the undercurrent element. Where element reset or CB open resetting is used the undercurrent time setting should still be used if this proves to be the worst case.

The examples above consider direct tripping of a circuit breaker. Note that where auxiliary tripping relays are used, an additional 10-15ms must be added to allow for trip relay operation.

2.24.1.2 Breaker Fail Undercurrent Settings

The phase undercurrent threshold (I<) must be set below the load current, to ensure that I< operation indicates that the circuit breaker pole is open. A typical setting for overhead lines or cable circuits is 20% In, with 5% In common for generator circuit breaker CBF.

The standard earth fault undercurrent element must be set to less than the trip setting, typically as follows:

IN< = (IN> trip) / 2

2.25 Trip Circuit Supervision (Model A and E)

The trip circuit extends beyond the relay enclosure and passes through more components, such as fuse, wires, relay contacts, auxiliary switch contact and so on.

These complications, coupled with the importance of the circuit, have directed attention to its supervision.

The simplest arrangement for trip circuit supervision contains a healthy trip lamp in series with a resistance placed in parallel with a trip output relay contacts of the protection device.

2.25.1 Trip Circuit Supervision Mechanism

The Trip Circuit Supervision function included in the VAMP 11F relays is described below:

A logic input is assigned to the **GLOBAL SETTINGS/CIRCUIT BREAKER/TC Supervision?** function. This logic input is labeled **Trip Circ Supervis.** in the ***SETTING GROUP x/INPUTS CONFIGURATION Gx*** menu. This logic input is then wired to the trip circuit according to one of the typical application scheme examples shown below.

When the TC Supervision function is set to "Yes" under the **TC Supervision?** sub-menu, the relay checks continuously the trip circuit continuity whether the CB status is CB opened or CB closed.

When the ***TC Supervision*** function is set to ***Yes-52A*** under the ***CIRCUIT BREAKER*** sub-menu, the relay checks continuously on trip circuit continuity in case when the CB's status is closed only.

The **TC Supervision** function is enabled when the ***Prot.Trip pulse*** and ***Trip CB order*** outputs are not energized. The **TC Supervision** function is not enabled when the ***Prot.Trip pulse*** and ***Trip CB order*** output are energized.

An ***Alarm***: **TC Supervision** (trip circuit failure) signal is generated if the logic input detects no voltage signal for a time longer than the settable timer ***tSUP***. See Chapter V11F/EN OP (Operation) and Chapter V11F/EN TD (Technical Data) for the settings.

As this function is disabled when the ***Prot.Trip pulse*** and ***Trip CB order*** outputs are energized, it is suitable for use with the output latching logic disabled.

The tSUP timer can be set according to the following table:

MENU TEXT	SETTING RANGE		STEP SIZE
	MIN	MAX	
TC Supervision ?	No or Yes or Yes-52A		
tSUP	100 ms	10 s	10 ms

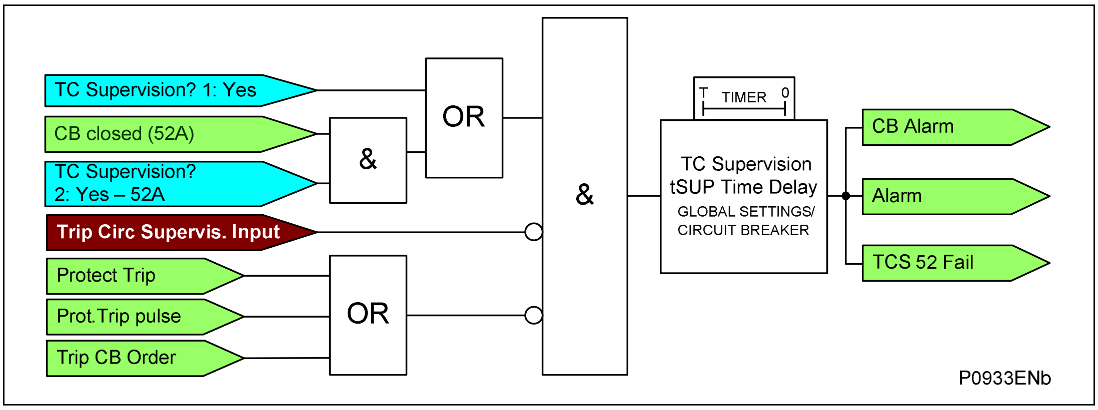

Figure 22: Trip Circuit Supervision Principle

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Three examples of application are given below.

Note: It is considered that the CB is fitted out with its own safety device.

Example 1

In this example only the 52a auxiliary contact is available, the VAMP relay monitors the trip coil whatever the CB status is (CB open or CB closed).

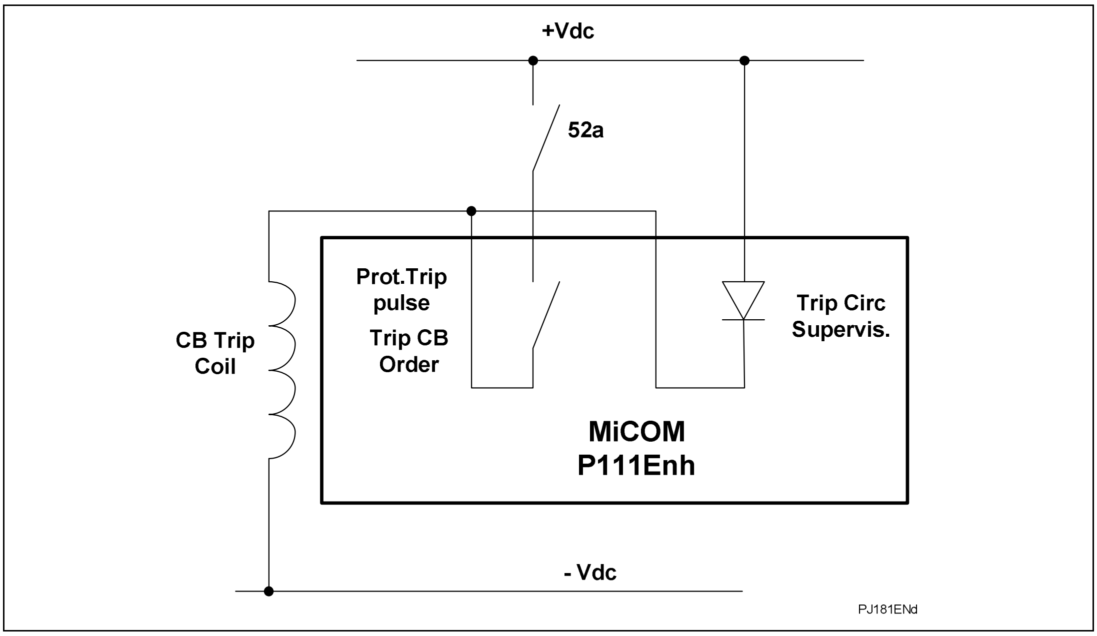

Figure 23: Trip Coil Monitoring

Example 2

In this example both 52a and 52b auxiliary contacts are available; the VAMP 11F relay monitors the complete trip circuit when the CB is closed and a part of the trip circuit when the CB is open.

In this case it is necessary to insert a resistor R1 in series with 52b, if either the output trip is latched or if it stays accidently closed, or if a long time trip pulse is programmed.

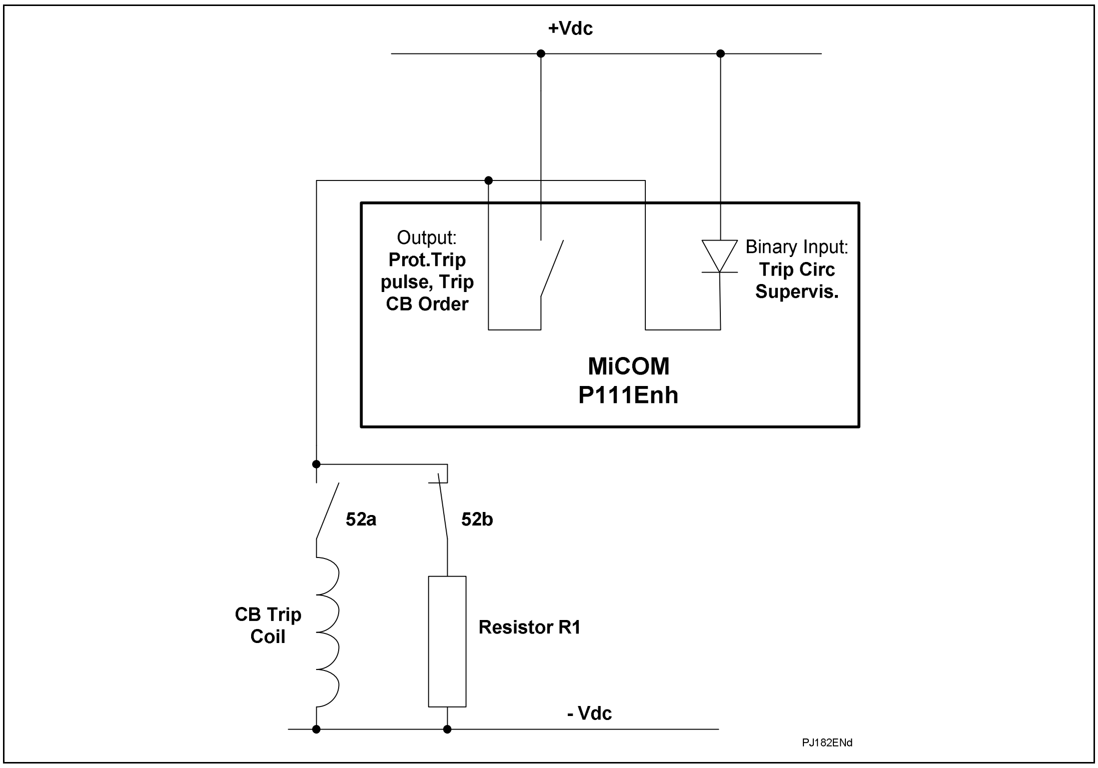

Figure 24: Example 2: Trip Coil and Auxiliary Contact Monitoring

Example 3

In this example both 52a and 52b auxiliary contacts are available, the VAMP 11F relay monitors the complete trip circuit whatever the CB status (CB open or CB closed).

In this case it is necessary to insert a R1, if either the output trip is latched, or if it stays accidently closed, or if a long time trip pulse is programmed.

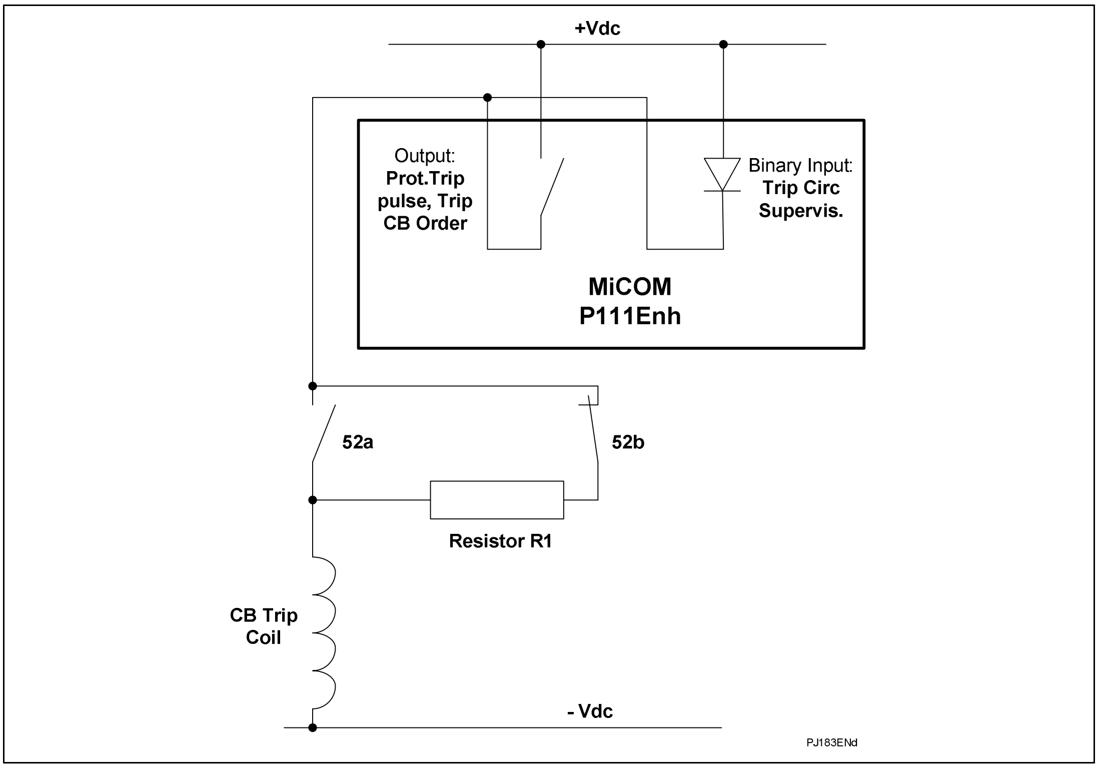

Figure 25: Example 3: Trip Coil and Auxiliary Contact Monitoring Whatever the Position of the CB contacts

External Resistor R1 Calculation

The calculation of the R1 resistor value will take into account the fact that a minimum current is flowing through the logic input. This minimum current value is a function of the relay auxiliary voltage range (U_{aux}).

<u>1 - Case of example 2:</u>

The R1 resistor maximum value (in Ohm) is defined by the following formula:

$$R1 < \frac{0.8 \times U_{aux} - U_{min}}{I_{min}}\ \Omega$$

Where:

U_{aux} = auxiliary voltage value (in this case a DC voltage; range is given on label under the top hinged cover. See table below).
U_{min} = internal minimum voltage value needed for the opto logic input to operate.
I_{min} = minimum current value needed for the opto logic input to operate.

$I_{min} = U_{min}/R_{input}$ (see 2.4 section of Technical Data)

Relay auxiliary voltage range (U_{aux})	
24-60 Vdc (ordering code V11Fxxxxxx**1**xxxxxxx)	90-250 Vdc/ac (ordering code V11Fxxxxxx2xxxxxxx)
R1 < (0.8 x U_{aux} – 16V)/ (16V/6000Ω)	R1 < (0.8 x U_{aux} – 66V)/ (66V/109000Ω)

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The R1 resistor withstand value (in Watt) is defined below:

$$P_{R1} > 2 \times \frac{(1.2 \times U_{aux})^2}{R1} \text{ Watts}$$

2 - Case of example 3:

The R1 resistor maximum value (in Ohm) is defined by the following formula:

$$R1 < \frac{0.8 \times U_{aux} - U_{min}}{I_{min}} - R_{coil} \quad \Omega$$

Where:

U_{aux} = auxiliary voltage value (in this case a DC voltage; its range is given on the label under the top hinged cover. See table below.)
U_{min} = internal minimum voltage value needed for the opto-input to operate.
I_{min} = minimum current value needed for the opto-input to operate.
R_{coil} = trip coil resistance value.

Relay auxiliary voltage range (U_{aux}) (see Technical Data chapter)	
24-60 Vdc (ordering code V11Fxxxxxx**1**xxxxxxx)	90-250 Vdc/ac (ordering code V11Fxxxxxx2xxxxxxx)
R1 < (0.8 x U_{aux} – 16)/(16V/6000Ω) – R_{coil}	R1 < (0.8 x U_{aux} – 66)/ (66V/109000Ω) – R_{coil}

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The R1 resistor withstand value (in Watt) is defined below:

$$P_{R1} > 2 \times \frac{(1{,}2 \times U_a)^2}{(R1 + R_{Coil})} [W]$$

Notes: – The presence of auxiliary relays, such as an anti-pumping system for instance, in the trip circuit must be taken into account for the R1 resistance values specification.
– We consider that the maximum variation of the auxiliary voltage value is ±20%.

Example 4

In this example both 52a and 52b auxiliary contacts are available, the VAMP 11F relay monitors the complete trip circuit whatever the CB status (CB open or CB closed).

This application need to assign two Binary Inputs to one ***Trip Circuit Supervision*** input logic function.

In this case it is necessary to insert a RL1, if either the output trip is latched, or if it stays accidently closed, or if a long time trip pulse is programmed.

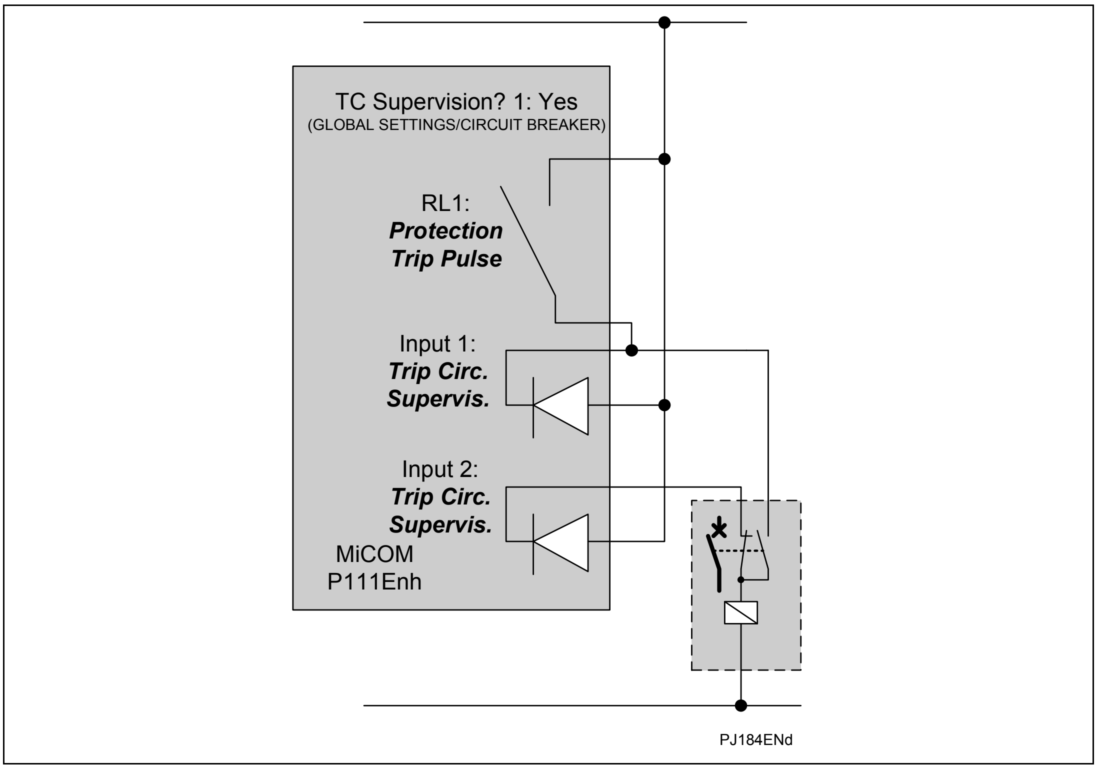

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Figure 26: Example 4: Trip Coil and Auxiliary Contact Monitoring by using two Binary Inputs

<u>Example 5</u>

In this example 52a auxiliary contacts is available, the VAMP 11F relay monitors the complete trip circuit if the CB status is closed.

This application need to assign one Binary Input to ***Trip Circuit Supervision*** input logic function.

In this case it is necessary to insert a RL1, if either the output trip is latched, or if it stays accidently closed, or if a long time trip pulse is programmed.

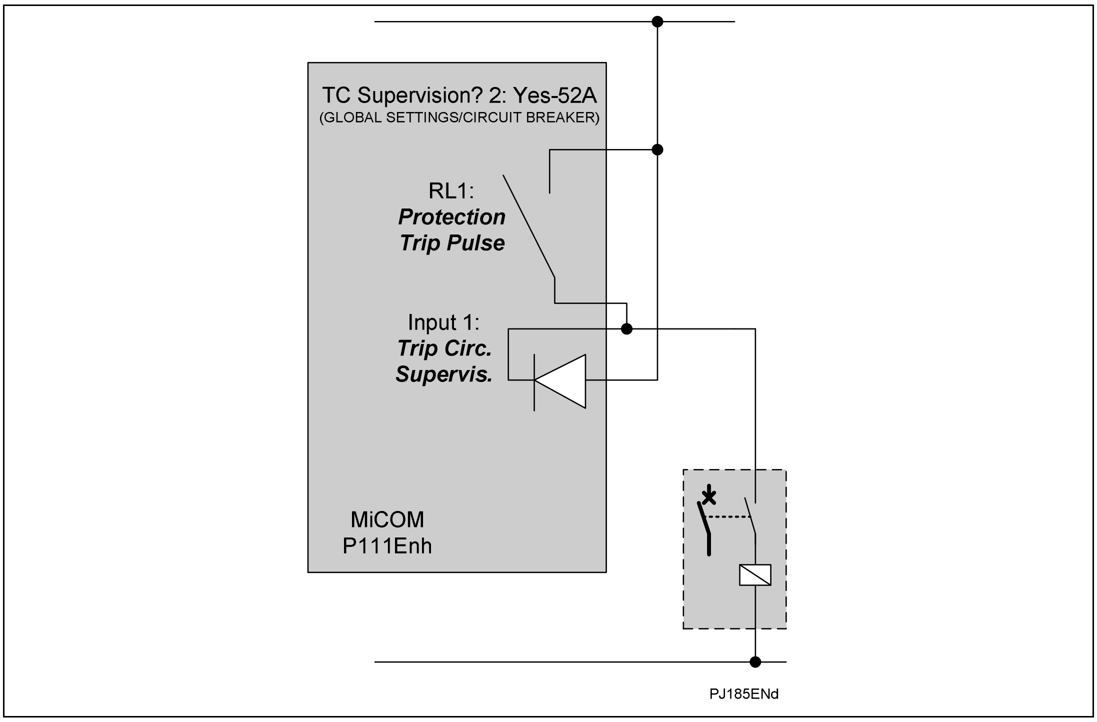

Figure 27: Example 4: Trip Coil and Auxiliary Contact Monitoring by using two Binary Inputs

2.26 Real time clock synchronization via opto-inputs (Model B and E)

In modern protection schemes it is often desirable to synchronize the relay's real time clock so that events from various relays can be placed in chronological order. This can be done using the communication interface connected to the substation control system or via a binary input. Any of the available binary inputs on the V11F relay can be selected for synchronization. Pulsing this input will result in the real time clock snapping to the nearest minute. The recommended pulse duration is 20 ms to be repeated no more than once per minute. An example of the time synchronization function is shown.

Time of "Sync. Pulse"	Corrected Time
19:47:00.000 to 19:47:29.999	19:47:00.000
19:47:30.000 to 19:47:59.999	19:48:00.000

Note: The above assumes a time format of hh:mm:ss

The input is configured in the ***SETTING GROUPx/INPUT CONFIGURATION Gx*** menu. The input must be assigned to ***Time Synchr.***

2.27 Event Records

The relay records and time-tags up to 200 events and stores them in a non-volatile (Fram) memory. This allows the system operator to analyze the sequence of events that has occurred within the relay after a particular power system condition, or switching sequence, etc. When the available space is exhausted, the new fault automatically overwrites the oldest fault.

The real time clock within the relay time-tags each event, with a resolution of 1 ms.

The user can view the event records either locally via the USB port, or remotely, via the rear EIA(RS)485 port.

2.28 Fault Records

Each time any of the set protection elements trips (***Protect.Trip*** output), a fault record is created and stored in memory. The fault record tags up to 20 faults and stores them in a non-volatile (Fram) memory. This allows the operator to identify and analyze system failures. When the available memory space is exhausted, the new fault automatically overwrites the oldest fault.

The user can view the latest fault record in the ***RECORD/FAULT RECORDS*** menu, where he or she can choose to display up to 20 stored records. These records are the fault flags, the fault measurements, etc. Also note that the time stamp displayed in the fault record itself will be more accurate than the corresponding time stamp given in the event record. This is due to the fact that events are logged some time after the actual fault is recorded.

The user can view event records either via the front panel interface, via the USB port, or remotely, via the rear EIA (RS) 485 port.

2.29 Instantaneous Recorder (Model E)

Each time any of set thresholds are crossed, an instantaneous record is created and displayed in the ***RECORDS/INSTANTANEOUS RECORD*** menu. The last five starting records are available, with the duration of the signal.

The following information is displayed in the ***RECORDS/INSTANTANEOUS RECORD*** menu: number of starts, time, date, origin (crossing of a current threshold or start of a protection element's time-delay), current values.

Instantaneous Recorder is memorized if V11F is powered from auxiliary voltage (Vx).

2.30 Alarm Recorder

Each time any of the programmed protection element makes ALARM signal (***Alarm*** output), an Alarm record is created and stored in memory. The fault record tags up to 5 faults and stores them in a non-volatile (Fram) memory. This allows the system operator to identify and analyze network failures. When the available memory space is exhausted, the new fault automatically overwrites the oldest Alarm.

The user can view actual Alarm record under the ***RECORD/ALARM RECORDS*** menu, where he can select to display up to 5 stored records. These records are Alarm flags, Alarm measurements, etc. Also note that the time stamp displayed in the Alarm record itself will be more accurate than the corresponding time stamp given in the event record.

2.31 Disturbance Recorder (Model A and E)

The integral disturbance recorder has a memory space specifically dedicated to the storage of disturbance records. Up to 4 seconds of disturbance recording can be stored. When the available memory space is exhausted, the new record automatically overwrites the oldest record.

The recorder stores actual samples that are taken at a rate of 16 samples per cycle.

Each disturbance record consists of analogue and digital channels. (Note that the relevant CT ratios for the analogue channels are also extracted to enable scaling to primary quantities).

The disturbance recorder is set in the ***GLOBAL SETTINGS/DISTURBANCE RECORDER*** menu.

The total disturbance recording time is 4 s but not more than 5 records are available.

Total number of records available in disturbance recorder is:

- o One - for set Max Record Time from in range: 2.01s – 4.00s
- o Two – for set Max Record Time from in range: 1.51s – 2.00s
- o Three – for set Max Record Time from in range: 1.01s – 1.33s
- o Four – for set Max Record Time from in range: 0.81s – 1.00s
- o Five - for set Max Record Time from in range: 0.10s – 0.8s

Triggering of disturbance recording depends on the ***Disturb.Rec.Trig.*** configuration:

- ***0: on Inst.*** – Start of a protection element set to ***Trip***,
- ***1: on Trip*** – Trip by a protection element followed by the ***Protect.Trip*** output.

If the ***0: on Inst***. option is selected the record consists of: Pre-fault time + duration of the "any Start" signal presence + Post-fault time.

If the ***1: on Trip*** option is selected the record consists of: Pre-fault time + duration of the Trip signal presence (***Protect.Trip*** function active) + Post-fault time.

The pre-fault time can be set in the cell: ***GLOBAL SETTINGS/DISTURBANCE RECORDER/Pre-Time***. If the pre-fault time is set to 100 ms, recording starts 100 ms before the disturbance.

The post trip time can be set in the cell: ***GLOBAL SETTINGS/DISTURBANCE RECORDER/Post Trip Time***. If the post-fault time is set to 100 ms, recording stops 100 ms after the disturbance.

2.32 External trip (Model A, B and E)

A Binary Input can be configured to CB trip by using the AUX1 or AUX2 or AUX3 or AUX4 functions.

The AUX1 – AUX4 functions have a timer so a trip can be time-delayed.

tAUX1 – tAUX4 can be mapped to:

- RL1,
- RL2,
- RL3,
- RL4,
- RL5,
- RL6,
- Trip (protection trip)
- Alarm signal
- Programmable LEDs

If it is configured to Trip (protection trip), tAUX1 - tAUX2 will illuminate the “Trip” LED.

2.33 Protection functions suitable for low voltage

2.33.1 Low voltage earthing systems

There are 4 low voltage (LV) earthing systems designated by a 2 or 3-letter acronym:

- TN-S
- TN-C
- TT
- IT

The letters making up the acronym have the following meanings:

Letter	Meaning
First letter	Transformer neutral point
I	Earthed with an impedance
T	Directly earthed
Second letter	Electrical exposed conductive parts of the consumer
T	Earthed
N	Connected to the neutral conductor
Third letter (optional)	Protective Earth conductor
S	Separate N neutral conductor and PE Protective Earth conductor
C	Combined N neutral conductor and PE Protective Earth conductor (PEN)

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2.33.2 Capability of VAMP low voltage protection function

VAMP protection function can be used with low voltage (LV) as long as the conditions below are met:

- The distribution circuit must be rated higher than 32A
- The installation must comply with standard IEC 60364.

For additional information about the compability of VAMP protection functions with low voltage, please contact Schneider Electric technical support.

The table below lists the VAMP protection functions suitable for low voltage according to earthing system used. VAMP protection functions not listed in this table are not suitable for low voltage. The protection functions listed in this table are available according to the VAMP type.

Protection	ANSI code	Earthing system				Comments
		TN-S	TN-C	TT	IT	
Phase overcurrent	50/51	■	■	■	■	Neutral conductor not protected
Earth fault /Sensitive earth fault	50N/51N	■	■	■	(1)	
Earth fault /Sensitive earth fault	50G/51G	■	■	■	(3)	
Negative sequence /unbalance	46	■	■	■	■	Threshold to be adopted to the phase unbalance
Thermal overload for cables /capacitors /transformer / generic	49RMS	■	■	■	■	Neutral conductor not protected
Restricted earth fault	64REF	■	■	■	(3)	
Two-winding transformer differential	87T	■	■	■	■	
Directional phase overcurrent	67	■	■	■ (4)	■ (4)	
Directional earth fault	67N/67NC					Incompability with LV diagrams (4-wire)
Directional active overpower	32P	■	■	(2)	(2)	
Directional reactive overpower	32Q	■	■	(2)	(2)	
Under-voltage (L-L or L-N)	27	■	■	■	■	
Remanent overvoltage	27R	■	■	■	■	
Over-voltage (L-L or L-N)	59	■	■	■	■	
Neutral voltage displacement	59N	■	■	(4)	(4)	Residual voltage not available with 2 VTs
Negative sequence over-voltage	47	■	■	■	■	
Over-frequency	81H	■	■	■	■	
Under-frequency	81L	■	■	■	■	
Rate of change of frequency	81R	■	■	■	■	
Synchro-check	25	■	■	■	■	

■ : Protection function suitable for low voltage (according to VAMP)
(1) : Not recommended even on the second fault
(2) : 2-wattmeter method not suitable for unbalanced loads
(3) : Residual current too low in IT
(4) : 2 phase-to-phase VTs

3. CT REQUIREMENTS

For the conventional case of a resistive load, the voltage at the secondary winding of the transformer is proportional to the primary current, therefore the error remains constant.

In the case of a VAMP 11F self-powered protection relay, this no longer applies, since the voltage at the input of the protection circuit is in a non-proportional ratio to the input current.

The best solution to check whether the VAMP 11F relay is adapted to a given CT is to have available the magnetization curve and the internal resistance of the CT in question.

To guarantee good accuracy at low current levels, the magnetizing current of the CT must be low. In other words, the input voltage of the relay must be sufficiently low compared with the knee-point voltage Vk of the CT.

The following sections show the ac burden of the VAMP 11F relay and, taking into account the magnetizing curve of a CT, it is then possible to determine the accuracy of the system as a whole for the entire current range: V11F + associated CT.

3.1 Recapitulation of the Current Transformer's Characteristics

3.1.1 Characterization of a Current Transformer

The characteristics of a protection relay CT are based on:

- Its rated output burden expressed in VA, its relevant accuracy class (5P or 10P) and the **accuracy limit current** (5 In, 10 In, 15 In, 20 In). The **accuracy limit factor (K)** is the ratio between the precision limit current and the nominal current rating.
- Naturally, the transformation ratio of the CT is to be added to this. This ratio is the ratio of the primary current to the secondary current **I1/I2**. The secondary current rating is generally 1 A or 5 A.
- Other characteristics such as the insulating voltage or the thermal behavior are also taken into account.

Standard BS 3938 proposes a specification identical to that of IEC 185 for class P transformers. The CT is characterized in accordance with a second class known as X class (Cx) which, in addition to the calculated ratio, requires a knee-point voltage **Vk** and an internal resistance **Rct**.

The following quantities are associated with the magnetization curve of a CT:

- The knee-point voltage **Vk**, which is determined by the point on the curve V=f (Im) beyond which an increase of 10% in the voltage V results in a 50% increase of the magnetizing current.
- The voltage related to the accuracy limit of the CT.

\- For a 5PK CT (accuracy class 5P, accuracy limit factor K):

At the saturation voltage **Vs1** we will have a 5% accuracy on the current K * In.

\- For a 10PK TC (accuracy class 10P, accuracy limit factor K):

At the saturation voltage **Vs2** we will have a 10% accuracy on the current K * In

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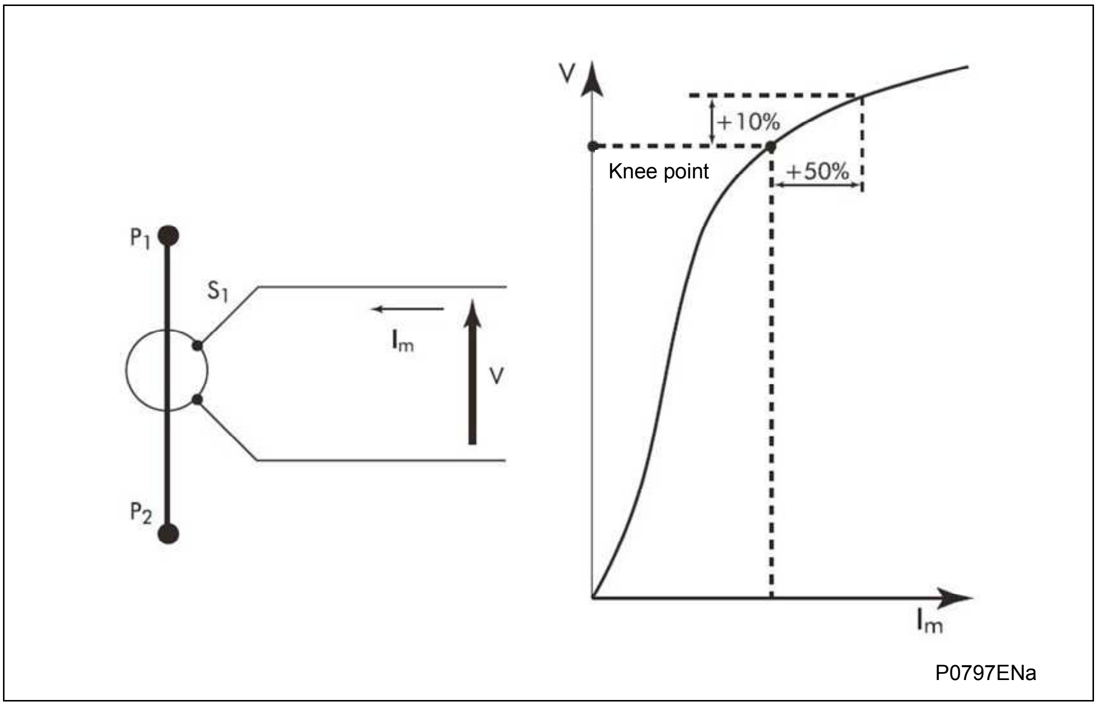

Figure 28: Definition of the Magnetizing Curve's Knee-Point

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With the materials generally used to manufacture current transformers, we have:

Vk corresponds to 1.4 tesla

Vs1 corresponds to 1.6 tesla

Vs2 corresponds to 1.9 tesla

3.1.2 Equivalent diagram of a current transformer

The equivalent diagram of a CT is indicated below:

- CT ratio: n2/n1
- L_m: magnetization self-induction coil of the CT
- I_m: magnetizing current
- I_1: primary current
- I_2: secondary current = I_1 * n2 /n1
- I_s: secondary current passing through the load resistance Rp.: $\overrightarrow{I_S} = \overrightarrow{I_2} - \overrightarrow{I_m}$
- Rct: secondary winding resistance of the CT (ohms)

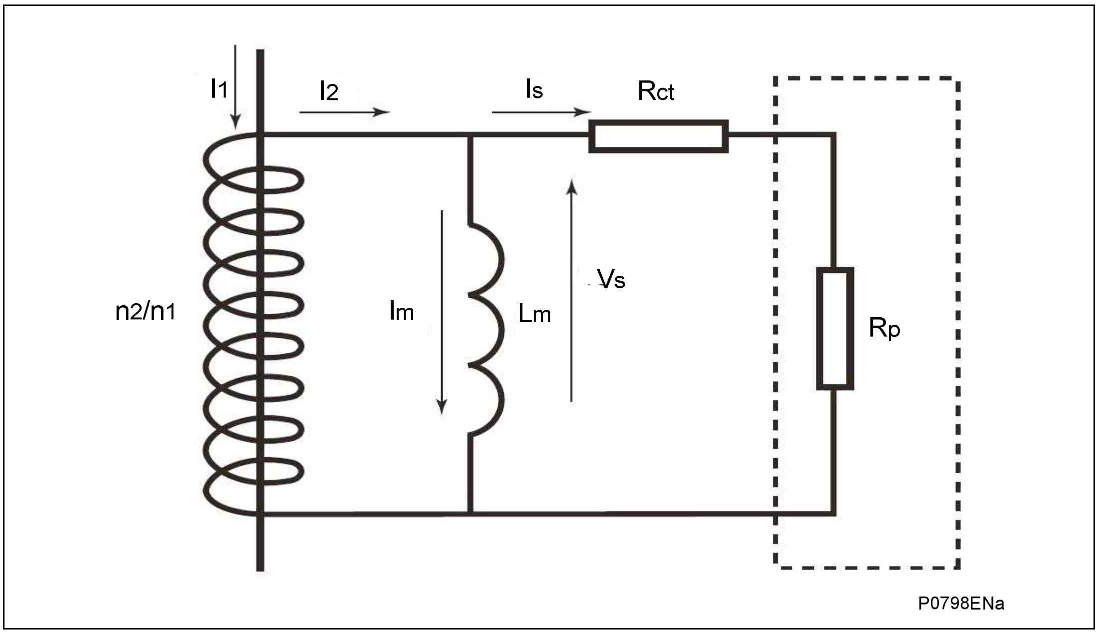

Figure 29: Equivalent diagram of a current transformer

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The magnetizing current Im of the transformer depends on the voltage generated at the secondary windings of the transformer.

It is this current that introduces an error signal into the measurement. If the CT were perfect, the magnetizing current would be null.

3.1.3 How to calculate the rated burden, in VA, of a CT based on its characteristic quantities (Vk, Rct)

The saturation voltage is derived using the following formula: Vs = (Rct + Rp) Is

The nominal load impedance of the CT is Rp = Pn /In^2

We have Vs = (Rct + Pn /In^2) Is

Hence: Pn = (Vs/Is - Rct) In^2

• For a transformer with in a **5P** accuracy class: Vs1/Vk = 1.6/1.4

Thus: Vs1 = 1.6/1.4 * Vk, at Is1 equals K * In

Hence: Pn = [(1.6/1.4 * Vk)/K * In - Rct] * In^2

• For a transformer with a 10P accuracy class: Vs2/Vk = 1.9/1.4

thus Vs2 = 1.9/1.4 * Vk, at Is2 equals K * In

Hence: Pn = [(1.9/1.4 * Vk)/K * In - Rct] * In^2

3.1.4 Definition equivalence for common CTs

Since the only constants of a CT are its magnetizing curve, its Rct resistance and its transformation ratio, it is possible to replace a transformer which Pn1 power in VA is of the 5PK1 type with a transformer which Pn2 power in VA is of the 5PK2 type.

Given that the values of Vs1 and Rct are known:

Vs1 = (Rct +Pn1/In^2)*K1 * In = (Rct + Pn2/In^2)*K2 *In

Pi = Rct * In^2 (ohmic lossof CT)

(Pi +Pn1) * K1 = (Pi + Pn2) * K2

Hence K2 = [(Rct * In^2 + Pn1)/ (Rct * In^2 + Pn2)] * K1

3.1.5 How to calculate the knee-point voltage Vk of a CT defined in class **P**

• For a transformer with accuracy class of **5P**: Vs1/Vk = 1.6/1.4

$Pn = [(1.6/1.4 * Vk)/K * In - Rct] * In^2$

Hence $Vk = 1.4/1.6 (Pn/In^2 + Rct) K * In$

• For a transformer with a precision class **10P**: Vs2/Vk = 1.9/1.4

$Pn = [(1.9/1.4 * Vk)/K * In - Rct] * In^2$

Hence $Vk = 1.4/1.9 (Pn/In^2 + Rct) K * In$.

3.2 Consumption of VAMP 11F Relays

Nominal current (In)	1 or 5 A (selectable via HMI)
Operating range	0.1 – 40 In
Nominal Burden at In	< 0.2 VA for In=5A; < 0.05 VA for In=1A
Resistance of phase current input at 30In	< 0.008 Ω for In=5A; < 0.05 Ω for In=1A
Thermal withstand	1 s @ 100 x rated current 2 s @ 40 x rated current 10 s @ 30 x rated current continuous: 4 x rated current

Table 2: V11F Current Input Resistance for phase current inputs

Ion: earth fault input nominal current (Ien)

Nominal current (Ien):	1 or 5 A (selectable via HMI)
Operating range	Selected at order (Cortec): 0.01 – 2Ion (Ien) 0.05 – 12Ion (Ien) 0.01 – 12Ion (Ien) (limited market version)
Nominal Burden at Ion	< 0.2 VA for In=5A; < 0.05 VA for In=1A
Resistance of earth current input at 30In	< 0.008 Ω for In=5A; < 0.05 Ω for In=1A
Thermal withstand	1 s @ 100 x rated current 2 s @ 40 x rated current 10 s @ 30 x rated current continuous @ 4 x rated current

Table 3: V11F Current Input Resistance for earth fault current input

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3.3 Calculation of Required CT for Protection Relays

It is not possible to recommend any CT without detailed information. The decision needs to be based on calculation.

The following parameters have to be considered:

- Type of CT (nominal power, nominal current and current ratio, internal resistance, nominal accuracy limit factor, class and construction),
- Resistance of wiring (length, cross section, specific resistance of material),
- Resistance of V11F current inputs (as per table 2 in section 3.2).

Depend on the regional standards and the best practice two ways of calculation is possible:

- The first method gives the minimum CT requirement to be sure that the relay trips
- The second method assures that CTs will be not saturated at all conditions (DC component in fault condition). This method is recommended for full functionality (measurement, recording in full range, etc) of the relay.

Note: Assuming that the CT does not supply any circuits other than the VAMP 11F and the distance between V11F and CTs is short, the folowing CTs types are recommended as minimum:

- 5VA 10P20 for 1A secondary rating
- 10VA 10P20 for 5A secondary rating

The first method:

Protection type	Knee-point voltage
Non-directional DT/IDMT overcurrent and earth fault protection	
Time-delayed phase overcurrent	$V_k \geq \frac{I_{fp}}{2}(R_{ct} + R_l + R_{rp})$
Time-delayed earth fault overcurrent	$V_k \geq \frac{I_{fn}}{2}(R_{ct} + 2 \cdot R_l + R_{rp} + R_{rn})$
Non-directional instantenous overcurrent and earth fault protection	
Instantenous phase overcurrent	$V_k \geq I_{sp} \cdot (R_{ct} + R_l + R_{rp})$
Instantenous earth fault overcurrent	$V_k \geq \frac{I_{fn}}{2}(R_{ct} + 2 \cdot R_l + R_{rp} + R_{rn})$

Where:

V_k : Required CT knee-point voltage [V]

I_{fp} : Maximum prospective secondary phase current [A]

I_{fn} : Maximum prospective secondary earth fault current [A]

I_{sp} : Stage 2 and 3 setting [A]

R_{ct} : Secondary CT winding resistance [Ω]

R_l : Resistance of single lead from the relay to current transformer [Ω]

R_{rp} : Resistance of V11F phase current input at 30In [Ω]

R_{rn} : Resistance of V11F neutral current input at 30In [Ω]

For more details refer to B&CT_EN_AP_D11.pdf ("Burdens & Current Transformer Requirements of VAMP Relays, Application Notes.")

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The second method:

Two critical cases have to be checked for different types of faults:

- the lowest set current threshold value at which the relay has to operate (minimum current).
- the highest possible short-circuit current, which depends on the maximum short-circuit power on the busbar of the substation (maximum current).

The following equation is used for dimensioning a current transformer:

$$V_{sal} = n_n \cdot I_{sn} \cdot (R_{ct} + R_{bn}) \geq \frac{I_{psc}}{K_n} \cdot (R_{ct} + R_b)$$

The current transformer can be dimensioned for the minimum required secondary accuracy limiting voltage acc. to IEC 60044-1, 2.3.4:

$$V_{sal} \geq \frac{I_{psc}}{K_n} \cdot (R_{ct} + R_b)$$

$$\geq \frac{I_{psc}}{I_{pn}} \cdot I_{sn} \cdot (R_{ct} + R_b)$$

$$\boxed{V_{sal} \geq K_{ssc} \cdot I_{sn} \cdot (R_{ct} + R_b)}$$

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Alternatively, the current transformer can also be dimensioned for the minimum required rated accuracy limit factor acc. to IEC 60044-1, 2.3.3:

$$n_n \geq \frac{I_{psc}/K_n}{I_{sn}} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})}$$

$$\geq \frac{I_{psc}}{I_{pn}} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})}$$

$$\boxed{n_n \geq K_{ssc} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})} = K_{ssc} \cdot \frac{(P_{ct} + P_b)}{(P_{ct} + P_{bn})}}$$

The actual secondary connected burden Rb is given as follows:

- For phase-to-ground faults: $R_b = 2 \cdot R_l + 2 \cdot R_{rel}$
- For phase-to-phase faults: $R_b = R_l + R_{rel}$

The relay's burden R_{rel} is per table 2 (see section 3.2).
The lead resistance R_l is to be calculated from wire length, cross section and specific resistance.

