

NUMERICAL POWER SUPPLY MONITORING RELAY ARM30 [AN+ SERIES]



USER MANUAL



**ALUMINIUM INDUSTRIES LIMITED
RELAYS DIVISION, THIRUVANANTHAPURAM**

ARM30

Numerical Power Supply Monitoring Relay

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SAFETY REQUIREMENTS

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INTRODUCTION

Before using this product, be sure to read this chapter carefully.

This chapter describes safety precautions when using the relay. Before installing and using the equipment, read and understand this chapter thoroughly.

It's not a secret – electricity can be dangerous and when things go wrong lives can be at stake!

Electrical engineers are Industrial safety doctors, so it's our duty to keep employees health and maintain a quality of life that we all deserve by providing safe work practices to avoid electrical accidents.

How much electricity is dangerous?????

| CURRENT | EFFECT |
|-------------|---|
| 0.5 – 3mA | Tingling sensations |
| 3 – 10mA | Muscle contractions (painful) |
| 10 – 40mA | "can't let go" phenomena |
| 40 – 75mA | Respiratory paralysis (possibly fatal) |
| 75 – 200mA | Ventricular fibrillation (likely fatal) |
| 200 – 500mA | Heart clamps tight |
| >1.5A | Tissue and organs began to burn |

Fact: A 15 amp circuit breaker was designed to protect equipment – not people!

The relay is developed with zero percentage of risk factor by its own design. The current carrying paths and circuits are isolated from the metal case and structure. Suitable clearance depending on the type of insulation required for different classes are provided.

The relay confirms to Product safety requirement standard IEC 60255-27.

HEALTH AND SAFETY

It deals with the handling of relay in proper way. An individual to be considered as 'qualified' with regard to certain equipment in the workplace, but 'unqualified' as to other equipment. "An employee, who is undergoing on the job training and who, in the course of such training, has demonstrated the ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person also considered to be a qualified person for the performance of those duties."

The following requirements must be met, in the order given, before circuits or equipments are re-energized, even temporarily.

- ✚ People handling the equipment should be aware about the relay safety handlet.
- ✚ Ensure that the product is in the off condition before working on the conducting or terminal side.
- ✚ A qualified person must conduct tests and visual inspections, as necessary, to verify that tools electrical jumpers, shorts, grounds and other such devices have been removed, so that the circuits and equipment can be safely re-energized.
- ✚ Employees exposed to the hazards associated with re-energizing the circuit or equipment must be warned to stay clear of the circuits and equipment.
- ✚ Each lock and tag must be removed by the employee who applied it or someone else under that employee's direct supervision.
- ✚ A visual determination that all employees are clear of the circuits and equipments must be made.

For any queries related to relays, feel free to contact ALIND.

SYMBOLS AND LABELS USED IN THE RELAY

1. FRONT SIDE



Caution: refer to equipment documentation



Caution: risk of electric shock



Caution: Over voltage Cat.III

2. REAR SIDE

**WARNING**

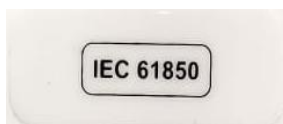
1. No user serviceable components inside.
2. Refer servicing to authorized personnel.



Protective Conductor (*Earth) terminal
Functional/Protective Conductor (*Earth) terminal.



CMOS Battery provided for the RTC (Real Time Clock) purpose.
Confirm polarity of the battery while replacing.



IEC 61850 sticker

WARNING**Current transformer circuit**

Never allow the current transformer (CT) secondary circuit connected to this equipment to be opened while the primary system is live. Opening the CT circuit will produce a dangerous high voltage.

**Exposed terminals**

Do not touch the terminals of this equipment while the power is on, as the high voltage generated is dangerous.

**Residual voltage**

Hazardous voltage can be present in the DC circuit just after switching off the DC power supply. It takes about 30 seconds for the voltage to discharge.

CAUTION**Earth**

Earth the earthing terminal of the equipment securely.

**Operation conditions**

Use the equipment within the range of ambient temperature, humidity and dust as detailed in the specification and in an environment free of abnormal vibration.

**Ratings**

Before applying AC voltage and current or DC power supply to the equipment, check that they conform to the equipment ratings.

**Printed circuit board**

Do not attach and remove the printed circuit board while the DC power to the equipment is on, as this may cause the equipment to malfunction.

**External circuit**

When connecting the output contacts of the equipment to an external circuit, carefully check the supply voltage used and prevent the connected circuit from overheating.

**Connection cable**

Carefully handle the connection cable without applying excessive force.



Modification

Do not modify this equipment, as this may cause the equipment to malfunction, and in any such cases, warranty may be affected.

DECOMMISSIONING 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, the capacitors should be safely discharged via the external terminals prior to de-commissioning.



Disposal

When disposing of this equipment, do so in a safe manner according to local regulations. It is recommended that incineration and disposal to water courses is avoided. Ensure the relay is in de-energized condition and take precautions to avoid short circuits.

TECHNICAL SPECIFICATIONS FOR SAFETY

1. Protective class

| | | |
|-------------------|---------|--|
| IEC 60255-27:2005 | Class I | (This equipment requires a protective conductor (earth) connection to ensure user safety.) |
|-------------------|---------|--|

2. Environment

| | | |
|-------------------|--------------------|--|
| IEC 60255-27:2005 | Pollution degree 2 | (Normally only non-conductive pollution occurs except occasionally a temporary conductivity caused by condensation is to be expected.) |
|-------------------|--------------------|--|

3. Overvoltage Category

| | | |
|-------------------|--------------|---|
| IEC 60255-27:2005 | Category III | (The auxiliary energizing circuits of the equipment are connected to a common battery, common mode transient voltages of a relatively high value may appear on the supply leads, and differential mode voltages may arise from switching in other circuits connected to the same battery source.) |
|-------------------|--------------|---|

4. Contact data

Test voltage across open contact: 1 kV DC for 1 min source.

INTRODUCTION

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AN SERIES DESCRIPTION

PREVIOUS HISTORY OF SUPPLY MONITORING RELAYS

BRIEF DESCRIPTION OF ARM30

MAIN FUNCTIONS

GENERAL FUNCTIONS

AN+ SERIES (ALIND NUMERICAL SERIES)

- ❖ Advanced Digital Fourier Transform based Numerical algorithm design using 32-bit Digital Signal Controller.
- ❖ Compact Construction covering several protection modules viz Over Current Protection, Earth Fault/ Restricted Earth Fault protection along with Trip Circuit supervision in single module thus saving panel space.
- ❖ Display of protection acted, fault current, fault clearing time, fault date & time of latest 200 faults at Relay LCD.
- ❖ Man-Machine Communication through 20x4 character LCD display.
- ❖ Self-supervision of both hardware and software units.
- ❖ Interface ability with SCADA through IEC 60870-5-103 & IEC 61850 communication protocol
- ❖ Facility for storing fault waveforms (Disturbance recorder) and events with date and time stamping. At a time, a total of 5000 events and 200 latest fault waveform (Disturbance recorder) will be stored in the relay.
- ❖ Graphical User Interface for Harmonic analysis, DC analysis and di/dt analysis can be done on the uploaded fault waveforms with facility for report generation.
- ❖ Facility to access/modify the relay settings both online as well as through menu in local PC
- ❖ Relay Indication (LED) reset from RCC
- ❖ IP 54 grade enclosure protection.
- ❖ SNTP (Simple Network Time Protocol) & optional GPS based IRIG -B time code standard Synchronization Facility.
- ❖ Online HV current & LV current display on relay LCD.
- ❖ Settable CT ratios.
- ❖ Relay operation Counter