The relation between secondary accuracy limiting voltage acc. to IEC 60044-1, 2.3.4 and rated accuracy limit factor acc. to IEC 60044-1, 2.3.3 is given as follows:

$$V_{sal} = n_n \cdot \left(\frac{P_{bn}}{I_{sn}} + I_{sn} \cdot R_{ct} \right)$$

Sample calculation

The following application data are given:

CT ratio 100/1 A

CT nominal power Sn=2.5 VA (R_{bn} = 2.5 Ohm)

CT internal burden R_{ct} = 0.5 Ohm

Lead resistance R_l = 0.01774 Ohm (2 m one way, 2.5 mm^2 Cu)

$R_{N\ rel}$ = 0.05 Ohm

For three phase fault:

$$R_b = R_l + R_{Nrel}$$

For a one phase fault without core balance CT (3xCTs connection):

$$R_b = 2 \cdot (R_l + R_{Nrel})$$

Nominal burden resistance of CT:

$$R_{bn} = \frac{S_n}{I_n^2} = \frac{2.5VA}{(1A)^2} = 2.5\Omega$$

Max. short-circuit current: INmax (I_{fn}): phase-ground = 2 kA = 20 IN_{nom}
Imax (I_{fp}): phase-phase = 10 kA = 100 In

Max value which can be measured with good accuracy by V11F = 60In.

Relay minimum operating current: IN> = 0.2 In
IN>> = 1 In:
I> = 1 In:
I>> = 10 In

Phase-earth fault, minimum current ($K_d \cdot K_{ssc} = IN >$): :

$$n_n \geq K_d \cdot K_{ssc} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})} = 0.2 \cdot \frac{0.5 + 2 \cdot (0.01774 + 0.05)}{0.5 + 2.5} \approx 0.043$$

Phase-earth fault, maximum current ($K_d \cdot K_{ssc} = IN \max / INnom$):

$$n_n \geq K_d \cdot K_{ssc} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})} = 20 \cdot \frac{0.5 + 2 \cdot (0.01774 + 0.05)}{0.5 + 2.5} \approx 4.24$$

Phase-phase fault, minimum current ($K_d \cdot K_{ssc} = I >$):

$$n_n \geq K_d \cdot K_{ssc} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})} = 1.0 \cdot \frac{0.5 + 0.01774 + 0.05}{0.5 + 2.5} \approx 0.189$$

Phase-phase fault, maximum current which be measured by V11F ($K_d \cdot K_{ssc} = 60 Inom / Inom$):

$$n_n \geq K_d \cdot K_{ssc} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})} = 60 \cdot \frac{0.5 + 0.01774 + 0.05}{0.5 + 2.5} = 11.3$$

Phase-phase fault, maximum current ($K_d \cdot K_{ssc} = I \max / Inom$):

$$n_n \geq K_d \cdot K_{ssc} \cdot \frac{(R_{ct} + R_b)}{(R_{ct} + R_{bn})} = 100 \cdot \frac{0.5 + 0.01774 + 0.05}{0.5 + 2.5} = 18.92$$

Overall, a minimum rated accuracy limit factor of 18.92 is required. A typical (standard) value thus would be n_n = 20.

A typical (standard) value thus would be 2.5 VA (2.5 VA P20);

If a CT with n_n = 10 is to be used, it is necessary to increase the nominal power of the CT based on the following formula:

$$\boxed{S_{n2} = S_{n1} \cdot \frac{(n_{n1})}{(n_{n2})} = 2.5VA \cdot \frac{(20)}{(10)} = 5VA}$$

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The new CT requirement calculation based on 5 VA P10 CT can be repeated again.

4. AUXILIARY SUPPLY FUSE RATING

In the Safety section of this manual, the maximum allowable fuse rating of 16 A is quoted. To allow time grading with upstream fuses, a lower fuse link current rating is often preferable. Use of standard ratings of between 6 A and 16 A is recommended. Low voltage fuse links, rated at 250 V minimum and compliant with IEC 60269-2 general application type gG, with high rupturing capacity are acceptable. This gives equivalent characteristics to HRC "red spot" fuses type NIT/TIA often specified historically.

The table below recommends advisory limits on relays connected per fused spur. This applies to the VAMP 11F**,** as these have inrush current limitation on switch-on, to conserve the fuse-link.

Maximum Number of VAMP 11F Relays Recommended Per Fuse				
Battery Nominal Voltage	6 A	10 A Fuse	15 or 16 A Fuse	Fuse Rating > 16 A
24 to 60 Vac/dc	2	4	6	Not permitted
90 to 240 Vac/ 90 to 250 Vdc	6	10	16	Not permitted

Alternatively, miniature circuit breakers (MCB) may be used to protect the auxiliary supply circuits.

MEASUREMENTS AND RECORDING

MR

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

CONTENTS

1. MEASUREMENTS AND RECORDING

1.1 Introduction

The P111Enh is equipped with integral fault recording facilities suitable for analysis of complex system disturbances. Fault records can be read out by setting software MiCOM S1 via the USB port accessible on the P111Enh front panel. The USB port offers a communications facility to the P111Enh.

Communications can be established via the USB port even if the P111Enh is not supplied by the auxiliary voltage (function not available in Model N).

Access to the USB port is protected by means of a plastic cover.

1.2 Event records (not available in Model L w/o RS485)

The relay records and time tags up to 200 events and stores them in non-volatile FRAM memory. This enables the system operator to establish the sequence of events that occurred within the relay following a particular power system condition, switching sequence etc. When the available space is exhausted, the oldest event is automatically overwritten by the most recent.

The real time clock within the relay provides the time tag for each event, to a resolution of 1 ms.

The event records are available for remote viewing, via the communications ports RS485 or USB.

For extraction from a remote source via communications ports, refer to the SCADA Communications section (P111Enh/EN CT), where the procedure is fully explained.

Types of event

An event may be a change of state of a control input or output relay, a trip condition, etc. The following sections show the various items that constitute an event:

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Change of state of binary inputs (ABE)

If one or more of the binary inputs has changed state since the last time that the protection algorithm ran, the new status is logged as an event. The information is available if the event is extracted and viewed via a PC.

Change of state of one or more output relay contacts

If one or more of the output relay contacts have changed state since the last time that the protection algorithm ran, then the new status is logged as an event. The information is available if the event is extracted and viewed via PC.

Relay alarm conditions

Any alarm conditions generated by the relays will also be logged as individual events. The following table shows examples of some of the alarm conditions and how they appear in the event list:

Alarm Condition	Event Text	Event Value
Auxiliary Supply Fail	Vx Fail ON/OFF	Bit position 0 in 32 bit field
CT Supply Fail	CT Supply Fail ON/OFF	Bit position 1 in 32 bit field

The above table shows the abbreviated description that is given to the various alarm conditions and also a corresponding value between 0 and 31. This value is appended to each alarm. It is used by the event extraction software, such as MiCOM S1, to identify the alarm. Either ON or OFF is shown after the description to signify whether the particular condition is operational or has reset.

Protection element trips

Any operation of protection elements (a trip condition) will be logged as an event record, consisting of a text string indicating the operated element and an event value. Again, this value is intended for use by the event extraction software, such as MiCOM S1.

1.3 Fault records

Each fault record is generated with time stamp.

The following data is recorded for any relevant elements that operated during a fault, and can be viewed in each of the last 20 fault records:

(i) Event Text (the reason for a trip):

Phase Overcurrent:
- I> trip
- I>> trip
- I>>> trip
- SOTF trip (**ABE**)
- IN_1 trip
- IN_2 trip
- IN_3 trip (**E**)
- I2> trip (**E**)
- Brkn Cond (**E**) trip
- CB Fail trip
- AUX1 trip (**ABE**)
- AUX2 trip (**ABE**)
- AUX3 trip (**ABE**)
- AUX4 trip (**ABE**)
- Therm OL (**NABE**)

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(ii) Active setting Group

(iii) Fault Time an Fault Date

(iv) Fault Orgin: type of fault (for example: phase A-B, A-B-C, etc)

(v) Event Value:

Per phase record of the current value during the fault: Iφ and measured IN

Fault records are stored in non-volatile memory (FRAM memory). This type of memory does not require any maintenance (no battery inside the P111Enh). Fault records are stored without any time limitation even if the P111Enh is not supplied from any power source.

1.4 Alarm records

Each alarm record is generated with time stamp.

The following data is recorded for any relevant elements that operated during an alarm, and can be viewed in each of the last 5 alarm records:

(i) Event Text (the reason for a protection alarm):

Phase Overcurrent:
- tI> Alarm
- tI>> Alarm
- tI>>> Alarm
- tSOTF Alarm (**ABE**)
- tIN_1 Alarm
- tIN_2 Alarm
- tIN_3 Alarm (**E**)
- tI2> Alarm (**E**)
- tBrkn Cond Alarm (**E**)
- tCB Fail Alarm
- tAUX1 Alarm (**ABE**)

tAUX2 Alarm (**ABE**)
tAUX3 Alarm (**ABE**)
tAUX4 Alarm (**ABE**)
tTherm OL Alarm (**NABE**)

(ii) Active setting Group

(iii) Alarm Time an Alarm Date

(iv) Alarm Orgin: type of alarm (for example: phase A-B, A-B-C, etc)

(v) Event Value:

Per phase record of the current value during the alarm: Iφ and measured IN

Alarm records are stored in non-volatile memory (FRAM memory). This type of memory does not require any maintenance (no battery inside the P111Enh). Alarm records are stored without any time limitation even if the P111Enh is not supplied from any power source.

1.5 Instantaneous records (Model E)

Each instantaneous record is generated with time stamp.

The following data is recorded for any relevant current elements with the crossed threshold, and can be viewed in each of the last 5 instantaneous records:

(i) Event Text (the reason for a current protection start):

Phase Overcurrent:
I>
I>>
I>>>
SOTF
IN_1
IN_2
IN_3

(ii) Active setting Group

(iii) Alarm Time an Alarm Date

(iv) Alarm Orgin: type of alarm (for example: phase A-B, A-B-C, etc)

(v) Event Value:

Per phase record of the current value during the alarm: Iφ and measured IN

Instantaneous records are recorded in case of powering from an auxiliary voltage (not recorded if P111Enh is powered from CTs only) and stored in non-volatile memory (FRAM memory). This type of memory does not require any maintenance (no battery inside the P111Enh). Instantaneous records are stored without any time limitation even if the P111Enh is not supplied from any power source.

1.6 Alarm status

Alarm status presents the current Alarm signals.

The Alarm signals information can be with latching or without latching, depends on the setting value ***GLOBAL SETTINGS/LOC/***

- Alarms Info 0:Self-reset – only current Alarm status is displayed,

- Alarms Info 1:Latching – Alarm information is latched up to reset in cell: ALARM STATUS/Reset Press ENTER cell.

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The following Alarm is viewed:

tI> Alarm	Alarm by the first phase overcurrent stage
tI>> Alarm	Alarm by the second phase overcurrent stage
tI>>> Alarm	Alarm by the third phase overcurrent stage
tSOTF Alarm (**ABE**)	Alarm by SOTF element
tIN_1 Alarm	Alarm by the first earth fault overcurrent stage
tIN_2 Alarm	Alarm by the second earth fault overcurrent stage
tIN_3 Alarm (**E**)	Alarm by the third earth fault overcurrent stage
tI2> Alarm (**E**)	Alarm by the negative sequence overcurrent element
tBrkn Cond Alarm	Alarm by Broken Conductor protection
CB Fail Alarm	Circuit Breaker Failure protection time-delay elapsed
tAUX1 Alarm (**ABE**)	tAUX1 time-delay elapsed
tAUX2 Alarm (**ABE**)	tAUX2 time-delay elapsed
tAUX3 Alarm (**ABE**)	tAUX3 time-delay elapsed
tAUX4 Alarm (**ABE**)	tAUX4 time-delay elapsed
Thermal Overload Alarm (**NABE**)	Thermal Alarm stage crossed by actual Thermal State value
tCB FLTY Ext.Sign. Alarm	An input mapped to this function detects CB problems that may influence control possibilities (for example spring problem, insufficient pressure, etc.)
Inrush Bl. Alarm. (**AE**)	Inrush Blocking (the second harmonic level crossing threshold
TC Supervision Alarm. (**AE**)	Trip Circuit Supervision detects a problem
CB Time Monit. Alarm. (**AE**)	The monitoring time for CB opening/closing
CB Curr.Diagn. Alarm. (**AE**)	Summation of the current interrupted by the CB
CB Nb Diagn. Alarm. (**AE**)	CB open operations counter monitoring
[79] Lockout Alarm (**E**)	Auto-recloser lockout condition
Hardw.Warning Alarm	Any hardware problem detected
State of CB Alarm (**AE**)	The abnormal CB's position for two bits CB's connection (00 or 11)
[79] Roll.Demand Alarm (**E**)	The number of Autoreclose cycles in the defined (set) time window is greater than set value

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1.7 Measurements

The relay produces a variety of directly measured power system quantities:

IA, IB, IC - R.M.S. values

I1 (**E**), I2 (**E**), I2/I1 (**E**) - calculated fundamental harmonic ratio

IN - measured fundamental harmonic only (E/F analogue input)

Thermal (**NABE**) - thermal state based on RMS value from the max phase current

IA 2nd harmonic (**AE**) - second harmonic in phase A

IB 2nd harmonic (**AE**) - second harmonic in phase B

IC 2nd harmonic (**AE**) - second harmonic in phase C

1.8 Counters

The P111Enh's counters are available in the ***RECORDS/COUNTERS*** menu:

- ***CONTROL COUNTER***:
    - ***No. Trips*** – Number of manual trip commands (inputs, menu default Control Window, trip key, remote control via RS485 or USB)
    - ***No. Close -*** Number of manual close commands (inputs, menu default Control Window, trip key, remote control via RS485 or USB)

    Counters can be reset in the ***CONTROL COUNTER*** column.
- ***FAULT COUNTER***:
    - ***No. Fault Trips –*** Number of trip commands from protection elements (current-based protection element trip, AUX trips and Auto-recloser trips)
    - ***No. Fault Starts*** – Number of timer starts by protection elements set to trip (current-based protection element and AUX)
    - ***No. Alarms*** - Number of Alarm signals from protection elements set to Alarm or functions mapped to an Alarm signal,
    - ***No. HW Warnings*** – Number of hardware problems detected by the self-monitoring function.

    Counters can be reset in the ***FAULT COUNTER*** column.
- ***AUTORECLOSE COUNTER*** (**E**):
    - ***No. Total [79] action –*** Total number of Auto-recloser starts
    - ***No. Trips&Lockout*** – Total number of final trips or lockouts
    - ***No. Successful –*** Total number of successful auto-reclosures (the reclaim time has elapsed without tripping)
    - ***Cycle 1 Reclose –*** Number of first shots (the counter is incremented with each first close shot, even if the following trip occurs during the reclaim time)
    - ***Cycle 2 Reclose –*** Number of second shots (the counter is incremented with each second close shot, even if the following trip occurs during the reclaim time)
    - ***Cycle 3 Reclose –*** Number of third shots (the counter is incremented with each third close shot, even if the following trip occurs during the reclaim time)
    - ***Cycle 4 Reclose –*** Number of fourth shots (the counter is incremented with each fourth close shot, even if the following trip occurs during the reclaim time)

Counters can be reset in the ***AUTORECLOSE COUNTER*** column.

Note: For a 4-shot auto-reclose sequence (TCTCTC, the next TCTC, the next TCTCTCTCT and the next TCT (lockout)) the counters shows:

Total [79] action:	4
Total Trips&Lockout:	1
Total Successful:	2
Cycle 1 Reclose:	4
Cycle 2 Reclose:	3
Cycle 3 Reclose:	2
Cycle 4 Reclose:	1

- ***CB MONITORING COUNTER*** (**AE**):
    - ***CB Close Mon.*** – total number of close commands (auto-recloser included)
    - ***CB Open Mon. –*** total number of open commands (Manual and Fault trips)
    - ***CB AMPS Value*** – cumulative value of current broken by the CB for fault clearance trips.

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1.9 Disturbance Recorder (Model A and E)

The integral disturbance recorder has an area of memory specifically set aside for record storage. The number of records that may be stored by the relay is dependent upon the selected recording duration:

Total number of records available in disturbance recorder is:

- One - for set Max Record Time from in range: 2.01s – 4.00s
- Two – for set Max Record Time from in range: 1.51s – 2.00s
- Three – for set Max Record Time from in range: 1.01s – 1.33s
- Four – for set Max Record Time from in range: 0.81s – 1.00s
- Five - for set Max Record Time from in range: 0.10s – 0.8s

The recorder stores actual samples that are taken at a rate of 16 samples per cycle. Each disturbance record consists of eight analog data channels and thirty-two digital data channels. The relevant CT and VT ratios for the analog channels are also extracted to enable scaling to primary quantities.

Note: If a CT ratio is set to less than a unit, the relay will choose a scaling factor of zero for the appropriate channel.

The "**DISTURBANCE RECORDER**" menu column is shown in the following table:

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Pre-Time	0.1 s	0.1 s	2 s	0.01 s
Setting for the disturbance record pre-fault time. The pre-fault time adjusts the beginning of the disturbance record: In this example, the record starts 100ms before the disturbance. Its length can be limited by setting.				
Post-Fault Time	0.1 s	0.1 s	1 s	0.01 s
Setting for the disturbance record post-fault time. The total disturbance recording time is: pre-fault time + high state of triggering criteria (Start or Trip time)+ post-fault time. The above total recording time is limited by setting.				
Disturbance Rec.Trig.	0: on Inst.	0: on Inst. 1: on Trip		
Setting for the trigger criteria: ***0: on Inst***. – the trigger is the disturbance indicated by the starting of a protection element set to trip the CB. If this option is chosen the total recording time is: pre-fault time + duration of protection start + post-fault time, but no longer than the value of ***Max Record Time***. ***1: on Trip***. – the trigger is the disturbance indicated by the protection element trip. If this option is chosen the total recording time is: pre-fault time + duration of protection trip+ post-fault time, but no longer than the value of ***Max Record Time***.				
Max Record Time	1.0 s	0.1 s	4 s	0.01 s
Setting for the maximum total recording time. If default value is kept (3 s) it means that 2 records will be recorded.				

It is not possible to display the disturbance records locally on the LCD; they must be extracted using suitable software such as MiCOM S1 or MiCOM S1 Studio.

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1.10 Measurement Settings

The following settings under the measurements heading can be used to configure the relay measurement function.

1.10.1 CT Ratio

GLOBAL SETTINGS/CT RATIO menu

Menu Text	Default Setting	Setting Range		Step Size
		Min.	Max.	
Line CT Primary	1.000 A	1	30k	1
Sets the phase current transformer input's primary current rating.				
Line CT Sec	1 A	1 A	5 A	N/A
Sets the phase current transformer input's secondary current rating: 1A or 5A.				
E/Gnd CT Primary	1.000 A	1	30k	1
Sets the earth fault current transformer input's primary current rating.				
E/Gnd CT Sec	1.000 A	1 A	5 A	N/A
Sets the earth fault current transformer input's secondary current rating: 1A or 5A.				

1.10.2 Default Measuring Window

Default window is after connection of power supply to P111Enh or after resetting of signaling.

GLOBAL SETTINGS/LOC menu

<table>
<tr><th>Menu Text</th><th>Default Setting</th><th>Available Settings</th></tr>
<tr><td>Default Display</td><td>0:Meas. In</td><td>0:Meas. In
1: Meas.A
2: Control CB (BAE)
3: [79] CTRL (E)
4:Control Mode (E)</td></tr>
<tr><td colspan="3">This cell is used to change the default display window
0: Measurements referred to In
1: Measurements in Amps
2: Control CB window for control of CB (close and trip command) (BAE)
3: Auto-reclose control window for blocking of the auto-recloser and readout of auto-reclose status information (E)
4: Control Mode window for changing of the CB control mode: Local/Remote and for presenting Control Mode state information (E)</td></tr>
</table>

1.10.3 Measurement criteria

The ***LOC*** submenu makes it possible to set parameters associated with this function. (Fundamental harmonic or True RMS)

GLOBAL SETTINGS/LOC menu

<table>
<tr><th rowspan="2">Menu Text</th><th rowspan="2">Default Setting</th><th colspan="2">Setting Range</th><th rowspan="2">Step Size</th></tr>
<tr><th>Min.</th><th>Max.</th></tr>
<tr><td>I>, I>>, I>>></td><td>1 harm.</td><td>0: 1harm.</td><td>1: TrueRMS</td><td>n/a</td></tr>
<tr><td colspan="5">Setting for the measuring criteria for 50/51 protection elements.
1harm – means that I>, I>>, I>> compare fundamental component (harmonic) with the set stage of protection element,
True RMS – means that means that I>, I>>, I>> compare True RMS value with the set stage of protection element,
Note: Above setting is used for 50/51 protection elements (I>, I>>, I>>>)
49: TrueRMS is fixed
46, 46BC, 50N/51N: fundamental (the first) harmonic is fixed</td></tr>
</table>

COMMISSIONING

CM

Date: **1st July 2015**
Connection Diagrams: **10V11F01**

CONTENTS

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INTRODUCTION

The VAMP 11F feeder protection relays are fully numerical in design, implementing all protection and non-protection functions in software. The relays employ a high degree of self-monitoring. The commissioning tests do not need to be as extensive as with non-numeric electronic or electro-mechanical relays.

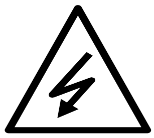
In the commissioning of numeric relays, it is only necessary to verify that the hardware is functioning correctly and that the application-specific software settings have been applied to the relay. It is considered unnecessary to test every function of the relay if the settings have been verified by one of the following methods:

- Extracting the settings applied to the relay using appropriate setting software (preferred method)
- Via the operator interface

Unless previously agreed to the contrary, the customer will be responsible for determining the application-specific settings applied to the relay and for testing of any scheme logic applied by external wiring.

Blank commissioning test and setting records are provided at the end of this chapter for completion as required.

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4L M/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTION OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.



For safety reasons, no work must be carried out on the V11F until all power sources to the unit have been disconnected.

1. SETTING FAMILIARIZATION

When commissioning a VAMP 11F relay for the first time, sufficient time should be allowed to enable the user to become familiar with the method by which the settings are applied.

The Getting Started chapter (V11F/EN GS) contains a detailed description of the V11F relay.

Via the front panel all the settings can be changed (refer to Settings chapter V11F/EN ST of this manual), LEDs and alarms reset, and fault and event records cleared. However, menu cells with access levels higher than the default level will require the appropriate password to be entered, before changes can be made.

Alternatively, if a portable PC is available together with suitable setting software (such as MiCOM S1 Studio 5.1.0 or higher), the menu can be viewed a page at a time to display a full column of data and text. This PC software also allows settings to be entered more easily, saved to a file on disk for future reference or printed to produce a setting record. Refer to the PC software user manual for details (refer to Getting Started V11F/EN GS). If the software is being used for the first time, allow sufficient time to become familiar with its operation.

2. EQUIPMENT REQUIRED FOR COMMISSIONING

2.1 Minimum equipment required

Multifunctional dynamic current injection test set.

Multimeter with suitable ac current range.

Ensure that the multimeter fuse is not open-circuited if used for CT current measurement.

Multimeter with maximum value recording of the dc voltage (to measure the dc magnitude of the trip pulse)

Continuity tester (if not included in multimeter).

Note: Modern test equipment may contain many of the above features in one unit.

3. PRODUCT CHECKS

These product checks cover all aspects of the relay and should be carried out to ensure that the unit has not been physically damaged prior to commissioning, that it is functioning correctly and that all input quantity measurements are within the stated tolerances.

If the application-specific settings have been applied to the relay prior to commissioning, it is advisable to make a copy of the settings to allow their restoration later. This could be done by:

- Obtaining a setting file from the customer.
- Extracting the settings from the relay itself (this again requires a portable PC with appropriate setting software)
- Manually creating a setting record. This could be done using a copy of the setting record located at the end of this chapter to record the settings. As the relay's menu is scrolled through sequentially via the front panel user interface.

3.1 With the relay de-energized

The following group of tests should be carried out without powering the V11F.

The current transformer connections must be isolated from the relay for these operations to be carried out.

WARNING: NEVER OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION.

The line current transformers should be short-circuited and disconnected from the relay terminals. If this is not possible to complete this operation, the wiring to these circuits must be disconnected and the exposed ends suitably short-circuited to prevent a safety hazard.

3.1.1 Visual inspection

The rating information given under the top access cover on the front of the relay should be checked. Check that the relay being tested is correct for the protected line/circuit. Ensure that the circuit reference and system details are entered onto the setting record sheet. Double-check the CT primary current rating, and be sure to record the actual CT setting used.

Carefully examine the relay to check that no physical damage has occurred since installation.

3.1.2 Insulation

Insulation resistance tests are only necessary during commissioning and if they have not been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic or brushless insulation tester at a dc voltage not exceeding 500V. Terminals of the grouped circuits should be temporarily connected together.

The main groups of relay terminals are:

Current transformer circuits,

Auxiliary voltage supply

Binary control inputs

Relay contacts

EIA(RS)485 communication port

The insulation resistance should be greater than 100 MΩ at 500 V.

On completion of the insulation resistance tests, ensure all external wiring is correctly reconnected to the relay.

3.1.3 External wiring

Check that the external wiring is correct when compared to the relevant relay and scheme diagram. Ensure as far as practical that the phase sequence is as expected. The relay diagram number appears on the rating label on the upper side of the case.

The connections should be checked against the scheme (wiring) diagram.

3.1.4 Auxiliary supply voltage (Vx)

The relay can be operated from either a dc only or AC/DC auxiliary supply depending on the relay's nominal supply rating. The incoming voltage must be within the operating range specified in Table 1.

Without energizing the relay measure the auxiliary supply to ensure it is within the operating range.

Nominal Supply Rating DC	[AC r.m.s.]	DC Operating Range	AC Operating Range	**V11F Models**
24 - 250 V	[24 - 240 V]	19 to 300 V	19 to 264 V	**L, N**
24 - 60 V	[24 - 60 V]	19 to 72 V	19 to 66 V	**A. B, E**
90 - 250 V	[90 - 240 V]	48 to 300 V	48 to 264 V	

Table 1: Operational range of auxiliary supply Vx

It should be noted that the relay can withstand an ac ripple of up to 12% of the upper rated voltage on the dc auxiliary supply.

Do not energize the relay or interface unit using the battery charger with the battery disconnected as this can irreparably damage the relay's power supply circuitry.

Energize the relay only if the auxiliary supply is within the specified operating ranges. If a test block is provided, it may be necessary to link across the front of the test plug to connect the auxiliary supply to the relay.

Note: Vx nominal supply rating is common to auxiliary voltage supply and binary control inputs

3.2 With the relay energized

The following group of tests verifies that the relay hardware and software are functioning correctly and should be carried out while the V11F is powered.

MV isolators should be opened and the MV side should be connected to the earth to allow safe operation of the CB.

3.2.1 Light emitting diodes (LEDs)

On power up the green LED should have lit up and stayed on indicating that the relay is healthy. The relay has a non-volatile memory that remembers the state (on or off) of the alarm, trip and, if configured to latch, LED indicators when the relay was last energized from an auxiliary supply. Therefore these indicators may also lit up when the auxiliary supply is applied.

Latching of LEDs can be configured via MiCOM S1 Studio 5.1.0 (or higher) setting software (USB port) or manually by the front panel

Default configuration of LEDs (except ***Trip*** LED): without latching

Note: The above default configuration can be changed using the MiCOM S1 Studio 5.1.0 setting software (USB port).

Trip LED is fixed to protection trip with latching.

The eight LEDs are on the front panel of the relay:

- The green ***Healthy*** LED indicates that the V11F is powered and no internal faults are detected. A flashing LED indicates a hardware problem on the V11F. Not lit – V11F has no power supply
- Red ***Trip*** LED: indicates that the time-delay of the protection element set to trip has elapsed
- Yellow ***Alarm*** LED: indicates that the time-delay of the protection element set to Alarm has elapsed or that non-protection functions as issued an Alarm signal. This LED can be programmed as 3-7 LEDs too.
- Note: By default ***Alarm*** LED is not configured to Alarm. It is necessary to configure this LED for Alarm function via MiCOM S1 Studio 5.1.0 setting software (USB port) or manually by the front panel

The red LEDs 2 to 7 are programmable to the following signals:

Protect.Trip –	Trip by protection elements
Alarm –	Alarm signal
Start Phase A –	Start of the phase overcurrent element (set to trip) in phase A
Start Phase B –	Start of the phase overcurrent element (set to trip) in phase B
Start Phase C –	Start of the phase overcurrent element (set to trip) in phase C
I> –	Start of the first phase overcurrent stage
I>> –	Start of the second phase overcurrent stage
I>>>–	Start of the third phase overcurrent stage
SOTF –	Start of the Switch On To Fault overcurrent element (**ABE**)
IN_1 –	Start of the first earth fault overcurrent stage
IN_2 –	Start of the second earth fault overcurrent stage
IN_3 –	Start of the third earth fault overcurrent stage (**E**)
AUX1 –	Trigger of AUX1 timer (via a binary input) (**ABE**)
AUX2 –	Trigger of AUX2 timer (via a binary input) (**ABE**)
AUX3 –	Trigger of AUX3 timer (via a binary input) (**ABE**)
AUX4 –	Trigger of AUX4 timer (via a binary input) (**ABE**)
AUX5 –	Trigger of AUX5 timer (via a binary input) (**ABE**)
AUX6 –	Trigger of AUX6 timer (via a binary input) (**ABE**)
tI> –	Trip by the first phase overcurrent stage (if flashing: start)
tI>> –	Trip by the second phase overcurrent stage (if flashing: start)

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tI>>> – Trip by the third phase overcurrent stage (if flashing: start)

tSOTF – Trip by SOTF element (if flashing: start) (**AE**)

tIN_1 – Trip by the first earth fault overcurrent stage (if flashing: start)

tIN_2 – Trip by the second earth fault overcurrent stage (if flashing: start)

tIN_3 – Trip by the third earth fault overcurrent stage (if flashing: start) (**E**)

tI2> – Trip by the negative sequence o/c element (if flashing: start) (**E**)

t Brkn Cond – Trip by Broken Conductor protection (if flashing: start) (**E**)

Therm Trip – Trip by Thermal Overload protection (if flashing: alarm) (**NABE**)

Therm Alarm – Thermal Overload protection alarm (**NABE**)

CB Fail – Circuit Breaker Failure protection time-delay elapsed

tAUX1 – tAUX1 time-delay elapsed (if flashing: start) (**ABE**)

tAUX2 – tAUX2 time-delay elapsed (if flashing: start) (**ABE**)

tAUX3 – tAUX3 time-delay elapsed (if flashing: start) (**ABE**)

tAUX4 – tAUX4 time-delay elapsed (if flashing: start) (**ABE**)

[79] in Progress – The auto-reclose function is running (**E**)

[79] F. Trip – Auto-reclose not successful: Final Trip (**E**)

[79] Lockout – Lockout of the auto-reclose function (**E**)

[79] Blocked – The auto-reclose function is blocked (**E**)

[79] Success – The auto-reclose operation is successful (the CB remains closed) (**E**)

Local CTRL Mode – Local Control Mode (**AE**)

CB Alarm – Circuit Breaker condition alarm signal (CB Open NB, Sum Amps(n), CB Open Time and CB Close Time) (**AE**)

Maintenance Mode – Maintenance Mode (outputs are disconnected from all functions) (**AE**)

tCB FLT Ext.Sign. – An input mapped to this function detects CB problems that may influence control possibilities (for example spring problem, insufficient pressure, etc.). Signaling is active during a settable time (*GLOBAL SETTINGS/CIRCUIT BREAKER/tCB FLT ext*) (**ABE**)

Setting Group n – Setting Group n active (n= 1, 2)

After establishing the connection between PC and V11F via the USB port, the green ***Healthy*** LED should be lit permanently (it means that the V11F is powered), even if V11F is not connected to auxiliary voltage supply.

The remaining LEDs can be checked via the "LEDs Reset" function. This function can be mapped to the L1 – L8 inputs.

Check that the correct nominal voltage and polarity are applied to opto inputs L1 – L6 (D1 - D10 terminals), then connect the field voltage to the appropriate terminals for the input being tested.

All red LEDs should be lit within 1 s.

<u>Default LEDs setting (both Setting Groups):</u>

- LED2 – LED7: not configured.

3.2.2 Binary Inputs

This test checks that all the binary inputs on the relay are functioning correctly.

The binary inputs should be energized one at a time, see external connection diagrams (V11F/EN IN) for terminal numbers.

The V11F is fitted with an LCD display which makes it possible to view the state of the binary inputs, in the ***COMMISSIONING/Opto I/P Status*** menu cell. This information is also available via the MiCOM S1 Studio 5.1.0 (or higher) Measurement Viewer software. Refer to MiCOM S1 Studio 5.1.0 user manual for details.

If it is not possible to use the Measurement Viewer software, it is necessary to check the binary inputs by means of a functional test of the entire configuration.

Check that the correct nominal voltage and correct polarity are applied to the opto-inputs, then connect the field voltage to the appropriate terminals for the input being tested.

> Note: The binary inputs may be energized from an external DC auxiliary supply (e.g. the substation battery) in some installations. Check that this is not the case before connecting the field voltage, otherwise damage to the relay may result. If an external 24/27 V, 30/34 V, 48/54 V, 110/125 V, 220/250 V supply is being used it will be directly connected to the relay's optically isolated inputs. If an external supply is being used then it must be energized for this test but only if it has been confirmed that it is suitably rated with less than 12% AC ripple.

<u>Default factory settings:</u>

- L1 binary input (**ABE**): not configured
- L2 binary input (**ABE**): not configured
- L3 binary input(**ABE**): not configured
- L4 binary input(**ABE**): not configured
- L5 binary input (**E**): not configured
- L6 binary input(**E**): not configured
- L5 binary input (**E**): not configured
- L6 binary input (**E**): not configured

Reverse Input Logic indicates the low state of the Binary Input triggered by a programmable function.

3.2.3 Output Relays

To check output contacts it is necessary to carry out a functional test of the entire configuration.

> Note: It should be ensured that thermal ratings of anything connected to the output relays during the contact test procedure are not exceeded by the associated output relay being operated for too long. It is therefore advised that the time between application and removal of the contact test is kept to the minimum.

<u>Default factory settings:</u>

- RL1-RL6 outputs: not configured

Reverse Output Logic means that after powering the V11F, n/o contacts are closed. Output triggering via a programmable function opens the contacts (rest position).

3.2.4 Rear Communications Port

This test should only be performed where the relay is to be accessed from a remote location and will vary depending on the communications standard adopted.

It is not the intention of the test to verify the operation of the complete system from the relay to the remote location, just the relay’s rear communications port and any protocol converter necessary.

3.2.4.1 IEC60870-5-103 (VDEW) communications

IEC60870-5-103/VDEW communication systems are designed to have a local Master Station and this should be used to verify that the relay’s EIA(RS)485 port, is working.

The relay address and baud rate settings for EIA(RS)485 can be set by using local communication via the USB port (setting software) or via the relay's front panel.

Default Factory Setting:

- Baud Rate: 19.2 bps
- Parity: No parity
- Stop Bits: one stop bit
- Data Bits: 8 (fixed)

Also ensure that the relay's address and baud rate settings in the application software are the same as those set via the USB port.

Check that, using the Master Station, communications with the relay can be established.

3.2.4.2 MODBUS communications

Connect a portable PC running the appropriate MODBUS Master Station software to the relay’s first rear EIA(RS)485 port via an EIA(RS)485 to EIA(RS)232 interface converter. The terminal numbers for the relay's EIA(RS)485 port are up to 31.

The relay address, Parity and Baud Rate settings for EIA(RS)485 are set by using local communication via USB port (MiCOM S1 Studio 5.1.0).

Default Factory Setting:

- Baud Rate: 19.2 bps
- Parity: No parity
- Stop Bits: one stop bit
- Data Bits: 8 (no settable)

Ensure that the relay's address and baud rate settings in the application software are the same as those set via the USB port.

Check that communications with the relay can be established.

3.2.5 USB communications port

The USB port is used for local communications between a PC and the V11F.

Note: Max current necessary to supply V11F from USB port is 450mA. USB standard offers 500mA for a one PC’s USB controller, so it is not recommended to connect any additional devices to the same PC’s USB controller. If the total power consumption from a one PC’s USB controller is greater than 500mA, V11F can be in permanent rest (V11F display and the green *Healthy* LED will be flashing)

The USB port integrates electronic boards only to allow communications with the V11F via the HMI and USB interfaces. Input (binary and current) and Output boards are not supplied.

For local communications, the MiCOM S1 Studio 5.1.0 setting software is used.

USB parameters (not settable in the V11F):

- Protocol: Modbus RTU
- Address: 1

- Baud Rate: 115.2 kbits/s
- Data Bits: 8
- Stop bit: 1
- Parity: None

3.2.6 Current inputs

This test verifies that the accuracy of current measurement is within the acceptable tolerances.

The V11F measures the RMS and Fundamental harmonic values.

Apply a current equal to the rating of the line current transformer secondary winding to each current transformer input of the corresponding rating, in turn (see Table 1 or external connection diagram (V11F/EN IN) for appropriate terminal numbers), checking its magnitude using a multimeter/test set readout. The corresponding reading can then be checked in the MEASUREMENT column of the menu or via the MiCOM S1 Studio 5.1.0 /Measurement Viewer connected to the V11F via USB port. Refer to the PC software user manual for details.

If MiCOM S1 Studio 5.1.0 is not available, it is necessary to test the protection stages to measure the accuracy of analogue inputs.

<u>Measuring accuracy of the relay:</u>

Reference Conditions:

Sinusoidal signals with nominal frequency fn total harmonic distortion = 2 %, ambient temperature 20 °C and nominal auxiliary voltage Vx.

Deviation relative to the relevant nominal value under reference conditions.

Operating Data

For currents up to 2 In (Ien):

Phase and earth current: ±2% at In (Ien)

Asymmetry current: ±5% at In

Fault Data

Phase and earth current:

For currents ≤ 3 In (Ien): ±5% at In (Ien)

For currents > 3 In (Ien): ±5% of measured current value

However, an additional allowance must be made for the accuracy of the test equipment being used.

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4. SETTING CHECKS

The setting checks ensure that all of the application-specific relay settings (i.e. the relay's functions), for the particular installation, have been correctly applied to the relay.

Note: The trip circuit should remain isolated during these checks to prevent accidental operation of the associated circuit breaker.

4.1 Apply application-Specific Settings

There are two methods of applying the settings to the relay:

Downloading them from a pre-prepared setting file to the relay using a portable PC running the MiCOM S1 Studio 5.1.0 support software. Communication between the PC and the V11F is done via the relay's USB front port, located at the bottom of front panel, or rear communications port. This method is preferred for transferring function settings as it is much faster and there is less margin for error.

If a setting file has been created for the particular application and is available on an external memory disk, this will further reduce the commissioning time.

Enter them manually via the relay's operator interface.

Application notes for the setting values are given in Application Notes chapter V11F/EN AP of this manual.

4.2 Demonstrate correct relay operation

The above tests have already demonstrated that the relay is within calibration, thus the purpose of these tests is as follows:

– To determine that the primary protection functions of the relay, overcurrent, earth-fault etc. can trip according to the correct application settings.

– by monitoring the response to a selection of fault injections.

4.2.1 Overcurrent protection testing

This test, performed on stage 1 of the overcurrent protection function, demonstrates that the relay is operating correctly at the application-specific settings.

4.2.1.1 Connection and preliminaries

The testing current is fed via terminals: C5-C6, C7-C8, and C9-C10, C11-C12 connected to CTs. The type of connection is shown in Figure 1. The external connection diagram is also available for the V11F front panel.

Ensure that I> is mapped to the RL1 output.

Connect the auxiliary voltage supply to the V11F terminals A1 and A2.

Connect the trip output RL1 to trip circuit of CB so that its operation will trip the test set and stop the timer.

The timer should be compatible with the RL1 output.

Connect the current output of the test set to phase "A" of the relay current transformer input (terminals C5 and C6).

Ensure that the timer starts when the current is applied to the relay.

Protection accuracy of the relay:

PROTECTION ACCURACY					
Element	Range	Deviation	Trigger	Reset	Time deviation
Phase overcurrent elements (I> & I>> & I>>> & SOTF(**BAE**))	0.1 to 40 In	± 5%± 0.01In	DT: Is ± 5%± 0.01In IDMT: 1.1Is ±5%± 0.01In	0.95 Is ±5%± 0.01In 1.05 Is ±5%± 0.01In	±2% +20…50 ms ±5% +20…50 ms
Earth fault overcurrent elements (IN_1 & I N_2 & IN_3 (**E**))	0.01 to 2Ien 0.05 to 12 Ien 0.01 to 12 Ien	± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	DT: Ies ± 5%± 0.002 Ien Ies ± 5%± 0.005 Ien Ies ± 5%± 0.004 Ien	0.95 Ies Ies ± 5%± 0.002 Ien Ies ± 5%± 0.005 Ien Ies ± 5%± 0.004 Ien	±2% +20…50 ms
	0.01 to 2Ien 0.05 to 12 Ien 0.01 to 12 Ien	± 5%± 0.002 Ien ± 5%± 0.005 Ien ± 5%± 0.004 Ien	IDMT: 1.1Ies Ies ± 5%± 0.002 Ien Ies ± 5%± 0.005 Ien Ies ± 5%± 0.004 Ien	1.05 Ies Ies ± 5%± 0.002 Ien Ies ± 5%± 0.005 Ien Ies ± 5%± 0.004 Ien	±5% +20…50 ms
Negative sequence phase overcurrent elements (I2>) (**E**)	0.1 to 4 In	± 5%± 0.01In	DT: Is ± 5% Is ± 2%±0.01In IDMT: 1.1Is ±5%±0.01In	0.95 Is ±5%± 0.01In 1.05 Is ±5%± 0.01In	±2% +20…50 ms ±5% +20…50 ms
Broken conductor (I2/I1) (**E**)	20 to 100%	± 5%± 0.01In	DT: Is ± 5%± 0.01In	0.95 Is ±5%± 0.01In	±5% +20…50 ms
Thermal overload (I_{therm}, θ Alarm, θ Trip) (**NBAE**)	0.10 to 3.0 In	± 5%± 0.01In	I_{therm} ± 5%± 0.01In	0.97 I_{therm} ±5%±0.01In	±5% +20…50 ms (ref. IEC 60255-8)

Note: For e/f settings below 0.1In it is strongly recommend to use screened cable between e/f CT and V11F terminals. Without using screened cable the accuracy can be worse than given in the table above (additional errors caused by external disturbances should be taken into account).