PREVIOUS HISTORY OF SUPPLY MONITORING RELAYS**TAR 6E**

Static Type

ADCM

Numerical DC monitoring relay

Disturbance & event recorder

Built in counter facility

APSM

Numerical AC & DC Monitoring relay

Disturbance & event recorder

Built in counter facility

ANSM

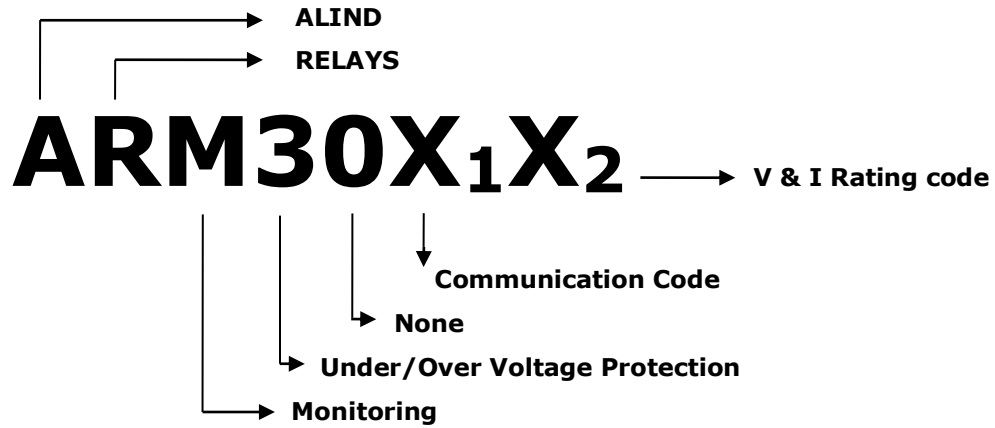
Numerical AC & DC Monitoring relay

Disturbance & event recorder

Built in counter facility

IEC 60870-5-103 communication

Designed as per RDSO specification no. TI/SPC/PSI/PROTCT/7101 and 6072.



| Protection naming codes | |
|-------------------------|---------------------------------|
| 0 | None |
| 1 | Panto Flash Over Protection |
| 2 | Distance Protection |
| 3 | Under/Over Voltage Protection |
| 4 | Current Unbalance Protection |
| 5 | Over Current Protection |
| 6 | EF/REF Protection |
| 7 | Delta I Protection |
| 8 | Current Differential Protection |
| 9 | Voltage Unbalance Protection |
| M | Monitoring |

| Communication naming codes- X ₁ | |
|--|--|
| A | IEC 60870-5-103 |
| B | IEC 60870-5-103 + IEC61850 (RJ45) |
| C | IEC 60870-5-103 + IEC61850 (LC) |
| D | IEC 60870-5-103 + IEC61850 (Redundant RJ45) |
| E | IEC 60870-5-103 + IEC61850 (Redundant LC) |
| F | IEC 60870-5-103 + IEC61850 (Redundant RJ45) + IRIG B |
| G | IEC 60870-5-103 + IEC61850 (Redundant LC) + IRIG B |
| H | IEC 60870-5-103 + IRIG B |
| I | IEC 60870-5-103 + IEC61850 (RJ45) + IRIG B |
| J | IEC 60870-5-103 + IEC61850 (LC) + IRIG B |

| V & I Rating codes-X ₂ | |
|-----------------------------------|------------------|
| 1 | 1A CT |
| 2 | 110V AC& 1A |
| 3 | 110V AC& 5A |
| 4 | 230V AC& 110V DC |
| 5 | 5A CT |
| 6 | 100AC& 1A |
| 7 | 100AC& 5A |
| 8 | 100AC |
| 9 | 110V AC |

ARM30:

The relay conforms to RDSO specification no. TI/SPC/PSI/PROTCT/7101 & 6072.

ARM30 (AN+ Series) relay is a comprehensive AC & DC Supply Monitoring relay for the 25 KV & 2X25 KV AC traction System

MAIN FUNCTIONS

| SI No. | PARTICULARS. | ARM30 |
|-----------|-------------------------|-------|
| 1. | MAIN PROTECTIONS | |
| 1.1 | DC Under Voltage trip | ✓ |
| 1.2 | DC Under Voltage Alarm | ✓ |
| 1.3 | DC Over Voltage Alarm | ✓ |
| 1.4 | AC Under Voltage Alarm | ✓ |
| 1.5 | AC Over Voltage Alarm | ✓ |
| 1.6 | Relay Error | ✓ |
| 2. | STATUS INPUTS | |
| 2.1 | RCC RESET | ✓ |
| 2.2 | TIME SYNC | ✓ |

GENERAL FUNCTIONS

| SI No. | PARTICULARS | ANSM 022 |
|-----------|---|----------|
| 1. | Password protection | ✓ |
| 2. | Event Memory | 5000 |
| 3. | Disturbance recorder waveforms | 200 |
| 4. | 50 cycles (45 pre and 5 post fault) of fault waveform | ✓ |
| 5. | COMMUNICATION | |
| 5.1 | GUI Interface | RJ45 |
| 5.2 | Isolated RS 485 Interface | ✓ |
| 5.3 | Communication Protocol Interface- IEC 60870-5-103 & IEC 61850 | ✓ |
| 5.4 | GPS Time Sync Facility through IRIG-B (optional) | ✓ |
| 5.5 | Date/time synchronization through PC | ✓ |
| 5.6 | Relay programming through front RJ 45 port | ✓ |
| 6. | MONITORING | |
| 6.1 | DC Voltage (Vdc) | ✓ |
| 6.2 | AC Voltage (Vac) | ✓ |
| 6.3 | Counters for each element (DC,AC) | ✓ |
| 7. | USER INTERFACE | |
| 7.1 | Test facility in Relay setting Mode (offline) | ✓ |
| 7.2 | Compact Module | ✓ |
| 7.3 | Plug In Type | ✓ |

HANDLING INSTALLATIONS & CASE DIMENSIONS

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HANDLING OF RELAY

STORAGE

RELAY AND RACK MOUNTING

CASE DIMENSIONS

HANDLING OF RELAY

Protective relays generally of robust construction require careful treatment prior to installation on site. Care must be taken when unpacking and installing the relays so that none of the parts are damaged. Relays must be handled by skilled personnel. The following should be taken into account while handling the relay:

- ✦ The relay use components that are sensitive to electrostatic discharges. The relay comprises of various semi-conductor devices which can damage if touched by means of direct contact. Handle the cards in static free environment since electrostatic discharge can affect performance of the relay or cause damage to the cards.
- ✦ The electronic circuits are well protected by the metal case and the internal module should not be withdrawn unnecessarily.
- ✦ The relay is normally shipped in separately packed condition. After unpacking, see if there is any mechanical damage to the cabinet, the nameplate, terminal blocks etc. Damage of any such sort identified shall be intimated to works.
- ✦ Avoid plugging in/ pulling out the cards when the power is ON.
- ✦ If the cards are withdrawn for testing, ensure proper positioning while replacing.
- ✦ Keep the relays in well-packed condition in a dust-free dry environment without direct exposure to sunlight.