TYPICAL OPERATION TIME (protection time-delay set to 0 ms)		
Operation time:	All types of faults	≤ 40ms

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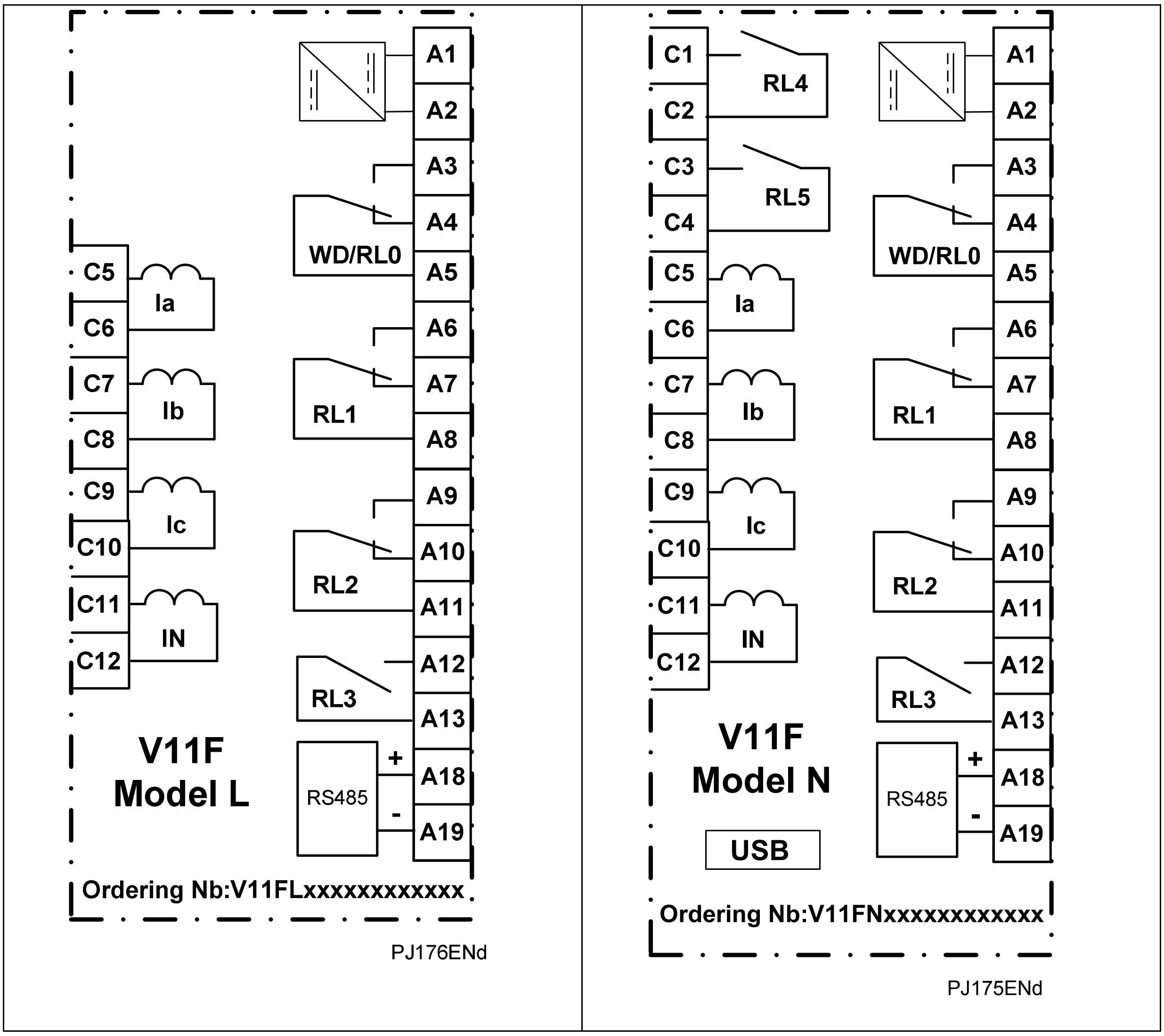

Figure 1: V11F Model L and N Connection Diagram

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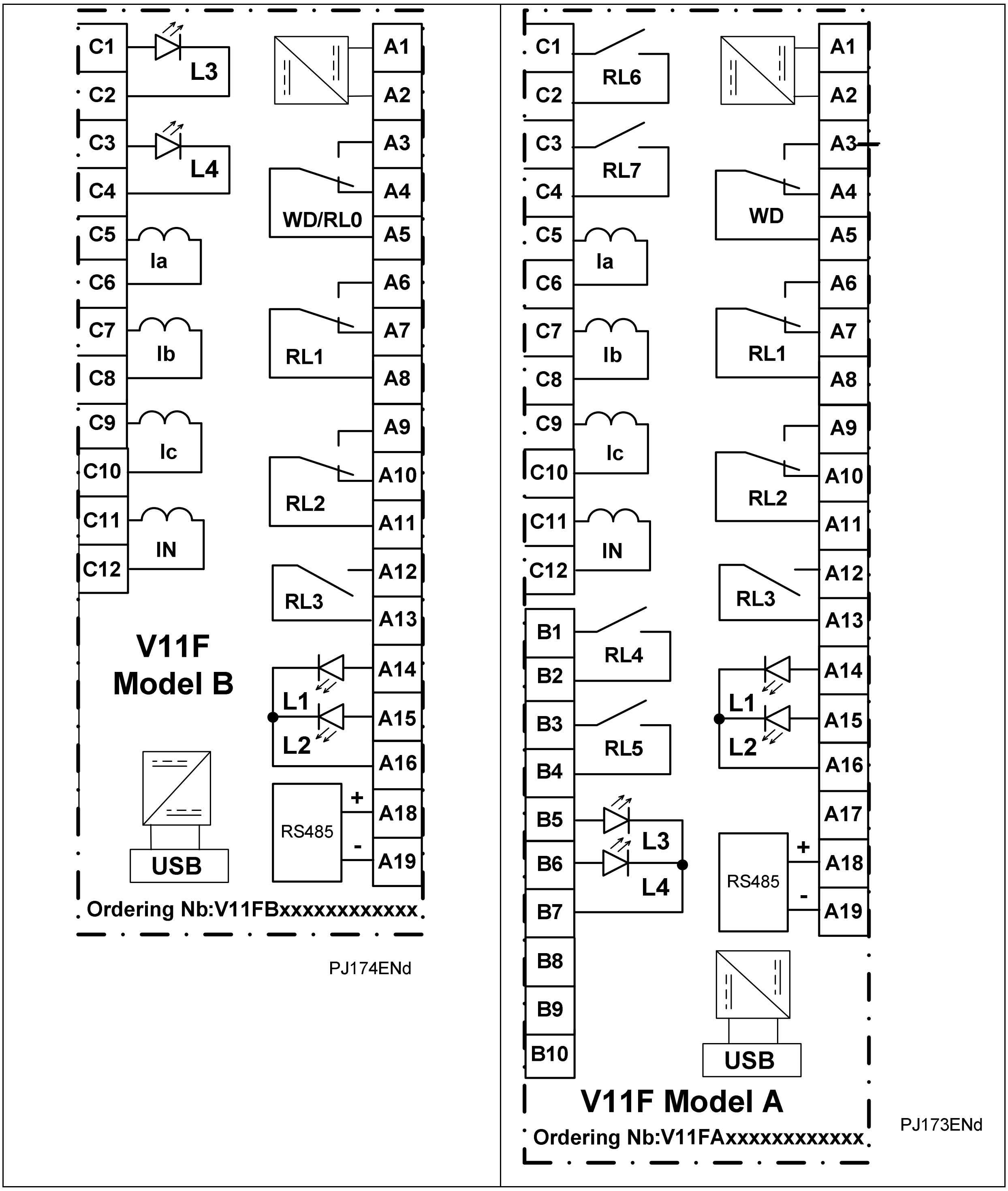

Figure 2: V11F Model B and A Connection Diagram

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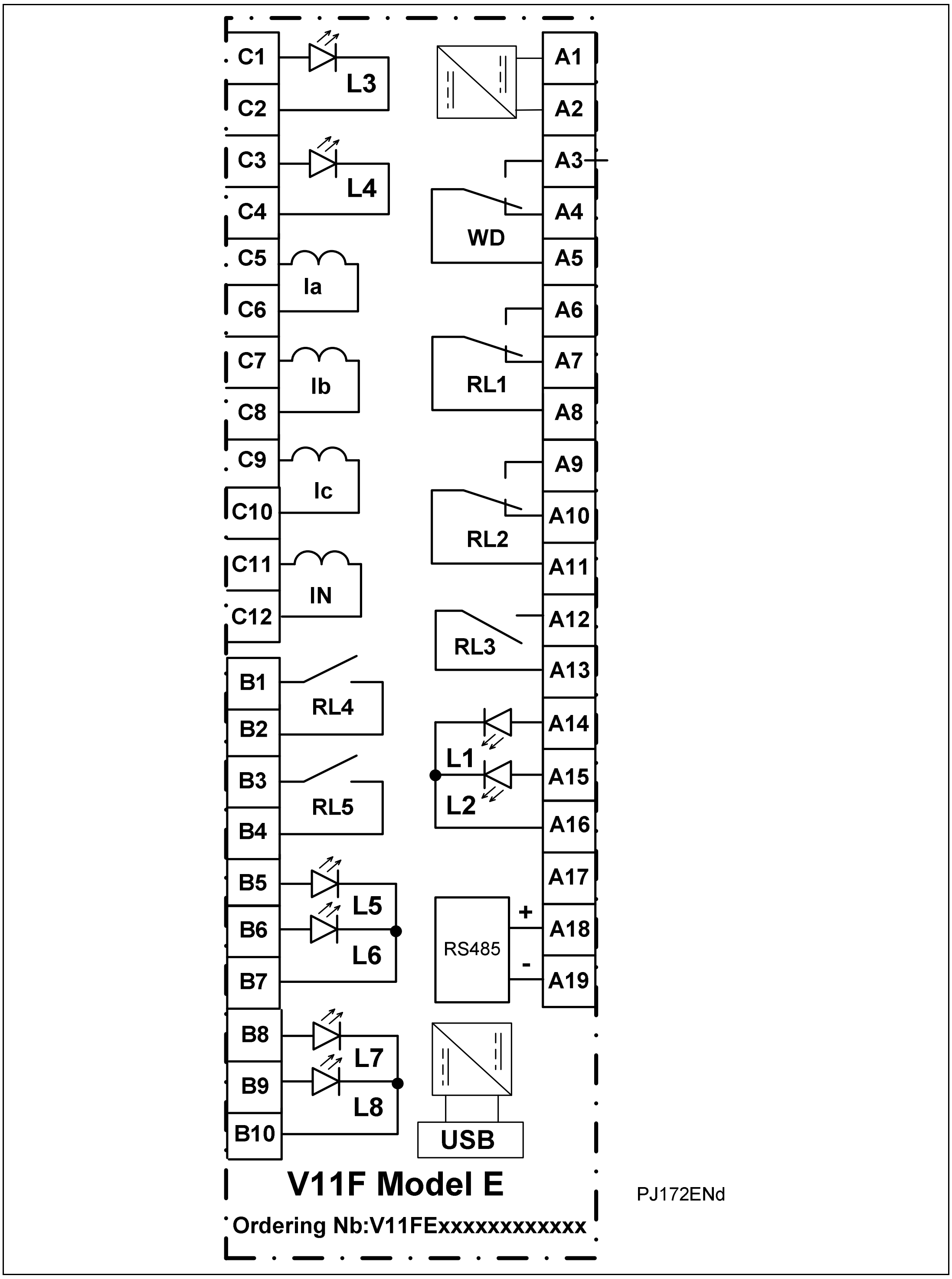

Figure 3: V11F Model E Connection Diagram

4.2.1.2 Perform the test

Ensure that the timer is reset.

Apply to the relay a current of twice the setting for I> (refer to chapter V11F/EN ST of this manual) and make a note of the time displayed when the **chronometer** stops.

WARNING: Never open circuit the secondary circuit of a current transformer since the high voltage produced may be lethal and could damage insulation.

4.2.1.3 Check the Operating Time

Check that the operating time recorded by the timer is within the range shown in Table 2.

Notes: Except for the definite time characteristic, the operating times given in Table 2 are for a time multiplier or time dial setting of 1. Therefore, to obtain the operating time at other time multiplier or time dial settings, the time given in Table 2 must be multiplied by the setting for IDMT characteristics.

In addition, for definite time and inverse characteristics there is an additional delay of up to 0.03 seconds that may need to be added to

For all characteristics, allowance must be made for the accuracy of the test equipment being used.

Characteristic	Operating Time at Twice Current Setting and Time Multiplier/Time Dial Setting of 1.0	
	Nominal (Seconds)	Range (Seconds)
DT	tI> Time Delay Setting	Setting ±5%
IEC S Inverse	10.03	9.28 – 11.78
IEC V Inverse	13.50	12.49 – 14.51
IEC E Inverse	26.67	24.67 – 29.67
UK LT Inverse	120.00	111.00 – 129.00
UK ST Inverse	1.78	1.65 – 1.91
IEEE M Inverse	3.8	3.52 – 4.08
IEEE V Inverse	7.03	6.51 – 7.55
IEEE E Inverse	9.52	8.81 – 10.23
US Inverse (CO8)	2.16	2.00 – 2.32
US Inverse (CO2 P40)	12.12	11.22 – 13.02
RI Inverse	4.52	4.19 – 4.86

Table 2: Characteristic Operating Times for I>

Reconfigure to test a phase B fault. Repeat the test in section 0, this time ensuring that the breaker trip output relative to phase B operation trips correctly. Record the tripping time for phase B. Repeat for phase C fault.

5. FUNCTIONAL TESTS

VAMP 11F has special functions for this purpose available in COMMISIONING column.

In Model A and E the special function ***Maintenance Mode*** is available for more comfortable testing of the relay.

Note: If ***Maintenance Mode*** is not selected all test cells are hidden in V11F menu.

It is possible to set following ***Maintenance mode*** options (settings):

- "***No***" - ***Maintenance mode*** is disabled. All window cells below are hidden (***Maintenance mode*** is the latest cell in ***COMMISIONING*** column)
- "***Yes,outp.trips***" - ***Maintenance mode*** is enabled. In this mode all test cells in ***COMMISIONING*** column are shown. During tests outputs are energized.
- "***Yes,outp.block***" - ***Maintenance mode*** is enabled and all test cells in ***COMMISIONING*** column are shown. In this mode, the high state of output functions are ignored (control of outputs are blocked).

  This option allows the user to check the operation of the protection functions without actually sending any external command (Tripping or signalling).

Depends on the rear protocol selected in menu, transmission of information to SCADA is blocked (Modbus RTU) or sent (IEC 103) with additional information to know that V11F is in Maintenance mode (refer to Communication chapter and EN 60870-5-103 standard).

Changing of setting from "***No***" to "***Yes,….***" from the front panel activate this mode for **10 minutes only**. After this time the option is automatically switched to "***No***".

The selection of the maintenance mode is possible by logic input (the level), control command (rear or front port), or by front panel interface. The maintenance mode is terminated by:

- Low state of logic input assigned to ***Maintenance mode*** function,
- Control command which activate this mode (rear command or setting: "***Yes,….***") and by turning off the power supply.

Note: Maintenance rear command is available in Modbus protocol only

Maintenance Mode
1: Yes,outp.trips

When this menu is activated (set to YES: "***Yes,outp.trips***" or "***Yes,outp.block***"), the Alarm led is lit.

In "***Yes,outp.block***" case, all the output contacts are blocked, and no command can be issued to these contacts, even if a protection threshold associated with one of these output contacts has been crossed. (If a protection threshold is crossed, all associated LEDs will be ON, even the TRIP LED, if protection element is set to ***Trip***).

The commissioning cells allow the user to check the external wiring to the relay's output contacts. This function is available after activation of ***Maintenance mode.*** To do this, the user has only to set to 1 the desired output contact's corresponding bit, and this will close the contact and allow the continuity of the wiring to be checked.

Test	87654321
Pattern	00000000

In the cell below, the contact test time can be set:

Contact Test	
Time	001.00s

If the outputs for test are selected and Time for output closing is set, the closing command can be executed in this cell:

Test output
0: no operation

To execute the test, press OK key, press the 2 or 8 key to select ***1: Apply test*** and confirm action by OK. The contact will be closed for the duration of the ***Contact Test Time*** pulse.

The next commissioning cells, which appears in ***Maintenance mode***, allows the user to check the functional output configuration of the V11F. To do this, the user has only to select which protection element will be triggered, and this will close the contact assigned to this protection element and allow the continuity of the wiring to be checked.

Functional Test
0: I>

In the cell below the end of the functional test can be configured:

Functional Test
End 0: CB trip

The following options are possible:

- ***0: CB trip*** – after triggering the functional test, the test is interrupted after trip command.
- ***1: Time*** – the protection element will be triggered for the duration of the pulse time.

If the ***1: Time*** option is selected it is necessary to set the pulse length:

Contact Test	
Time	001.00s

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The next cell is used for functional test execution:

Functional Test
CTRL: no operation

To execute this test, press the OK key, press the 2 or 8 key to select ***1: Operate*** and confirm action by pressing OK. The contact will be closed for the duration of the ***Contact Test Time*** pulse.

6. COMMISSIONING TEST RECORD

Date:		Engineer:	
Station:		Circuit:	
		System Frequency:	Hz

V11F Front Plate Information

Overcurrent protection relay	**VAMP 11F**
Model number	
Serial number	

Test Equipment Used

This section should be completed to allow future identification of protective devices that have been commissioned using equipment, that is later found to be defective or incompatible, but may not be detected during the commissioning procedure.

Injection test set	Model: Serial No:	
Insulation tester	Model: Serial No:	
Setting software:	Type: Version:	

*Delete as appropriate

	Have all relevant safety instructions been followed?	Yes* ☐ No* ☐
1.	**Product Checks**	
1.1	**With the relay de-energized**	
1.1.1	Visual inspection	
1.1.1.1	Relay damaged?	Yes* ☐ No* ☐
1.1.1.2	Rating information correct for installation?	Yes* ☐ No* ☐
1.1.2	Insulation resistance >100MΩ at 500V dc	Yes* ☐ No* ☐ Not Tested* ☐
1.1.3	External wiring	
1.1.3.1	Wiring checked against diagram?	Yes* ☐ No* ☐
1.1.4	Measured auxiliary voltage supply	______ V ac*

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1.2	**With the relay energized**	
1.2.1	Light-emitting diodes and Watchdog Contact	
1.2.1.1	Connect the auxiliary voltage supply to terminals A1 and A2. Are the green ***Healthy*** LED and the ***WD*** output contact (A3-A5) working?	Yes* ☐ No* ☐
1.2.1.2	Establish connection between PC and V11F via USB port. Green ***Healthy*** LED working?	Yes* ☐ No* ☐
1.2.1.3	Reset LEDs by pressing the C key on the V11F front panel. Red "***I>***" LED flashing rapidly?	Yes* ☐ No* ☐
1.2.2	Inputs	
1.2.2.1	Auxiliary voltage for binary control inputs: Value measured (see: **COMMISSIONING/Opto I/P *Status*** window of menu) (**ABE**)	_____ V dc
1.2.2.2	L1 binary input working? (**ABE**)	Yes* ☐ No* ☐
1.2.2.3	L2 binary input working? (**ABE**)	Yes* ☐ No* ☐
1.2.2.4	L3 binary input working? (**ABE**)	Yes* ☐ No* ☐
1.2.2.5	L4 binary input working? (**ABE**)	Yes* ☐ No* ☐
1.2.2.6	L5 binary input working? (**E**)	Yes* ☐ No* ☐
1.2.2.7	L6 binary input working? (**E**)	Yes* ☐ No* ☐
1.2.2.7	L7 binary input working? (**E**)	Yes* ☐ No* ☐
1.2.2.8	L8 binary input working? (**E**)	Yes* ☐ No* ☐
1.2.3	Outputs (for tests in model B and E, ***COMMISSIONING/ Test outputs*** cell can be used)	
1.2.3.1	Output Relays	
1.2.3.1.1	Relay 1 working? (**LNABE**)	Yes* ☐ No* ☐
1.2.3.1.2	Relay 2 working? (**LNABE**)	Yes* ☐ No* ☐
1.2.3.1.3	Relay 3 working? (**LNABE**)	Yes* ☐ No* ☐
1.2.3.1.4	Relay 4 working? (**NAE**)	Yes* ☐ No* ☐
1.2.3.1.5	Relay 5 working? (**NAE**)	Yes* ☐ No* ☐
1.2.3.1.6	Relay 6 working? (**A**)	Yes* ☐ No* ☐
1.2.3.1.7	Relay 7 working? (**A**)	Yes* ☐ No* ☐
1.2.3.1.7	Relay WD working? (**LNABE**)	Yes* ☐ No* ☐
1.2.3.2	Close CB, after which apply current above setting value. CB has opened?	Yes* ☐ No* ☐
1.2.4	Communications between PC and MiCOM S1 Studio 5.1.0 setting software established?	Yes* ☐ No* ☐
2.	Setting Checks	
2.1	Protection function timing tested?	Yes* ☐ No* ☐

	Applied current	______ A
	Expected operating time	______ s
	Measured operating time	______ s

3.	Final Checks	
3.1	All test equipment, leads, shorts and test blocks removed safely?	Yes* ☐ No* ☐
3.2	Disturbed customer wiring re-checked?	Yes* ☐ No* ☐ N/A* ☐
3.3	All commissioning tests disabled?	Yes* ☐ No* ☐
3.4	Records reset (via S1 software)?	Yes* ☐ No* ☐

COMMENTS #
(# Optional, for site observations or utility-specific notes).

______________________ ______________________
Commissioning Engineer Customer Witness

Date: ______________________ Date: ______________________

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7. SETTING RECORD

Date:		Engineer:	
Station:		Circuit:	
		System Frequency:	Hz
		CT Ratio (tap in use):	/ A

Front Plate Information

Overcurrent protection relay	**VAMP 11F**
Model number	
Serial number	

*Delete as appropriate

Column	Identification of Relay	
OP PARAMETERS	Firmware version	
	Hardware version	

Column	Global Setting Data	
GLOBAL SETTINGS/ LOC	Language	V11Fxxxxxxxxxxx1xx: 0: English* ☐ 1: Deutsch * ☐ 2: Francaise * ☐ 3: Espanol * ☐ 4: Portugues * ☐ 5: Regional* ☐ V11Fxxxxxxxxxxx2xx: 0: English* ☐ 1: Russian* ☐ 2: Polski * ☐ 3: Turkey* ☐ 4: Regional1* ☐ 5: Regiona2l* ☐
	Default Display	0: Meas. In * ☐ 1: Meas. A* ☐ 2: Control CB * ☐ 3: [79] CTRL* ☐ 4: Control Mode* ☐
	LEDs Reset	0: Manual only* ☐ 1: Protect.Start* ☐ 2: Close Command * ☐
	Ltchd Outp. Reset	0: Manual only* ☐ 1: Protect.Start * ☐ 2: Close Command * ☐
	Trip Info Reset	0: Manual only* ☐ 1: Protect.Start * ☐ 2: Close Command * ☐
	Alarm Info	0: Self-Reset * ☐ 1: Latchig * ☐
	Nominal Frequency	0: 50Hz * ☐ 1: 60Hz * ☐
	Control Keys Confirm.	0: No * ☐ 1:Yes * ☐
	I>, I>>, I>>>	0: 1 harm * ☐ 1: True RMS * ☐
GLOBAL SETTINGS/ SETTING GROUP	Number of Groups	1: One Group* ☐ 2: Two Groups * ☐
	Setting Group	0: Group 1* ☐ 1: Group 2 * ☐

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Column	Global Setting Data	
SELECT	t Change Settings G1→G2 (**BAE**)	s
GLOBAL SETTINGS/ CT RATIO	Line CT primary	A
	Line CT Sec	A
	E/Gnd CT primary	A
	E/Gnd CT Sec	A
GLOBAL SETTINGS/ CIRCUIT BREAKER	tOpen pulse min	s
	tClose Pulse	s
	Time Delay for Close (**BAE**)	s
	tCB FLT Ext. Sign. (**BAE**)	s
	Remote CTRL Mode (**AE**)	0:Remote only *☐ 1:Remote+Local *☐
	52 Unblock SOTF Time (**BAE**)	s
	TC Supervision? (**AE**)	Yes * ☐ No * ☐ Yes-52 * ☐
	TC Supervision tSUP (**AE**)	s
	CB Supervision? (**AE**)	0:No * ☐ 1:Yes * ☐
	Max.CB Open Time (**AE**)	s
	Max.CB Close Time (**AE**)	s
	CB Diagnostic? (**AE**)	0:No * ☐ 1:Yes * ☐
	Max.CB Open No. (**AE**)	
	Max Sum AMPS^n (**AE**)	MA^n
	AMPS's n= (**AE**)	1* ☐ 2 * ☐
GLOBAL SETTINGS/ INRUSH BLOCKING (**AE**)	Inrush Blocking?	0:No * ☐ 1:Yes * ☐ 2:Closing*☐
	2nd Harmonic Ratio	%
	Inrush Reset Time	s
	Unblock Inrush Time	s
GLOBAL SETTINGS/ O/C ADVANCED (**NABE**)	[46BC] Brkn Cond I< Block (**E**)	In
	IDMT Interlock by DMT (**NABE**)	0:No * ☐ 1:Yes * ☐
GLOBAL SETTINGS/ [79] ADVANCED SETTINGS (**E**)	CB FLT Monitor.?	0: No * ☐ 1: Yes *☐
	Block.via Input?	0: No * ☐ 1: Block.[79] ☐ 2: Block.[79+tI/52a] ☐
	Start Dead t on	0: Protect.Reset * ☐ 1: CB trips * ☐
	Rolling Demand?	0: No * ☐ 1: Yes *☐
	Max cycles No. Rol.Demand	

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Column	Global Setting Data	
	Time period Rol. Demand	mn
	Inhibit Time tI on Close	s
	Signaling Reset	0: No * ☐ 1: Close via 79 * ☐
GLOBAL SETTINGS/ COMMUNICATION ORDERS (**AE**)	Pulse Time tCOM1	s
	Pulse Time tCOM2	s
	COM2 Order Conf.	0: RS485 * ☐ 1: RS485+Button C * ☐ 2: Button C * ☐
GLOBAL SETTINGS/ COMMUNICATION (**Model L is optional**)	Protocol	0: Modbus RTU* ☐ 1: IEC103* ☐
	Relay Address RS485	
	Baud Rate RS485	4800 * ☐ 9600 * ☐ 19200 * ☐ 38400 * ☐
	Parity RS485	0: No parity* ☐ 1: Odd parity * ☐ 2: Even parity* ☐
	StopBits RS485	0: 1 stop bit* ☐ 1: 2 stop bits* ☐
GLOBAL SETTINGS/ DISTURBANCE RECORDER (**AE**)	Pre-Time	s
	Post Trip Time	s
	Disturbance Rec.Trig.	0: on Inst.* ☐ 1: on Trip * ☐
	Max Record Time	s

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OVERCURRENT G1		
SETTING GROUP 1/ PROTECTION G1/ PHASE O/C [50/51] G1		Settings
1	I> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	I> Threshold	In
3	Delay Type I>	
4	tI>/TMS/TD	s *
5	Reset Delay Type I>	0: DMT* ☐ 1: IDMT * ☐
6	DMT tReset I> RTD/RTMS Reset I>	
7	I>> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
8	I>> Threshold	In
9	Delay Type I>>	
10	tI>>/TMS/TD	s
11	Reset Delay Type I>>	0: DMT* ☐ 1: IDMT * ☐
12	DMT tReset I> RTD/RTMS Reset I>	
13	I>>> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
14	I>>> Threshold	In
15	tI>>>	s

SOTF G1 (**ABE**)		
SETTING GROUP 1/ PROTECTION G1/ SOTF [50/51] G1		Settings
1	SOTF?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	SOTF Threshold	In
3	tSOTF	s

EARTH FAULT (Measured) G1		
SETTING GROUP 1/ PROTECTION G1 / E/GND FAULT [50N/51N] G1		Settings
1	IN_1 stage ?	0: Disabled* ☐ 1: IN>Trip* ☐ 2: IN> Alarm* ☐ 3: IN> Trip-Inrush Bl * ☐ 4: IN> Trip-Latch * ☐
2	IN_1 Threshold	Ien
3	Delay Type IN_1	
4	tIN_1/TMS/TD	s
5	Reset Delay Type IN_1	0: DMT* ☐ 1: IDMT * ☐
6	DMT tReset IN_1 RTD/RTMS Reset IN_1	s
7	IN_2 stage ?	0: Disabled* ☐ 1: IN>>Trip* ☐ 2: IN>> Alarm* ☐ 3: IN>> Trip-Inrush Bl * ☐ 4: IN>> Trip-Latch * ☐
8	IN_2 Threshold	
9	tIN_2	s
10	IN_3 stage ? (**E**)	0: Disabled* ☐ 1: IN>>>Trip* ☐ 2: IN>>> Alarm* ☐ 3: IN>>> Trip-Inrush Bl* ☐ 4: IN>>> Trip-Latch * ☐
11	IN_3 Threshold (**E**)	
12	tIN_3 (**E**)	s

Negative Sequence O/C [46] G1 (**E**)

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SETTING GROUP 1/ PROTECTION G1 / NEGATIVE SEQ.O/C [46] G1		Settings
1	I2> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	I2> Threshold	In
3	Delay Type I2>	
4	tI2>/TMS/TD	s
5	Reset Delay Type I2>	0: DMT* ☐ 1: IDMT * ☐
6	DMT tReset I2> RTD/RTMS Reset I2>	s

Broken Conductor G1 (**E**)		
SETTING GROUP 1/ PROTECTION G1/ BROKEN CONDUCTOR [46BC] G1		Settings
1	Broken Cond.?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	Ratio I2/I1	%
3	tBCond	s

CM

[49] Thermal Overload G1 (**NABE**)		
SETTING GROUP 1/ PROTECTION G1 / THERMAL OVERLOAD [49] G1		Settings
1	Therm OL?	0: Disabled* ☐ 1: Enabled* ☐
2	Itherm	In
3	Te (heating)	mn
4	Tr (cooling)	mn
5	Theta Trip	%
6	Theta Trip/Reset Ratio	%
7	Alarm OL?	0: Disabled* ☐ 1: Enabled* ☐
8	Theta Alarm	%

[50BF] CB Fail G1

SETTING GROUP 1/ PROTECTION G1 / CB Fail [50BF] G1		Settings
1	CB Fail ?	0: Disabled* ☐ 1: Retrip* ☐ 2: Alarm* ☐
2	CB Fail Time tBF	s
3	I< Threshold CBF	In
4	IN< Threshold CBF	Ien
5	Block I> ? (**E**)	0: No* ☐ 1: Yes* ☐
6	Block IN> ? (**E**)	0: No* ☐ 1: Yes* ☐

AUX TIMERS G1 (**NABE**)		
SETTING GROUP 1/ PROTECTION G1 / AUX TIMERS G1		Group 1 Settings
1	AUX1 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐ 5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
2	tAUX1	s
3	AUX2 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐ 5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
4	tAUX2	s
5	AUX3 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐ 5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
6	tAUX3	s
7	AUX4 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐

CM

AUX TIMERS G1 (NABE)		
SETTING GROUP 1/ PROTECTION G1 / AUX TIMERS G1		Group 1 Settings
		5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
8	tAUX4	s

Logic Selectivity G1 (E)		
SETTING GROUP 1/ PROTECTION G1 / LOGIC SELECT. G1		Settings
1	Sel1?	0: Disabled* ☐ 1: Enabled* ☐
2	tSel1	s
3	Sel2?	0: Disabled* ☐ 1: Enabled* ☐
4	tSel2	s

Cold Load Pick Up G1		
SETTING GROUP 1/ PROTECTION G1 / COLD LOAD PU G1		Settings
1	Cold Load PU ?	0: Disabled* ☐ 1: Current+Input* ☐ 2: Input* ☐
2	Cold Load PU Level	%
3	Cold Load PU tCL	s
4	Cold Load PU I>	0: No* ☐ 1: Yes* ☐
5	Cold Load PU I>>	0: No* ☐ 1: Yes* ☐
6	Cold Load PU I>>>	0: No* ☐ 1: Yes* ☐
7	Cold Load PU IN_1	0: No* ☐ 1: Yes* ☐
8	Cold Load PU IN_2	0: No* ☐ 1: Yes* ☐
9	Cold Load PU IN_3 (E)	0: No* ☐ 1: Yes* ☐
10	Cold Load PU Brkn.Cond (E)	0: No* ☐ 1: Yes* ☐
11	Cold Load PU Itherm (NABE)	0: No* ☐ 1: Yes* ☐
12	Cold Load PU I2> (E)	0: No* ☐ 1: Yes* ☐

CM

Autoreclose [79] G1 (E)		
SETTING GROUP 1/ PROTECTION G1 / AUTORECLOSE [79] G1		Settings
1	Autoreclose ?	0: Disabled* ☐ 1: Enabled* ☐
2	Dead Time tD1	s

Autoreclose [79] G1 (E)		
SETTING GROUP 1/ PROTECTION G1 / AUTORECLOSE [79] G1		Settings
3	Dead Time tD2	s
4	Dead Time tD3	s
5	Dead Time tD4	s
6	Reclaim Time tR	s
7	Fast O/C Trip	1 Trip Shot* ☐ 2 Trip Shot * ☐ 3 Trip Shot * ☐ 4 Trip Shot * ☐ 5 Trip Shot * ☐
8	Fast O/C Trip Delay	s
9	Fast E/Gnd Trip	1 Trip Shot * ☐ 2 Trip Shot * ☐ 3 Trip Shot * ☐ 4 Trip Shot * ☐ 5 Trip Shot * ☐
10	Fast E/Gnd Trip Delay	s
11	Close Shot? tI>	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
12	Inhib.Trip tI>: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
13	Close Shot? tI>>	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
14	Inhib.Trip tI>>: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
15	Close Shot? tI>>>	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
16	Inhib.Trip tI>>>: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
17	Close Shot? tIN_1	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐

Autoreclose [79] G1 (E)		
SETTING GROUP 1/ PROTECTION G1 / AUTORECLOSE [79] G1		Settings
18	Inhib.Trip tIN_1: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
19	Close Shot? tIN_2	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
20	Inhib.Trip tIN_2: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
21	Close Shot? tIN_3	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
22	Inhib.Trip tIN_3: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
23	Close Shot? tAUX1	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
24	Inhib.Trip tAUX1: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
25	Close Shot? tAUX2	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
26	Inhib.Trip tAUX2: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐

SETTING GROUP 1/ OUTPUT RELAY CONFIGURATION G1		OUTPUT RELAYS CONFIGURATION G1							
		WD	RL7	RL6	RL5	RL4	RL3	RL2	RL1
		LNA BE	**A**	**A**	**NAE**	**NAE**	**LNA BE**	**LNA BE**	**LNA BE**
1	Latched outputs								
2	Reverse outp. logic								
3	Protect. Trip								
4	Prot.Trip pulse								
5	Trip CB Order								
6	Close CB Order								
7	Alarm								
8	start I>								
9	start I>>								
10	start I>>>								
11	Start SOTF (**BAE)**								
12	start IN_1								
13	start IN_2								
14	start IN_3 (**E**)								
15	start I2> (**E**)								
16	Start Brkn Cond (**E**)								
17	AUX1 (**BAE**)								
18	AUX2 (**BAE**)								
19	AUX3 (**BAE**)								
20	AUX4 (**BAE**)								
21	AUX5 (**BAE**)								
22	AUX6 (**BAE**)								
23	tI>								
24	tI>>								
25	tI>>>								
26	tSOTF (**BAE**)								
27	tIN_1								
28	tIN_2								
29	tIN_3 (**E**)								
30	tI2> (**E**)								
31	tBrkn Cond. (**E**)								
32	Thermal Trip (**NBAE**)								
33	Thermal Alarm (**NBAE**)								

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SETTING GROUP 1/ OUTPUT RELAY CONFIGURATION G1		OUTPUT RELAYS CONFIGURATION G1							
		WD	RL7	RL6	RL5	RL4	RL3	RL2	RL1
		LNA BE	**A**	**A**	**NAE**	**NAE**	**LNA BE**	**LNA BE**	**LNA BE**
34	tCB Fail								
35	tAUX1 (**BAE**)								
36	tAUX2 (**BAE**)								
37	tAUX3 (**BAE**)								
38	tAUX4 (**BAE**)								
39	Comm. Order 1 (**AE**)								
40	Comm. Order 2 (**AE**)								
41	[79]in Progress (**E**)								
42	[79] F.Trip (**E**)								
43	[79] Lockout (**E**)								
44	[79] Blocked (**E**)								
45	[79] Success. (**E**)								
46	TCS 52 Fail (**AE**)								
47	CB Alarm (**AE**)								
48	tCB FLT Ext.Sign (**AE**)								
49	Setting Group 1								

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SETTING GROUP 1/ INPUT CONFIGURATION G1		INPUTS CONFIGURATION G1							
		L8	L7	L6	L5	L4	L3	L2	L1
		E	**E**	**E**	**E**	**ABE**	**ABE**	**ABE**	**ABE**
1	Reverse Input Logic								
2	Mainten. Mode (**AE**)								
3	Reset Latch Sign								
4	Reset Latchd Out								
5	Block. tI>								
6	Block. tI>>								
7	Block. tI>>								
8	Block.tSOTF								
9	Block. tIN_1								
10	Block. tIN_2								

SETTING GROUP 1/ INPUT CONFIGURATION G1		INPUTS CONFIGURATION G1							
		L8	L7	L6	L5	L4	L3	L2	L1
		E	E	E	E	ABE	ABE	ABE	ABE
11	Block. tIN_3 (**E**)								
12	Block. tI2> (**E**)								
13	Block. tBrkn Cond (**E**)								
14	Block. Itherm.								
15	Block. AUX1								
16	Block. AUX2								
17	Block. AUX3								
18	Block. CB Fail								
19	Block. [79] (**E**)								
20	SEL1 tI>> (**E**)								
21	SEL1 tI>>> (**E**)								
22	SEL1 tIN_2 (**E**)								
23	SEL1 tIN_3 (**E**)								
24	SEL2 tI>> (**E**)								
25	SEL2 tI>>> (**E**)								
26	SEL2 tIN_2 (**E**)								
27	SEL2 tIN_3 (**E**)								
28	AUX1								
29	AUX2								
30	AUX3								
31	AUX4								
32	AUX5								
33	AUX6								
34	Cold Load PU (**AE**)								
35	Strt tBF (**AE**)								
36	CB Status 52A								
37	CB Status 52B								
38	CB FLT Ext.Sign								
39	Setting Group 2								
40	Manual Close								
41	Manual Trip								
42	Trip Circ Supervis. (**AE**)								
43	Reset Theta val.								
44	Start Distur. R. (**AE**)								

SETTING GROUP 1/ INPUT CONFIGURATION G1		INPUTS CONFIGURATION G1							
		L8	L7	L6	L5	L4	L3	L2	L1
		E	**E**	**E**	**E**	**ABE**	**ABE**	**ABE**	**ABE**
45	Local CTRL Mode (**AE**)								
46	Time Synchr. (**BE**)								

LEDs CONFIGURATION G1							
SETTING GROUP 1/ LEDs CONFIGURATION G1		LED2	LED3	LED4	LED5	LED6	LED7
1	Latched LEDs						
2	Protect. Trip						
3	Alarm						
4	General Start						
5	Start Phase A						
6	Start Phase B						
7	Start Phase C						
8	Start I>						
9	Start I>>						
10	Start I>>>						
11	Start SOTF (**BAE**)						
12	Start IN_1						
13	Start IN_2						
14	Start IN_3 (**E**)						
15	AUX1 (**BAE**)						
16	AUX2 (**BAE**)						
17	AUX3 (**BAE**)						
18	AUX4 (**BAE**)						
19	AUX5 (**BAE**)						
20	AUX6 (**BAE**)						
21	tI>						
22	tI>>						
23	tI>>>						
24	tSOTF (**BAE**)						
25	tIN_1						
26	tIN_2						
27	tIN_3 (**E**)						
29	tI2> (**E**)						
30	tBrkn Cond. (**E**)						
31	Thermal Trip (**NBAE**)						
32	Thermal Alarm (**NBAE**)						
33	CB Fail						
34	tAUX1 (**BAE**)						
35	tAUX2 (**BAE**)						
36	tAUX3 (**BAE**)						
37	tAUX4 (**BAE**)						
38	[79] in Progress (**E**)						
39	[79] F.Trip (**E**)						

LEDs CONFIGURATION G1							
SETTING GROUP 1/ LEDs CONFIGURATION G1		LED2	LED3	LED4	LED5	LED6	LED7
40	[79] Lockout (**E**)						
41	[79] Blocked (**E**)						
42	[79] Success. (**E**)						
43	Local CRTL Mode (**AE**)						
44	CB Alarm (**AE**)						
45	Maintenance Mode (**AE**)						
46	tCB FLT Ext.Sign (**BAE**)						
47	Setting Group 1						

OVERCURRENT G2		
SETTING GROUP 1/ PROTECTION G2/ PHASE O/C [50/51] G2		Settings
1	I> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	I> Threshold	In
3	Delay Type I>	
4	tI>/TMS/TD	s *
5	Reset Delay Type I>	0: DMT* ☐ 1: IDMT * ☐
6	DMT tReset I> RTD/RTMS Reset I>	
7	I>> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
8	I>> Threshold	In
9	Delay Type I>>	
10	tI>>/TMS/TD	s
11	Reset Delay Type I>>	0: DMT* ☐ 1: IDMT * ☐
12	DMT tReset I> RTD/RTMS Reset I>	
13	I>>> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
14	I>>> Threshold	In
15	tI>>>	s

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SOTF G2 (ABE)		
SETTING GROUP 1/ PROTECTION G2/ SOTF [50/51] G2		Settings
1	SOTF?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	SOTF Threshold	In
3	tSOTF	s

EARTH FAULT (Measured) G2		
SETTING GROUP 1/ PROTECTION G2 / E/GND FAULT [50N/51N] G2		Settings
1	IN_1 stage ?	0: Disabled* ☐ 1: IN>Trip* ☐ 2: IN> Alarm* ☐ 3: IN> Trip-Inrush Bl * ☐ 4: IN> Trip-Latch * ☐
2	IN_1 Threshold	Ien
3	Delay Type IN_1	
4	tIN_1/TMS/TD	s
5	Reset Delay Type IN_1	0: DMT* ☐ 1: IDMT * ☐
6	DMT tReset IN_1 RTD/RTMS Reset IN_1	s
7	IN_2 stage ?	0: Disabled* ☐ 1: IN>>Trip* ☐ 2: IN>> Alarm* ☐ 3: IN>> Trip-Inrush Bl * ☐ 4: IN>> Trip-Latch * ☐
8	IN_2 Threshold	
9	tIN_2	s
10	IN_3 stage ? (E)	0: Disabled* ☐ 1: IN>>>Trip* ☐ 2: IN>>> Alarm* ☐ 3: IN>>> Trip-Inrush Bl* ☐ 4: IN>>> Trip-Latch * ☐
11	IN_3 Threshold (E)	
12	tIN_3 (E)	s

CM

Negative Sequence O/C [46] G2 (E)

SETTING GROUP 1/ PROTECTION G2 / NEGATIVE SEQ.O/C [46] G2		Settings
1	I2> ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	I2> Threshold	In
3	Delay Type I2>	
4	tI2>/TMS/TD	s
5	Reset Delay Type I2>	0: DMT* ☐ 1: IDMT * ☐
6	DMT tReset I2> RTD/RTMS Reset I2>	s

Broken Conductor G2 (E)		
SETTING GROUP 1/ PROTECTION G2/ BROKEN CONDUCTOR [46BC] G2		Settings
1	Broken Cond.?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐
2	Ratio I2/I1	%
3	tBCond	s

CM

[49] Thermal Overload G2 (NABE)		
SETTING GROUP 1/ PROTECTION G2 / THERMAL OVERLOAD [49] G2		Settings
1	Therm OL?	0: Disabled* ☐ 1: Enabled* ☐
2	Itherm	In
3	Te (heating)	mn
4	Tr (cooling)	mn
5	Theta Trip	%
6	Theta Trip/Reset Ratio	%
7	Alarm OL?	0: Disabled* ☐ 1: Enabled* ☐
8	Theta Alarm	%

[50BF] CB Fail G2

SETTING GROUP 1/ PROTECTION G2 / CB Fail [50BF] G2		Settings
1	CB Fail ?	0: Disabled* ☐ 1: Retrip* ☐ 2: Alarm* ☐
2	CB Fail Time tBF	s
3	I< Threshold CBF	In
4	IN< Threshold CBF	Ien
5	Block I> ? (**E**)	0: No* ☐ 1: Yes* ☐
6	Block IN> ? (**E**)	0: No* ☐ 1: Yes* ☐

AUX TIMERS G2 (NABE)		
SETTING GROUP 1/ PROTECTION G2 / AUX TIMERS G2		Group 1 Settings
1	AUX1 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐ 5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
2	tAUX1	s
3	AUX2 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐ 5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
4	tAUX2	s
5	AUX3 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐ 5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
6	tAUX3	s
7	AUX4 ?	0: Disabled* ☐ 1: Trip* ☐ 2: Alarm* ☐ 3: Trip-Inrush Bl * ☐ 4: Trip-Latch * ☐

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AUX TIMERS G2 (NABE)		
SETTING GROUP 1/ PROTECTION G2 / AUX TIMERS G2		Group 1 Settings
		5: Load Shedding* ☐ 6: AR after LS Hi* ☐ 7: AR after LS Lo* ☐
8	tAUX4	s

Logic Selectivity G2 (E)		
SETTING GROUP 1/ PROTECTION G2 / LOGIC SELECT. G2		Settings
1	Sel1?	0: Disabled* ☐ 1: Enabled* ☐
2	tSel1	s
3	Sel2?	0: Disabled* ☐ 1: Enabled* ☐
4	tSel2	s

Cold Load Pick Up G2			
SETTING GROUP 1/ PROTECTION G2 / COLD LOAD PU G2		Settings	
1	Cold Load PU ?	0: Disabled* ☐ 1: Current+Input* ☐ 2: Input* ☐	
2	Cold Load PU Level	%	
3	Cold Load PU tCL	s	
4	Cold Load PU I>	0: No* ☐	1: Yes* ☐
5	Cold Load PU I>>	0: No* ☐	1: Yes* ☐
6	Cold Load PU I>>>	0: No* ☐	1: Yes* ☐
7	Cold Load PU IN_1	0: No* ☐	1: Yes* ☐
8	Cold Load PU IN_2	0: No* ☐	1: Yes* ☐
9	Cold Load PU IN_3 (E)	0: No* ☐	1: Yes* ☐
10	Cold Load PU Brkn.Cond (E)	0: No* ☐	1: Yes* ☐
11	Cold Load PU Itherm (NABE)	0: No* ☐	1: Yes* ☐
12	Cold Load PU I2> (E)	0: No* ☐	1: Yes* ☐

CM

Autoreclose [79] G2 (E)		
SETTING GROUP 1/ PROTECTION G2 / AUTORECLOSE [79] G2		Settings
1	Autoreclose ?	0: Disabled* ☐ 1: Enabled* ☐
2	Dead Time tD1	s

Autoreclose [79] G2 (E)		
SETTING GROUP 1/ PROTECTION G2 / AUTORECLOSE [79] G2		Settings
3	Dead Time tD2	s
4	Dead Time tD3	s
5	Dead Time tD4	s
6	Reclaim Time tR	s
7	Fast O/C Trip	1 Trip Shot* ☐ 2 Trip Shot * ☐ 3 Trip Shot * ☐ 4 Trip Shot * ☐ 5 Trip Shot * ☐
8	Fast O/C Trip Delay	s
9	Fast E/Gnd Trip	1 Trip Shot * ☐ 2 Trip Shot * ☐ 3 Trip Shot * ☐ 4 Trip Shot * ☐ 5 Trip Shot * ☐
10	Fast E/Gnd Trip Delay	s
11	Close Shot? tI>	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
12	Inhib.Trip tI>: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
13	Close Shot? tI>>	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
14	Inhib.Trip tI>>: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
15	Close Shot? tI>>>	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
16	Inhib.Trip tI>>>: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
17	Close Shot? tIN_1	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐

Autoreclose [79] G2 (E)		
SETTING GROUP 1/ PROTECTION G2 / AUTORECLOSE [79] G2		Settings
18	Inhib.Trip tIN_1: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
19	Close Shot? tIN_2	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
20	Inhib.Trip tIN_2: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
21	Close Shot? tIN_3	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
22	Inhib.Trip tIN_3: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
23	Close Shot? tAUX1	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
24	Inhib.Trip tAUX1: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
25	Close Shot? tAUX2	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐
26	Inhib.Trip tAUX2: Shot	1 Close Shot* ☐ 2 Close Shot* ☐ 3 Close Shot* ☐ 4 Close Shot* ☐

SETTING GROUP 1/ OUTPUT RELAY CONFIGURATION G2		OUTPUT RELAYS CONFIGURATION G2							
		WD	RL7	RL6	RL5	RL4	RL3	RL2	RL1
		LNABE	**A**	**A**	**NAE**	**NAE**	**LNABE**	**LNABE**	**LNABE**
1	Latched outputs								
2	Reverse outp. logic								
3	Protect. Trip								
4	Prot.Trip pulse								
5	Trip CB Order								
6	Close CB Order								
7	Alarm								
8	start I>								
9	start I>>								
10	start I>>>								
11	Start SOTF (**BAE**)								
12	start IN_1								
13	start IN_2								
14	start IN_3 (**E**)								
15	start I2> (**E**)								
16	Start Brkn Cond (**E**)								
17	AUX1 (**BAE**)								
18	AUX2 (**BAE**)								
19	AUX3 (**BAE**)								
20	AUX4 (**BAE**)								
21	AUX5 (**BAE**)								
22	AUX6 (**BAE**)								
23	tI>								
24	tI>>								
25	tI>>>								
26	tSOTF (**BAE**)								
27	tIN_1								
28	tIN_2								
29	tIN_3 (**E**)								
30	tI2> (**E**)								
31	tBrkn Cond. (**E**)								
32	Thermal Trip (**NBAE**)								
33	Thermal Alarm (**NBAE**)								

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SETTING GROUP 1/ OUTPUT RELAY CONFIGURATION G2		OUTPUT RELAYS CONFIGURATION G2							
		WD	RL7	RL6	RL5	RL4	RL3	RL2	RL1
		LNA BE	**A**	**A**	**NAE**	**NAE**	**LNA BE**	**LNA BE**	**LNA BE**
34	tCB Fail								
35	tAUX1 (**BAE**)								
36	tAUX2 (**BAE**)								
37	tAUX3 (**BAE**)								
38	tAUX4 (**BAE**)								
39	Comm. Order 1 (**AE**)								
40	Comm. Order 2 (**AE**)								
41	[79]in Progress (**E**)								
42	[79] F.Trip (**E**)								
43	[79] Lockout (**E**)								
44	[79] Blocked (**E**)								
45	[79] Success. (**E**)								
46	TCS 52 Fail (**AE**)								
47	CB Alarm (**AE**)								
48	tCB FLT Ext.Sign (**AE**)								
49	Setting Group 1								

CM

SETTING GROUP 1/ INPUT CONFIGURATION G2		INPUTS CONFIGURATION G2							
		L8	L7	L6	L5	L4	L3	L2	L1
		E	**E**	**E**	**E**	**ABE**	**ABE**	**ABE**	**ABE**
1	Reverse Input Logic								
2	Mainten. Mode (**AE**)								
3	Reset Latch Sign								
4	Reset Latchd Out								
5	Block. tI>								
6	Block. tI>>								
7	Block. tI>>								
8	Block.tSOTF								
9	Block. tIN_1								
10	Block. tIN_2								

SETTING GROUP 1/ INPUT CONFIGURATION G2		INPUTS CONFIGURATION G2							
		L8	L7	L6	L5	L4	L3	L2	L1
		E	**E**	**E**	**E**	**ABE**	**ABE**	**ABE**	**ABE**
11	Block. tIN_3 (**E**)								
12	Block. tI2> (**E**)								
13	Block. tBrkn Cond (**E**)								
14	Block. Itherm.								
15	Block. AUX1								
16	Block. AUX2								
17	Block. AUX3								
18	Block. CB Fail								
19	Block. [79] (**E**)								
20	SEL1 tI>> (**E**)								
21	SEL1 tI>>> (**E**)								
22	SEL1 tIN_2 (**E**)								
23	SEL1 tIN_3 (**E**)								
24	SEL2 tI>> (**E**)								
25	SEL2 tI>>> (**E**)								
26	SEL2 tIN_2 (**E**)								
27	SEL2 tIN_3 (**E**)								
28	AUX1								
29	AUX2								
30	AUX3								
31	AUX4								
32	AUX5								
33	AUX6								
34	Cold Load PU (**AE**)								
35	Strt tBF (**AE**)								
36	CB Status 52A								
37	CB Status 52B								
38	CB FLT Ext.Sign								
39	Setting Group 2								
40	Manual Close								
41	Manual Trip								
42	Trip Circ Supervis. (**AE**)								
43	Reset Theta val.								
44	Start Distur. R. (**AE**)								

SETTING GROUP 1/ INPUT CONFIGURATION G2		INPUTS CONFIGURATION G2							
		L8	L7	L6	L5	L4	L3	L2	L1
		E	**E**	**E**	**E**	**ABE**	**ABE**	**ABE**	**ABE**
45	Local CTRL Mode (**AE**)								
46	Time Synchr. (**BE**)								

LEDs CONFIGURATION G2							
SETTING GROUP 1/ LEDs CONFIGURATION G2		LED2	LED3	LED4	LED5	LED6	LED7
1	Latched LEDs						
2	Protect. Trip						
3	Alarm						
4	General Start						
5	Start Phase A						
6	Start Phase B						
7	Start Phase C						
8	Start I>						
9	Start I>>						
10	Start I>>>						
11	Start SOTF (**BAE**)						
12	Start IN_1						
13	Start IN_2						
14	Start IN_3 (**E**)						
15	AUX1 (**BAE**)						
16	AUX2 (**BAE**)						
17	AUX3 (**BAE**)						
18	AUX4 (**BAE**)						
19	AUX5 (**BAE**)						
20	AUX6 (**BAE**)						
21	tI>						
22	tI>>						
23	tI>>>						
24	tSOTF (**BAE**)						
25	tIN_1						
26	tIN_2						
27	tIN_3 (**E**)						
29	tI2> (**E**)						
30	tBrkn Cond. (**E**)						
31	Thermal Trip (**NBAE**)						
32	Thermal Alarm (**NBAE**)						
33	CB Fail						
34	tAUX1 (**BAE**)						
35	tAUX2 (**BAE**)						
36	tAUX3 (**BAE**)						
37	tAUX4 (**BAE**)						
38	[79] in Progress (**E**)						
39	[79] F.Trip (**E**)						

CM

LEDs CONFIGURATION G2							
SETTING GROUP 1/ LEDs CONFIGURATION G2		LED2	LED3	LED4	LED5	LED6	LED7
40	[79] Lockout (**E**)						
41	[79] Blocked (**E**)						
42	[79] Success. (**E**)						
43	Local CRTL Mode (**AE**)						
44	CB Alarm (**AE**)						
45	Maintenance Mode (**AE**)						
46	tCB FLT Ext.Sign (**BAE**)						
47	Setting Group 1						

CM

Commissioning Engineer

Date:

Customer Witness

Date:

CM

MAINTENANCE

MT

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

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Maintenance

1.1 Maintenance period

It is recommended that products supplied by SCHNEIDER ELECTRIC ENERGY receive periodic monitoring after installation. In view of the critical nature of protective relays and their infrequent operation, it is desirable to confirm that they are operating correctly, at regular intervals.

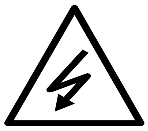
SCHNEIDER ELECTRIC ENERGY protective relays are designed for a life in excess of 20 years.

VAMP 11x relays are self-monitoring and so require less maintenance than earlier designs of relay. Most problems will set off an alarm so that remedial action can be taken. However, some periodic tests should be carried out to ensure that the relay is functioning correctly and that the external wiring is intact.

1.2 Maintenance checks

Although some functionality checks can be performed from a remote location by utilizing the communications ability of the relays, these are predominantly restricted to checking that the relay is measuring the applied currents accurately. Therefore it is recommended that maintenance checks are performed locally (i.e. at the substation itself).

Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety Guide SFTY/4L M/E11 or later issue, OR the safety and technical data section of the technical manual and also the ratings on the equipment rating label.



For safety reasons, no work must be carried out on the V11F until all power sources to the unit have been disconnected.

1.2.1 Binary Inputs

Binary inputs can be checked to ensure that the relay responds to its energization by repeating the commissioning test detailed in section 3.2.3 of the Commissioning chapter (V11F/EN CM).

1.2.2 Outputs

Output relays' operation can be checked by repeating the commissioning test detailed in section 3.2.4 of the Commissioning chapter (V11F/EN CM).

1.2.3 Measurement Accuracy

If the power system is energized, the values measured by the relay can be compared with known system values to check that they are in the approximate expected range.. If they are, then the analogue/digital conversion and calculations are being performed correctly by the relay. Suitable test methods can be found in sections 3.2.7 of the Commissioning chapter (V11F/EN CM).

Alternatively, the values measured by the relay can be checked against known values injected into the relay via the test block, if fitted, or injected directly into the relay terminals. These tests will prove the calibration accuracy is being maintained.

1.3 Method of Repair

It is recommended that the V11F relay is returned to an SCHNEIDER ELECTRIC ENERGY service centre for repair.

Before carrying out any work on the equipment, the user should be familiar with the contents of the Safety Guide SFTY/4L M/E11 or later issue, OR the safety and technical data section of the technical manual and also the ratings on the equipment rating label.

For safety reasons, no work must be carried out on the V11F until all power sources to the unit have been disconnected.

1.4 Cleaning

Before cleaning the equipment ensure that all current transformers and voltage input connections are isolated to prevent any possibility of an electric shock whilst cleaning.

The equipment may be cleaned using a lint-free cloth moistened with clean water. The use of detergents, solvents or abrasive cleaners is not recommended as they may damage the relay's surface and leave a conductive residue.

TROUBLESHOOTING

TS

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

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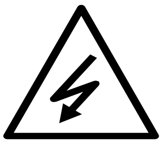
TS

TS

1. INTRODUCTION

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4L M/E11 OR LATER ISSUE, or THE SAFETY AND TECHNICAL DATA SECTION OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.



For safety reasons, no work must be carried out on the V11F until all power sources to the unit have been disconnected.

The purpose of this section of the service manual is to allow an error condition on the relay to be identified so that appropriate corrective action can be taken.

In cases where a faulty relay is being returned to the manufacturer or one of their approved service centers, a completed copy of the Repair/Modification Return Authorization Form located at the end of this section should be included.

2. INITIAL PROBLEM IDENTIFICATION

Consult the table below to find the description that best matches the problem experienced, then consult the section referenced to perform a more detailed analysis of the problem.

Symptom	Refer To
Relay fails to power up	Section 3
Maloperation of the relay during testing	Section 4

Table 1: Problem identification

3. POWER UP ERRORS

V11F can be powered up using the following power sources:

- USB connection to PC (function not available in Miodel L and N)
- Auxiliary voltage (Vx)

If the relay does not appear to power up then the following procedure can be used to determine whether the fault is in the external wiring or in the power supply module of the relay.

Test	Check	Action
1	1. Connect the V11F to a PC via the USB port. 2. Disconnect the PC from the V11F USB port.	(i) If the green “Healthy” LED and display are lit then proceed to test 2. (ii) If the green “Healthy” LED and display are not lit then proceed to test 2.
2	1. Apply a Vx auxiliary voltage on terminals A1-A2 (check the level on the V11F nominal label) 2. Check whether the green “Healthy” LED on the V11F front panel is lit. 3. Disconnect the ac auxiliary voltage from terminals A1-A2.	(i) If the green “Healthy” LED and display are lit then proceed to test 3. (ii) If the green “Healthy” LED and display are not lit then send the relay back to Schneider Electric Energy's repair centre.

Table 2: Failure of relay to power up

4. MALOPERATION OF THE RELAY DURING TESTING

4.1 Failure of Binary Inputs (A, B and E only)

The binary inputs are configured in the ***SETTING GROUPx/INPUTS CONFIGURATION*** column for each setting group. If an input does not appear to be recognized by the relay scheme logic the ***COMMISSIONING/Opto I/P Status*** menu option can be used to verify whether the problem is in the binary input itself or the mapping of its signal to the scheme logic functions. If the binary input appears to be read correctly then it is necessary to examine its configuration.

Ensure the voltage rating for the opto inputs has been configured correctly with applied voltage. If the binary input state is not read correctly by the relay the applied signal should be tested. Verify the connections to the binary input using the correct wiring diagram. Next, using a voltmeter verify that 80% opto setting voltage is present on the terminals of the binary input in the energized state. If the signal is being correctly applied to the relay then the failure may be on the input card itself.

Notes:

1. If the V11F is exclusively powered from the USB port, only some of the relay's electronic circuits (necessary for communications) are supplied. For this reason, inputs are in high state (independent of the voltage at the terminals). Any action pertaining to binary inputs is blocked.

2. Only the logical state of the inputs is given in the ***COMMISSIONING /Opto I/P Status*** cell, not presence of voltage at the terminals. For example: If Vx (high state) and Reverse Input Logic are set (function active in low state of binary input) at the terminals of a binary input in the **COMMISSIONING /Opto I/P Status** cell, the logical state of the input is low (logical status after application of the Reverse Input Logic function).

4.2 Failure of Output Contacts

An apparent failure of the relay's output contacts may be caused by the relay configuration; the following tests should be performed to identify the real cause of the failure. Tests of outputs can be performed using the ***COMMISSIONING/Test outputs*** cell. The command is executed and the configured outputs (***COMMISSIONING/Test Pattern***) will be energized for the duration of ***Contact Test Time*** (***COMMISSIONING***).

Test	Check	Action
1	Is the Out of Service LED illuminated?	Illumination of this LED may indicate that the relay is in test mode or that the protection has been disabled due to a hardware verify error (see Table 2).
2	Examine the ***Test outputs*** (AE) in the Commissioning section of the menu.	If the relevant bits of the contact status are operated then proceed to test 4, if not proceed to test 3.
3	Verify by examination of the fault record whether the protection element is operating correctly.	If the protection element does not operate verify whether the test is being correctly applied. If the protection element operates then it is necessary to check the configuration, to ensure that the configuration of the protection element to the contacts is correct.
4	Using the procedure described in the Commissioning chapter (V11F/EN CM) energize every output (note the correct external connection diagram should be consulted). A continuity tester can be connected at the rear of the relay for this purpose.	If the output relay operates then the problem must be situated in the external wiring to the relay. If the output relay does not operate this could indicate a failure of the output relay contacts (note that the self-tests verify that the relay coil is being energized). Ensure that the closed resistance is not too high for the continuity tester to detect.

Table 3: Failure of Output Contacts

TS

5. REPAIR AND MODIFICATION PROCEDURE

Please follow these 5 steps to return an Automation product to us:

1. Get the Repair and Modification Authorization Form (RMA)

Find a copy of the RMA form at the end of this section.

To obtain an electronic version of the RMA form for e-mailing, please connect your lical Schneider Electric Energy service.

2. Fill in RMA form

Fill in only the white part of the form.

Please ensure that all fields marked **(M)** are completed such as:

- Equipment model
- Model No. and Serial No.
- Description of failure or modification required (please be specific)
- Value for customs (in case the product requires export)
- Delivery and invoice addresses
- Contact details

3. Send RMA form to your local contact

4. Receive shipping information from local service contact

Your local service contact will provide you with all the information:

- Pricing details
- RMA n°
- Repair center address

If required, an acceptance of the quote must be delivered before going to the next step. .

5. Send the product to the repair center

- Address the shipment to the repair center specified by your local contact
- Ensure all items are protected by appropriate packaging: anti-static bag and foam protection
- Ensure a copy of the import invoice is enclosed with the unit being returned
- Ensure a copy of the RMA form is enclosed with the unit being returned
- E-mail or fax a copy of the import invoice and air waybill to your local contact.

\

TS

SYMBOLS AND GLOSSARY

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

SG

Logic Symbols

Symbols	Explanation
>	**Greater than:** Used to indicate an “over” threshold, such as overcurrent (current overload).
C/O	**A changeover contact having normally closed and normally open connections:** Often called a “form C” contact.
CB	Circuit breaker.
CT	Current transformer.
Dly	Time delay.
DT	**Abbreviation of “Definite Time”:** An element which always responds with the same constant time-delay on operation.
E/F	**Earth fault:** Directly equivalent to ground fault.
FLC	**Full load current:** The nominal rated current for the circuit.
Flt.	**Abbreviation of “Fault”:** Typically used to indicate faulted phase selection.
FN	Function.
Gnd.	**Abbreviation of “Ground”:** Used in distance settings to identify settings that relate to ground (earth) faults.
I	Current.
I>>	**First stage of phase overcurrent protection:** Could be labeled 51-1 in ANSI terminology.
I>>	**Second stage of phase overcurrent protection:** Could be labeled 51-2 in ANSI terminology.
I>>>	**Third stage of phase overcurrent protection:** Could be labeled 51-3 in ANSI terminology.
IN>	**Earth Fault current:** Equals the neutral current measured at the analog input.
I2>	**Negative sequence overcurrent protection** Could be labeled 46 in ANSI terminology.
I2	**Negative sequence current**.
I1	**Positive sequence current**.
IA	**Phase A current:** Might be phase L1, red phase.. or other, in customer terminology.
IB	**Phase B current:** Might be phase L2, yellow phase.. or other, in customer terminology.
IC	**Phase C current:** Might be phase L3, blue phase.. or other, in customer terminology.
IDMT	**Inverse definite minimum time:** A characteristic whose trip time depends on the measured input (e.g. current) according to an inverse-time curve.

SG

Symbols	Explanation
In	**The rated nominal current of the CT:** Software selectable as 1 amp or 5 amp to match the line CT input.
Ien	**The rated nominal current of the E/F CT:** Software selectable as 1 amp or 5 amp to match the line E/F CT input.
IN	**Neutral current, or residual current:** This results from an external summation of the three measured phase currents.
Inst.	**An element with "instantaneous" operation:** i.e. having no deliberate time delay.
I/O	**Abbreviation of "Inputs and Outputs":** Used in connection with the number of opto-coupled inputs and output contacts within the relay.
I/P	Abbreviation of "Input".
LD	**Abbreviation of "Level Detector":** An element responding to a current or voltage below its set threshold.
LED	**Light emitting diode:** Red or green indicator on the relay front-panel.
N	**Indication of "Neutral" involvement in a fault:** i.e. a ground (earth) fault.
N/A	Not applicable.
N/C	**A normally closed or "break" contact:** Often called a "form B" contact.
N/O	**A normally open or "make" contact:** Often called a "form A" contact.
O/P	Abbreviation of "output".
Opto	**An opto-coupled logic input:** Alternative terminology: binary input.
PCB	Printed circuit board.
Ph	**Abbreviation of "Phase":** Used in distance settings to identify settings that relate to phase-phase faults.
IN_1	The first stage of earth fault protection element [50/50N]
IN_2	The second stage of earth fault protection element [50/50N]
Rx	**Abbreviation of "Receive":** Typically used to indicate a communication receive line/pin.
T	A time delay.
TE	**A standard for measuring the width of a relay case:** One inch = 5TE units.
TMS	The time multiplier setting applied to IEC or UK inverse-time curves
TD	The time multiplier setting applied to IEEE or US inverse-time curves
Tx	**Abbreviation of "Transmit":** Typically used to indicate a communication transmit line/pin.

INSTALLATION

Date:	**1st July 2015**
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IN

CONTENTS

FIGURES

1. RECEIPT OF RELAYS

Upon receipt, relays should be examined immediately to ensure no external damage has been sustained in transit. If damage has been sustained, a claim should be made to the transport contractor and Schneider Electric Energy should be promptly notified.

Relays that are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags and delivery carton. Section 3 of V11F/EN IN gives more information about the storage of relays.

2. HANDLING OF ELECTRONIC EQUIPMENT

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semi-conductor devices when handling electronic circuits can cause serious damage that, although not always immediately apparent can reduce the reliability of the circuit. The relay's electronic circuits are protected from electrostatic discharge when housed in the case. Do not expose them to risk by removing the front panel or printed circuit boards unnecessarily.

Each printed circuit board incorporates the highest practicable protection for its semi-conductor devices. However, if it becomes necessary to remove a printed circuit board, the following precautions should be taken to preserve the high reliability and long life for which the relay has been designed and manufactured.

Before removing a printed circuit board, ensure that you are at the same electrostatic potential as the equipment by touching the case.

Handle analog input modules by the front panel, frame or edges of the circuit boards. Printed circuit boards should only be handled by their edges. Avoid touching the electronic components, printed circuit tracks or connectors.

Do not pass the module to another person without first ensuring you are both at the same electrostatic potential. Shaking hands achieves equipotential.

Place the module on an anti-static surface, or on a conducting surface that is at the same potential as you.

If it is necessary to store or transport printed circuit boards removed from the case, place them individually in electrically conducting anti-static bags.

In the unlikely event that you are making measurements on the internal electronic circuitry of a relay in service, it is preferable that you are earthed to the case with a conductive wrist strap. Wrist straps should have a resistance to ground between 500 kΩ and 10 MΩ. If a wrist strap is not available you should maintain regular contact with the case to prevent a build-up of electrostatic potential. Instrumentation which may be used for making measurements should also be earthed to the case whenever possible.

More information on safe working procedures for all electronic equipment can be found in BS EN 100015: Part 1:1992. It is strongly recommended that detailed investigations on electronic circuitry or modification work should be carried out in a special handling area such as described in the British Standard document.

3. STORAGE

If relays are not to be installed immediately upon receipt, they should be stored in a place free from dust and moisture in their original cartons. Where de-humidifier bags have been included in the packing they should be retained.

Care should be taken on subsequent unpacking that any dust, which has collected on the carton, does not fall inside. In locations of high humidity the carton and packing may become impregnated with moisture and the de-humidifier crystals will lose their efficiency.

Prior to installation, relays should be stored at a temperature of between –25°C to +70°C (-13°F to +158°F).

4. UNPACKING

Care must be taken when unpacking and installing the relays so that none of the parts are damaged and additional components are not accidentally left in the packing or lost. Ensure that any User's CD ROM or technical documentation is NOT discarded – this should accompany the relay to its destination substation.

Relays must only be handled by qualified persons.

The site should be well lit to facilitate inspection, clean, dry and reasonably free from dust and excessive vibration.

5. RELAY MOUNTING

Individual relays are normally supplied with an outline diagram showing the dimensions. This information can also be found in the product publication.

Flush mounted version:

Make a cut-out in mounting plate according to fig. 1. Then insert the relay into it. Fit fastening elements (see fig. 1) into the slots in the sides of the housing, and keep turning the fastening screws until the relay is securely fixed to the plate. To remove the relay undo the screws, so that the fastening element could be taken out, and then the relay could be withdrawn from the cut-out in the mounting plate.

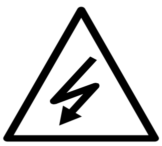
Mounting on the wall:

Flush mounting case of V11F can be mounted on the wall by using optional Wall Mounting Case Adaptor (ordering number: REL10030)

Insert the relay into wall mounting adaptor according to fig. 2. Fit fastening elements (see fig. 2) into the slots in the sides of the housing, and keep turning the fastening screws until the relay is securely fixed to the wall mounting adaptor. To remove the relay undo the screws, so that the fastening element could be taken out, and then the relay could be withdrawn from the wall mounting adaptor.

6. RELAY WIRING

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4L M/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTION OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.



For safety reasons, no work must be carried out on the V11F until all power sources to the unit have been disconnected.

The measuring current inputs of the V11F should be connected to the secondary wires of the power system CTs as shown in the connection diagrams in section 8. " External Connection Diagram" of this chapter V11F/EN IN.

The CT types which can be connected to the V11F current input terminals are shown in section 3 of the Applications chapter V11F/EN AP.

6.1 Terminal Block Connections

AC Current Input Terminals

AC Current Input Terminals

Threaded M3 screw-type plug-in terminals, with wire protection for conductor cross-section

(i) 0.2 - 6 mm^2 single-core

(ii) 0.2 - 4 mm^2 finely stranded

General Input/Output Terminals

For power supply, binary and contact inputs, output contacts and COM for rear communications.

Threaded M3 screw-type plug-in terminals, with wire protection for conductor cross-section

(i) 0.2 - 4 mm^2 single-core

(ii) 0.2 - 2.5 mm^2 finely stranded

Connections to the equipment must only be made using single strand wire or stranded wire with the use of insulated crimp terminals to maintain insulation requirements.

Where UL Listing of the equipment is not required the recommended fuse type for external wiring is a high rupture capacity (HRC) type with a maximum current rating of 16 Amps and a minimum DC rating of 250 Vdc, for example the Red Spot NIT or TIA type.

To maintain UL and CUL Listing of the equipment for North America a UL Listed fuse shall be used. The UL Listed type shall be a Class J time delay fuse, with a maximum current rating of 15 A and a minimum DC rating of 250 Vdc, for example type AJT15.

The protective fuse(s) should be located as close to the unit as possible.

6.2 USB Port

Connection to the USB (**ABEN**) port can be made by means of an USB cable. The USB port allows the user to download settings or fault records from the V11F or change I/O configuration.

To access this port it is necessary to remove the cover plate on the V11F front panel.

Note: Model N is not supplied via USB port.

A typical cable specification would be:

Cable Type: USB 2.0

Connectors:

PC: type A male

V11F: type mini B 5-pin male

USB Cable: minimum 1P*28AWG/2C*24AWG, max : 2m

Communication software: MiCOM S1 Studio 5.1.0 (or higher)

The virtual COM port for USB communications should be set in as follows:

Address: 1

Baud rate*:* 115 200 bits/s

Data bit: 8

Stop bit: 1

Parity: None

6.3 Rear Communications Port (in Model L optional)

EIA(RS)485 signal levels, two wire

Connections located on the general-purpose terminal block, M3 screw

For screened twisted pair cable, distance to be bridged: multi-endpoint link: max. 100 m

For Modbus RTU or IEC-103 protocol; Isolation to SELV level

7. V11F CASE AND ADAPTOR DIMENSIONS

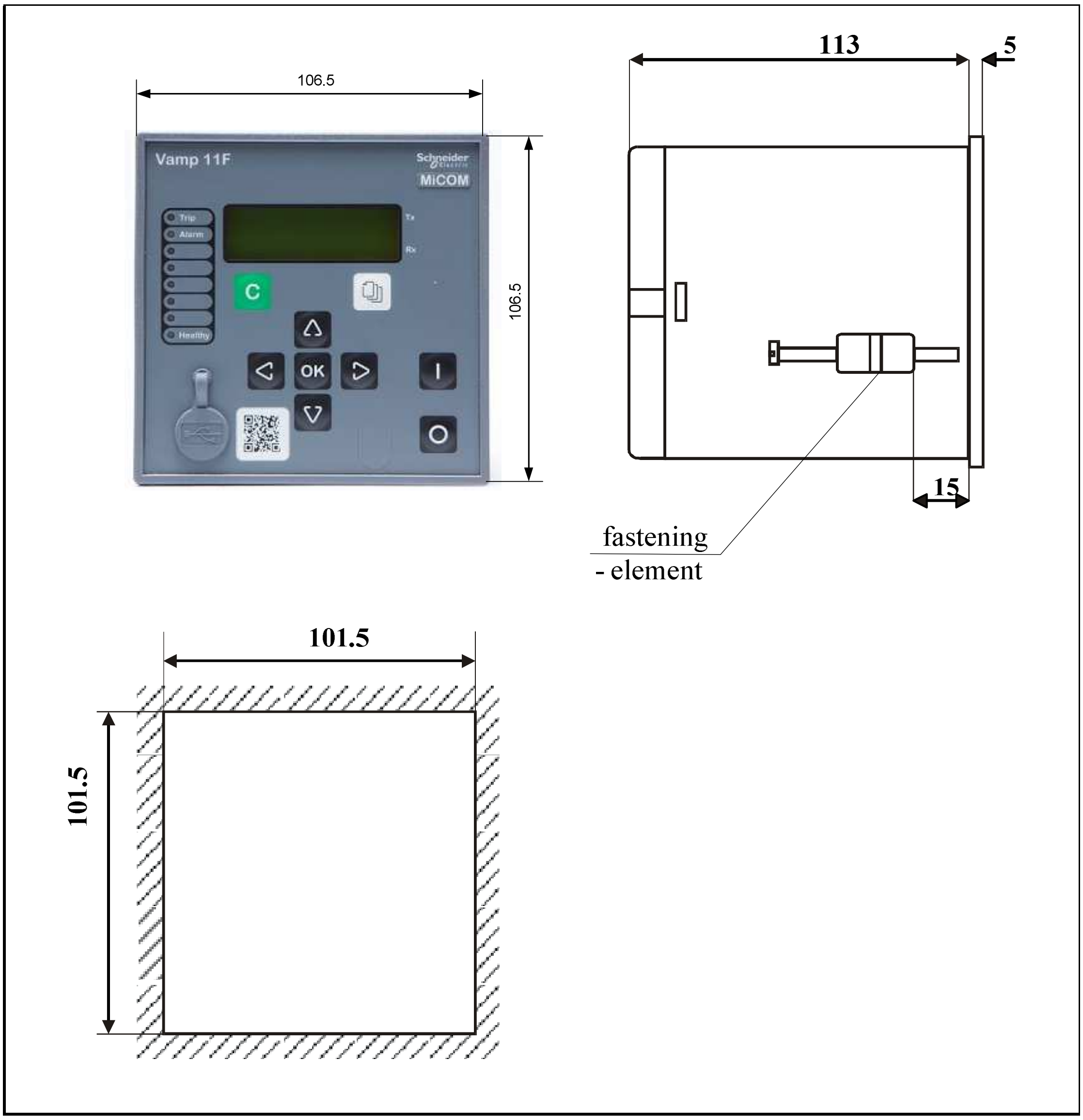


Figure 1: Dimensions. V11F flush mounting basic case

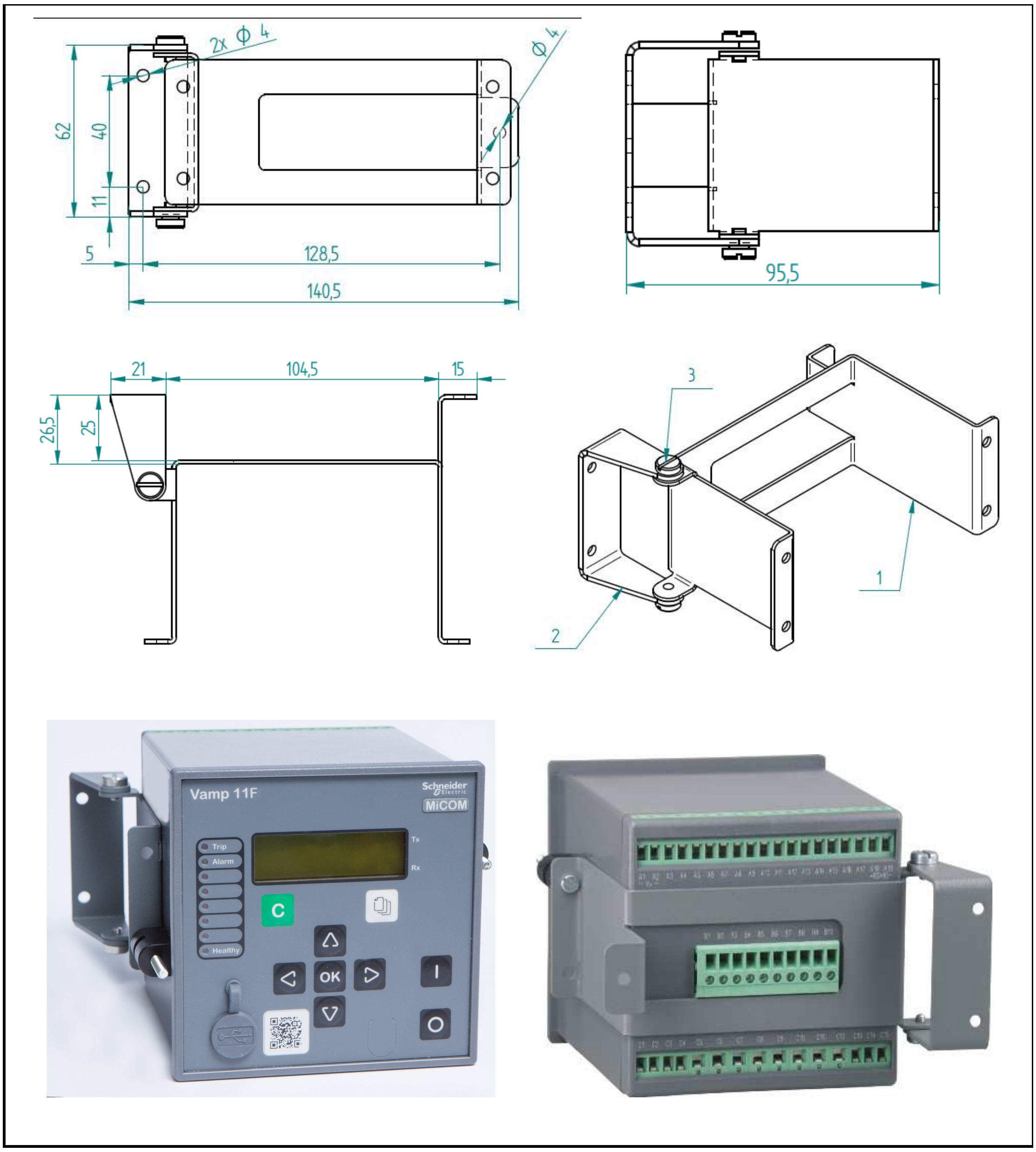


Figure 2: Dimensions. Wall mounting case adaptor

8. EXTERNAL CONNECTION DIAGRAMS

Note: The current leads should be connected exactly as shown in Figures: 2 to 16.

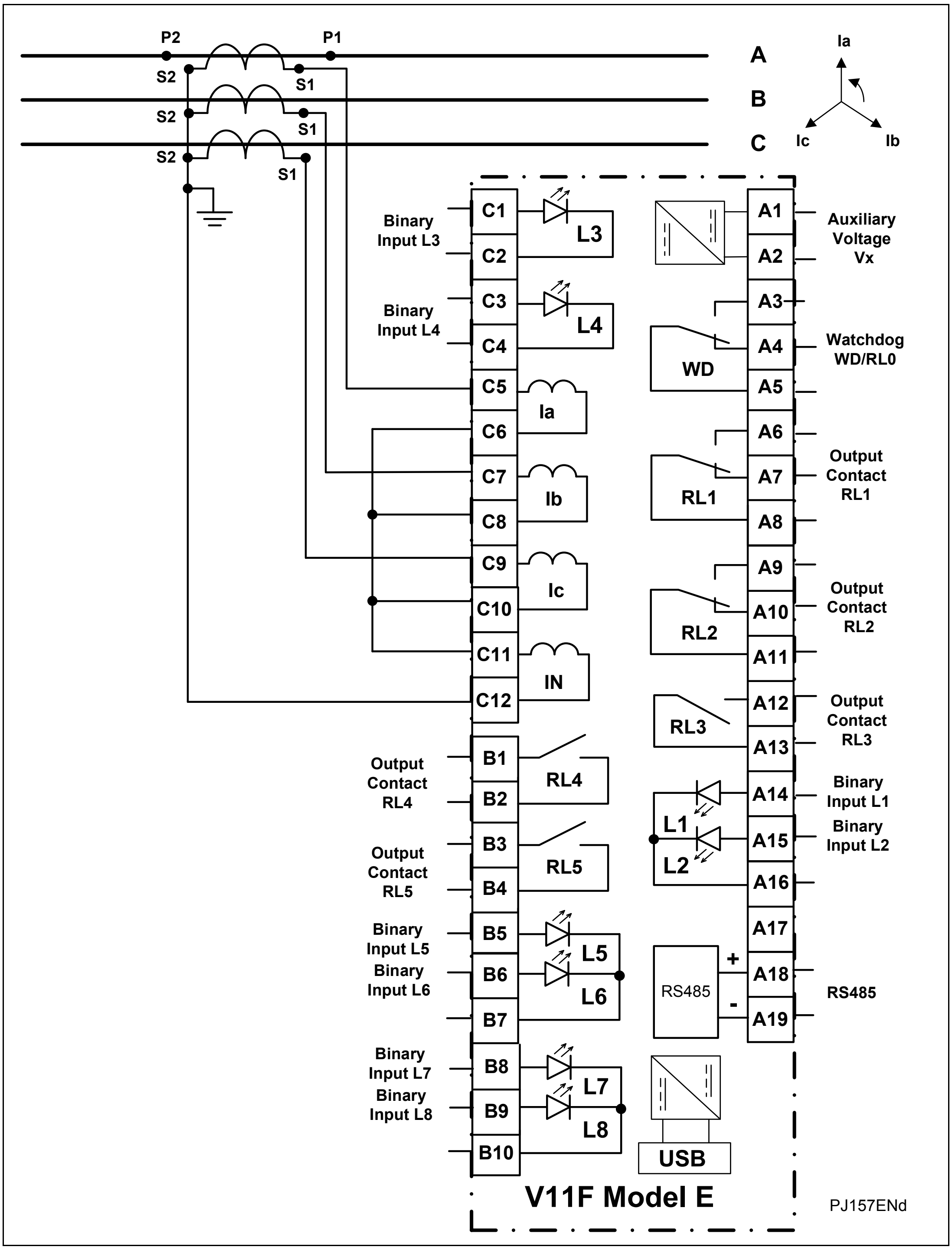


Figure 3: Model E, typical connection to 3 Phase CTs

IN

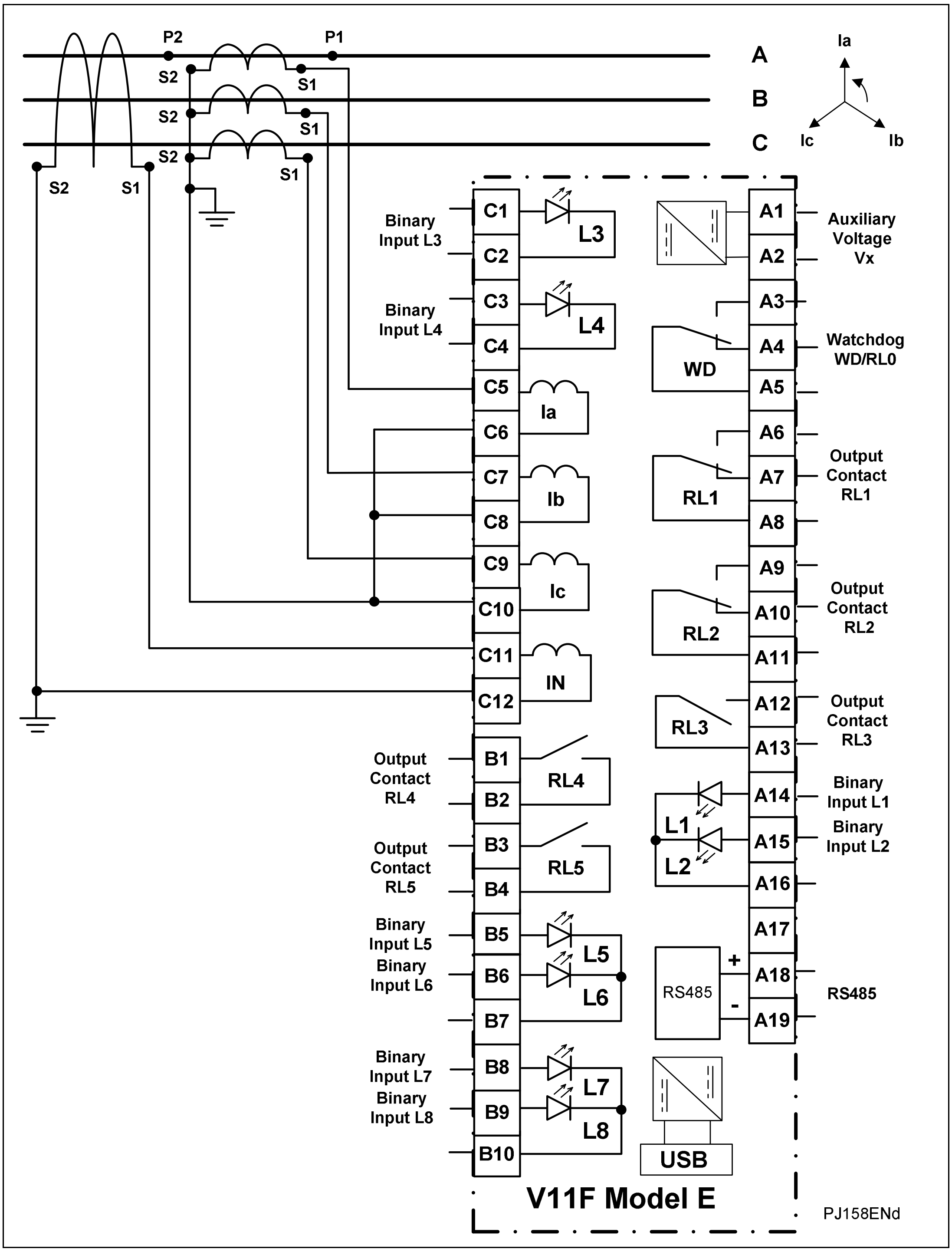


Figure 4: Model E, typical Connection to 3 Phase CTs + a Core Balance CT

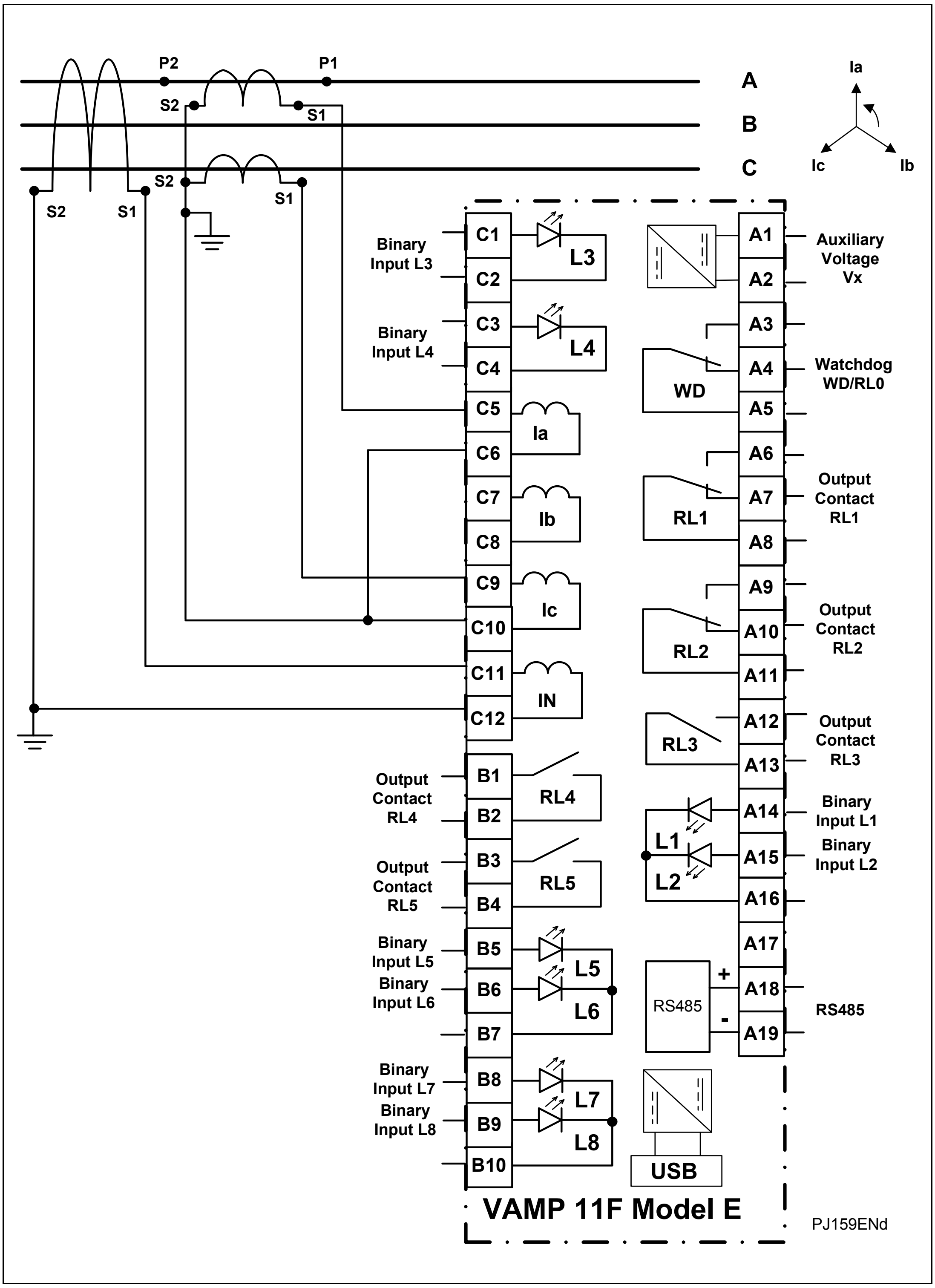


Figure 5: Model E, typical connection to 2 Phase CTs + a Core Balance CT

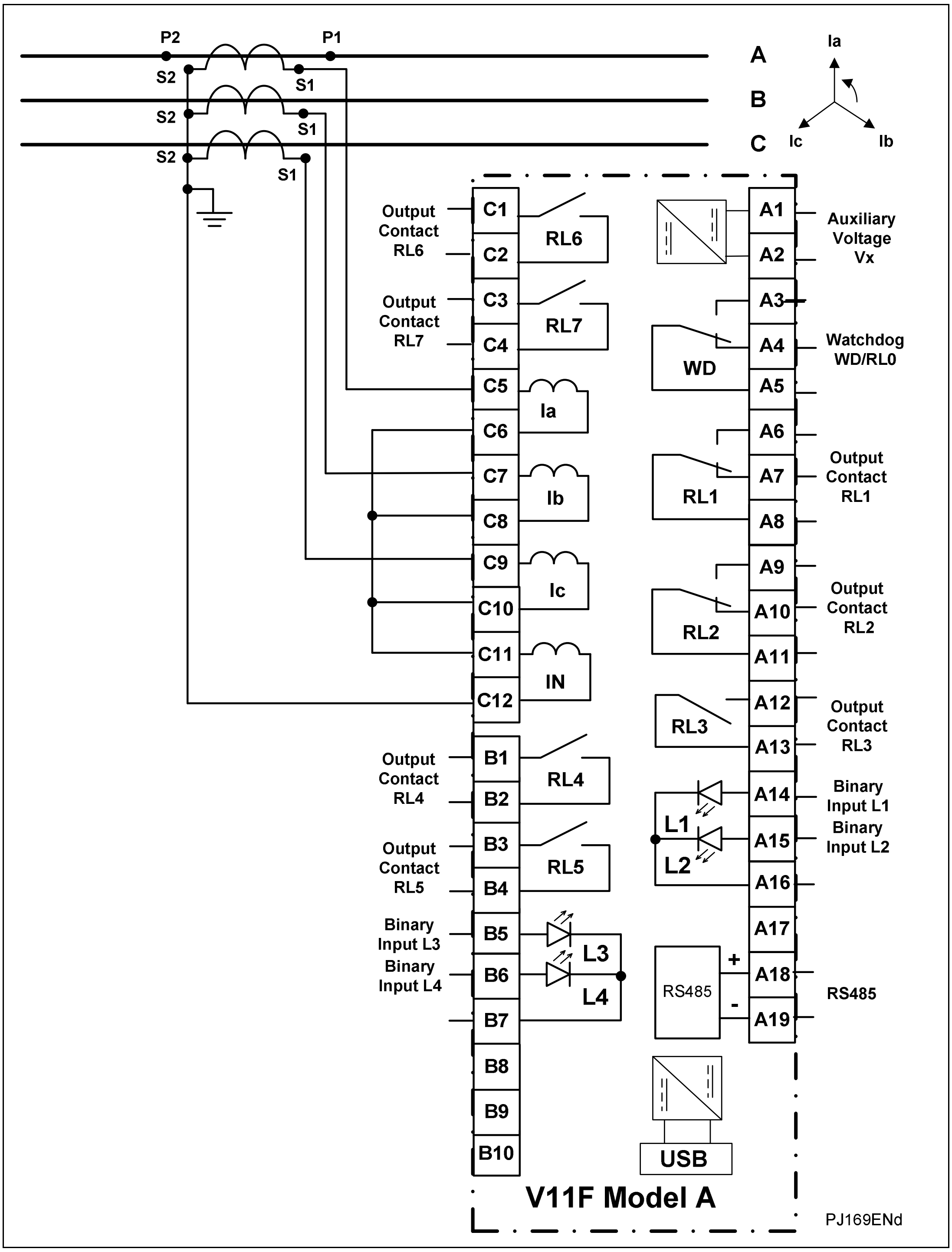


Figure 6: Model A, typical connection to 3 Phase CTs

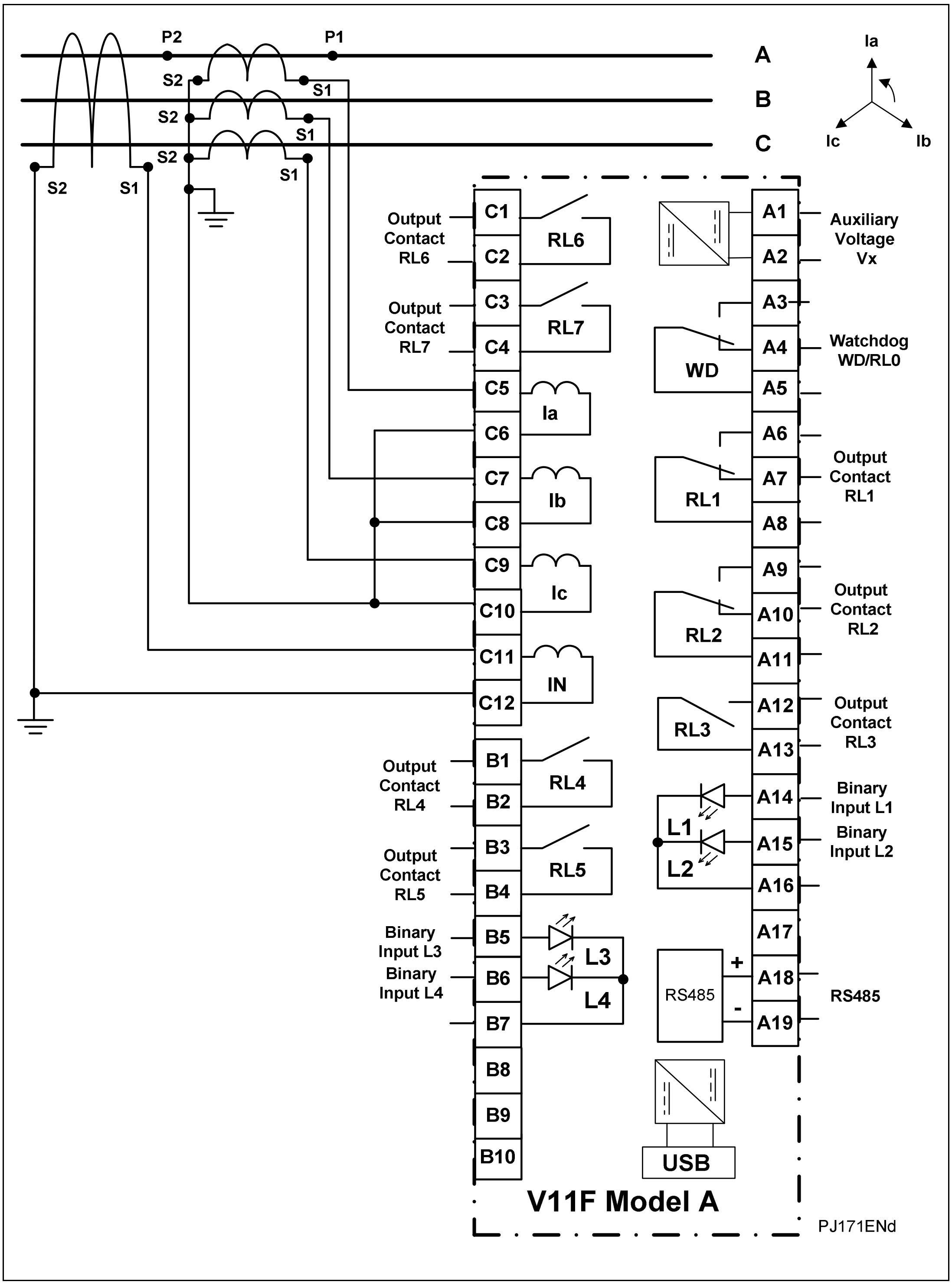


Figure 7: Model A, typical Connection to 3 Phase CTs + a Core Balance CT

IN

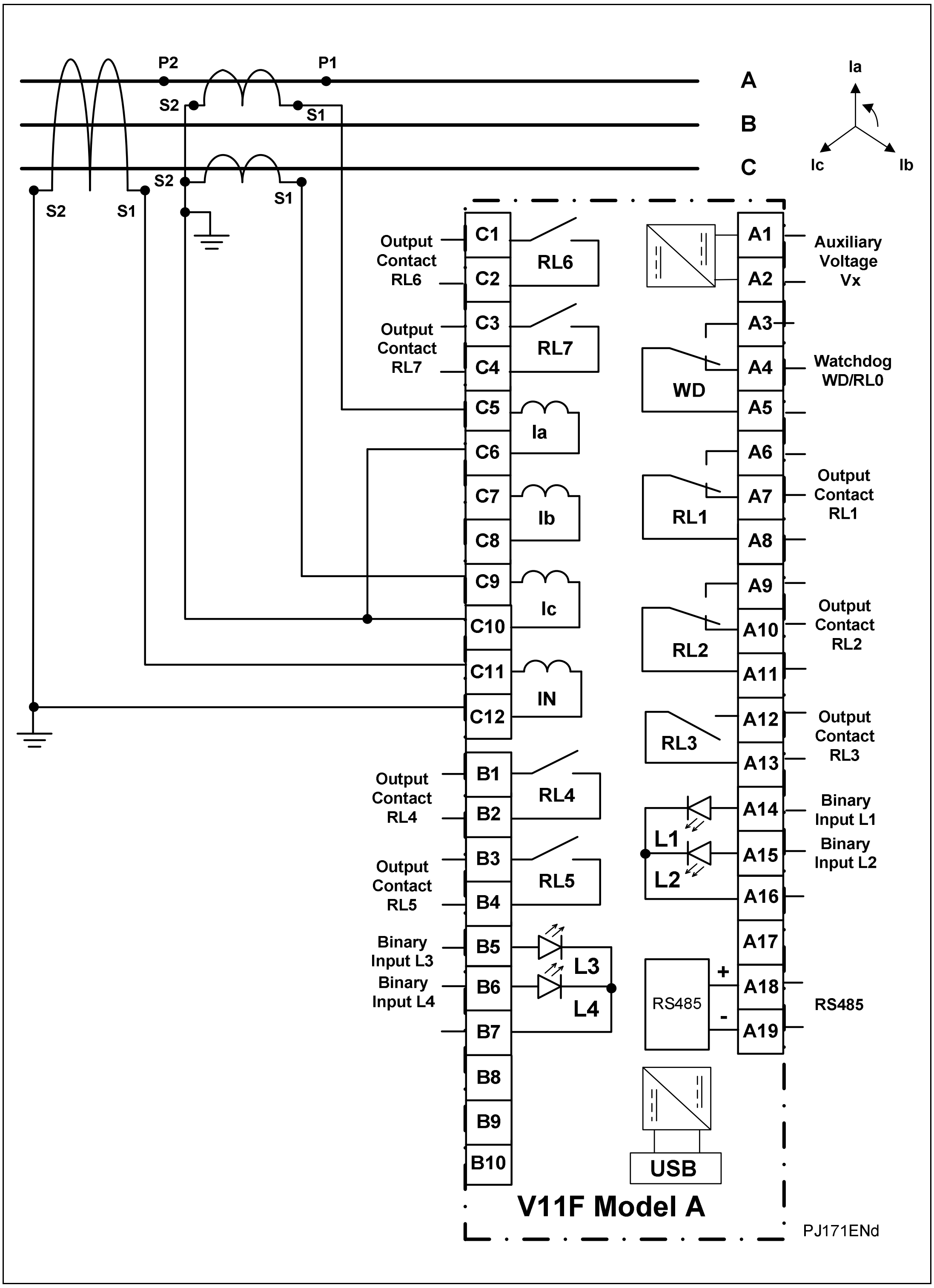


Figure 8: Model A, typical connection to 2 Phase CTs + a Core Balance CT

IN

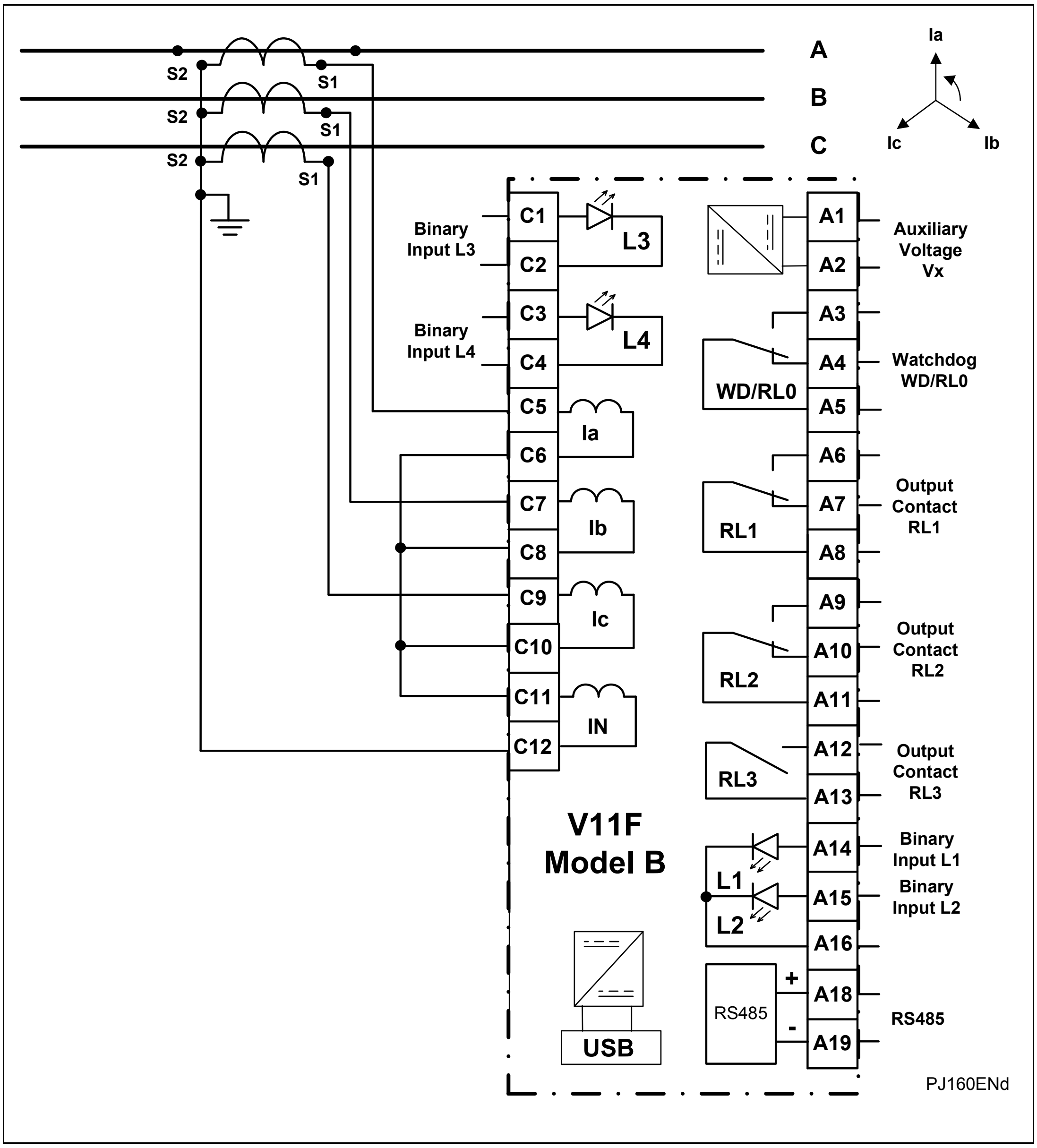


Figure 9: Model B, typical connection to 3 Phase CTs

IN

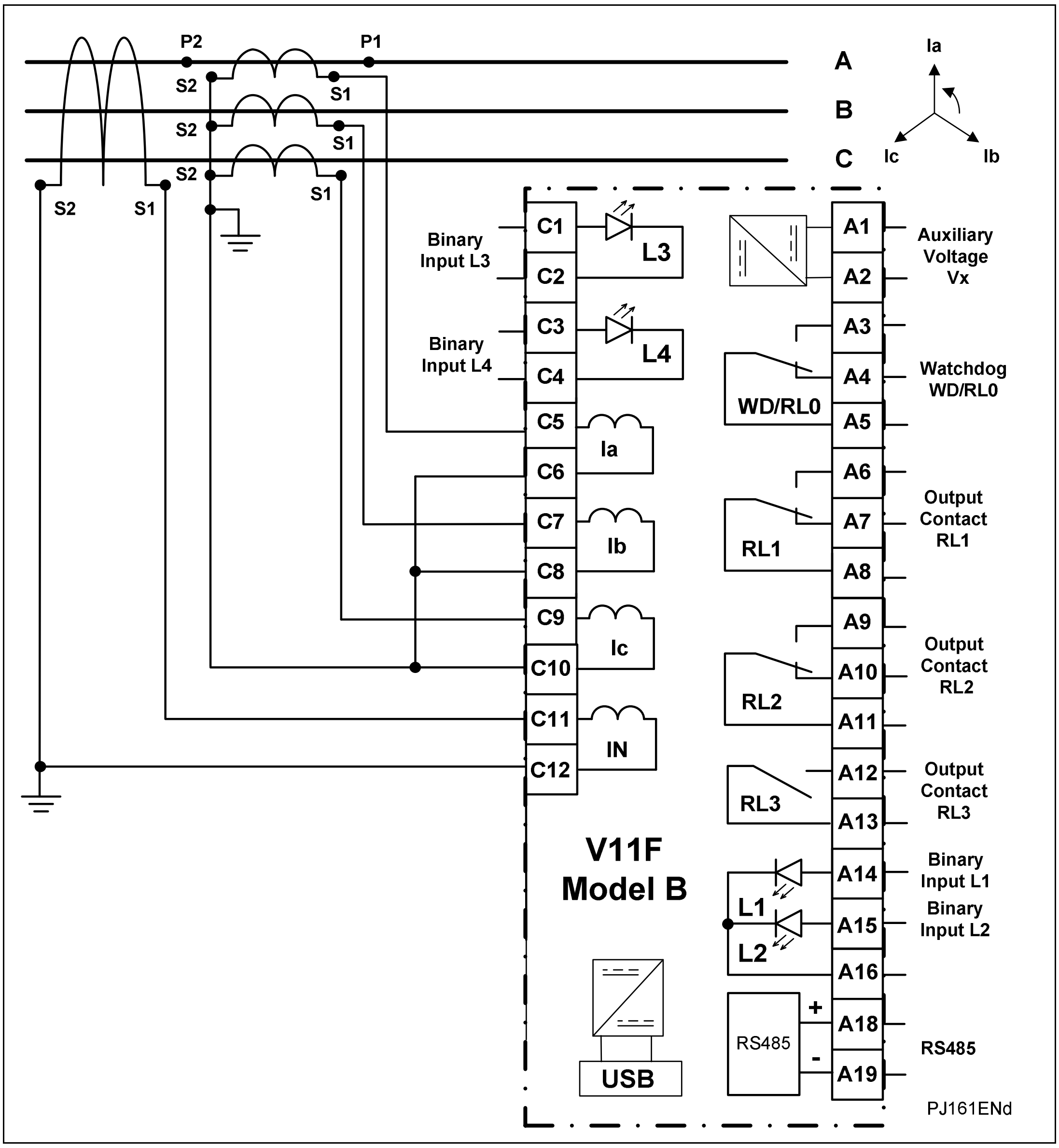


Figure 10: Model B, typical Connection to 3 Phase CTs + a Core Balance CT

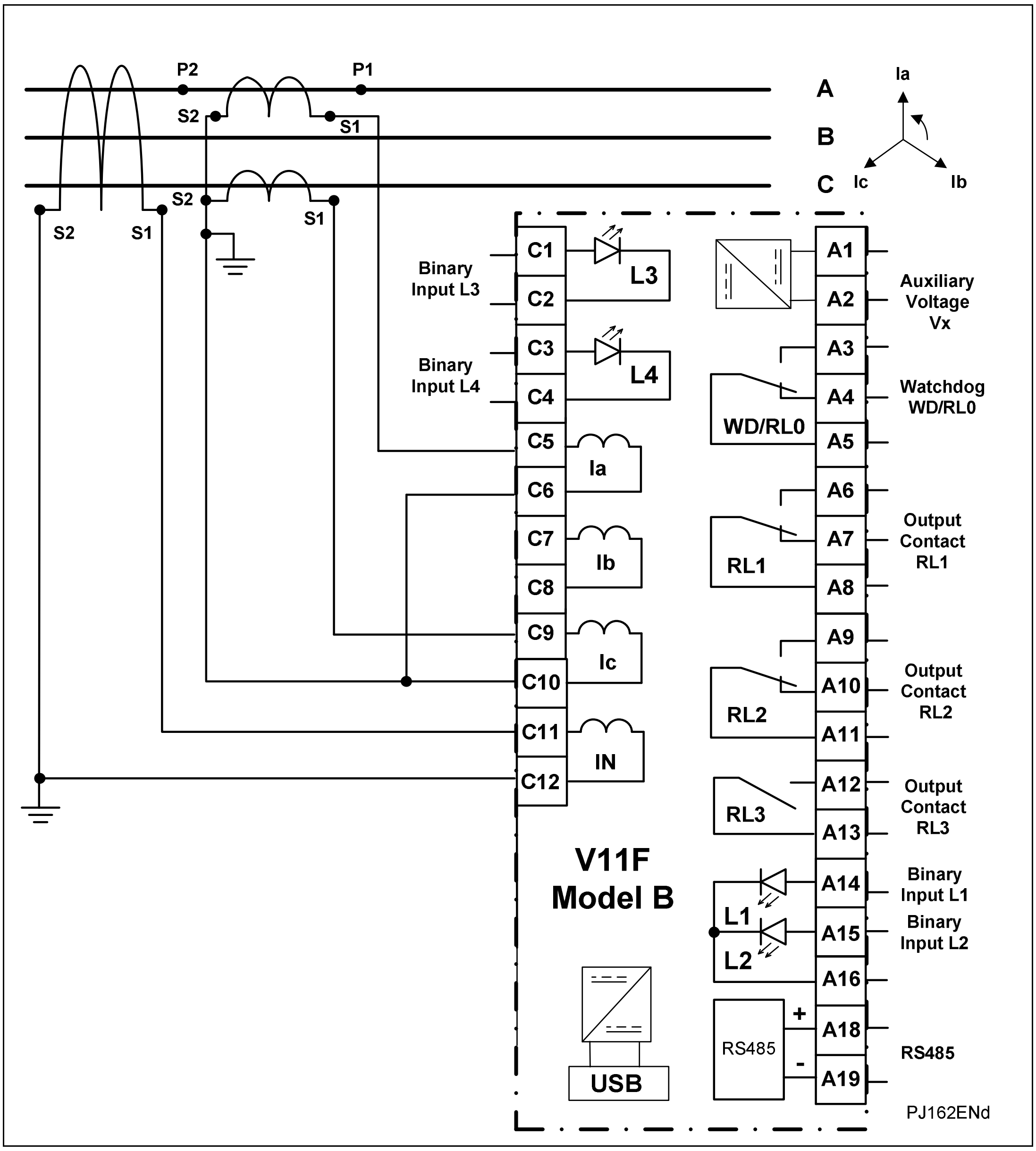


Figure 11: Model B, typical connection to 2 Phase CTs + a Core Balance CT

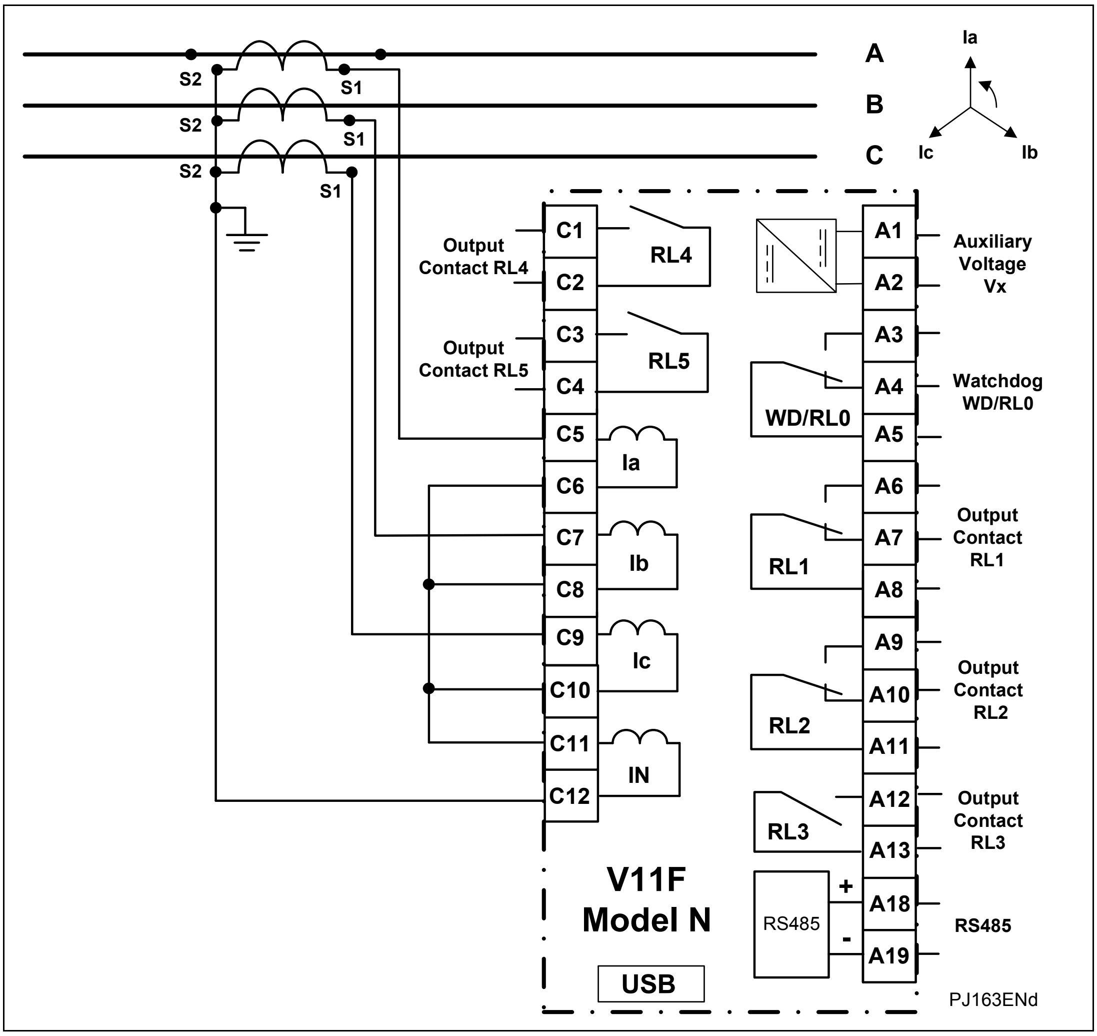


Figure 12: Model N, typical connection to 3 Phase CTs

IN

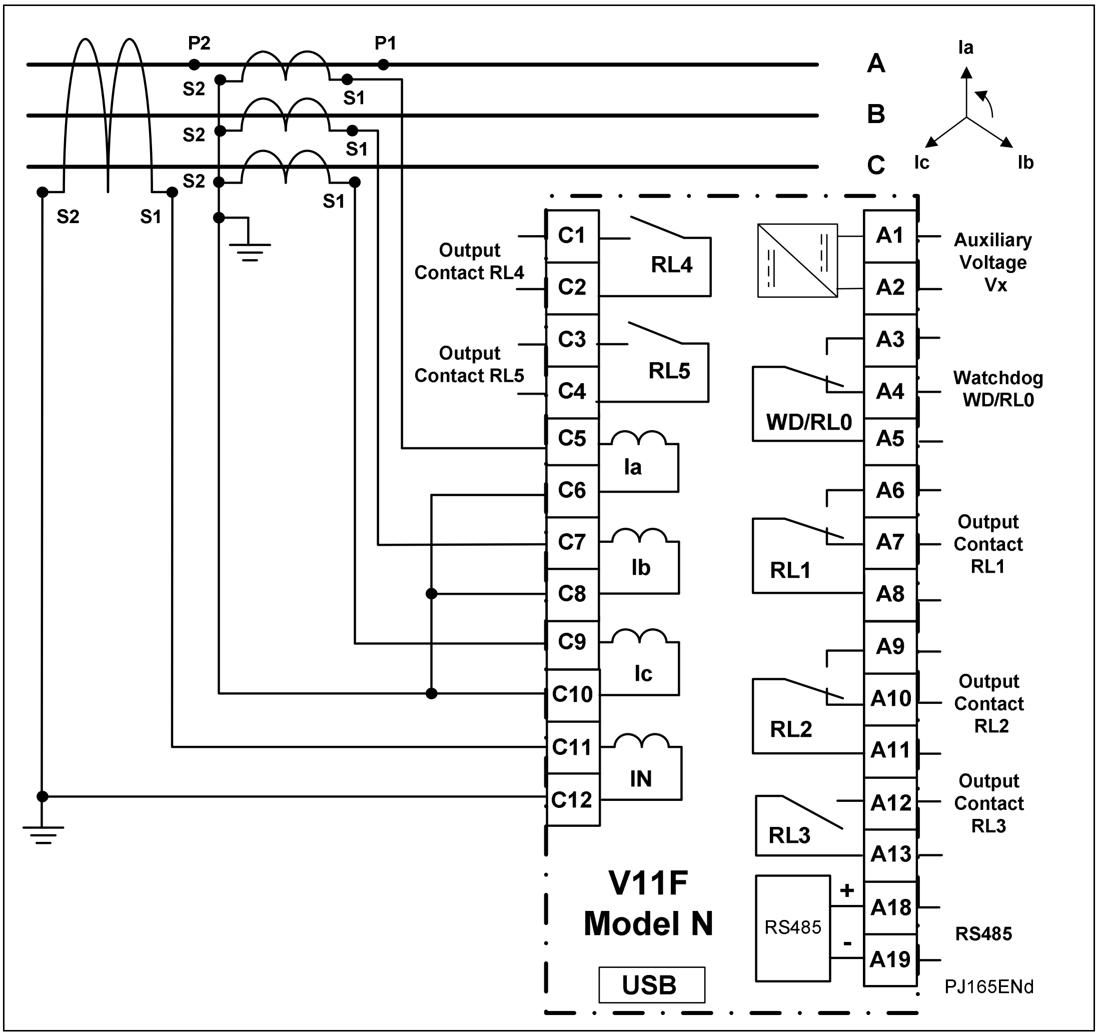


Figure 13: Model N, typical Connection to 3 Phase CTs + a Core Balance CT

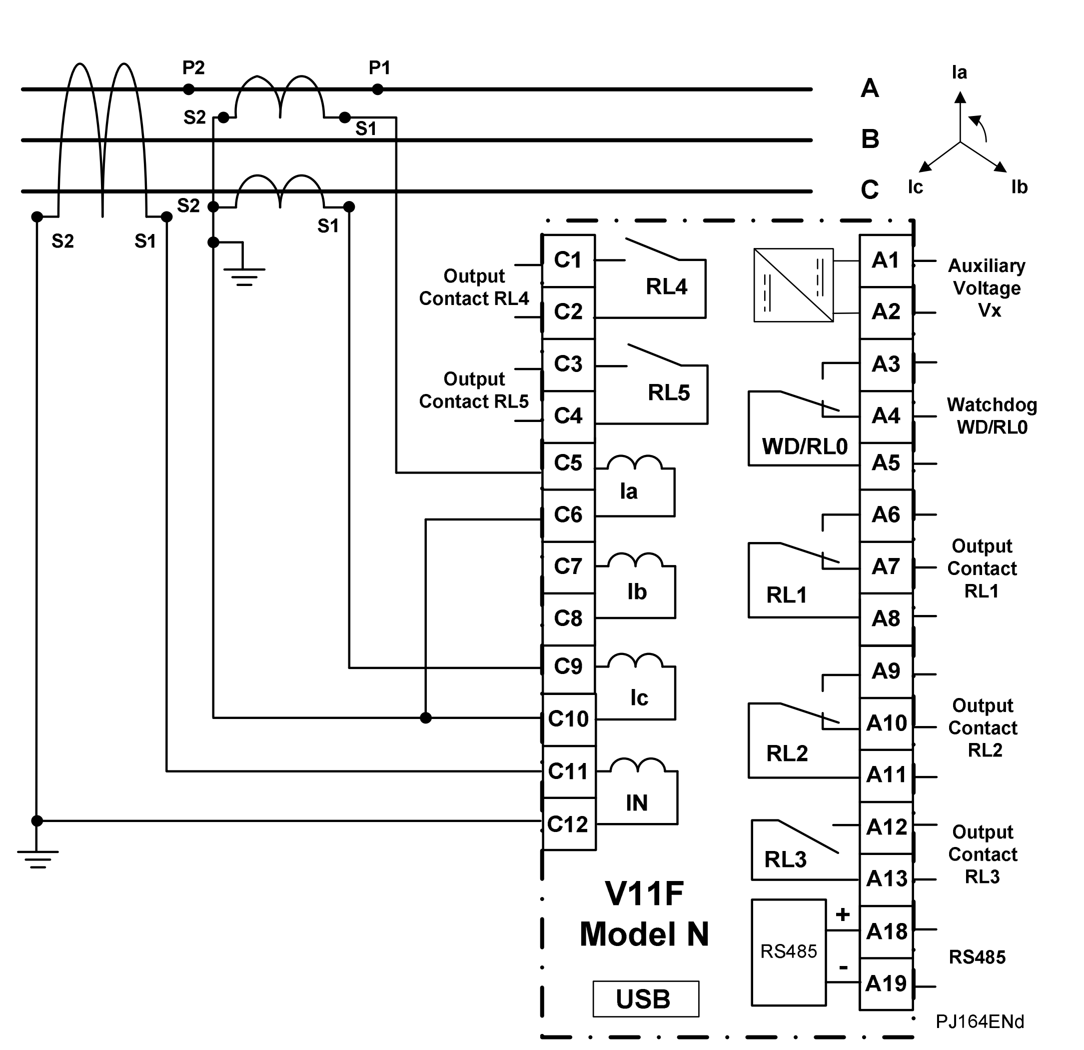


Figure 14: Model N, typical connection to 2 Phase CTs + a Core Balance CT

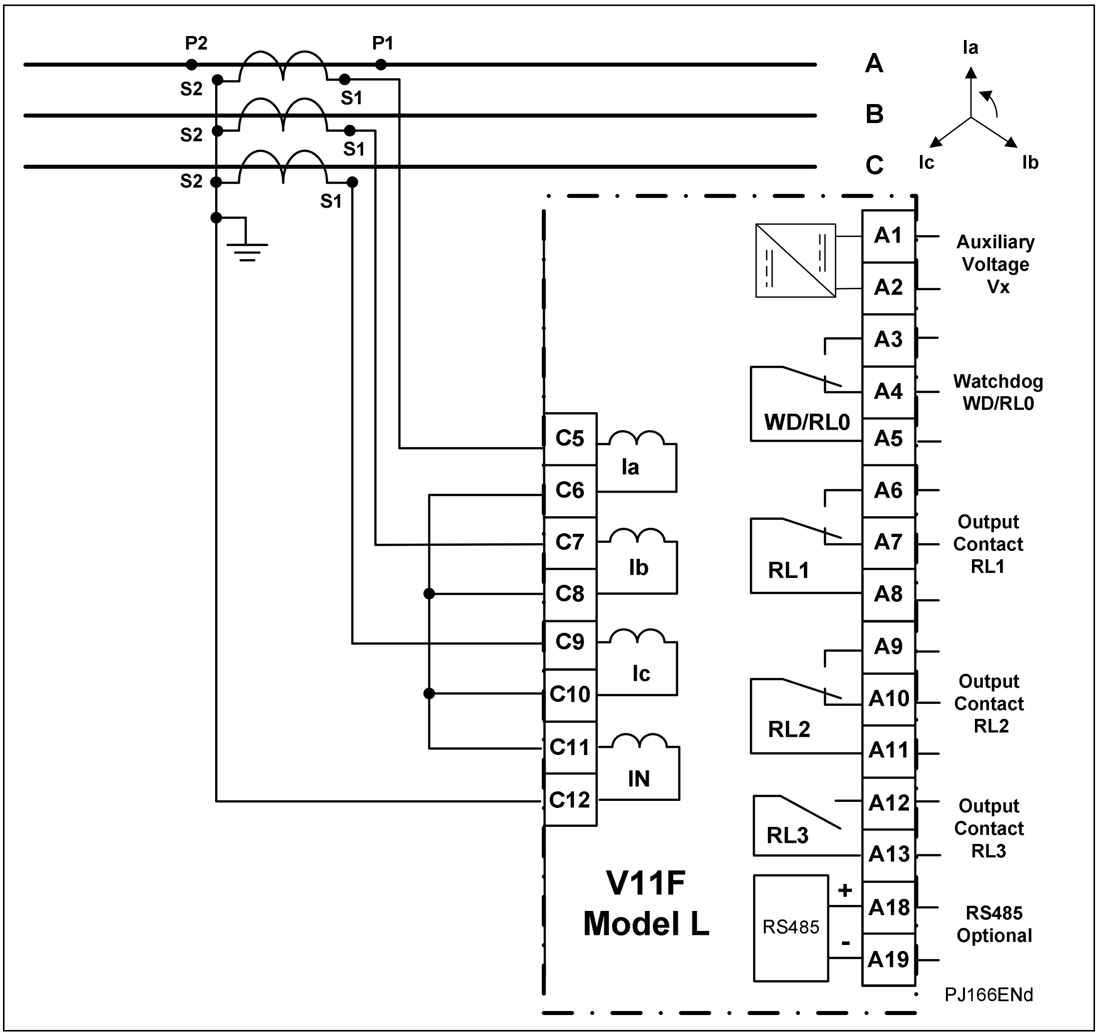


Figure 15: Model L, typical connection to 3 Phase CTs

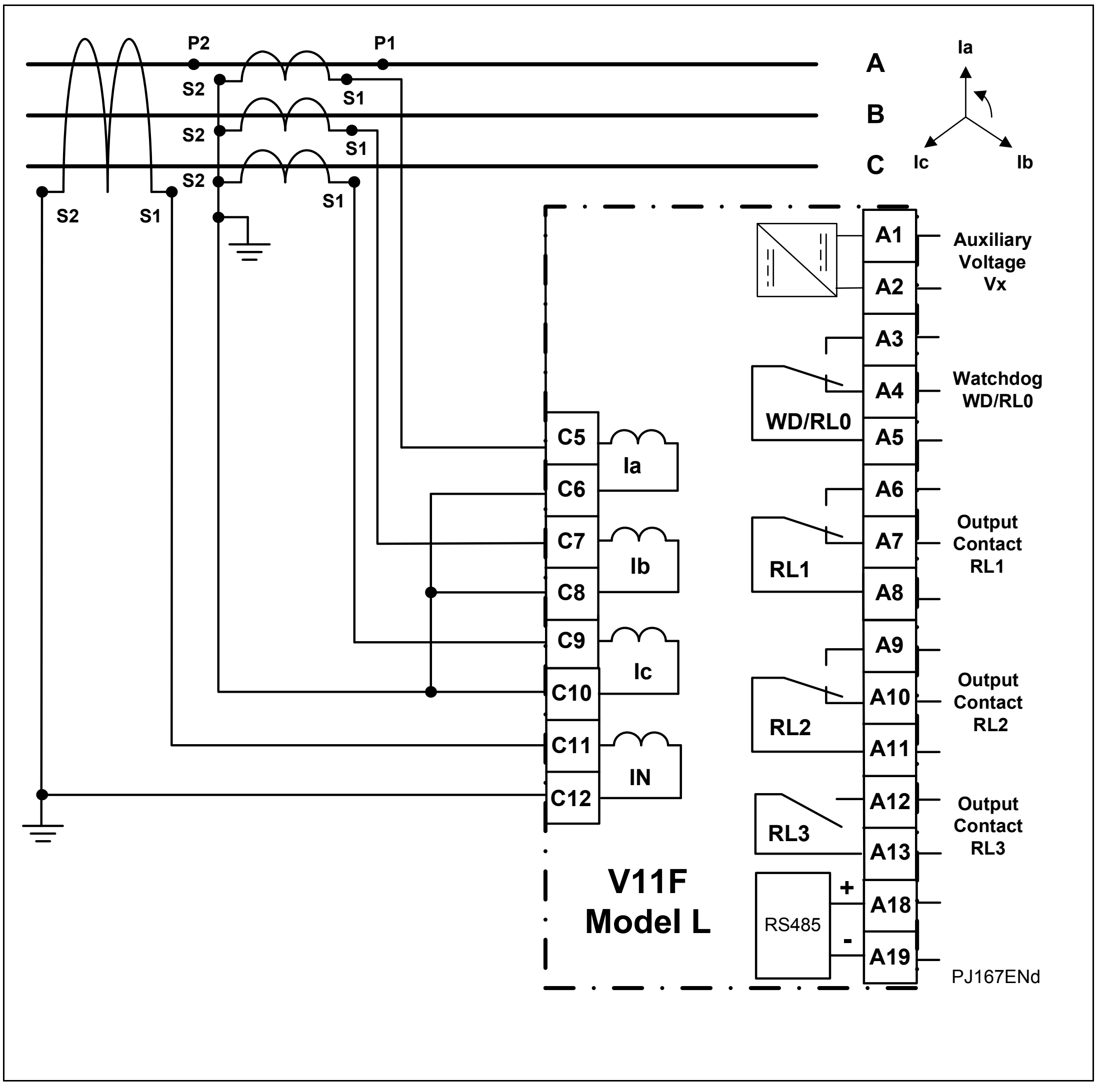


Figure 16: Model L, typical Connection to 3 Phase CTs + a Core Balance CT

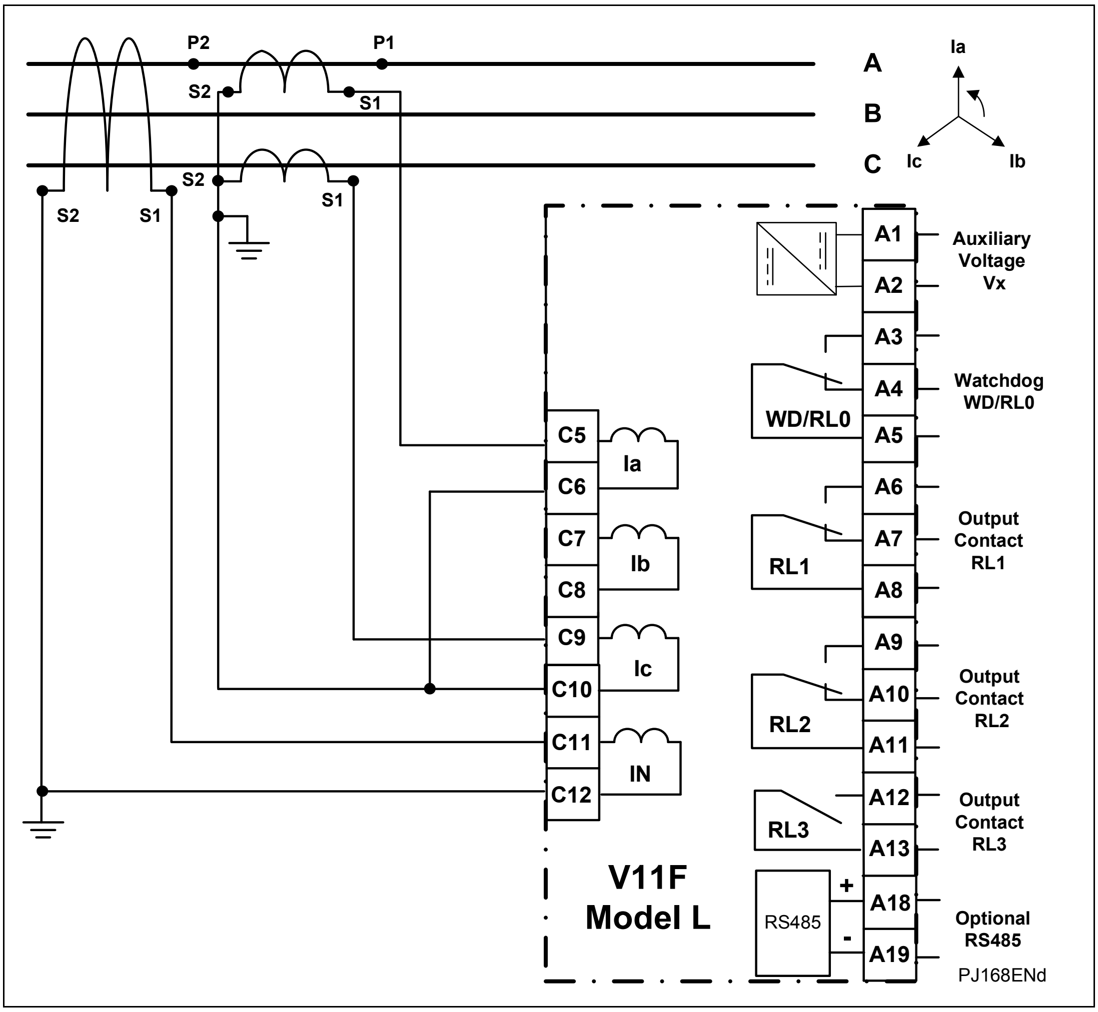


Figure 17: Model L, typical connection to 2 Phase CTs + a Core Balance CT

IN

COMMUNICATION DATABASE

CT

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

CONTENT

CT

1. INTRODUCTION

1.1 Purpose of this document

This document describes the characteristics of the different communication protocol of **VAMP 11F** relay.

The available communication protocols of **VAMP 11F** relay are as follows:

- MODBUS.
- IEC 60870-5-103.

NOTE:

V11F has hardware options which are called Models: Model L, Model N, Model B, Model A, Model E, which has different functions.

This document shows all available functions in V11F. To see which function are available in model refer to the rest chapters/sections of this manual.

For example: disturbance recorder is available in model A and E only, etc.

1.2 Glossary

IA, IB, IC : currents measured on the concerned phases (A, B, C)

IN : residual current measured by earth input (= 3.I zero sequence)

pf : soft weight of a word of 16 bits

PF : heavy weight of a word of 16 bits.

2. MODBUS PROTOCOL

VAMP 11F relay can communicate by a RS 485 link behind the unit following the MODBUS MODICON RTU protocol.

In VAMP 11F the status of the rear communication port is signalled by flashing rectangles in the top and bottom right corners of the display. Tx (Transmit) is assigned to the top right corner, Rx (Receive) is assigned to the bottom right corner of the display.Flashing of the rectangles indicate the operation of the communication port only (not frames received and/or transmitted).

2.1 Technical characteristics of the MODBUS connection

2.1.1 Parameters of the MODBUS connection

The different parameters of the MODBUS connection are as follows :

- Isolated two-point RS485 connection (2kV 50Hz),
- MODBUS MODICON line protocol in RTU mode
- Communication speed can be configured by an operator dialog in the front panel of the relay :

Baud rate
4800
9600
38400
57600
115200

Transmission mode of the configured characters by operator dialog:

Mode
1 start / 8 bits / 1 stop : total 10 bits
1 start / 8 bits / even parity / 1 stop : total 11 bits
1 start / 8 bits / odd parity / 1 stop : total 11 bits
1 start / 8 bits / 2 stop : total 11 bits

2.1.2 Synchronisation of exchanges messages

All character received after a silence on the line with more or equal to a transmission time of 3 characters is considered as a firm start.

2.1.3 Message validity check

The frame validity is working with a cyclical redundancy code CRC with 16 bits. The generator polynomial is:

$1 + x^2 + x^{15} + x^{16}$ = 1010 0000 0000 0001 binary = A001h

Address of the VAMP 11x relays

The address of the VAMP 11x relay on a same MODBUS network is situated between 1 and 254. The address 0 is reserved for the broadcast messages

2.2 MODBUS functions of the VAMP 11x relays

The MODBUS functions implemented on the VAMP 11x relays are :

Function 3 or 4 : Reading of n words

Function 5 : Writing of 1 bit

Function 6 : Writing of 1 word

Function 7 : Fast reading of 8 bits

Function 16 : Writing of n words

2.3 Presentation of the MODBUS protocol

Master slave protocol, all exchange understands a master query and a slave response

Frame size received from **VAMP 11F** relay

Frame transmitted by the master (query) :

Slave number	Function code	Information	CRC1 6
1 byte	1 byte	n bytes	2 bytes
0 à FFh	1 à 10h		

Slave number:

The slave number is situated between 1 and 254.

A frame transmitted with a slave number 0 is globally addressed to all pieces of equipment (broadcast frame)

Function code:

Requested MODBUS function (1 to 16)

Information:

Contains the parameters of the selected function.

CRC16:

Value of the CRC16 calculated by the master.

Note: The VAMP 11x relay does not respond to globally broadcast frames sent out by the master.

2.3.1 Format of frames sent by the VAMP 11x relay

Frame sent by the VAMP 11x relay (response)

Slave number	Function code	Data	CRC16
1 byte	1 byte	n bytes	2 bytes
1 à FFh	1 à 10h		

Slave number :

The slave number is situated between 1 and 254.

Function code :

Processed MODBUS function (1 to 16) .

Data :

Contains reply data to master query .

CRC 16:

Value of the CRC 16 calculated by the slave.

2.3.2 Messages validity check

When **VAMP 11F** relay receive a master query, it validates the frame :

- If the CRC is false, the frame is invalid. **VAMP 11F** relay do not reply to the query. The master must retransmit its query. Excepting a broadcast message, this is the only case of non-reply by **VAMP 11F** relay to a master query.
- If the CRC is good but the VAMP 11x relay can not process the query, it sends an exception response.

Warning frame sent by the VAMP 11x relay (response)

Slave number	Function code	Warning code	CRC16
1 byte	1 byte	1 byte	2 bytes
1 to FFh	81h or 83h or 8Ah or 8Bh		pf ... PF

Slave number :

The slave number is situated between 1 and 254.

Function code :

The function code returned by the VAMP 11x relay in the warning frame is the code in which the most significant bit (b7) is forced to 1.

Warning code :

On the 8 warning codes of the MODBUS protocol, the VAMP 11x relay manages two of them :

- code 01 : function code unauthorised or unknown.
- code 03 : a value in the data field is unauthorised (incorrect data).

Control of pages being read

Control of pages being written

Control of addresses in pages

Length of request messages

CRC16:

Value of the CRC16 calculated by the slave.

2.4 VAMP 11F relay database organisation

2.4.1 Description of the application mapping

2.4.1.1 Settings

VAMP 11F application mapping has 9 pages of parameters.

Page 0h: Product information, remote signalling, measurements

Page 1h: General remote parameters

Page 2h: Setting group 1 remote parameters

Page 3h: Setting group 2 remote parameters

Page 4h: Remote controls

Pages 5h/6h: Reserved pages

Pages 7h: Quick reading byte

Pages 8h: Time synchronisation

2.4.1.2 Disturbance Records

Before uploading any disturbance record, a service request must be send to select the record number to be uploaded.

The answer following this request contain the following information:

- Numbers of samples (pre and post time)
- Phase CT ratio
- Earth CT ratio
- Internal phase and earth ratios
- Number of the last disturbance mapping page
- Number of samples in this last disturbance mapping page

The mapping pages used for this service request are from 38h to 3Ch.

Pages 9h to 21h : Contain the disturbance data (25 pages)

A disturbance mapping page contains 250 words:

0900 to 09FAh : 250 disturbance data words
0A00 to 0AFAh : 250 disturbance data words
0B00 to 0BFAh : 250 disturbance data words

......
2100 to 21FAh : 250 disturbance data words

The disturbance data pages contain the sample of a single channel from a record.

Page 22h : contains the index of the disturbance

Page 38h to 3Ch : Selection of the disturbance record and channel

Page 3Dh : A dedicated request allows to know the number of disturbance records stored in FRAM memory.

CT

2.4.1.3 Event records

To upload the event records two requests are allowed:

Page 35h: Request to upload an event record without acknowledge of this event.

Used addresses:

3500h : EVENT 1

.....
3563h : EVENT 100

Page 36h: Request to upload the non-acknowledged oldest stored event record.

Two modes are available for the acknowledgement: automatic acknowledgement or manual acknowledgement

The mode depends of the state of bit 12 of telecommand word (address 400 h).

If this bit is set, then the acknowledgement is manual else the acknowledgement is automatic.

In automatic mode, the reading of the event acknowledges the event.

In manual mode, it is necessary to write a specific command to acknowledge the oldest event

(set the bit 13 of control word 400 h)

2.4.1.4 Fault records

Page 37h: Page dedicated to upload fault record

Used addresses:

3700h : FAULT 1
3701h : FAULT 2

.....
3704h : FAULT 5

Page 3Eh: Request to upload the non-acknowledged oldest stored fault record.

Two modes are available for the acknowledgement: automatic acknowledgement or manual acknowledgement

The mode depends of the state of bit 12 of telecommand word (address 400 h).

If this bit is set, then the acknowledgement is manual else the acknowledgement is automatic.

In automatic mode, the reading of the fault acknowledges automatically the event.

In manual mode, it is necessary to write a specific command to acknowledge the oldest fault.

(set the bit 14 of control word 400 h)

2.4.1.5 Characteristics

Page 0h can only be read through communication.

Pages 1h, 2h, 3h and 4h can be read and write.

Page 7h can be access in quick reading only.

Page 8h can be write.

They are describe more precisely in the following chapters.

2.4.2 Page 0h : Product information, remote signalling, measurements

Read access only

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0000	**Product Information**	Relay description characters 1 and 2	32-127	1	-	F10	P1
0001		Relay description characters 3 and 4	32-127	1	-	F10	16
0002		Relay description characters 5 and 6	32-127	1	-	F10	
0003		Unit reference characters 1 and 2	32-127	1	-	F10	SE
0004		Unit reference characters 3 and 4	32-127	1	-	F10	
0005		Software Version	10 to 99		-	F15	
0006		Hardware Version	0 to 3		-	F58	
0007		Line CT Sec	0 to 1		-	F23	
0008		E/Gnd CT Sec	0 to 1		-	F23A	
0009		Active Set Group	0 to 1		-	F32	0
000A		Nominal frequency	0 to 1	1	-	F57	0
000B		Software Version Number	0 to 1	1	-	F90	
000C-000F		Reserved			-		
0010	**Remote signalling**	Logical inputs	0 to 15	1	bits	F11	
0011		Current Protection disable status (1)	0 to 15	1	bits	F12	
0012		Protection Function disable status (2)	0 to 15	1	bits	F12A	
0013		Output contacts status	0 to 15	1	bits	F24	
0014		Logical LEDs status	0 to 15	1	bits	F25	
0015		Latched Output info.: Current Protection starting status (1)	0 to 15	1	bits	F28	
0016		Latched Output info.: Protection Fuction starting status (2)	0 to 15	1	bits	F28A	
0017		Latched Output info.: Currrent Protection trip status (1)	0 to 15	1	bits	F29	
0018		Output information: Protection Fuction trip status (2)	0 to 15	1	bits	F29A	
0019		Latched Output info.:Current Protection Alarm status 1	0 to 15	1	bits	F31	
001A		Latched Output info.: Protection Fuction Alarm status 2	0 to 15	1	bits	F31A	
001B		CB status	0 to 15	1	-	F30	
001C		[79] Status	0 to 15	1	-	F59	
001D		[79] Blocking Status	0 to 15	1	-	F60	
001E		Local/Romote Mode Status	0 to 15	1	-	F61	

Address	Group	Description	Values range	Step	Unit	Format	Default Value
001F		Maintance Mode	0 to 15	1	-	F62	
0020		Hardware Warning	0 to 15	1	-	F26	
0021		Output information: I>	0 to 15	1	bits	F37	
0022		Output information: I>>	0 to 15	1	bits	F37	
0023		Output information: I>>>	0 to 15	1	bits	F37	
0024		Output information: IN_1 stage	0 to 15	1	bits	F50	
0025		Output information: IN_2 stage	0 to 15	1	bits	F50	
0026		Output information: IN_3 stage	0 to 15	1	bits	F50	
0027		Output information: AUX1	0 to 15	1	bits	F51	
0028		Output information: AUX2	0 to 15	1	bits	F51	
0029		Output information: CB Fail	0 to 15	1	bits	F51	
002A		Output information: tCB ext. sign	0 to 15	1	bits	F51	
002B		Output information: SOTF	0 to 15	1	bits	F37	
002C		Output information: I<	0 to 15	1	bits	F50	
002D		Output information: I2>	0 to 15	1	bits	F50	
002E		Output information: Brkn.Cond	0 to 15	1	bits	F50	
002F		Output information: Thermal OL	0 to 15	1	bits	F50	
0030		Output information: AUX3	0 to 15	1	bits	F51	
0031		Output information: AUX4	0 to 15	1	bits	F51	
0032		Output information: Input Protection blocking 1	0 to 15	1	bits	F101	
0033		Output information: Input Protection blocking 2	0 to 15	1	bits	F102	
0034		Output information: Input Selective logic 1	0 to 15	1	bits	F103	
0035		Output information: Input logic data	0 to 15	1	bits	F104	
0036		Output information: Internal logic data	0 to 15	1	bits	F105	
0037 to 003F		Reserved					
0040	**Remote measurements**	Phase IA (L1) current [A]	0 to 60 000	1	[A]/100	F1	
0041		Phase IB (L2) current [A]	0 to 60 000	1	[A]/100	F1	
0042		Phase IC (L3) current [A]	0 to 60 000	1	[A]/100	F1	
0043		E/GND IN (IE) current [A]	0 to 60 000	1	[A] x 100	F1	
0044		I2 (negative sequence) current [A]	0 to 60 000		[A] x 100	F1	
0044		I1 (positive sequence) current [A]	0 to 60 000		[A] x 100	F1	
0045-004F		Reserved					
0050		Phase IA (L1) current [In]	0 to 60 000		[In]	F1	

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0051		Phase IB (L2) current [In]	0 to 60 000	1	[In]	F1	
0052		Phase IC (L3) current [In]	0 to 60 000	1	[In]	F1	
0053		E/F current [Ien]	0 to 60 000	1	[Ien]	F1	
0054		I2 (negative sequence) current [In]	0 to 60 000	1	[In]	F1	
0055		I1 (positive sequence) current [In]	0 to 60 000	1	[In]	F1	
0056-005F		Reserved					
0060		I2/I1 current [%]	0 to 100	1	[%]	F1	
0061		Thermal Overload [%]	0 to 300	1	[%]	F1	
0062		2th harmonic [%] Phase A	0 to 100	1	[%]	F1	
0063		2th harmonic [%] Phase B	0 to 100	1	[%]	F1	
0064		2th harmonic [%] Phase C	0 to 100	1	[%]	F1	
0066-00FF		Reserved					

2.4.3 Page 1h, VAMP 11F: general remote parameters

Read and write access

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0100	**Remote parameters**	Address	1 to 127	1	-	F1	254
0101		Protocol for RS485	0 to 1	1		F56	0
0102		Baud Rate	0 to 5	1		F19	2
0103		Parity	0 to 2	1		F20	0
0104		Stop bits	0 to 1	1		F22	0
0105-010F		Reserved					
0110	**Counters**	Trips Number	0 to 65535	1	-	F1	0
0111		Close Number	0 to 65535	1	-	F1	0
0112		Fault Trips Number	0 to 65535	1	-	F1	0
0113		Fault Start Number	0 to 65535	1	-	F1	0
0114		Alarm Number	0 to 65535	1	-	F1	0
0115		HW Warnings Number	0 to 65535	1	-	F1	0
0116		79 Action Total	0 to 65535	1	-	F1	0
0117		79 Total Trips&Lockout	0 to 65535	1	-	F1	0
0118		79 Successful Number	0 to 65535	1	-	F1	0
0119		79 Cycle 1 Recloses	0 to 65535	1	-	F1	0
011A		79 Cycle 2 Recloses	0 to 65535	1	-	F1	0
011B		79 Cycle 3 Recloses	0 to 65535	1	-	F1	0
011C		79 Cycle 4 Recloses	0 to 65535	1	-	F1	0
011D		CB close Monitoring	0 to 65535	1	-	F1	0
011E		CB open Monitoring	0 to 65535	1	-	F1	0
011F		CB AMPS Value	0 to 65535	1	-	F1	0
0116-011F		Reserved					
0120	**CT Ratio**	**Line CT primary**	1 to 30000	1	A	F1	
0121		Line CT Sec.	0 to 1	1	-	F91	
0122		E/Gnd CT Primary	1 to 30000	1	A	F1	
0123		E/GND CT Sec.	0 to 1	1	-	F92	
0122-012F		Reserved					
0130	**Blocking Inrush**	**Inrush Blocking ?**	0 to 2	1	-	F74	0
0131		2nd Harmonic Ratio	10 to 50	1	%	F1	20
0132		Inrush Reset Time	0 to 20000	1	1/100 s	F1	100
0133		Unblock Inrush Time	0 to 20000	1	1/100 s	F1	100
0134-013F		Reserved					
0137	**O/C Advanced Settings**	**I< stage for Broken Conductor**	**10 to 100**	**1**	[In]/100	F1	10
0138		IDMT interlock by DMT stage	0 to 1	1	-	F88	0

Address	Group	Description	Values range	Step	Unit	Format	Default Value
GLOBAL SETTINGS							
0140	**LOC**	**Language**	0 to 5	1	-	F52	0
0141		Default display	0 to 2	1	-	F53	0
0142		LEDs Reset by	0 to 1	1	-	F54	0
0143		Ltchd Outp Reset	0 to 1	1	-	F54	0
0144		Trip Info Reset	0 to 1	1	-	F54	0
0145		Alarm Display Reset	0 to 1	1	-	F55	0
0146		Nominal frequency	0 to 1	1	-	F57	0
0147		Reserved					
0148		Control Keys Confirmation	0 to 1	1	-	F82	0
0149		I>, I>>, I>>> (1harmonic or True RMS)	0 to 1	1	-	F81	0
014A-014F		Reserved					
0150	**SETTING GROUP SELECT**	**Number of Setting Groups**	0 to 1	1	-	F71	0
0151		Setting group change	0 to 1	1	-	F32	0
0152		t Change Setting G1->G2	0 to 20000	1	1/100 s	F1	0
0153-015F		Reserved					
0160	**[79] ADVANCED SETTINGS**	**[79] CB Healthy Monit?**	0 to 1	1	-	F63	
0161		[79] Block via Input ?	0 to 1	1	-	F63	0
0162		[79] Start Dead t On	0 to 1	1	-	F64	1
0163		Rolling Demand?	0 to 1	1	-	F54	0
0164		Max cycles Nb Rol.Demand	2 to 100	1	-	F1	2
0165		Time Period Rol.Demand	1 to 1410	1	mn	F1	
0166		[79] Time Inhibit on Close	1 to 60000	1	1/100 s	F1	100
0167		[79] Reset Signaling on Close	0 to 1	1	-	F106	0
0168-017F		Reserved					
0180	**CIRCUIT BREAKER**	**tOpen pulse min**	10 to 1000	1	1/100 s	F1	50
0181		tClose Pulse	10 to 1000	1	1/100 s	F1	50
182		Time Delay for close Command	0 to 20000	1	1/100 s	F1	0
0184		tCB FLT ext.sign.	1 to 200	1	S	F1	16
0185		Remote Mode	0 to 1	1	-	F73	
0186		52 Unblock SOTF Time	10 to 20000	1	1/100 s	F1	100
0187		TC Supervision?	0 to 1	1	-	F107	0
0188		tSUP	10 to 1000		1/100 s	F1	10
0189		CB Supervision?	0 to 1	1	-	F63	0
018A		Max CB Open Time	1 to 1000	1	1/100 s	F1	10
018B		Max CB Close Time	1 to 1000	1	1/100 s	F1	10

Address	Group	Description	Values range	Step	Unit	Format	Default Value
018C		CB Diagnostic?	0 to 1	1	-	F63	0
018D		Max CB Open No.	0 to 65535	1	-	F1	0
018E		Max Sum AMPS^n	0 to 65535	1	-	F1	0
018F		AMPS's n=	1 to 2	1	-	F1	2
0190		Reserved					
019A	**DISTURBANCE RECORDER**	**Pre-Time**	10 to 700	1	1/100 s	F1	10
019B		Post TripTime	10 to 100	1	1/100 s	F1	10
019C		Distrurb Rec Trig	0 to 1	1	-	F65	0
019D		Max record Time	150 to 750	1	1/100 s	F1	10
019E-01A4		Reserved					
01A5	**COMMISIONING**	**Maintenace Mode**	0 to 1	1	-	F54	0
01A6		Test Pattern			bits	F40	00000000
01A7		Contact Test Time	0-20000	1	1/100 s	F1	10
01A8		Test Outputs	0 to 1	1	-	F75	0
01A9		Functional Test Pattern	0 to 12	1	-	F76	0
01AA		Functional Test End	0 to 1	1	-	F77	0
01AB		Functional Test Time	10-20000	1	1/100 s	F1	10
01AC		Functional Test	0 to 1	1	-	F75	0
01AD-01AF		Reserved					
01C3-01FF		Reserved					

2.4.4 Page 2h : setting Group 1

Access in reading and in writing

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0200	Setting Group 1 / Protection G1 /Phase O/C	I> ?	0-4	1	-	F16A	0
0201		I> threshold	10 to 4000	1	In/100	F1	140
0202		ItI>/TMS/TD	2 to 20000	1	1/100 s	F1	100
0203		I> Delay Type	0 to 15	1	-	F18	1
0204		I> Reset Delay Type	0 -1	1	-	F41	0
0205		I> DMT/RTMS tReset	0 to 20000	1	1/100 s	F1	0
0206		I>>?	0-4	1	-	F16A	0
0207		I>> Threshold	10 to 4000	1	In/100	F1	140
0208		tI>>/TMS/TD	2 to 20000	1	1/100 s	F1	100
0209		*I>> Delay Type*	0 to 15	1	-	F18	1
020A		*I>> Reset Delay Type*	0 -1	1	-	F41	0
020B		*I>> DMT/RTMS tReset*	0 to 20000	1	1/100 s	F1	0
020C		*I>>>?*	0-4	1	-	F16A	0
020D		I>>> Threshold	10 to 4000	1	In/100	F1	400
020E		tI>>>	0 to 20000	1	1/100 s	F1	100
020F	Setting Group 1 / Protection G1 /SOTF G1	*SOTF?*	0-4		-	F16	0
0210		SOTF Threshold	10 to 4000	1	In/100	F1	400
0211		tSOTF	0 to 60000	1	1/100 s	F1	100
0212	Setting Group 1 / Protection G1 /E/GND Fault	IN_1 stage?	0-4	1	-	F84	0
0213		IN_1 Threshold	Ref TD	1	Ien/100	F1	10 50 100
0214		tIN_1/TMS/TD	2 to 20000	1	1/100 s	F1	100
0215		IN_1 Delay Type	0 to 12	25	-	F18	1
216		IN_1 Reset Delay Type	0 -1	5	-	F41	0
217		IN_1 DMT tReset	0 to 20000	1	1/100 s	F1	0
0218		IN_2?	0-2	0-2	-	F84	0
0219		IN_2 Threshold	Ref TD	1	Ien/100	F1	options
021A		tIN_2	0 to 20000	1	1/100 s	F1	10
021B		IN_3?	0-2	0-2	-	F84	0
021C		IN_3 Threshold	Ref TD	1	Ien/100	F1	options
021D		tIN_3	0 to 20000	1	1/100 s	F1	10
0221	Setting Group 1 / Protection G1	I2>?	0-4	1	-	F16	0

Address	Group	Description	Values range	Step	Unit	Format	Default Value
	/Neg.Seq.O/C						
0222		I2> threshold	10 to 400	1	In/100	F1	140
0223		tI2>/TMS/TD	2 to 20000	1	1/100 s	F1	100
0224		I2> Delay Type	0 to 15	1	-	F18	1
0225		I2> Reset Delay Type	0 -1	25	-	F41	0
0226		I2> DMT/RTMS tReset	0 to 60000	5	1/100 s	F1	0
0227	Setting Group 1 / Protection G1 /Broken Conductor	Broken Cond.?	0-4	1	-	F16	0
0228		Ratio I2/I1	20 to 100	1	%	F1	20
0229		tBCond	0 to 60000	1	1/100 s	F1	100
022A	Setting Group 1 / Protection G1 /Thermal Overload	Therm OL?	0-1	1	-	F109	0
022B		Itheta>	10 to 300	1	In/100	F1	140
022C		Therm Alarm?	0-1	1	-	F109	0
022D		Te	1 to 200	1	min	F1	1
022E		Tr	1 to 999	1	min	F1	1
022F		Theta Trip	50 to 200	1	%	F1	100
0230		Theta Reset	20 to 99	1	%	F1	95
0231		Theta Alarm	20 to 200	1	%	F1	80
0232	Setting Group 1 / Protection G1 /Aux Timers	AUX1?	0-7	1	-	F110	0
0233		tAUX1	0 to 60000	1	1/100 s	F1	0
0234		AUX2?	0-7	1	-	F110	0
0235		tAUX2	0 to 60000	1	1/100 s	F1	0
0236		AUX2?	0-7	1	-	F110	0
0237		tAUX2	0 to 60000	1	1/100 s	F1	0
0238		AUX2?	0-7	1	-	F110	0
0239		tAUX2	0 to 60000	1	1/100 s	F1	0
023A	Setting Group 1 / Protection G1 /CB Fail	CB Fail?	0-2	1	-	F111	0
023B		CB Fail Time tBF	0 to 1000	1	1/100 s	F1	20
023C		I< Threshold CBF	10 to 200	1	In/100	F1	10
023D		IN< Threshold CBF	10 to 200	1	Ien/100	F1	10
023E		Block I>	0 to 1	1	-	F63	0
023F		Block IN>	0 to 1	1	-	F63	0
0240	Setting Group 1 / Protection G1 /Logic Selective	Sel1?	0-1	1	-	F109	0
0241		tSEL1	0 to 60000	5	1/100 s	F1	0

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0242		Sel2?	0-1	1	-	F109	0
0243		tSEL2	0 to 60000	5	1/100 s	F1	0
0244	Setting Group 1 / Protection G1 /Cold Load PU	Cold Load PU?	0-1	1	-	F109	0
0245		Cold Load PU Level	20 to 999	1	%	F1	100
0246		Cold Load PU tCL	0 to 60000	1	1/100 s	F1	0
0247		Cold Load PU I>	0 -1	1	-	F63	0
0248		Cold Load PU I>>	0 -1	1	-	F63	0
0249		Cold Load PU I>>>	0 -1	1	-	F63	0
024A		Cold Load PU IN_1	0 -1	1	-	F63	0
024B		Cold Load PU IN_2	0 -1	1	-	F63	0
024C		Cold Load PU IN_3	0 -1	1	-	F63	0
024D		Cold Load PU Brkn Cond	0 -1	1	-	F63	0
024E		Cold Load PU Itherm	0 -1	1	-	F63	0
024F		Cold Load PU I2>	0 -1	1	-	F63	0
0250	Setting Group 1 / Protection G1 /Autoreclose	Autoreclose?	0 -1	1	-	F109	0
0251		Dead Time tD1	0 to 60000	1	1/100 s	F1	0
0252		Dead Time tD2	0 to 60000	1	1/100 s	F1	0
0253		Dead Time tD3	0 to 60000	1	1/100 s	F1	0
0254		Dead Time tD4	0 to 60000	1	1/100 s	F1	0
0255		Dead Time tR	0 to 60000	1	1/100 s	F1	0
0256		Fast O/C Trip	0 to 1	1	Bits	F72	00000
0257		Fast O/C Trip Delay	0 to 999	1	1/100 s	F1	0
0258		Fast E/GND Trip	0 to 1	1	Bits	F72	00000
0259		Fast E/GND Trip Delay	0 to 999	1	1/100 s	F1	0
025A		tI> Close Shot ?	0 to 1	1	Bits	F67	0000
025B		tI> Inhibit Trip : Shot	0 to 1	1	Bits	F67	00000
025C		tI>> Close Shot ?	0 to 1	1	Bits	F67	0000
025D		tI>> Inhibit Trip : Shot	0 to 1	1	Bits	F67	00000
025E		tI>>> Close Shot ?	0 to 1	1	Bits	F67	0000
025F		tI>>> Inhibit Trip : Shot	0 to 1	1	Bits	F67	00000
0260		tIN_1 Close Shot ?	0 to 1	1	Bits	F67	0000
0261		tIN_1 Inhibit Trip : Shot	0 to 1	1	Bits	F67	00000
0262		tIN_2 Close Shot ?	0 to 1	1	Bits	F67	0000
0263		tIN_2 Inhibit Trip : Shot	0 to 1	1	Bits	F67	00000
0264		tIN_3 Close Shot ?	0 to 1	1	Bits	F67	0000
0265		tIN_3 Inhibit Trip : Shot	0 to 1	1	Bits	F67	00000
0266		tAUX1 Close Shot ?	0 to 1	1	Bits	F67	0000
0267		tAUX1 Inhibit Trip : Shot	0 to 1	1	Bits	F67	00000

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0268		tAUX2 Close Shot ?	0 to 1	1	bits	F67	0000
0269		tAUX2 Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
026A	Setting group 1 /Inputs configuration	Reverse Input Logic	0 to 1	1	bits	F35	000000
026B		Maintenance Mode	0 to 1	1	bits	F35	000000
026C		Reset Latched Signaling	0 to 1	1	bits	F35	000000
026D		Reset Latched Outputs	0 to 1	1	bits	F35	000000
026E		Blocking tI>	0 to 1	1	bits	F35	000000
026F		Blocking tI>>	0 to 1	1	bits	F35	000000
0270		Blocking tI>>>	0 to 1	1	bits	F35	000000
0271		Blocking tSOTF	0 to 1	1	bits	F35	000000
0272		Blocking tIN_1	0 to 1	1	bits	F35	000000
0273		Blocking tIN_2	0 to 1	1	bits	F35	000000
0274		Blocking tIN_3	0 to 1	1	bits	F35	000000
0275		Reserved					
0276		Blocking tI2>	0 to 1	1	bits	F35	000000
0277		Blocking tBroken Conductor	0 to 1	1	bits	F35	000000
0278		Blocking Itherm	0 to 1	1	bits	F35	000000
0279		Blocking tAUX1	0 to 1	1	bits	F35	000000
027A		Blocking tAUX2	0 to 1	1	bits	F35	000000
027B		Blocking tAUX3	0 to 1	1	bits	F35	000000
027C		Blocking CB Fail	0 to 1	1	bits	F35	000000
027D		Blocking Autoreclose [79]	0 to 1	1	bits	F35	000000
027E		Selectivity Logic 1 tI>>	0 to 1	1	bits	F35	000000
027F		Selectivity Logic 1 tI>>>	0 to 1	1	bits	F35	000000
0280		Selectivity Logic 1 tIN_2	0 to 1	1	bits	F35	000000
0281		Selectivity Logic 1 tIN_3	0 to 1	1	bits	F35	000000
0282		Selectivity Logic 2 tI>>	0 to 1	1	bits	F35	000000
0283		Selectivity Logic 2 tI>>>	0 to 1	1	bits	F35	000000
0284		Selectivity Logic 2 tIN_2	0 to 1	1	bits	F35	000000
0285		Selectivity Logic 2 tIN_3	0 to 1	1	bits	F35	000000
0286		AUX1	0 to 1	1	bits	F35	000000
0287		AUX2	0 to 1	1	bits	F35	000000
0288		AUX3	0 to 1	1	bits	F35	000000
0289		AUX4	0 to 1	1	bits	F35	000000
028A		AUX5	0 to 1	1	bits	F35	000000
028B		AUX6	0 to 1	1	bits	F35	000000
028C		Cold Load Pick Up	0 to 1	1	bits	F35	000000
028D		Start tBF (CB Fail)	0 to 1	1	bits	F35	000000
028E		CB status 52A	0 to 1	1	bits	F35	000000

Address	Group	Description	Values range	Step	Unit	Format	Default Value
028F		*CB status 52B*	0 to 1	1	bits	F35	000000
0290		CB Faulty External Signal	0 to 1	1	bits	F35	000000
0291		Setting Group 2	0 to 1	1	bits	F35	000000
0292		Manual Close	0 to 1	1	bits	F35	000000
0293		Manual Trip	0 to 1	1	bits	F35	000000
0294		Trip Circuit Supervision	0 to 1	1	bits	F35	000000
0295		Reset Theta value	0 to 1	1	bits	F35	000000
0296		Start Disturbance Recorder	0 to 1	1	bits	F35	000000
0297		Local CTRL Mode	0 to 1	1	bits	F35	000000
0298		Time Synchronization	0 to 1	1	bits	F35	000000
0299	Setting group 1 /Outputs relays configuration	Latched outputs	0 to 1	1	bits	F36	000000
029A		Reverse output Logic	0 to 1	1	bits	F36	0000000
029B		Protection Trip	0 to 1	1	bits	F36	0000000
029C		Protection Trip (pulse)	0 to 1	1	bits	F36	0000000
029D		Trip CB order	0 to 1	1	bits	F36	0000000
029E		Close CB order	0 to 1	1	bits	F36	0000000
029F		Alarm	0 to 1	1	bits	F33	00000000
02A0-02A2		Reserved					
02A3		Start I>	0 to 1	1	bits	F36	0000000
02A4		Start I>>	0 to 1	1	bits	F36	0000000
02A5		Start I>>>	0 to 1	1	bits	F36	0000000
02A6		Start SOTF	0 to 1	1	bits	F36	0000000
02A7		Start IN_1	0 to 1	1	bits	F36	0000000
02A8		Start IN_2	0 to 1	1	bits	F36	0000000
02A9		Start IN_3	0 to 1	1	bits	F36	0000000
02AA		Reserved					
02AB		Start I2>	0 to 1	1	bits	F36	0000000
02AC		Start Broken Conductor	0 to 1	1	bits	F36	0000000
02AD		AUX1	0 to 1	1	bits	F36	0000000
02AE		AUX2	0 to 1	1	bits	F36	0000000
02AF		AUX3	0 to 1	1	bits	F36	0000000
02B0		AUX4	0 to 1	1	bits	F36	0000000
02B1		AUX5	0 to 1	1	bits	F36	0000000
02B2		AUX6	0 to 1	1	bits	F36	0000000
02B3		tI>	0 to 1	1	bits	F36	0000000
02B4		tI>>	0 to 1	1	bits	F36	0000000
02B5		tI>>>	0 to 1	1	bits	F36	0000000
02B6		tSOTF	0 to 1	1	bits	F36	0000000
02B7		tIN_1	0 to 1	1	bits	F36	0000000
02B8		tIN_2	0 to 1	1	bits	F36	0000000
02B9		tIN_3	0 to 1	1	bits	F36	0000000
02BA		Reserved					
02BB		tI2>	0 to 1	1	bits	F36	0000000

Address	Group	Description	Values range	Step	Unit	Format	Default Value
02BC		t Broken Conductor	0 to 1	1	Bits	F36	0000000
02BD		Thermal Trip	0 to 1	1	Bits	F36	0000000
02BE		Thermal Alarm	0 to 1	1	bits	F36	0000000
02BF		CB Fail	0 to 1	1	bits	F36	0000000
02C0		tAUX1	0 to 1	1	bits	F36	0000000
02C1		tAUX2	0 to 1	1	bits	F36	0000000
02C2		tAUX3	0 to 1	1	bits	F36	0000000
02C3		tAUX4	0 to 1	1	bits	F36	0000000
02C4		Communication Order 1 (remote via RS485)	0 to 1	1	bits	F36	0000000
02C5		Communication Order 2 (remote via RS485)	0 to 1	1	bits	F36	0000000
02C6		[79] Autoreclose in progress	0 to 1	1	bits	F36	0000000
02C7		[79] Autoreclose Final Trip	0 to 1	1	bits	F36	0000000
02C8		[79] Autoreclose Lockout (internal block)	0 to 1	1	bits	F36	0000000
02C9		[79] Autoreclose blocked (external blocking)	0 to 1	1	bits	F36	0000000
02CA		79 Autoreclose Successful	0 to 1	1	bits	F36	0000000
02CB		TCS Trip Circuit Supervision (52) : CB Fail	0 to 1	1	bits	F36	0000000
02CC		CB Alarm (CB diagnostic)	0 to 1	1	bits	F36	0000000
02CD		Reserved					
02CE		tCB Faulty detection based on External Signal (input)	0 to 1	1	bits	F36	0000000
02CF		Setting Group 1 is set	0 to 1	1	bits	F36	0000000
02D0	Setting group 1 /LEDs configuration	Latched LEDs	0 to 1	1	bits	F39	000000
02D1		Protection Trip	0 to 1	1	bits	F39	000000
02D2		Alarm	0 to 1	1	bits	F39	000000
02D3		General Start	0 to 1	1	bits	F39	000000
02D4		Start Phase A	0 to 1	1	bits	F39	000000
02D5		Start Phase B	0 to 1	1	bits	F39	000000
02D6		Start Phase C	0 to 1	1	bits	F39	000000
02D7		Start I>	0 to 1	1	bits	F39	000000
02D8		Start I>>	0 to 1	1	bits	F39	000000
02D9		Start I>>>	0 to 1	1	bits	F39	000000
02DA		Start SOTF	0 to 1	1	bits	F39	000000
02DB		Start IN_1	0 to 1	1	bits	F39	000000
02DC		Start IN_2	0 to 1	1	bits	F39	000000
02DD		Start IN_3	0 to 1	1	bits	F39	000000
02DE		AUX1	0 to 1	1	bits	F39	000000
02DF		AUX2	0 to 1	1	bits	F39	000000
02E0		AUX3	0 to 1	1	bits	F39	000000
02E1		AUX4	0 to 1	1	bits	F39	000000
02E2		AUX5	0 to 1	1	bits	F39	000000
02E3		AUX6	0 to 1	1	bits	F39	000000

Address	Group	Description	Values range	Step	Unit	Format	Default Value
02E4		tI>	0 to 1	1	bits	F39	000000
02E5		tI>>	0 to 1	1	bits	F39	000000
02E6		tI>>>	0 to 1	1	bits	F39	000000
02E7		tSOTF	0 to 1	1	bits	F39	000000
02E8		tIN_1	0 to 1	1	bits	F39	000000
02E9		tIN_2	0 to 1	1	bits	F39	000000
02EA		tIN_3	0 to 1	1	bits	F39	000000
02EB		Reserved					
02EC		tI2>	0 to 1	1	bits	F39	000000
02ED		tBroken Conductor	0 to 1	1	bits	F39	000000
02EE		Thermal Trip	0 to 1	1	bits	F39	000000
02EF		Thermal Alarm	0 to 1	1	bits	F39	000000
02F0		tCB Fail	0 to 1	1	bits	F39	000000
02F1		tAUX1	0 to 1	1	bits	F39	000000
02F2		tAUX2	0 to 1	1	bits	F39	000000
02F3		tAUX3	0 to 1	1	bits	F39	000000
02F4		tAUX4	0 to 1	1	bits	F39	000000
02F5		[79] Autoreclose in progress	0 to 1	1	bits	F39	000000
02F6		[79] Autoreclose Final Trip	0 to 1	1	bits	F39	000000
02F7		[79] Autoreclose Lockout (internal block)	0 to 1	1	bits	F39	000000
02F8		[79] Autoreclose blocked (external blocking)	0 to 1	1	bits	F39	000000
02F9		[79] Autoreclose Successful	0 to 1	1	bits	F39	000000
02FA		Local CTRL Mode	0 to 1	1	bits	F39	000000
02FB		CB Alarm (CB diagnostic)	0 to 1	1	bits	F39	000000
02FC		Maintenance Mode	0 to 1	1	bits	F39	000000
02FD		tCB Faulty detection based on External Signal (input)	0 to 1	1	bits	F39	000000
02FE		Setting Group 1 is set	0 to 1	1	bits	F39	000000

2.4.5 Page 3h : setting Group 2

Access in reading and in writing

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0300	Setting Group 1 / Protection G2 /Phase O/C	I> ?	0-4	1	-	F16	0
0301		I> threshold	10 to 4000	1	In/100	F1	140
0302		ItI>/TMS/TD	2 to 20000	1	1/100 s	F1	100
0303		I> Delay Type	0 to 15	1	-	F18	1
0304		I> Reset Delay Type	0 -1	1	-	F41	0
0305		I> DMT/RTMS tReset	0 to 20000	1	1/100 s	F1	0
0306		I>>?	0-4	1	-	F16	0
0307		I>> Threshold	10 to 4000	1	In/100	F1	140
0308		tI>>/TMS/TD	2 to 20000	1	1/100 s	F1	100
0309		*I>> Delay Type*	0 to 15	1	-	F18	1
030A		*I>> Reset Delay Type*	0 -1	1	-	F41	0
030B		*I>> DMT/RTMS tReset*	0 to 20000	1	1/100 s	F1	0
030C		*I>>>?*	0-4	1	-	F16	0
030D		I>>> Threshold	10 to 4000	1	In/100	F1	400
030E		tI>>>	0 to 20000	1	1/100 s	F1	100
030F	Setting Group 2 / Protection G2 /SOTF G1	*SOTF?*	0-4		-	F16	0
0310		SOTF Threshold	10 to 4000	1	In/100	F1	400
0311		tSOTF	0 to 60000	1	1/100 s	F1	100
0312	Setting Group 2 / Protection G2 /E/GND Fault	IN_1 stage?	0-4	1	-	F84	0
0313		IN_1 Threshold	Ref TD	1	Ien/100	F1	10 50 100
0314		tIN_1/TMS/TD	2 to 20000	1	1/100 s	F1	100
0315		IN_1 Delay Type	0 to 12	25	-	F18	1
0316		IN_1 Reset Delay Type	0 -1	5	-	F41	0
0317		IN_1 DMT tReset	0 to 20000	1	1/100 s	F1	0
0318		IN_2?	0-2	0-2	-	F84	0
0319		IN_2 Threshold	Ref TD	1	Ien/100	F1	options
031A		tIN_2	0 to 20000	1	1/100 s	F1	10
031B		IN_3?	0-2	0-2	-	F84	0
031C		IN_3 Threshold	Ref TD	1	Ien/100	F1	options
031D		tIN_3	0 to 20000	1	1/100 s	F1	10
031E -0320		Reserved					

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0321	Setting Group 2 / Protection G2 /Neg.Seq.O/C	I2>?	0-4	1	-	F16	0
0322		I2> threshold	10 to 400	1	In/100	F1	140
0323		tI2>/TMS/TD	2 to 20000	1	1/100 s	F1	100
0324		I2> Delay Type	0 to 15	1	-	F18	1
0325		I2> Reset Delay Type	0 -1	25	-	F41	0
0326		I2> DMT/RTMS tReset	0 to 60000	5	1/100 s	F1	0
0327	Setting Group 2 / Protection G /Broken Conductor	Broken Cond.?	0-4	1	-	F16	0
0328		Ratio I2/I1	20 to 100	1	%	F1	20
0329		tBCond	0 to 60000	1	1/100 s	F1	100
032A	Setting Group 2 / Protection G2 /Thermal Overload	Therm OL?	0-1	1	-	F109	0
032B		Itheta>	10 to 300	1	In/100	F1	140
032C		Therm Alarm?	0-1	1	-	F109	0
032D		Te	1 to 200	1	min	F1	1
032E		Tr	1 to 999	1	min	F1	1
032F		Theta Trip	50 to 200	1	%	F1	100
0330		Theta Reset	20 to 99	1	%	F1	95
0331		Theta Alarm	20 to 200	1	%	F1	80
0332	Setting Group 2 / Protection G2 /Aux Timers	AUX1?	0-7	1	-	F110	0
0333		tAUX1	0 to 60000	1	1/100 s	F1	0
0334		AUX2?	0-7	1	-	F110	0
0335		tAUX2	0 to 60000	1	1/100 s	F1	0
0336		AUX2?	0-7	1	-	F110	0
0337		tAUX2	0 to 60000	1	1/100 s	F1	0
0338		AUX2?	0-7	1	-	F110	0
0339		tAUX2	0 to 60000	1	1/100 s	F1	0
033A	Setting Group 2 / Protection G2 /CB Fail	CB Fail?	0-2	1	-	F111	0
033B		CB Fail Time tBF	0 to 1000	1	1/100 s	F1	20
033C		I< Threshold CBF	10 to 200	1	In/100	F1	10
033D		IN< Threshold CBF	10 to 200	1	Ien/100	F1	10
033E		Block I>	0 to 1	1	-	F63	0
033F		Block IN>	0 to 1	1	-	F63	0
0340	Setting Group 2 / Protection G2 /Logic Selective	Sel1?	0-1	1	-	F109	0

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0341		tSEL1	0 to 60000	5	1/100 s	F1	0
0342		Sel2?	0-1	1	-	F109	0
0343		tSEL2	0 to 60000	5	1/100 s	F1	0
0344	Setting Group 2 / Protection G2 /Cold Load PU	Cold Load PU?	0-1	1	-	F109	0
0345		Cold Load PU Level	20 to 999	1	%	F1	100
0346		Cold Load PU tCL	0 to 60000	1	1/100 s	F1	0
0347		Cold Load PU I>	0 -1	1	-	F63	0
0348		Cold Load PU I>>	0 -1	1	-	F63	0
0349		Cold Load PU I>>>	0 -1	1	-	F63	0
034A		Cold Load PU IN_1	0 -1	1	-	F63	0
034B		Cold Load PU IN_2	0 -1	1	-	F63	0
034C		Cold Load PU IN_3	0 -1	1	-	F63	0
034D		Cold Load PU Brkn Cond	0 -1	1	-	F63	0
034E		Cold Load PU Itherm	0 -1	1	-	F63	0
034F		Cold Load PU I2>	0 -1	1	-	F63	0
0350	Setting Group 2 / Protection G2 /Autoreclose	Autoreclose?	0 -1	1	-	F109	0
0351		Dead Time tD1	0 to 60000	1	1/100 s	F1	0
0352		Dead Time tD2	0 to 60000	1	1/100 s	F1	0
0353		Dead Time tD3	0 to 60000	1	1/100 s	F1	0
0354		Dead Time tD4	0 to 60000	1	1/100 s	F1	0
0355		Dead Time tR	0 to 60000	1	1/100 s	F1	0
0356		Fast O/C Trip	0 to 1	1	bits	F72	00000
0357		Fast O/C Trip Delay	0 to 999	1	1/100 s	F1	0
0358		Fast E/GND Trip	0 to 1	1	bits	F72	00000
0359		Fast E/GND Trip Delay	0 to 999	1	1/100 s	F1	0
035A		tI> Close Shot ?	0 to 1	1	bits	F67	0000
035B		tI> Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
035C		tI>> Close Shot ?	0 to 1	1	bits	F67	0000
035D		tI>> Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
035E		tI>>> Close Shot ?	0 to 1	1	bits	F67	0000
035F		tI>>> Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
0360		tIN_1 Close Shot ?	0 to 1	1	bits	F67	0000
0361		tIN_1 Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
0362		tIN_2 Close Shot ?	0 to 1	1	bits	F67	0000
0363		tIN_2 Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
0364		tIN_3 Close Shot ?	0 to 1	1	bits	F67	0000
0365		tIN_3 Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
0366		tAUX1 Close Shot ?	0 to 1	1	bits	F67	0000

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0367		tAUX1 Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
0368		tAUX2 Close Shot ?	0 to 1	1	bits	F67	0000
0369		tAUX2 Inhibit Trip : Shot	0 to 1	1	bits	F67	00000
036A	Setting group 2 /Inputs configuration G2	Reverse Input Logic	0 to 1	1	bits	F35	000000
036B		Maintenance Mode	0 to 1	1	bits	F35	000000
036C		Reset Latched Signaling	0 to 1	1	bits	F35	000000
036D		Reset Latched Outputs	0 to 1	1	bits	F35	000000
036E		Blocking tI>	0 to 1	1	bits	F35	000000
036F		Blocking tI>>	0 to 1	1	bits	F35	000000
0370		Blocking tI>>>	0 to 1	1	bits	F35	000000
0371		Blocking tSOTF	0 to 1	1	bits	F35	000000
0372		Blocking tIN_	0 to 1	1	bits	F35	000000
0373		Blocking tIN_2	0 to 1	1	bits	F35	000000
0374		Blocking tIN_3	0 to 1	1	bits	F35	000000
0375		Reserved					
0376		Blocking tI2>	0 to 1	1	bits	F35	000000
0377		Blocking tBroken Conductor	0 to 1	1	bits	F35	000000
0378		Blocking Itherm	0 to 1	1	bits	F35	000000
0379		Blocking tAUX1	0 to 1	1	bits	F35	000000
037A		Blocking tAUX2	0 to 1	1	bits	F35	000000
037B		Blocking tAUX3	0 to 1	1	bits	F35	000000
037C		Blocking CB Fail	0 to 1	1	bits	F35	000000
037D		Blocking Autoreclose [79]	0 to 1	1	bits	F35	000000
037E		Selectivity Logic 1 tI>>	0 to 1	1	bits	F35	000000
037F		Selectivity Logic 1 tI>>>	0 to 1	1	bits	F35	000000
0380		Selectivity Logic 1 tIN_2	0 to 1	1	bits	F35	000000
0381		Selectivity Logic 1 tIN_3	0 to 1	1	bits	F35	000000
0382		Selectivity Logic 2 tI>>	0 to 1	1	bits	F35	000000
0383		Selectivity Logic 2 tI>>>	0 to 1	1	bits	F35	000000
0384		Selectivity Logic 2 tIN_2	0 to 1	1	bits	F35	000000
0385		Selectivity Logic 2 tIN_3	0 to 1	1	bits	F35	000000
0386		AUX1	0 to 1	1	bits	F35	000000
0387		AUX2	0 to 1	1	bits	F35	000000
0388		AUX3	0 to 1	1	bits	F35	000000
0389		AUX4	0 to 1	1	bits	F35	000000
038A		AUX5	0 to 1	1	bits	F35	000000
038B		AUX6	0 to 1	1	bits	F35	000000
038C		Cold Load Pick Up	0 to 1	1	bits	F35	000000
038D		Start tBF (CB Fail)	0 to 1	1	bits	F35	000000

Address	Group	Description	Values range	Step	Unit	Format	Default Value
038E		CB status 52A	0 to 1	1	bits	F35	000000
038F		*CB status 52B*	0 to 1	1	bits	F35	000000
0390		CB Faulty External Signal	0 to 1	1	bits	F35	000000
0391		Setting Group 2	0 to 1	1	bits	F35	000000
0392		Manual Close	0 to 1	1	bits	F35	000000
0393		Manual Trip	0 to 1	1	bits	F35	000000
0394		Trip Circuit Supervision	0 to 1	1	bits	F35	000000
0395		Reset Theta value	0 to 1	1	bits	F35	000000
0396		Start Disturbance Recorder	0 to 1	1	bits	F35	000000
0397		Local CTRL Mode	0 to 1	1	bits	F35	000000
0398		Time Synchronization	0 to 1	1	bits	F35	000000
0399	Setting group 2 /Outputs relays configuration G2	Latched outputs	0 to 1	1	bits	F36	0000000
039A		Reverse output Logic	0 to 1	1	bits	F36	0000000
039B		Protection Trip	0 to 1	1	bits	F36	0000000
039C		Protection Trip (pulse)	0 to 1	1	bits	F36	0000000
039D		Trip CB order	0 to 1	1	bits	F36	0000000
039E		Close CB order	0 to 1	1	bits	F36	0000000
039F		Alarm	0 to 1	1	bits	F33	00000000
03A0-03A2		Reserved	0 to 1	1	bits	F36	0000000
03A3		Start I>	0 to 1	1	bits	F36	0000000
03A4		Start I>>	0 to 1	1	bits	F36	0000000
03A5		Start I>>>	0 to 1	1	bits	F36	0000000
03A6		Start SOTF	0 to 1	1	bits	F36	0000000
03A7		Start IN_1	0 to 1	1	bits	F36	0000000
03A8		Start IN_2	0 to 1	1	bits	F36	0000000
03A9		Start IN_3	0 to 1	1	bits	F36	0000000
03AA		Reserved					
03AB		Start I2>	0 to 1	1	bits	F36	0000000
03AC		Start Broken Conductor	0 to 1	1	bits	F36	0000000
03AD		AUX1	0 to 1	1	bits	F36	0000000
03AE		AUX2	0 to 1	1	bits	F36	0000000
03AF		AUX3	0 to 1	1	bits	F36	0000000
03B0		AUX4	0 to 1	1	bits	F36	0000000
03B1		AUX5	0 to 1	1	bits	F36	0000000
03B2		AUX6	0 to 1	1	bits	F36	0000000
03B3		tI>	0 to 1	1	bits	F36	0000000
03B4		tI>>	0 to 1	1	bits	F36	0000000
03B5		tI>>>	0 to 1	1	bits	F36	0000000
03B6		tSOTF	0 to 1	1	bits	F36	0000000
03B7		tIN_1	0 to 1	1	bits	F36	0000000
03B8		tIN_2	0 to 1	1	bits	F36	0000000
03B9		tIN_3	0 to 1	1	bits	F36	0000000
03BA		Reserved					

Address	Group	Description	Values range	Step	Unit	Format	Default Value
03BB		tI2>	0 to 1	1	bits	F36	0000000
03BC		t Broken Conductor	0 to 1	1	bits	F36	0000000
03BD		Thermal Trip	0 to 1	1	bits	F36	0000000
03BE		Thermal Alarm	0 to 1	1	bits	F36	0000000
03BF		CB Fail	0 to 1	1	bits	F36	0000000
03C0		tAUX1	0 to 1	1	bits	F36	0000000
03C1		tAUX2	0 to 1	1	bits	F36	0000000
03C2		tAUX3	0 to 1	1	bits	F36	0000000
03C3		tAUX4	0 to 1	1	bits	F36	0000000
03C4		Communication Order 1 (remote via RS485)	0 to 1	1	bits	F36	0000000
03C5		Communication Order 2 (remote via RS485)	0 to 1	1	bits	F36	0000000
03C6		[79] Autoreclose in progress	0 to 1	1	bits	F36	0000000
03C7		[79] Autoreclose Final Trip	0 to 1	1	bits	F36	0000000
03C8		[79] Autoreclose Lockout (internal block)	0 to 1	1	bits	F36	0000000
03C9		[79] Autoreclose blocked (external blocking)	0 to 1	1	bits	F36	0000000
03CA		79 Autoreclose Successful	0 to 1	1	bits	F36	0000000
03CB		TCS Trip Circuit Supervision (52) : CB Fail	0 to 1	1	bits	F36	0000000
03CC		CB Alarm (CB diagnostic)	0 to 1	1	bits	F36	0000000
03CD		Reserved					
03CE		tCB Faulty detection based on External Signal (input)	0 to 1	1	bits	F36	0000000
03CF		Setting Group 2 is set	0 to 1	1	bits	F36	0000000
03D0	Setting group 2 /LEDs configuration G2	Latched LEDs	0 to 1	1	bits	F39	000000
03D1		Protection Trip	0 to 1	1	bits	F39	000000
03D2		Alarm	0 to 1	1	bits	F39	000000
03D3		General Start	0 to 1	1	bits	F39	000000
03D4		Start Phase A	0 to 1	1	bits	F39	000000
03D5		Start Phase B	0 to 1	1	bits	F39	000000
03D6		Start Phase C	0 to 1	1	bits	F39	000000
03D7		Start I>	0 to 1	1	bits	F39	000000
03D8		Start I>>	0 to 1	1	bits	F39	000000
03D9		Start I>>>	0 to 1	1	bits	F39	000000
03DA		Start SOTF	0 to 1	1	bits	F39	000000
03DB		Start IN_1	0 to 1	1	bits	F39	000000
03DC		Start IN_2	0 to 1	1	bits	F39	000000
03DD		Start IN_3	0 to 1	1	bits	F39	000000
03DE		AUX1	0 to 1	1	bits	F39	000000
03DF		AUX2	0 to 1	1	bits	F39	000000
03E0		AUX3	0 to 1	1	bits	F39	000000
03E1		AUX4	0 to 1	1	bits	F39	000000
03E2		AUX5	0 to 1	1	bits	F39	000000

Address	Group	Description	Values range	Step	Unit	Format	Default Value
03E3		AUX6	0 to 1	1	bits	F39	000000
03E4		tI>	0 to 1	1	bits	F39	000000
03E5		tI>>	0 to 1	1	bits	F39	000000
03E6		tI>>>	0 to 1	1	bits	F39	000000
03E7		tSOTF	0 to 1	1	bits	F39	000000
03E8		tIN_1	0 to 1	1	bits	F39	000000
03E9		tIN_2	0 to 1	1	bits	F39	000000
03EA		tIN_3	0 to 1	1	bits	F39	000000
03EB		Reserved					
03EC		tI2>	0 to 1	1	bits	F39	000000
03ED		tBroken Conductor	0 to 1	1	bits	F39	000000
03EE		Thermal Trip	0 to 1	1	bits	F39	000000
03EF		Thermal Alarm	0 to 1	1	bits	F39	000000
03F0		tCB Fail	0 to 1	1	bits	F39	000000
03F1		tAUX1	0 to 1	1	bits	F39	000000
03F2		tAUX2	0 to 1	1	bits	F39	000000
03F3		tAUX3	0 to 1	1	bits	F39	000000
03F4		tAUX4	0 to 1	1	bits	F39	000000
03F5		[79] Autoreclose in progress	0 to 1	1	bits	F39	000000
03F6		[79] Autoreclose Final Trip	0 to 1	1	bits	F39	000000
03F7		[79] Autoreclose Lockout (internal block)	0 to 1	1	bits	F39	000000
03F8		[79] Autoreclose blocked (external blocking)	0 to 1	1	bits	F39	000000
03F9		[79] Autoreclose Successful	0 to 1	1	bits	F39	000000
03FA		Local CTRL Mode	0 to 1	1	bits	F39	000000
03FB		CB Alarm (CB diagnostic)	0 to 1	1	bits	F39	000000
03FC		Maintenance Mode	0 to 1	1	bits	F39	000000
03FD		tCB Faulty detection based on External Signal (input)	0 to 1	1	bits	F39	000000
03FE		Setting Group 2 is set	0 to 1	1	bits	F39	000000

2.4.6 Page 4h : remote controls

In V11F it is possible to use both functions Function 5 or Function 6

Access in writing.

a) MODBUS Function 6

Note: A one control can be executed in a one message only. Two control commands in a one message will be rejected by V11F

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0400	**Remote control**	Remote control word 1	0 to 15	bits	-	F38	0
0401		Remote control word 2	0 to 15	bits	-	F38A	0
0402		Remote control word 3	0 to 15	bits	-	F38B	0

Examples of messages

The example 1
Query to apply "Thermal State reset" via VAMP 11F:

An example of request to "Thermal state reset" in slave 10 (dec):		
Field name	**Value (hex)**	**Remarks**
Slave Address	0A	V11F setting value
Function	06	
Register Address Hi (Adress Hi)	04	Address (See table above)
Register Address Lo (Address Lo)	01	
Preset Data Hi	00	bit 3 (See format F38A)
Preset Data LO	08	
Error Check (CRC)	-	-

The example 2:
Query to apply "Remote CB Close Command" via VAMP 11F:

An example of request to "Remote CB close command" in slave 17 (dec):		
Field name	**Value (hex)**	**Remarks**
Slave Address	11	V11F setting value
Function	06	
Register Address Hi (Adress Hi)	04	Address (See table above)
Register Address Lo (Address Lo)	00	
Preset Data Hi	80	bit 15 (See format F38)
Preset Data LO	00	
Error Check (CRC)	-	-

b) **MODBUS Function 5**

Group	Modbus Coil Address Hi (hex)	Modbus Coil Address Lo (hex)			Force Data Hi (hex)	Force Data Lo (hex)
		Number of control	Values range	Step		
Remote control	**04**	See format: F113	**0** to **21**	1	**FF**	**00**

The example of query to apply "Remote CB Close Command" via VAMP 11F:

An example of request to "remote CB close command" (force coil 0F - ON) in slave 17 (dec):		
Field name	**Value (Hex)**	**Remarks**
Slave Address	11	V11F setting value
Function	05	
Coil Address Hi	04	See table above
Coil Address Lo	0F	See format F113
Force Data Hi	FF	Fixed value
Force Data Lo	00	Fixed value
Error Check (CRC)	-	-

2.4.7 Pages 5h/6h

These pages are reserved

2.4.8 Page 7h

Access in quick reading only (MODBUS 07 function)

Address	Group	Description	Values range	Step	Unit	Format	Default Value
0700	**Quick reading byte**	Relay status description		1	-	F49	0

2.4.9 Page 8h : time synchronisation

Access in writing for n words (function 16). The time synchronisation format is based on 8 bits (4 words) (Inverted IEC 870-5-4 CP56Time2a):.

Timer	Address (hex)	Nb bytes	Mask (hex)	Values range	Unit
	0800	1 (Hi)			
Year		1 (Lo)	7F	0 – 99 (2000-2093)	Year
Month	0801	1 (Hi)	0F	1 - 12	month
Day of week		1 (Lo)	E0	Not used in V11F	-
day of month		1 (Lo)	1F	1 – 31	Day
Season	0802	1 (Hi)	80	0 – 1 (summer-winter) Not used	
Hour		1 (Hi)	1F	0-23	Hour
Invalidity		1 (Lo)	80	0 -1 (valid – invalid)	
Minute		1 (Lo)	3F	0-59	Minute
Millisecond pF+pf	0803	2	FFFF	0 – 59999	ms

CT

2.4.10 Mapping access characteristics

- Description of accessible addresses in reading of words (**function 03** and **04**).

PAGE 00h 0000h to 0054h	PAGE 01h 0100h to 0184h	PAGE 02h 0200h to 02FAh
PAGE 03h 0300h to 03F6h		

- Definition of accessible addresses in writing of 1 word (**function 06**).

PAGE 01h 0100h to 0184h	PAGE 02h 0200h to 02FAh	PAGE 03h 0300h to 03FAh

- Definition of accessible addresses in writing of n words (**function 16).**

PAGE 01h 0100h to 0184h	PAGE 02h 0200h to 02FAh	PAGE 03h 0300h to 03FAh
PAGE 08h 0800h to 0803h		

- Definition of accessible addresses in reading of bits (**function 01** and **02**).

Not available

- Definition of accessible addresses in writing of 1 bit (**function 05**).

PAGE 04h
0400h to 0402h

WARNING: THE BITS NUMBER MUST NOT BE HIGHER THAN 16.

CT

2.4.11 Page 9h to 21h: disturbance record data (25 pages)

Access in words writing (**function 03**)
Each disturbance mapping page contain 250 words.

Address	Contents
0900h to 09FAh	250 disturbance data words
0A00h to 0AFAh	250 disturbance data words
0B00h to 0BFAh	250 disturbance data words
0C00h to 0CFAh	250 disturbance data words
0D00h to 0DFAh	250 disturbance data words
0E00h to 0DFAh	250 disturbance data words
0F00h to 0FFAh	250 disturbance data words
1000h to 10FAh	250 disturbance data words
1100h to 11FAh	250 disturbance data words
1200h to 12FAh	250 disturbance data words
1300h to 13FAh	250 disturbance data words
1400h to 14FAh	250 disturbance data words
1500h to 15FAh	250 disturbance data words
1600h to 16FAh	250 disturbance data words
1700h to 17FAh	250 disturbance data words
1800h to 18FAh	250 disturbance data words
1900h to 19FAh	250 disturbance data words
1A00h to 1AFAh	250 disturbance data words
1B00h to 1BFAh	250 disturbance data words
1C00h to 1CFAh	250 disturbance data words
1D00h to 1DFAh	250 disturbance data words
1E00h to 1EFAh	250 disturbance data words
1F00h to 1FFAh	250 disturbance data words
2000h to 20FAh	250 disturbance data words
2100h to 21FAh	250 disturbance data words

NB: The disturbance data pages contain values of one channel from one given disturbance record.

2.4.11.1 Meaning of each value channel

- IA, IB, IC and IN channels:

The value is an signed 16 bits word equivalent to the ADC value

Calculation formula for phase current values

Values in Amps can be calculated in following way:

$$\text{Value IA} = \sqrt{2} \cdot \frac{\text{sample\_IA} \cdot \text{Internal\_PhA} \cdot \text{Phase\_Primary\_CT\_In}}{\text{Phase\_Secondary\_CT\_In} \cdot 2000}$$

$$\text{Value IB} = \sqrt{2} \cdot \frac{\text{sample\_IB} \cdot \text{Internal\_PhB} \cdot \text{Phase\_Primary\_CT\_In}}{\text{Phase\_Secondary\_CT\_In} \cdot 2000}$$

$$\text{Value IC} = \sqrt{2} \cdot \frac{\text{sample\_IC} \cdot \text{Internal\_PhC} \cdot \text{Phase\_Primary\_CT\_In}}{\text{Phase\_Secondary\_CT\_In} \cdot 2000}$$

Where:
Internal_PhA, Internal_PhB, Internal_PhC: Internal scalling (see point 2.4.17 (Page 38h to 3Ch))

Calculation formula for earth current values

Value in Amps can be calculated in following way:

$$\text{Value IN} = \sqrt{2} \cdot \frac{\text{sample\_IN} \cdot \text{Internal\_N} \cdot \text{Earth\_Primary\_CT\_Ien}}{\text{Earth\_Secondary\_CT\_Ien} \cdot 2000}$$

Where:
Internal_N: Internal scalling (see point 2.4.17 (Page 38h to 3Ch))

- Frequency channel:

Time between two samples in microseconds

- Logic channels:

Logic channel	Contents
Bit 0	Binary Input 1
Bit 1	Binary Input 2
Bit 2	Binary Input 3
Bit 3	Binary Input 4
Bit 4	Binary Input 5
Bit 5	Binary Input 6
Bit 6	Binary Input 7
Bit 7	Binary Input 8
Bit 8	Output RL1
Bit 9	Output RL2
Bit 10	Output RL3
Bit 11	Output RL4
Bit 12	Output RL5
Bit 13	Output RL6
Bit 14	Protection Trip
Bit 15	Start of protection which trips

2.4.12 Page 22h: disturbance record index frame

Access in word reading (function 03)

Address	Contents
2200h	Disturbance data index frame

Disturbance record index frame

Word	Contents
n° 1	Disturbance record number
n° 2	Disturbance record finish date (second)
n° 3	Disturbance record finish date (second)
n° 4	Disturbance record finish date (millisecond)
n° 5	Disturbance record finish date (millisecond)
n° 6	Disturbance record starting condition : 1 : tripping 2 : instantaneous 3 : remote command 4 : logic input
n° 7	Frequency at the post-time beginning

2.4.13 Page 35h (addresses 3500h to 354Ah) : event record data (9 words)

Word n° 1: Event meaning

Word n° 2: MODBUS associated value

Word n° 3: MODBUS address

Word n° 4: *Reserved*

Words n° 5 & 6 & 7 & 8: Event date is Inverted IEC 870-5-4 CP56Time2a:

See format Page 8h

Word n° 9: Acknowledge
0=event non acknowledged
1= event acknowledged)

Code	Meaning of the event	Type	MODBUS address
00	No event	-	
01	CB closing (Remote/menu HMI)	F38 ↑	0400h (bit 15)
02	CB tripping (Remote/menu HMI)	F38 ↑	0400h (bit 7)
03	Reset latched outputs (Remote)	F38 ↑	0400h (bit 2)
04	Reset signaling (Remote)	F38 ↑	0400h (bit 1)
05	Reset signaling and latched outputs (Remote)	F38 ↑	0400h (bit 3)
06	Clear fault and disturbance recorder	F38A ↑	0401h (bit 0)
07	Clear event recorder	F38A ↑	0401h (bit 1)
08	Reserved		

Code	Meaning of the event	Type	MODBUS address
09	Warm restart	↑	-
10	Reserved		
11	Current Protection disable status	↑↓	-
12	START I>	F37↑↓	0021h (bit 0)
13	START I>>	F37↑↓	0022h (bit 0)
14	START IN_1	F50 ↑↓	0024h (bit 0)
15	START IN_2	F50 ↑↓	0025h (bit 0)
16	tI>	F37↑↓	0021h (bit 6)
17	tI>>	F37↑↓	0022h (bit 6)
18	tIN_1	F50 ↑↓	0024h (bit 6)
19	tIN_2	F50 ↑↓	0025h (bit 6)
20	tAUX1	F51 ↑↓	0027h (bit 6)
21	CB status: opened	F30 ↑	001Bh (value 0)
22	CB status: closed	F30 ↑	001Bh (value 1)
23	CB status: faulty	F30 ↑	001Bh (value 3)
24	CB status: undefined	F30 ↑	001Bh (value 4)
25	tCB Faulty External Signal.	F31A ↑	001Ah (bit 10)
26	Start tCB Fail Ext.	F51 ↑↓	002Ah (bit 0)
27	CHANGE OF INPUT LOGIC STATE	F11 ↑↓	0010h
28	CHANGE OF OUTPUT LOGIC STATE	F24 ↑↓	0013h
29	START I>>>	F37↑↓	0023h (bit 0)
30	tI>>>	F37↑↓	0023h (bit 6)
31	Start I2>	F50 ↑↓	002Dh (bit 0)
32	tI2>	F50 ↑↓	002Dh (bit 6)
33	tAUX2	F51 ↑↓	0028 (bit 6)
34	tCB Fail	F51 ↑↓	0029h (bit 6)
35	Setting Group 1 active	F32↑	0009h (bit 0)
36	Setting Group 2 active	F32↑	0009h (bit 1)
37	tI> Alarm	F31↑↓	0019h (bit 0)
38	tI>> Alarm	F31↑↓	0019h (bit 1)
39	tI>>> Alarm	F31↑↓	0019h (bit 2)
40	tIN_1 Alarm	F31 ↑↓	0019h (bit 4)
41	tIN_2 Alarm	F31 ↑↓	0019h (bit 5)
42	tAUX1 Alarm	F31A ↑↓	0020h (bit 5)
43	tAUX2 Alarm	F31A ↑↓	0020h (bit 6)
44	tI2> Alarm	F31 ↑↓	0019h (bit 8)
45	tCB Fail Alarm	F31 ↑↓	0019h (bit 10)
46	Start AUX1	F51 ↑↓	0027h (bit 0)
47	Start AUX2	F51 ↑↓	0028h (bit 0)

Code	Meaning of the event	Type	MODBUS address
48	[79] Autoreclose blocked (Remote/menu HMI)	F38 ↑	0400h (bit 8)
49	[79] Autoreclose unblocked (Remote/menu HMI)	F38 ↑	0400h (bit 9)
50	Reset latched Alarms	F38 ↑	0400h (bit 5)
51	Reserved		
52	Reserved		
53	Reserved		
54	Reserved		
55	Acknowledgement of the hardware alarm	F38A↑	0401h (bit 9)
56	Disturbance recorder start (Remote)	F38A↑	0401h (bit 5)
57	Communication order 1	F38A↑	0401h (bit 14)
58	Communication order 2	F38A↑	0401h (bit 15)
59	Thermal state reset (Remote/menu HMI)	↑	
60	Recloser counters reset (Remote/menu HMI)	F38A↑	0401h (bit 3)
61	Fault counters reset (Remote/menu HMI)	F38A↑	0401h (bit 10)
62	Control couters reset (Remote/menu HMI)	F38A↑	0401h (bit 12)
63	Maintenance mode	F38A↑	0401h (bit 13)
64	End of maintenance mode	F38A↑	0401h (bit 6)
65	START IN_3	F38A	0401h (bit 7)
66	tIN_3	F50 ↑↓	0026h (bit 0)
67	tIN_3 Alarm	F50 ↑↓	0026h (bit 6)
68	Start SOTF	F31 ↑↓	0019h (bit 6)
69	tSOTF	F37 ↑↓	002Bh (bit 0)
70	tSOTF Alarm	F37 ↑↓	002Bh (bit 6)
71	Reserved		
72	Reserved		
73	Reserved		
74	Start Broken Counductor	F31 ↑↓	0019h (bit 7)
75	tBroken Conductor	F50 ↑↓	002Eh (bit 0)
76	tBroken Conductor Alarm	F50 ↑↓	002Eh (bit 6)
77	Itherm>	F31 ↑↓	0019h (bit 9)
78	Thermal OL Trip	F50 ↑↓	002Fh (bit 0)
79	Thermal OL Alarm	F50 ↑↓	002Fh (bit 6)
80	START AUX3	F31 ↑↓	0019h (bit 11)
81	tAUX3	F51 ↑↓	0030h (bit 0)
82	tAUX3 Alarm	F51 ↑↓	0030h (bit 6)
83	Start AUX4	F31A ↑↓	001Ah (bit 7)
84	tAUX4	F51 ↑↓	0031h (bit 0)
85	tAUX4 Alarm	F51 ↑↓	0031h (bit 6)
86	Peak and rolling value reset (Remote/menu HMI)	F31A ↑	001Ah (bit 8)

Code	Meaning of the event	Type	MODBUS address
87	Max. values of the averag. in sub period reset (Remote/menu HMI)	F38A↑	0401h (bit 4)
88	Acknowledgement of the hardware alarm	F38A↑	0401h (bit 11)
89-95	Reserved		
96	Local CTRL mode	F61↑	001Eh (value: 2)
97	Remote CTRL mode	F61↑	001Eh (value: 1)
98	Local and remote CTRL mode	F61↑	001Eh (value: 0)
99	Setting change to Group 1 (Remote)	F38↑	0400h (bit 6)
100	Setting change to Group 2 (Remote)	F38↑	0400h (bit 11)
101	Protection Function disable status	↑↓	
102	Setting Group 2 set via Input	F104↑↓	0035h (bit 8)
103	Relays Test (Commissiong Test) active	↑	-
104	Test I> On	↑	-
105	Test I> Off	↑	-
106	Test I>> On	↑	-
107	Test I>> Off	↑	-
108	Test I>>> On	↑	-
109	Test I>>> Off	↑	-
110	Test SOTF On	↑	-
111	Test SOTF Off	↑	-
112	Test IN_1 On	↑	-
113	Test IN_1 Off	↑	-
114	Test IN_2 On	↑	-
115	Test IN_2 Off	↑	-
116	Test IN_3 On	↑	-
117	Test IN_3 Off	↑	-
118	Reserved		
119	Reserved		
120	Test I2> On	↑	-
121	Test I2> Off	↑	-
122	Test Brkn. Cond. On	↑	-
123	Test Brkn. Cond. Off	↑	-
124	Test Thermal OL On	↑	
125	Test Thermal OL Off	↑	
126	Test CBF On	↑	-
127	Test CBF Off	↑	-
128	Blocking tI> active	F101↑↓	0032h (bit 0)
129	Blocking tI>> active	F101↑↓	0032h (bit 1)
130	Blocking tI>>> active	F101↑↓	0032h (bit 2)
131	Blocking tSOTF active	F101↑↓	0032h (bit 3)

Code	Meaning of the event	Type	MODBUS address
132	Blocking tIN_1 active	F101↑↓	0032h (bit 4)
133	Blocking tIN_2 active	F101↑↓	0032h (bit 5)
134	Blocking tIN_3 active	F101↑↓	0032h (bit 6)
135	Reserved		
136	Blocking tI2> active	F101↑↓	0032h (bit 8)
137	Blocking tBrkn. Conductor active	F101↑↓	0032h (bit 9)
138	Blocking Itherm. Active	F101↑↓	0032h (bit 11)
139	Blocking tAUX1 active	F102↑↓	0033h (bit 5)
140	Blocking tAUX2 active	F102↑↓	0033h (bit 6)
141	Blocking tAUX3 active	F102↑↓	0033h (bit 7)
142	Blocking CB Fail active	F101↑↓	0032h (bit 10)
143	Blocking [79] active	F102↑↓	0033h (bit 0)
144	Sel1 tI>> active	F103↑↓	0034h (bit 0)
145	Sel1 tI>>> active	F103↑↓	0034h (bit 1)
146	Sel1 tIN_2 active	F103↑↓	0034h (bit 2)
147	Sel1 tIN_3 active	F103↑↓	0034h (bit 3)
148	reserved		
149	Sel2 tI>> ACTIVE	F103↑↓	0034h (bit 4)
150	Sel2 tI>>> ACTIVE	F103↑↓	0034h (bit 5)
151	Sel2 tIN_2 ACTIVE	F103↑↓	0034h (bit 6)
152	Sel2 tIN_3 ACTIVE	F103↑↓	0034h (bit 7)
153	reserved		
154	Cold Load PU active	F104↑↓	0035h (bit 3)
155	Manual Close via Input	↑	-
156	Manual Close via Function Key	↑	-
157	Manual Trip via Input	↑	-
158	Manual trip via Function Key	↑	-
159	TC Supervision alarm	F31A↑↓	001Ah (bit 11)
160	Theta Reset via Input	F104↑↓	0035h (bit 12)
161	Start Disturbance recorder via Input	↑	-
162	Changing CTRL mode via Input	F104↑	0035h (bit 14)
163	Changing CTRL mode (Remote/menu HMI)	F38↑	0400h (bit 4)
164	Active [79] in Progress	F59↑↓	001Ch (bit 1)
165	[79] Final trip	F59↑↓	001Ch (bit 4)
166	[79] Lockout	F59↑↓	001Ch (bit 6)
167	[79] Blocked	F59↑↓	001Ch (bit 0)
168	[79] Successful	F59↑↓	001Ch (bit 5)
169	[79] tD1 counting	F59↑↓	001Ch (bit 8)
170	[79] tD2 counting	F59↑↓	001Ch (bit 9)

Code	Meaning of the event	Type	MODBUS address
171	[79] tD3 counting	F59↑↓	001Ch (bit 10)
172	[79] tD4 counting	F59↑↓	001Ch (bit 11)
173	[79] tR counting	F59↑↓	001Ch (bit 12)
174	Fast O/C trip Delay Elapsed	F59↑	001Ch (bit 13)
175	Fast E/GND Trip Delay Elapsed	F59↑	001Ch (bit 14)
176	[79] Reclose order	F59↑	001Ch (bit 3)
177	[79] Inhibit Trip tI> active	↑	-
178	[79] Inhibit Trip tI>> active	↑	-
179	[79] Inhibit Trip tI>>> active	↑	-
180	[79] Inhibit Trip tIN_1 active	↑	-
181	[79] Inhibit Trip tIN_2 active	↑	-
182	[79] Inhibit Trip tIN_3 active	↑	-
183	[79] Inhibit Trip tAUX1 active	↑	-
184	[79] Inhibit Trip tAUX2 active	↑	-
185	[79] Rolling demand blocking active	↑	-
186	[79] Inhibit time on close counting	F60↑↓	001Dh (bit 2)
187	Autoreclose : T-C	↑	-
188	Autoreclose : T-C-T	↑	-
189	Autoreclose : T-C-T-C	↑	-
190	Autoreclose : T-C-T-C-T	↑	-
191	Autoreclose : T-C-T-C-T-C	↑	-
192	Autoreclose : T-C-T-C-T-C-T	↑	-
193	Autoreclose : T-C-T-C-T-C-T-C	↑	-
194	Autoreclose : T-C-T-C-T-C-T-C-T	↑	-
195	Reserved	↑	-
196	HD Warning Alarm	F31A↑↓	001Ah (bit 15)
197	CB Time Supervision Alarm	F31A↑↓	001Ah (bit 12)
198	Unblock SOTF active	↑↓	-
199	tReset I> active	F37↑↓	0021h (bit 5)
200-399	Reserved		
400	tReset I>> active	F37↑↓	0022h (bit 5)
401	tReset IN_1 active	F50 ↑↓	0024h (bit 5)
402	tReset I2> active	F50 ↑↓	002Dh (bit 5)
403	Administrator password entered	↑	-
404	Protection password entered	↑	-
405	Control password entered	↑	-
406	Reset signaling and latched outputs via C clear key	↑	-
407	Reset signalling via Input	F104↑	0035h (bit 1)
408	Reset latched outputs via Input	F104↑	0035h (bit 2)

Code	Meaning of the event	Type	MODBUS address
409	Inrush threshold active	F28A ↑↓	0016h (bit 4)
410	Inrush unblock active	↑↓	-
411	Reset Signalling via Close command	↑	
412	State of CB Alarm	F31A↑↓	001Ah (bit 2)
413	[79] Rolling demand Alarm	F31A↑↓	001Ah (bit 9)
414	CB current diagnostic Alarm	F31A↑↓	001Ah (bit 0)
415	CB number diagnostic Alarm	F31A↑↓	001Ah (bit 1)
416	Settings change	↑	-

Note: The double arrow ↑↓ means the event is generated on event occurrence (↑) and on event disappearance (↓).

On event occurrence, the corresponding bit of the associated format is set to « 1 ».

On event disappearance, the corresponding bit of the associated format is set to « 0 ».

2.4.14 Page 36h

Most older event data

Access in word reading (**function 03**)

Address	Contents
3600h	Most older event data

2.4.15 Page 37h : fault record value data

Access in word reading (**function 03**)

Address	Contents
3700h	Fault value record n°1
3701h	Fault value record n°2
3702h	Fault value record n°3
3703h	Fault value record n°4
3704h	Fault value record n°5
3705h	Fault value record n°6
3706h	Fault value record n°7
3707h	Fault value record n°8
3708h	Fault value record n°9
3709h	Fault value record n°10
3710h	Fault value record n°11
3711h	Fault value record n°12
3712h	Fault value record n°13
3713h	Fault value record n°14
3714h	Fault value record n°15
3715h	Fault value record n°16
3716h	Fault value record n°17

Address	Contents
3717h	Fault value record n°18
3718h	Fault value record n°19
3719h	Fault value record n°20

Word n° 1 : Fault number

Words n° 2 & 3 & 4 & 5: see table below (Inverted IEC 870-5-4 CP56Time2a)

Timer	Address (hex)	Nb bytes	Mask (hex)	Values range	Unit
	Word n° 2	1 (Hi)			
Year		1 (Lo)	7F	0 – 99 (2000-2093)	Year
Month	Word n° 3	1 (Hi)	0F	1 - 12	month
Day of week		1 (Lo)	E0	**Not used in V11F**	
day of month		1 (Lo)	1F	1 – 31	Day
Season	Word n° 4	1 (Hi)	80	0 – 1 (summer-winter) **Not used**	
Hour		1 (Hi)	1F	0-23	Hour
Invalidity		1 (Lo)	80	0 -1 (valid – invalid)	
Minute		1 (Lo)	3F	0-59	Minute
Millisecond pF+pf	Word n° 5	2	FFFF	0 – 59999	ms (included s)

Word n° 6 : Reserved

Word n° 7 : Active setting group during the fault (1 or 2)

Word n° 8 : Fault origin

0= none
1= phase A
2= phase B
3= phase C
4= phases A-B
5= phases A-C
6= phases B-C
7= phases A-B-C
8= earth

CT

Word n° 9: Fault recording starting origin

Fault nature code meaning

Code	Fault origin
00	Null event
01	Reserved
02	Thermal Overload
03	tI> trip
04	tI>> trip

Code	Fault origin
05	tI>>> trip
06	tIN>_1 trip
07	tIN_2 trip
08	tIN_3 trip
09	Reserved
10	tBrkn Cond
11	t Aux 1 trip
12	t Aux 2 trip
13	tI2> trip
14	Reserved
15	t Aux 3 trip
16	t Aux 4 trip
17	CB Fail trip
18	tSOTF
19	Reserved
20	CBext trip

Word n° 10: Fault value current (nominal value)

Word n° 11: Phase A current value (nominal value)

Word n° 12: Phase B current value (nominal value)

Word n° 13: Phase C current value (nominal value)

Word n° 14: Earth current value (nominal value)

Word n° 15: Acknowledge of fault 0 : fault non-acknowledged
1 : fault acknowledged

2.4.15.1 Calculation formula for phase current values

Line phase current value (primary value) = phase sampled value (e.g. word 10, 11, 12 or 13) * {line primary CT ratio (address 0120h)/Line CT sec (address 0121h)} A/10

2.4.15.2 Calculation formula for earth current values

The formula depends of nominal earth current :

0.01 to 2 Ien and 0.05-10Ien range
Line earth current value (primary value) = earth sampled value (e.g. word 10 or 14) * {line primary CT ratio (address 0122h)/Line CT sec (address 0123h)} A/1000

0.1 to 40 Ien range
Line earth current value (primary value) = earth sampled value (e.g. word 10 or 14) * {line primary CT ratio (address 0122h)/Line CT sec (address 0123h)} A/10

2.4.16 Page 3Eh : most older Fault record value data

Access in word reading (**function 03**)

Address	Contents
3E00h	Most older Fault record

CT

2.4.17 Page 38h to 3Ch: Disturbance recorder

Selection of the disturbance record and channel (36 bytes are uploaded for each address reading)

Access in word reading (**function 03**)

Address	Disturbance record number	Format
3800h	1	IA
3801h	1	IB
3802h	1	IC
3803h	1	IN
3804h	1	Frequency
3805h	1	Logic input and outputs
3900h	2	IA
3901h	2	IB
3902h	2	IC
3903h	2	IN
3904h	2	Frequency
3905h	2	Logic input and outputs
3A00h	3	IA
3A01h	3	IB
3A02h	3	IC
3A03h	3	I_E
3A04h	3	Frequency
3A05h	3	Logic input and outputs
3B00h	4	IA
3B01h	4	IB
3B02h	4	IC
3B03h	4	IN
3B04h	4	Frequency
3B05h	4	Logic input and outputs
3C00h	1	IA
3C01h	1	IB
3C02h	1	IC
3C03h	1	IN
3C04h	1	Frequency
3C05h	1	Logic input and outputs

Word n° 1 : Number of samples included in the mapping
Word n° 2 : Sample number in pre-time

Word n° 3 :	Sample number in post-time
Word n° 4 :	Line CT primary nominal current **(*Phase_Primary_CT_In*)**
Word n° 5 :	Line CT secondary nominal current **(*Phase_ Secondary _CT_In*)**
Word n° 6 :	E/GND CT primary nominal current **(*Earth_Primary_CT_Ien*)**
Word n° 7 :	E/GND CT secondary nominal current **(*Earth_ Secondary _CT_Ien*)**
Float[1)] n° 1 :	Phase A Internal PhA ratio (***Internal_PhA***)
Float[1)] n° 2 :	Phase B internal PhB ratio (***Internal_PhB***)
Float[1)] n° 3 :	Phase C internal PhC ratio (***Internal_PhC***)
Float[1)] n° 4 :	Earth internal ratio (***Internal_N***)
Word n° 8 :	Mapping last page number
Word n° 9 :	Number of words in the mapping last page

1) Float – 4 bytes floating point number

2.4.17.1 Calculation formula for phase current values

Values in Amps can be calculated in following way:

$$\text{Value IA} = \sqrt{2}\cdot\frac{\text{sample\_IA(e.g.3800h)}\cdot\text{Internal\_PhA}\cdot\text{Phase\_Primary\_CT\_In}}{\text{Phase\_ Secondary \_CT\_In}\cdot 2000}$$

$$\text{Value IB} = \sqrt{2}\cdot\frac{\text{sample\_IB(e.g.3801h)}\cdot\text{Internal\_PhB}\cdot\text{Phase\_Primary\_CT\_In}}{\text{Phase\_ Secondary \_CT\_In}\cdot 2000}$$

$$\text{Value IC} = \sqrt{2}\cdot\frac{\text{sample\_IC(e.g.3802h)}\cdot\text{Internal\_PhC}\cdot\text{Phase\_Primary\_CT\_In}}{\text{Phase\_ Secondary \_CT\_In}\cdot 2000}$$

2.4.17.2 Calculation formula for earth current values

Value in Amps can be calculated in following way:

$$\text{Value IN} = \sqrt{2}\cdot\frac{\text{sample\_IN(e.g.3803h)}\cdot\text{Internal\_N}\cdot\text{Earth\_Primary\_CT\_Ien}}{\text{Earth\_ Secondary \_CT\_Ien}\cdot 2000}$$

2.4.18 Pages 3Dh : number of disturbance records available

Access in word reading (function 03)

Address	Contents
3D00h	Number of disturbance records available

Word n° 1 :	Number of disturbance records available
Word n° 2:	Oldest disturbance record number (n)
Words n° 3 & 4 :	Oldest disturbance record date (second)
Words n° 5 & 6 :	Oldest disturbance record date (millisecond)
Word n° 7 :	Disturbance record starting origin 1= Protection trip 2= instantaneous threshold 3= remote command 4= logic input
Word n° 8 :	Acknowledge
Word n° 9 :	Disturbance record previous number (n+1)
Words n° 10 & 11:	Previous disturbance record date (second)
Words n° 12 & 13:	Previous disturbance record date (millisecond)

Word n° 14 : Disturbance record starting origin
1= Protection trip
2= instantaneous threshold
3= remote command
4= logic input
Word n° 15 : Acknowledge
Word n° 16 : Disturbance record previous number (n+2)
Words n° 17 & 18: Previous disturbance record date (second)
Words n° 19 & 20: Previous disturbance record date (millisecond)
Word n° 21 : Disturbance record starting origin
1= Protection trip
2= instantaneous threshold
3= remote command
4= logic input
Word n° 22 : Acknowledge
Word n° 23 : Disturbance record previous number (n+3)
Words n° 24 & 25: Previous disturbance record date (second)
Words n° 26 & 27: Previous disturbance record date (millisecond)
Word n° 28 : Disturbance record starting origin
1= Protection trip
2= instantaneous threshold
3= remote command
4= logic input
Word n° 29 : Acknowledge
Word n° 30 : Disturbance record previous number (n+4)
Words n° 31 & 32: Previous disturbance record date (second)
Words n° 33 & 34: Previous disturbance record date (millisecond)
Word n° 35 : Disturbance record starting origin
1= Protection trip
2= instantaneous threshold
3= remote command
4= logic input
Word n° 36 : Acknowledge

2.4.19 Description of the mapping format, VAMP 11F

CODE	DESCRIPTION
F1	Unsigned integer – numerical data : 1 – 65535
F10	Characters ASCII byte 1 : ASCII character 32-127 byte 2 : ASCII character 32-127
F11	Unsigned integer -Binary input status bit 0 : logic input 1 bit 1 : logic input 2 bit 2 : logic input 3 bit 3 : logic input 4 bit 4 : logic input 5 bit 5 : logic input 6 bit: 6-15 reserved
F12	Unsigned integer – Current Protection disable status bit 0 : I> disabled bit 1 : I>> disabled bit 2 : I>>> disabled bit 3 : SOTF disabled bit 4 : IN_1 disabled bit 5 : IN_2 disabled bit 6 : IN_3 disabled bit 7 : reserved bit 8 : I2> disabled bit 9 : Brkn Cond. disabled bit 10 : CB Fail disabled bit 11 : Thermal OL disabled bit 12 to 15 : reserved
F12A	Unsigned integer –Protection Function disable status bit 0 : 79 Autoreclose disabled bit 1 : SEL1 disabled bit 2 : SEL2 disabled bit 3 : Cold Load PU disabled bit 4 : Blocking Inrush disabled bit 5 : AUX1 disabled bit 6 : AUX2 disabled bit 7 : AUX3 disabled bit 8 : AUX4 disabled bit 9 to 15 : reserved
F13	Unsigned integer – numerical data : 1 – 65535
F15	Two-digit decimal number - Firmware version 1st digit - major version 2nd digit - minor version 10: 1A 11: 1B 12: 1C 13: 1D etc
F16	Unsigned integer – Configuration 0 : disabled 1 : enable Trip 2 : enable Alarm 3 : enable Trip with Inrush Blocking 4 : enable Trip with Latching
F16A	Unsigned integer – Configuration 0 : disabled 1 : enable Trip 2 : enable Alarm 3 : enable Trip with Inrush Blocking 4 : enable Trip with Latching 1 : enable Trip-Phase A 1 : enable Trip-Phase B

CODE	DESCRIPTION
	1 : enable Trip-Phase C
F17	Unsigned integer - Hardware version 00: A 11: B
F18	Unsigned integer – curves type 0: DTM 1 : SI IEC 2 : VI IEC 3 : EI IEC 4 : LTI (IEC) 5: STI (IEC) 6 : RC Rectifier curve 7: RI curve 8: MI IEEE 9 : VI IEEE 10 : EI IEEE 11: STI (US C02-P20) 12: LTI (US CO8) 13: RXIDG 14: BPN EDF 15: STI (US C02-P40)
F19	Unsigned integer - Baud rate value 0 : 4800 baud 1 : 9600 baud 2 : 19200 baud 3 : 38400 baud 4 : 57600 baud 5 : 115200 baud
F20	Unsigned integer – Parity 0 : NONE 1 : ODD 2 : EVEN
F22	Unsigned integer – Stop 0 : 1 stop 1 : 2 stop
F23	Unsigned integer - Line CT Sec 9: In = 1A/5A; 0.1-40In
F23A	Unsigned integer - E/GND Sec 4: 0.01-12Ien
F24	Unsigned integer - Logical output status bit 0 : logic output RL1 bit 1 : logic output RL2 bit 2 : logic output RL3 bit 3 : logic output RL4 bit 4 : logic output RL5 bit 5 : logic output RL6 bit 6 : **Reserved** bit 7-15: reserved
F25	Unsigned integer - Logical LED status bit 0: Trip bit 1 : Alarm bit 2 : LED3 bit 3 : LED4 bit 4 : LED5 bit 5 : LED6 bit 6: LED7 bit 7: Healthy bit 8-15: reserved

CODE	DESCRIPTION
F26	Unsigned integer - Logical heathy status bit 0 to 3 reserved bit 4 : Healthy bit10-15: reserved
F27	Unsigned Integer
F28	Unsigned integer - Protection start status bit 0 : I> bit 1 : I>> bit 2 : I>>> bit 3 : SOTF bit 4 : IN_1 bit 5 : IN_2 bit 6 : IN_3 bit 7 : reserved bit 8 : I2> bit 9 : Brkn Cond. bit 10 : tCB Fail Start bit 11 : Itherm Start bit 12 : starting in phase A bit 13 : starting in phase B bit 14: starting in phase C bit 15 : starting in N
F28A	Unsigned integer - Protection start status **bit 0 : Reserved** **bit 1 : Reserved** **bit 2 : Reserved** bit 3 : Cold Load PU active bit 4 : Blocking Inrush active bit 5 : AUX1 bit 6 : AUX2 bit 7 : AUX3 bit 8 : AUX4 bit 9-15 : Reserved
F29	Unsigned integer – Current Protection trip status bit 0 : tI> bit 1 : tI>> bit 2 : tI>>> bit 3 : tSOTF bit 4 : tIN_1 bit 5 : tIN_2 bit 6 : tIN_3 bit 7 : reserved bit 8 : tI2> bit 9 : tBrkn Conductor bit 10 : CB Fail bit 11 : Thermal Overload bit 12 : starting in phase A bit 13 : starting in phase B bit 14 : starting in phase C bit 15 : starting in N

CODE	DESCRIPTION
F29A	Unsigned integer - Protection Function trip status bit 0 : **Reserved** bit 1 : reserved bit 2 : reserved bit 3 : reserved bit 4 : reserved bit 5 : tAUX1 bit 6 : tAUX2 bit 7 : tAUX3 bit 8 : tAUX4 bit 9 : **Reserved** bit 10 : reserved bit 11 : reserved bit 12 : reserved bit 13 : reserved bit 14 : reserved bit 15 : reserved
F30	Unsigned integer - CB status (decimal value) 0 : CB opened 1 : CB closed 2 : reserved 3 : CB position faulty 4: CB position undefined 5:-15: reserved
F31	Unsigned integer (bit)- Protection Alarm status bit 0 : tI> bit 1 : tI>> bit 2 : tI>>> bit 3 : tSOTF bit 4 : tIN_1 bit 5 : tIN_2 bit 6 : tIN_3 bit 7 : reserved bit 8 : tI2> bit 9 : tBrkn Conductor bit 10 : tCB Fail bit 11 : Thermal Overload bit 12 : reserved bit 13 : reserved bit 14 : reserved bit 15 : reserved
F31A	Unsigned integer - Alarm Function status bit 0: CB current Diagnostic (Square Amps sum overreach) bit 1: CB number Diagnostic (operation number overreach) bit 2 : **Reserved** bit 3 : reserved bit 4 : reserved bit 5 : tAUX1 bit 6 : tAUX2 bit 7 : tAUX3 bit 8 : tAUX4 bit 9 : **Reserved** bit 10 : t CB Faulty ext sign bit 11 : TC Supervision (Trip circuit self-test) bit 12 : CB Time Supervision (time overreach) bit 13 : **Reserved** bit 14 : **Reserved** bit 15 : Hardware Warning
F32	Unsigned integer - Setting group 0: Setting group 1 1: Setting group 2

CODE	DESCRIPTION
F33	Unsigned integer -Output configuration bit 0: RL1 bit 1: RL2 bit 2: RL3 bit 3: RL4 bit 4: RL5 bit 5: RL6 bit 6: RL7 bit 7: WD bit 5-15: reserved
F35	Unsigned integer -Input configuration bit 0: Input L1 bit 1: Input L2 bit 2: Input L3 bit 3: Input L4 bit 4: Input L5 bit 5: Input L6 bit 6: Input L7 bit 7: Input L8 bit 8-15: reserved
F36	Unsigned integer -Output configuration bit 0: RL1 bit 1: RL2 bit 2: RL3 bit 3: RL4 bit 4: RL5 bit 5: RL6 bit 6: RL7 bit 7-15: reserved
F37	Unsigned integer: I> or I>> or I>>> or SOTF threshold phase information status: bit 0: information thresold exceeded bit 1: Instantaneous IA bit 2: Instantaneous IB bit 3: Instantaneous IC bit 4: Blocking signal active bit 5: tReset active bit 6: Time delay elapsed bit 7 to 15: reserved
F38	Unsigned integer - Remote control word 0: Warm restart 1: Reset LEDs 2: Reset Outputs 3: Reset LEDs and Outputs 4: Local Mode 5: Reset latched Alarms 6: Setting change to Group 1 7: Remote or HMI CB open order 8: Remote or HMI [79] Autoreclose blocking 9: Remote or HMI [79] Autoreclose unblocking 10: Remote Mode 11: Setting change to Group 2 12: Disable automatic acknowledgement of events 13: Oldest event acknowledge 14: Oldest fault acknowledge 15: Remote or via HMI CB close order

CODE	DESCRIPTION
F38A	Unsigned integer - Remote control word 0: Clear Recorders 1: Clear Events 2: reserved 3: Thermal state reset 4: Reserved 5: Disturbance record remote start 6: Maintenance mode 7: End of maintenance mode 8: Acknowledgement of the oldest disturbance record 9: Acknowledgment of the hardware RAM alarm 10: Recloser reset counters 11: Reserved 12: Reset Fault counters 13: Reset control counters 14: Communication Order 1 15: Communication Order 2
F38B	Unsigned integer - Remote control word 0 : [79] Unlockout 1: Enable automatic acknowledgement of events bit 1-15: reserved
F39A	Unsigned integer - LED function bit 0 : reserved bit 1 : LED3 bit 2 : LED4 bit 3 : LED5 bit 4: LED6 bit 5: LED7 bit 6-15: reserved
F39	Unsigned integer - LED function bit 0 : LED2 bit 1 : LED3 bit 2 : LED4 bit 3 : LED5 bit 4: LED6 bit 5: LED7 bit 6-15: reserved
F40	Unsigned integer -Output configuration (bit fields) bit 0 : RL1 bit 1 : RL2 bit 2 : RL3 bit 3 : RL4 bit 4 : RL5 bit 5 : RL6 bit 6 : RL7 bit 7-15: reserved
F41	Unsigned integer - Curve Type 0 : DT 1 : IDMT
F49	Unsigned integer - relay status bit 0 : Relay status (major alarms) bit 1: Minor hardware alarm bit 2: Presence of non-acknowledged event bit 3: Synchronisation state bit 4:Presence of non-acknowledged disturbance record bit 5: Presence of non-acknowledged fault record bit 6: Local Maintance Ack state bit 7-15: reserved

CODE	DESCRIPTION
F50	Unsigned integer: current protection IN_1, IN_2, IN_3, I2>, SOTF, Brkn Cond, Itheta> information status: bit 0: information threshold exceeded bit 1: reserved bit 2: reserved bit 3: reserved bit 4: Blocking signal active bit 5: tReset active bit 6: Time delay elapsed bit 7: Alarm information - Therm OL only bit 8 to 15: reserved
F51	Unsigned integer: information status about additional protection AUX1 or AUX2 or CB Fail or CB Fail ext. sign. status: bit 0: start bit 1: reserved bit 2: reserved bit 3: reserved bit 4: reserved bit 5: **Reserved** bit 6: Time delay elapsed bit 7 to 15: reserved
F52	Unsigned integer: information about language in menu 0: English; 1 : German; 2 : French; 3 : Spanish 4: Russian 5: Turkish 6 : Language 7
F53	Unsigned integer: information about language in menu 0: Measurements refered to In or Ien 1: Measurements refered to A 2: CB CTRL window 3: 79 CTRL window 4: CTRL Mode (Local/Remote)
F54	Unsigned integer 0: Manual only 1: Start Priotection 2: Close command
F55	Unsigned integer - Alarm Display Reset 0: Self-Reset 1: Manual Reset
F56	Unsigned integer - Protocol 0: Modbus 1: IEC103
F57	Unsigned integer – Nominal Frequency 0: 50Hz 1: 60Hz

CODE	DESCRIPTION
F59	Unsigned integer - [79] status bit 0: Recloser blocked bit 1: Recloser in progress bit 2: reserved bit 3: Closing command executed via Autorecloser bit 4: Recloser final trip bit 5: Recloser successful bit 6: Recloser lockout bit 7: Trip locked via Recloser (inhibit of protection stage) bit 8: Dead Time tD1 counting bit 9: Dead Time tD2 counting bit 10: Dead Time tD3 counting bit 11: Dead Time tD4 counting bit 12: Reclaim Time tR counting bit 13: Fast O/C Trip Delay elapsed bit 14: Fast E/GND Trip Delay elapsed bit 15: reserved
F60	Unsigned integer - [79] blocking status 0: Ready 1: In progress 2: Temporrary blocked (after close signal) 3: Lockout 4: Blocked via CTRL (HMI+RS485) 5: Blocked via input 6: Disabled
F61	Unsigned integer - Local/Remote Mode 0: Local and Remote 1: Remote only 2: Local only
F62	Unsigned integer –Maintenance Mode 0: No 1: Yes 2: Yes- Bl.Outputs
F63	Unsigned integer –Configuration 0: No 1: Yes
F64	Unsigned integer – 79 dead time configuration 0: Protection reset 1: CB trips
F65	Unsigned integer – Disturbance recorder configuration 0: On Instantenous 1: On Trip
F66	Unsigned integer –Configuration 0: Disabled 1: Current+Input 2: Input only
F67	Unsigned integer (bit) - Close Shot bit 0: First Reclose Shot bit 1: Second Reclose Shot bit 2 : Third Reclose shot bit 3 : Fourth Reclose shot bit 4-15: reserved
F71	Unsigned integer - Number of setting groups: 0 : One Group 1 :Two Groups

CODE	DESCRIPTION
F72	Unsigned integer - AR trips cycle bit 0: First trip shot bit 1: Second trip shot bit 2: Third trip shot bit 3: Fourth trip shot bit 4: Fifth trip shot bit 5-15: reserved
F73	Unsigned integer - Remote Mode configuration 0 : Remote Only 1 :Remote + Local
F74	Unsigned integer - Inrush Blocking configuration 0 : No 1: Yes 2: Closing
F75	Unsigned integer 0 : No operation 1: Apply Test
F76	bit 0 : tI> bit 1 : tI>> bit 2 : tI>>> bit 3 : tSOTF bit 4 : tIN_1 bit 5 : tIN_2 bit 6 : tIN_3 bit 7 : tI2> bit 8 : tBrkn Conductor bit 9 : Reserved bit 10 : Thermal OL Trip bit 11 : CB Fail bit 12 : reserved bit 14 : reserved bit 15 : reserved
F77	Unsigned integer - Functional Test End 0: CB Trip 1: Time elapsed
F82	Unsigned integer – Control key confirmation 0: No 1: Yes 2-15: reserved
F84	Unsigned integer - Configuration: 0: disable 1: IN_x Trip 2: IN_x Alarm 3: IN_x Trip with Inrush Blocking 4: IN_x Trip with Latching 5-15: reserved
F88	Unsigned integer – IDMT Interlock by DMT 0: No 1: Yes
F90	Unsigned Integer - Software Version Number: numeric Data 0-99
F91	Unsigned integer - Line CT Sec. 0: In=1A 1: In=5A
F92	Unsigned integer – E/GND CT Sec. 0: In=1A 1: In=5A
F94	Unsigned integer - TC Supervision 0: No 1: Yes 2: Yes-52A

CODE	DESCRIPTION
F101	Input Protection Blocking 1 (bits) bit 0 : tI> bit 1 : tI>> bit 2 : tI>>> bit 3 : tSOTF bit 4 : tIN_1 bit 5 : tIN_2 bit 6 : tIN_3 bit 7 : reserved bit 8 : tIs2> bit 9 : tBCond bit 10 : tCB Fail bit 11 : Thermal OL bit 12-15: reserved
F102	Input Protection Blocking 2 (bits) bit 0: blocking [79] Autoreclose bit 1-4: reserved bit 5 : AUX1 bit 6 : AUX2 bit 7 : AUX3 bit 8 : Reserved bit 9-15: Reserved
F103	Input Selective Logic (bits) bit 0 : SEL1 tI>> bit 1 : SEL1 tI>>> bit 2 : SEL1 tIN_2 bit 3 : SEL1 tIN_3 bit 4 : SEL2 tI>> bit 5 : SEL2 tI>>> bit 6 : SEL2 tIN_2 bit 7 : SEL2 tIN_3 bit 8-15: Reserved
F104	Input Logic Data (bits) bit 0: Maintenance Mode bit 1: Reset Latched Signalling bit 2: Reset Latched Outputs bit 3: Cold Load PU bit 4: reserved bit 5: CB status 52a bit 6: CB status 52b bit 7: CB FLT External Signal bit 8: Setting Group 2 bit 9: Manual Close bit 10: Manual Trip bit 11: Trip Circuit Supervision bit 12: Reset Theta value bit 13: Start Disturbance Recorder bit 14: Local CTRL Mode bit 15: reserved
F105	Internal Logic Data (bits) bit 0: **Reserved** bit 1-15: reserved
F107	Unsigned integer – TC supervision? 0 : No 1: Yes 2: Yes-52a bit 3-15: reserved
F109	Unsigned integer –Configuration 0: Disabled 1: Enabled

CODE	DESCRIPTION
F110	Unsigned integer –Configuration 0: Disabled 1 : enable Trip 2 : enable Alarm 3 : enable Trip with Inrush Blocking 4 : enable Trip with Latching 5: Load shedding 6: AR after LS Hi 7: AR after LS Lo bit 8-15: reserved
F111	Unsigned integer –Configuration 0: Disabled 1: Retrip 2: Alarm 3: Retrip-Inrush 4: Retrip-Latch
F113	Modicon Modbus Coil Address Lo (hex): 00: Warm restart 01: Reset LEDs 02: Reset Outputs 03: Reset LEDs and Outputs 04: Local Mode 05: Reset latched Alarms 06: Setting change to Group 1 07: Remote CB open order 08: Remote [79] Autoreclose blocking 09: Remote [79] Autoreclose unblocking 0A: Remote Mode 0B: Setting change to Group 2 0C: Disable automatic acknowledgement of events 0D: Oldest event acknowledge 0E: Oldest fault acknowledge 0F: Remote CB close order 10: Clear Recorders 11: Clear Events 12: reserved 13: Thermal state reset 14: Reserved 15: Disturbance record remote start 16: Maintenance mode 17: End of maintenance mode 18: Acknowledgement of the oldest disturbance record 19: Acknowledgment of the hardware RAM alarm 1A: Recloser reset counters 1B: Reserved 1C: Reset Fault counters 1D: Reset control counters 1E: Communication Order 1 1F: Communication Order 2 20: [79] Unlockout 21: Enable automatic acknowledgement of events

2.4.20 Request to retrieve the oldest non-acknowledge event

Slave number	Function code	Word address	Word number	CRC
xx	03h	36h 00	00 09h	xx xx

This event request may be answered an error message with the error code :

EVT_EN_COURS_ECRIT (5) : An event is being written into the saved FRAM.

Note : On event retrieval, two possibilities exist regarding the event record acknowledgement :
a) Automatic event record acknowledgement on event retrieval.
b) Non automatic event record acknowledgement on event retrieval.

a) Automatic event record acknowledgement on event retrieval :

The bit12 of the remote order frame (format F38 – mapping address 0400h) shall be set to 0. On event retrieval, this event record is acknowledged.

b) Non automatic event record acknowledgement on event retrieval :

The bit12 of the remote order frame (format F38 – mapping address 0400h) shall be set to 1. On event retrieval, this event record is not acknowledged. To acknowledge this event, an other remote order shall be sent to the relay. The bit 13 of this frame (format F38 – mapping address 0400h) shall be set to 1.

2.4.21 Request to retrieve a dedicated event

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	00 09h	xx xx

This event request may be answered an error message with the error code :

EVT_EN_COURS_ECRIT (5) : An event is being written into the saved FRAM.

Note : This event retrieval does not acknowledge this event.

2.4.22 Modbus request definition used to retrieve the fault records

Two ways can be followed to retrieve a fault record :

- Send a request to retrieve the oldest non-acknowledge fault record.
- Send a request to retrieve a dedicated fault record.

2.4.22.1 Request to retrieve the oldest non-acknowledge fault record

Slave number	Function code	Word address	Word number	CRC
xx	03h	3Eh 00	00 0Fh	xx xx

Note : On fault retrieval, two possibilities exist regarding the fault record acknowledgement:
a) Automatic fault record acknowledgement on event retrieval.
b) Non automatic fault record acknowledgement on event retrieval.

a) Automatic fault record acknowledgement on fault retrieval :

The bit12 of the remote order frame (format F38 – mapping address 0400h) shall be set to 0. On fault retrieval, this fault record is acknowledged.

b) Non automatic fault record acknowledgement on fault retrieval :

The bit12 of the remote order frame (format F38 – mapping address 0400h) shall be set to 1. On fault retrieval, this fault record is not acknowledged.

To acknowledge this fault, an other remote order shall be sent to the relay. The bit 14 of this frame (format F38 – mapping address 0400h) shall be set to 1.

2.4.22.2 Request to retrieve a dedicated fault record

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	00 0Fh	xx xx

Note : This fault value retrieval does not acknowledge this fault record.

3. IEC60870-5-103 INTERFACE

The IEC60870-5-103 interface is a master/slave interface with the relay as the slave device. This protocol is based on the VDEW communication protocol. The relay conforms to compatibility level 2, compatibility level 3 is not supported.

The following IEC60870-5-103 facilities are supported by this interface:

Initialisation (Reset)

Time Synchronisation

Event Record Extraction

General Interrogation

Cyclic Measurements

General Commands

Physical connection and link layer

Connection is available for IEC60870-5-103 through the rear RS485 port. It is possible to select both the relay address and baud rate using the front panel interface. Following a change, a reset command is required to re-establish communications.

The parameters of the communication are the following:

Even Parity

8 Data bits

1 stop bit

Data rate 9600 or 19200 bauds

Initialisation

Initialisation is implemented according to clause 7.4.1 of IEC 60870-5-103.

Whenever the relay has been powered up, or if the communication parameters have been changed a reset command is required to initialise the communications. The relay will respond to either of the two reset commands (Reset CU or Reset FCB), the difference being that the Reset CU will clear any unsent messages in the relay's transmit buffer.

The relay will respond to the reset command with an identification message ASDU 5, the Cause Of Transmission COT of this response will be either Reset CU or Reset FCB depending on the nature of the reset command. The following information will be contained in the data section of this ASDU:

Manufacturer Name: SE VAMP

According to the specification “Communication Architecture (ACA), Part 4: Communication based on IEC 60870-5-103” (Issue H, April 2010) the Software Identification Section will contain the relay model number and the version number to identify the type of relay.

CT

Software Identification Section, Byte 0:	Numerical part of device type, hex, low
Software Identification Section, Byte 1:	Numerical part of device type, hex, low
Software Identification Section, Byte 2:	Software version, hex, low
Software Identification Section, Byte 3:	Software version, hex, high

Letters in the software version are converted to numerical values according to the following rule: A=0, B=1, C=2, D=3 etc.

The Software Identification Section of V11F, version 1A, will then contain ‘111’ and ‘10’ as hexadecimal coded values:

Byte 0: 74H

Byte 1: 00H

Byte 2: 10H

Byte 3: 00H

In addition to the above identification message, if the relay has been powered up it will also produce a power up event.

Time synchronisation

Time synchronisation is implemented according to clause 7.4.2 of IEC 60870-5-103.

The relay time and date can be set using the time synchronisation feature of the IEC60870-5-103 protocol. The relay will correct for the transmission delay as specified in IEC60870-5-103. If the time synchronisation message is sent as a send/confirm message then the relay will respond with a confirm. Whether the time synchronisation message is sent as a send confirm or a broadcast (send/no reply) message, a time synchronisation message will be returned as Class 1 data.

Spontaneous events

The events created by the relay will be passed to the master station using the compatible range and the private range of IEC 60870-5-103 function types and information numbers.

Events are categorised using the following information:

Common Address

Function Type

Information number

3.10-3.14 contains a complete listing of all events produced by the relay.

General interrogation

General interrogation is implemented according to clause 7.4.3 of IEC 60870-5-103.

The GI request can be used to read the status of the relay, the function numbers, information numbers and common address offsets that will be returned during the GI cycle are indicated in 3.10-3.14.

Cyclic measurements

The relay will produce measured values using ASDU 3 and ASDU 9 on a cyclical basis. They can be read from the relay using a Class 2 poll.

It should be noted that the measurands transmitted by the relay are sent as a proportion of 2.4 times the rated value of the analogue value. The selection of 2.4 for a particular value is indicated in 3.10-3.14.

Commands

Command transmission is implemented according to clause 7.4.4 of IEC 60870-5-103.

A list of the supported commands is contained in 3.10-3.14. The relay will respond to all other commands with an ASDU 1, with a cause of transmission (COT) of negative acknowledgement of a command

Blocking of monitor direction

The relay does not support a facility to block messages in the Monitor direction.

Spontaneous messages managed by VAMP 11F

These messages includes a sub-assembly of events which are generated on the relay, because some generated events are not registered in VDEW. They are the most priority messages.

An event is always generated on the rising edge of the information.

Some events can be generated on the rising or lowering edge.

In the list below, events only generated on rising edge will be tagged with a '*'.

The following list of processed events contains the messages for the compatible and the private range.for all Overcurrent protection functions, with the associated FUNCTION TYPE, INFORMATION NUMBER, ASDU TYPE, CAUSE OF TRANSMISSION

FUN <160>: Function type in Public range for Overcurrent Protections (compatible).

FUN <162> ,<163>, <164>, <165>, <168>:: Function type in Private range (Reserved for Overcurrent Protections).

Status indications in monitor direction (Type Identification 1)

Indication (LEDs + Signal.) reset: FUN<160>;INF <19>; COT<1,7,11,12,20,21>; <ADDR>,*

Reset Latch. Sign Inp FUN<162>;INF<223>; COT<1,7>,<ADDR>*

Reset Latched Outputs (Inp+COM): FUN<162>; INF<46>; COT<1,7,11,12,20,21>,<ADDR>*

Reset Latched Signaling. and Outputs(HMI+COM):
FUN<249>;INF<131>;COT<1,7,11,12,20,21>,<ADDR>*

Reset Latched Outputs (Inp); FUN<162>; INF <86>; COT<1,7>,<ADDR>*

Maintenance (Test) Mode Inp; FUN<162>; INF <157>; COT<1,7>,<ADDR>

Maintenance Mode (Test Mode): FUN<160>; INF<21>; COT<11> <ADDR>

Local Mode : FUN<160> ; INF<22> ; COT <11> <ADDR>

Relay Blocked/faulty (Hardware Warning); FUN<160>;INF <47>; COT<1,7>,<ADDR>

Setting Group number 1: FUN<160>;INF <23>; COT<1,7,11,12,20,21>,<ADDR>

Setting Group number 2: FUN<160>;INF <24>; COT<1,7,11,12,20,21>,<ADDR>

Order Command 1: FUN<249>;INF <129>; COT<1,7,12,20,21>,<ADDR>*

Order Command 2: FUN<249>;INF <130>; COT<1,7,12,20,21>,<ADDR>*

Auxiliary input AUX1: FUN<160>;INF <27>; COT<1,7,11>,<ADDR>

Auxiliary input AUX2: FUN<160>;INF <28>; COT<1,7,11>,<ADDR>

Auxiliary input AUX3: FUN<160>;INF <29>; COT<1,7,11>,<ADDR>

Auxiliary input AUX4: FUN<160>;INF <30>; COT<1,7,11>,<ADDR>

Auxiliary input AUX5: FUN<163>;INF <81>; COT<1,7,11>,<ADDR>

Auxiliary input AUX6: FUN<163>;INF <82>; COT<1,7,11>,<ADDR>

Input 1: FUN<163>;INF <160>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Input 2: FUN<163>;INF <161>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Input 3: FUN<163>;INF <162>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Input 4: FUN<163>;INF <163>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Input 5: FUN<163>;INF <164>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Input 6: FUN<163>;INF <165>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Input 7: FUN<163>;INF <166>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Input 8: FUN<163>;INF <167>; COT<1,7>,<ADDR>

(Presence of the voltage on the input terminals)

Logical output 1: FUN<249>;INF <1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 2: FUN<249>;INF <2>; COT<1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 3: FUN<249>;INF <3>; COT<1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 4: FUN<249>;INF <4>; COT<1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 5: FUN<249>;INF <5>; COT<1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 6: FUN<249>;INF <6>; COT<1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 7: FUN<249>;INF <7>; COT<1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 8: FUN<249>;INF <8>; COT<1,7>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

CT

Therm: Starting Itherm>: FUN<162>; INF<194>; COT<1,7>,<ADDR>

Therm: Trip signal: FUN<162>; INF<67>; COT<1,7>,<ADDR>*

Therm: Reset Theta Val. (Inp); FUN<162>; INF <234>; COT<1,7>,<ADDR>*

Therm: Thermal Alarm; FUN<162>; INF <226>; COT<1,7>,<ADDR>

Therm: Reset replica (HMI+RS485+Inp); FUN<162>; INF <231>; COT<1,7>,<ADDR>*

Term: Block Itherm Ext (Inp); FUN<162>;INF <214>; COT<1,7>,<ADDR>

46 Blocking tI2> Ext (Inp); FUN<162>;INF <38>; COT<1,7>,<ADDR>

SOTF: Blocking tSOTF Ext (Inp); FUN< 165 >;INF < 34 >; COT<1,7>,<ADDR>

46BC Blocking tBrkCond Ext (Inp); FUN<165>;INF <35>; COT<1,7>,<ADDR>

AUX: Blocking tAUX1 Ext (Inp); FUN<165>;INF <36>; COT<1,7>,<ADDR>

AUX: Blocking tAUX2 Ext (Inp); FUN<165>;INF <37>; COT<1,7>,<ADDR>

AUX: Blocking tAUX3 Ext (Inp); FUN<165>;INF <38>; COT<1,7>,<ADDR>

ARC: CB drive ready Ext (Inp) : FUN<162>; INF<150>; COT<1,7>,<ADDR>

ARC: Blocked/Lockout FUN<162>; INF<185>; COT<1,7>,<ADDR>

(Blocked = Tempor.Block or Lockout or Block:CTRL or Block:Input or Disabled)

ARC: Enabled FUN<160>; INF<16>; COT<1,7,11,12,20,21>,<ADDR>

(Enabled = NOT(Block:CTRL or Block:Input or Disabled))

ARC: Reclaim time running; FUN<162>; INF<218>; COT<1,7>,<ADDR>

ARC: Blocking EXT (Inp); FUN<162>; INF<152>; COT<1,7>,<ADDR>

ARC: Reclosure successful; FUN<163>; INF<73>; COT<1,7>,<ADDR>

ARC: Reclosure final trip; FUN<165>; INF<40>; COT<1,7>,<ADDR>

ARC: Running; FUN<162>; INF<233>; COT<1,7>,<ADDR>

ARC: Dead time runn; FUN<162>; INF<236>; COT<1,7>,<ADDR>

ARC: (Re)close signal close (first shot); FUN<160>; INF<128>; COT<1,7>,<ADDR>*

ARC: (Re)close signal closes (2nd to 4th shot) FUN<160>; INF<129>; COT<1,7>,<ADDR>*

ARC: Fast Trip Phase; FUN<165>; INF<41>; COT<1,7>,<ADDR>*

ARC: Fast Trip Earth; FUN<165>; INF<42>; COT<1,7>,<ADDR>*

ARC: Not ready; FUN<160>; INF<130>; COT<1,7>,<ADDR>

ARC: Ext./user enabled; FUN<162>; INF<144>; COT<1,7>,<ADDR>

(Ext./user Enabled = NOT(Block:CTRL or Block:Input))

ARC: Recloser Lockout; FUN<165>; INF<43>; COT<1,7>,<ADDR>

(Lockout: ARC internally blocked up to Signalling reset)

ARC: Recloser Rolling Demand Alarm; FUN<165>; INF<44>; COT<1,7>,<ADDR>

(too many of ARC cycles in settable monitoring window)

Manual. Trip Ext (Inp); FUN<162>; INF <148>; COT<1,7>,<ADDR>*

Trip CB Order (Inp+HMI+RS485); FUN<162>; INF <9>; COT<1,7>,<ADDR>*

CT

Manual. Close Ext (Inp); FUN<162>; INF <47>; COT<1,7>,<ADDR>*

Manual. Close Command (Inp+HMI); FUN<162>; INF <246>; COT<1,7>,<ADDR>*

Close CB Order (Inp+HMI+RS485+79); FUN<162>; INF <239>; COT<1,7>,<ADDR>*

CB Status 52A Inp; FUN<163>; INF <253>; COT<1,7>,<ADDR>

CBM: CB Trip Number Diagnostic Alarm ; FUN<164>;INF <210>; COT<1,7>,<ADDR>

CBM: CB Trip Current Diagnostic Alarm; FUN<164>;INF <212>; COT<1,7>,<ADDR>

CBM: tCB FLT (faulty) Ext. Alarm; FUN<165>;INF <45>; COT<1,7>,<ADDR>

CBM: TCS Trip Curcuit Supervision Alarm; FUN<165>;INF <16>; COT<1,7>,<ADDR>

CBM: CB Time Monitoring Alarm; FUN<165>;INF <46>; COT<1,7>,<ADDR>*

CBM: State of CB (not correct) ALARM; FUN<165>;INF <47>; COT<1,7>,<ADDR>

FT_RC: Faulty time tag; FUN<163>; INF <74>; COT<1,7>,<ADDR>*

Fault Indications in monitor direction (Type Identification 2)

General Start / pick-up I>, I>>, I>>>, SOTF, IN_1, IN_2, IN_3; FUN<160>;INF <84>; COT<1,7>,<ADDR>

General Trip : FUN<160>;INF <68>; COT<1,7>,<ADDR>,*

Start / pick-up A; FUN<160>; INF <64>; COT<1,7>,<ADDR>

50/51: Start / pick-up B; FUN<160>; INF <65>; COT<1,7>,<ADDR>

50/51: Start / pick-up C; FUN<160>; INF <66>; COT<1,7>,<ADDR>

50/51: Start / pick-up N; FUN<160>; INF <67>; COT<1,7>,<ADDR>

Inrush restr. trig.; FUN<165>;INF <48>; COT<1,7>,<ADDR>

50/51: Start / pick-up I>: FUN<162>;INF <111>; COT<1,7>,<ADDR>

50/51: Blocking tI> Ext (Inp); FUN<162>;INF <32>; COT<1,7>,<ADDR>

50/51: tI> elapsed; FUN<162>; INF <169>; COT<1,7>,<ADDR>*

50/51: Trip tI>: FUN<160>;INF <90>; COT<1,7>,<ADDR>,*

50/51: Start / pick-up I>>: FUN<162>;INF <96>; COT<1,7>,<ADDR>

50/51: Blocking tI>> Ext (Inp); FUN<162>;INF <33>; COT<1,7>,<ADDR>

50/51: tI>> elapsed; FUN<162>; INF <162>; COT<1,7>,<ADDR>*

50/51: Trip tI>>: FUN<160>;INF <91>; COT<1,7>,<ADDR>,*

50/51: Start / pick-up I>>>: FUN<162>;INF <56>; COT<1,7>,<ADDR>

50/51: Blocking tI>>> Ext (Inp); FUN<162>;INF <82>; COT<1,7>,<ADDR>

50/51: tI>>> elapsed; FUN<162>; INF <163>; COT<1,7>,<ADDR>*

50/51: Trip tI>>>: FUN<162>;INF <141>; COT<1,7>,<ADDR>,*

SOTF: Start / pick-up SOTF: FUN<165>;INF <32>; COT<1,7>,<ADDR>

SOTF: tSOTF elapsed; FUN<165>; INF<33>; COT<1,7>,<ADDR>*

SOTF: Trip tSOTF: FUN< 162 >;INF < 211 >; COT<1,7>,<ADDR>,*

50/51N: Start / pick-up IN_1 stage (IN>): FUN<162>;INF <114>; COT<1,7>,<ADDR>

50/51N: Blocking t N_1 stage (IN>) Ext (Inp); FUN<162>;INF <83>; COT<1,7>,<ADDR>

50/51N: t IN_1 stage (IN>) elapsed; FUN<162>; INF <164>; COT<1,7>,<ADDR>*

50/51N: Trip tIN_1 stage (IN>): FUN<160>;INF <92>; COT<1,7>,<ADDR>,*

50/51N: Start / pick-up IN_2 stage (IN>>): FUN<162>;INF <97>; COT<1,7>,<ADDR>

50/51N: Blocking t IN_2 stage (IN>>) Ext (Inp); FUN<162>;INF <84>; COT<1,7>,<ADDR>

50/51N: t IN_2 stage (IN>>) elapsed; FUN<162>; INF <186>; COT<1,7>,<ADDR> *

50/51N: Trip tIN_2 stage (IN>>): FUN<160>;INF <93>; COT<1,7>,<ADDR>,*

50/51N: Start / pick-up IN_3 stage (IN>>>): FUN<162>; INF<57>; COT<1,7>,<ADDR>

50/51N: Blocking tIN_3 stage (IN>>>) Ext (Inp); FUN<162>;INF <85>; COT<1,7>,<ADDR>

50/51N: tIN_3 stage (IN>>>) elapsed; FUN<162>; INF <74>; COT<1,7>,<ADDR>*

50/51N: Trip signal tIN_3 stage (IN>>>): FUN<162>; INF<93>; COT<1,7>,<ADDR>*

46: Start / pick-up I2>; FUN<162>; INF <41>; COT<1,7>,<ADDR>

46: tI2> elapsed; FUN<162>; INF <182>; COT<1,7>,<ADDR>*

46: Trip signal tI2>; FUN<162>; INF<171>; COT<1,7>,<ADDR>*

46BC: Start / pick-up BrkCond; FUN<165>; INF <15>; COT<1,7>,<ADDR>

46BC: tBrkCond elapsed; FUN<165>; INF <49>; COT<1,7>,<ADDR>*

46BC: Trip signal tBrkCond; FUN<165>; INF<17>; COT<1,7>,<ADDR>*

CBF: CBF running; FUN<164>; INF <240>; COT<1,7>,<ADDR>*

CBF: Start tBF (Inp): FUN<165>; INF<20>; COT<1,7>,<ADDR>

CBF: tCBF elapsed: FUN<160>; INF<85>; COT<1,7>,<ADDR>*

CBF: Trip signal CBF: FUN<164>; INF<241>; COT<1,7>,<ADDR>*

CBF: Trip signal CBF: FUN<164>; INF<241>; COT<1,7>,<ADDR>*

AUX: Start AUX1: FUN<163>;INF <93>; COT<1,7>,<ADDR>

AUX: tAUX1 elapsed: FUN<163>;INF <94>; COT<1,7>,<ADDR>

AUX: Trip tAUX1: FUN<165>;INF <22>; COT<1,7>,<ADDR>*

AUX: Start AUX2: FUN<163>;INF <95>; COT<1,7>,<ADDR>

AUX: tAUX2 elapsed: FUN<163>;INF <96>; COT<1,7>,<ADDR>

AUX: Trip tAUX2: FUN<165>;INF <23>; COT<1,7>,<ADDR> *

AUX: Start AUX3: FUN<163>;INF <97>; COT<1,7>,<ADDR>

AUX: tAUX3 elapsed: FUN<163>;INF <98>; COT<1,7>,<ADDR>

AUX: Trip tAUX3: FUN<165>;INF <24>; COT<1,7>,<ADDR>*

AUX: Start AUX4: FUN<163>;INF <99>; COT<1,7>,<ADDR>

AUX: tAUX4 elapsed: FUN<163>;INF <100>; COT<1,7>,<ADDR>

AUX: Trip tAUX4: FUN<165>;INF <25>; COT<1,7>,<ADDR> *

FT_RC:System disturb. runn; FUN<162>; INF <241>; COT<1,7>,<ADDR>

FT_RC: Record. in progress; FUN<162>; INF <220>; COT<1,7>,<ADDR>

FT_RC: Start Distur. Recorder INP+COM; FUN<162>; INF <172>; COT<1,7>,<ADDR>

FT_RC: Trigger INP; FUN<162>; INF <22>; COT<1,7>,<ADDR>

Control indications in monitor direction:

CB monitoring : FUN<242>;INF <1>; COT<1, 7,11>,<ADDR>

NOTE: The value of CB monitoring DPI can have 4 stages:

DPI

<0000 0000> "Undefined / Between closed and opened"

<0000 0001> "opened"

<0000 0010> "closed"

<0000 0011> "Undefined / Faulty"

List of data contained in General Interrogation

It is given in the answer to the General Interrogation (GI).

Relay state information are Class 1 data, they are systematically sent to the master station, during a General Interrogation.

The list of processed data, following a General Interrogation, is given below: it is a sub-assembly of the spontaneous message list, so like spontaneous messages, these data are generated on rising and lowering edge.

Status indications (monitor direction):

Maintenance (Test) Mode Inp; FUN<162>; INF <157>; COT<9>,<ADDR>

Maintenance Mode (Test Mode): FUN<160>; INF<21>; COT<9> <ADDR>

Local Mode : FUN<160> ; INF<22> ; COT <9> <ADDR>

Relay Blocked/faulty (Hardware Warning); FUN<160>;INF <47>; COT<9>,<ADDR>

Setting Group number 1: FUN<160>;INF <23>; COT<9>,<ADDR>

Setting Group number 2: FUN<160>;INF <24>; COT<9>,<ADDR>

Auxiliary input AUX1: FUN<160>;INF <27>; COT<9>,<ADDR>

Auxiliary input AUX2: FUN<160>;INF <28>; COT<9>,<ADDR>

Auxiliary input AUX3: FUN<160>;INF <29>; COT<9>,<ADDR>

Auxiliary input AUX4: FUN<160>;INF <30>; COT<9>,<ADDR>

Auxiliary input AUX5: FUN<163>;INF <81>; COT<9>,<ADDR>

Auxiliary input AUX6: FUN<163>;INF <82>; COT<9>,<ADDR>

Input 1: FUN<163>;INF <160>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Input 2: FUN<163>;INF <161>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Input 3: FUN<163>;INF <162>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Input 4: FUN<163>;INF <163>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Input 5: FUN<163>;INF <164>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Input 6: FUN<163>;INF <165>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Input 7: FUN<163>;INF <166>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Input 8: FUN<163>;INF <167>; COT<9>,<ADDR>

(Presence of the voltage on the input terminals)

Logical output 1: FUN<249>;INF <1>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 2: FUN<249>;INF <2>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 3: FUN<249>;INF <3>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 4: FUN<249>;INF <4>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 5: FUN<249>;INF <5>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 6: FUN<249>;INF <6>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 7: FUN<249>;INF <7>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Logical output 8: FUN<249>;INF <8>; COT<9>,<ADDR>

(Logical state of the output - before Reverse Logic. Logical state of the output can differ from Physical state - terminals if Reverse Logic for this output is set)

Therm: Starting Itherm>: FUN<162>; INF<194>; COT<9>,<ADDR>

Therm: Thermal Alarm; FUN<162>; INF <226>; COT<9>,<ADDR>

Term: Block Itherm Inp; FUN<162>;INF <214>; COT<9>,<ADDR>

46 Blocking tI2> Inp; FUN<162>;INF <38>; COT<9>,<ADDR>

SOTF: Blocking tSOTF Ext (Inp); FUN< 165 >;INF < 34 >; COT<9>,<ADDR>

46BC Blocking tBrkCond Inp; FUN<165>;INF <35>; COT<9>,<ADDR>

AUX: Blocking tAUX1 Ext (Inp); FUN<165>;INF <36>; COT<9>,<ADDR>

AUX: Blocking tAUX2 Ext (Inp); FUN<165>;INF <37>; COT<9>,<ADDR>

AUX: Blocking tAUX3 Ext (Inp); FUN<165>;INF <38>; COT<9>,<ADDR>

ARC: CB drive ready Ext (Inp) : FUN<162>; INF<150>; COT<9>,<ADDR>

ARC: Blocked/Lockout FUN<162>; INF<185>; COT<9>,<ADDR>

(Blocked = Tempor.Block or Lockout or Block:CTRL or Block:Input or Disabled)

ARC: Enabled FUN<160>; INF<16>; COT<9>,<ADDR>

(Enabled = NOT(Block:CTRL or Block:Input or Disabled))

ARC: Reclaim time running; FUN<162>; INF<218>; COT<9>,<ADDR>

ARC: Blocking EXT (Inp); FUN<162>; INF<152>; COT<9>,<ADDR>

ARC: Reclosure successful; FUN<163>; INF<73>; COT<9>,<ADDR>

ARC: Reclosure final trip; FUN<165>; INF<40>; COT<9>,<ADDR>

ARC: Running; FUN<162>; INF<233>; COT<9>,<ADDR>

ARC: Dead time runn; FUN<162>; INF<236>; COT<9>,<ADDR>

ARC: Fast Trip Phase; FUN<165>; INF<41>; COT<9>,<ADDR>

ARC: Fast Trip Earth; FUN<165>; INF<42>; COT<9>,<ADDR>

ARC: Not ready; FUN<160>; INF<130>; COT<9>,<ADDR>

ARC: Ext./user enabled; FUN<162>; INF<144>; COT<9>,<ADDR>

(Ext./user Enabled = NOT(Block:CTRL or Block:Input))

ARC: Recloser Lockout; FUN<165>; INF<43>; COT<9>,<ADDR>

(Lockout: ARC internally blocked up to Signalling reset)

ARC: Recloser Rolling Demand Alarm; FUN<165>; INF<44>; COT<9>,<ADDR>

(too many of ARC cycles in settable monitoring window)

CB Status 52A Inp; FUN<163>; INF <253>; COT<9>,<ADDR>

CBM: CB Trip Number Diagnostic Alarm ; FUN<164>;INF <210>; COT<9>,<ADDR>

CBM: CB Trip Current Diagnostic Alarm; FUN<164>;INF <212>; COT<9>,<ADDR>

CBM: tCB FLT (faulty) Ext. Alarm; FUN<165>;INF <45>; COT<9>,<ADDR>

CBM: TCS Trip Curcuit Supervision Alarm; FUN<165>;INF <16>; COT<9>,<ADDR>

CBM: State of CB (not correct) ALARM; FUN<165>;INF <47>; COT<9>,<ADDR>

Fault Indications in monitor direction

General Start / pick-up I>, I>>, I>>>, SOTF, IN_1, IN_2, IN_3; FUN<160>;INF <84>; COT<9>,<ADDR>

Start / pick-up A; FUN<160>; INF <64>; COT<9>,<ADDR>

50/51: Start / pick-up B; FUN<160>; INF <65>; COT<9>,<ADDR>

50/51: Start / pick-up C; FUN<160>; INF <66>; COT<9>,<ADDR>

50/51: Start / pick-up N; FUN<160>; INF <67>; COT<9>,<ADDR>

Inrush restr. trig.; FUN<165>;INF <48>; COT<9>,<ADDR>

50/51: Start / pick-up I>: FUN<162>;INF <111>; COT<9>,<ADDR>

50/51: Blocking tI> Ext (Inp); FUN<162>;INF <32>; COT<9>,<ADDR>

50/51: Start / pick-up I>>: FUN<162>;INF <96>; COT<9>,<ADDR>

50/51: Blocking tI>> Ext (Inp); FUN<162>;INF <33>; COT<9>,<ADDR>

50/51: Start / pick-up I>>>: FUN<162>;INF <56>; COT<9>,<ADDR>

50/51: Blocking tI>>> Ext (Inp); FUN<162>;INF <82>; COT<9>,<ADDR>

SOTF: Start / pick-up SOTF: FUN<165>;INF <32>; COT<9>,<ADDR>

50/51N: Start / pick-up IN_1 stage (IN>): FUN<162>;INF <114>; COT<9>,<ADDR>

50/51N: Blocking t N_1 stage (IN>) Ext (Inp); FUN<162>;INF <83>; COT<9>,<ADDR>

50/51N: Start / pick-up IN_2 stage (IN>>): FUN<162>;INF <97>; COT<9>,<ADDR>

50/51N: Blocking t IN_2 stage (IN>>) Ext (Inp); FUN<162>;INF <84>; COT<9>,<ADDR>

50/51N: Start / pick-up IN_3 stage (IN>>>): FUN<162>; INF<57>; COT<9>,<ADDR>

50/51N: Blocking tIN_3 stage (IN>>>) Ext (Inp); FUN<162>;INF <85>; COT<9>,<ADDR>

46: Start / pick-up I2>; FUN<162>; INF <41>; COT<9>,<ADDR>

46BC: Start / pick-up BrkCond; FUN<165>; INF <15>; COT<9>,<ADDR>

CBF: Start tBF (Inp): FUN<165>; INF<20>; COT<1,7>,<ADDR>

AUX: Start AUX1: FUN<163>;INF <93>; COT<9>,<ADDR>

AUX: tAUX1 elapsed: FUN<163>;INF <94>; COT<9>,<ADDR>

AUX: Start AUX2: FUN<163>;INF <95>; COT<9>,<ADDR>

AUX: tAUX2 elapsed: FUN<163>;INF <96>; COT<9>,<ADDR>

AUX: Start AUX3: FUN<163>;INF <97>; COT<9>,<ADDR>

AUX: tAUX3 elapsed: FUN<163>;INF <98>; COT<9>,<ADDR>

AUX: Start AUX4: FUN<163>;INF <99>; COT<9>,<ADDR>

AUX: tAUX4 elapsed: FUN<163>;INF <100>; COT<9>,<ADDR>

FT_RC:System disturb. runn; FUN<162>; INF <241>; COT<9>,<ADDR>

FT_RC: Record. in progress; FUN<162>; INF <220>; COT<9>,<ADDR>

FT_RC: Start Distur. Recorder INP; FUN<162>; INF <172>; COT<9>,<ADDR>

FT_RC: Trigger; FUN<162>; INF <22>; COT<9>,<ADDR>

Control indications in monitor direction:

CB monitoring : FUN<242>;INF <1>; COT<9>,<ADDR>

NOTE: The value of CB monitoring DPI can have 4 stages:

DPI

<0000 0000> "Undefined / Between closed and opened"

<0000 0001> "opened"

<0000 0010> "closed"

<0000 0011> "Undefined / Faulty"

Processed Commands

System Commands:

Synchronization Command (ASDU 6): FUN<255>,INF <0>; TYP <6>;COT<8>

This command can be sent to a specific relay, or global. The time sent by master is the time of the first bit of the frame. The relay synchronizes with this time, corrected by the frame transmission delay. After updating its time, the relay send back an acknowledge to the master, by giving its new current time.

This acknowledge message will be an event of ASDU 6 type.

General Interrogation Initialization command (ASDU 7):

FUN<255>;INF <0>;TYP <7>; COT<9>

This command starts the relay interrogation:

The relay then sends a list of data containing the relay state (see list described above).

The GI command contains a scan number which will be included in the answers of the GI cycle generated by the GI command.

If a data has just changed before extracted by the GI, the new state is sent to the master station.

When an event is generated during the GI cycle, the event is sent in priority, and the GI cycle is temporarily interrupted. The end of the GI consists in sending an ASDU 8 to the master station.

If, during a General Interrogation cycle, another GI Initialization command is received, the precedent answer is stopped, and the new GI cycle started.

General Commands (ASDU 20) (Control direction): Availability

LED Reset and Sign. reset:
This command reset LEDs, signaling:
FUN<160>;INF<19>, TYP<20>, COT <20>,<ADDR>

In LED Reset control command the allowed value is:

DCO <0000 0010> "Reset"

Output Reset:
This command reset Latched Outputs:
FUN<162>;INF<46>, TYP<20>, COT <20>,<ADDR>

In Latched Outputs Reset control command the allowed value is:

DCO <0000 0010> "Reset"

Setting group number 1: FUN<160>;INF<23>, TYP<20>, COT <20>,<ADDR>

In Setting group number 1 control command the allowed value is:

DCO <0000 0010> "Set Group 1”

Setting group number 2: FUN<160>;INF<24>, TYP<20>, COT <20>,<ADDR>

In Setting group number 2 control command the allowed value is:

DCO <0000 0010> "Set Group 2”

Order Command 1: FUN<249>;INF <129>; COT<20>,<ADDR>

In Order Command 1 control command the allowed value is:

DCO <0000 0001> “OFF”

DCO <0000 0010> “ON”

Order Command 2: FUN<249>;INF <130>; COT<20>,<ADDR>

In Order Command 2 control command the allowed value is:

DCO <0000 0001> “OFF”

DCO <0000 0010> “ON”

Reset Latched Signaling and Outputs : FUN<249>;INF <131>; COT<20>,<ADDR>
Note: *Reset Latched Signaling and Outputs* is used for command and indication (see: ***Status indications in monitor direction Type Identification***).

Reset via RS485 the allowed value is:

DCO <0000 0001> “OFF”

DCO <0000 0010> “ON”

CB control Open command : FUN<242>;INF <65>; TYP <20>; COT<20>,<ADDR>

In CB control command the DCO allowed values are:

DCO <0000 0001> “OFF”: "Close CB"

<0000 0010> “ON”: "Open CB"

CB control Close command FUN<242>;INF <66>; TYP <20>; COT<20>,<ADDR>

In CB control command the DCO allowed values are:

DCO <0000 0001> “OFF”:"Open CB"

<0000 0010> “ON”: "Close CB"

ARC: Enabled FUN<160>; INF<16>; COT<20>,<ADDR>

Note: ARC: Enabled is used for command and indication (see: ***Status indications in monitor direction Type Identification***).

In ARC: Enabled command the DCO allowed values are:

DCO <0000 0001> "OFF"

<0000 0010> "ON"

General commands are processed according to clause 7.4.4 of IEC 60870-5-103.

After executing one of these commands, the relay sends an positive or negative acknowledge message, which contains the result of command execution.

If a state change is the consequence of the command, it must be sent in a ASDU 1 with COT 12 (remote operation).

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If the relay receives another command message from the master station before sending the acknowledge message for the previous command, it will be discarded and a negative acknowledge message will be sent.

Commands which are not processed by the relay are rejected with a negative acknowledge message.

Relay re initialization

In case of relay re initialization, the relay send to the master station:

A message indicating relay start/restart (FUN<160>;INF <5>; TYP <5> COT <5>) or a message indicating Reset CU (FUN<160>;INF <5>; TYP <3> COT <4>) or a message indicating Reset FCB (FUN<160>;INF <5>; TYP <2> COT <3>)

Manufacturer name and software indentification see 0

Cyclic Messages (ASDU9 and ASDU3)

Only measurements can be stored in these messages.

The measured values are stored in lower levels of communication, before polling by master station.

Ia, Ib, Ic are transmitted with ASDU 9 (FUN<160>,INF<148>).

IN is transmitted with ASDU 3(FUN<160>,INF<147>).

All other measurments are unused in ASDU 3 and ASDU 9.

The values are stored with a rate of 2,4 * nominal value = 4096.

Thermal Overload value is transmitted with ASDU 3 (FUN<162>,INF<23>).

Scalling: 1% * value (range: 0-200)

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FIRMWARE AND SERVICE MANUAL VERSION HISTORY

Date: **1st July 2015**

Connection Diagrams: **10V11F01**

Relay type: V11F						
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**Technical Documentation**
Major	Minor					
1	E	A	July 2015	1. Rebranding name of the relay from MiCOM P111Enh on VAMP 11F	MiCOM S1 Studio 5.1.0	V11F_EN_M_3.1

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