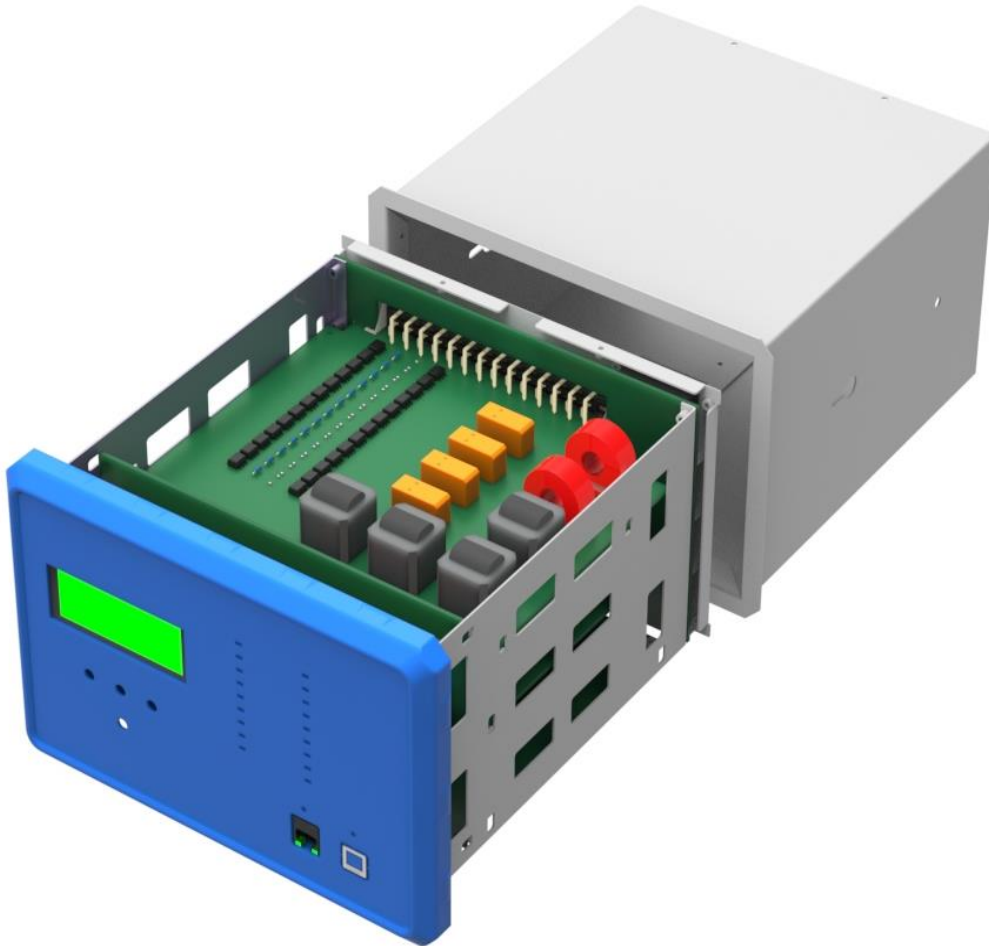
The relay is shipped from factory after detailed testing by our Quality Control Department. However, according to the customer requirement the relay settings/ functions can be verified before commissioning at respective sites with proper testing kits.

STORAGE

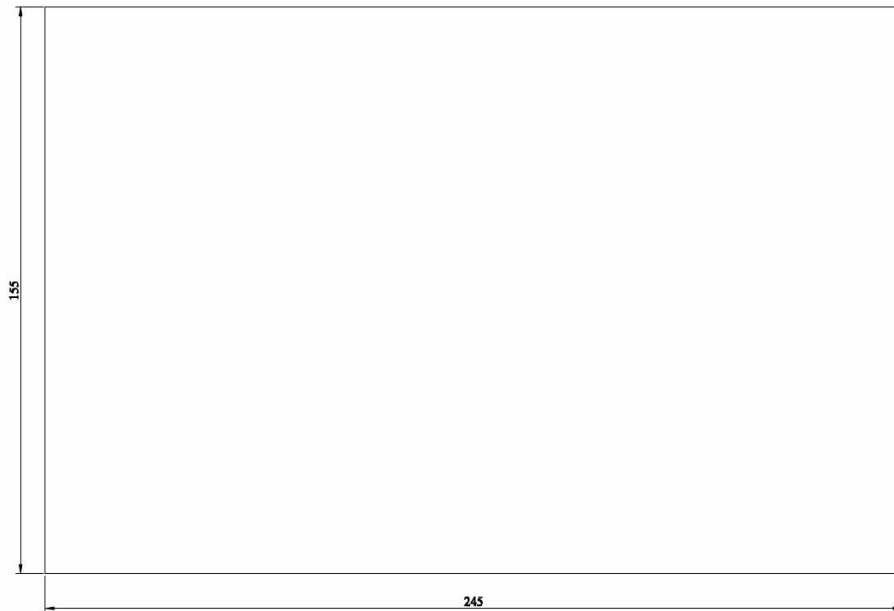
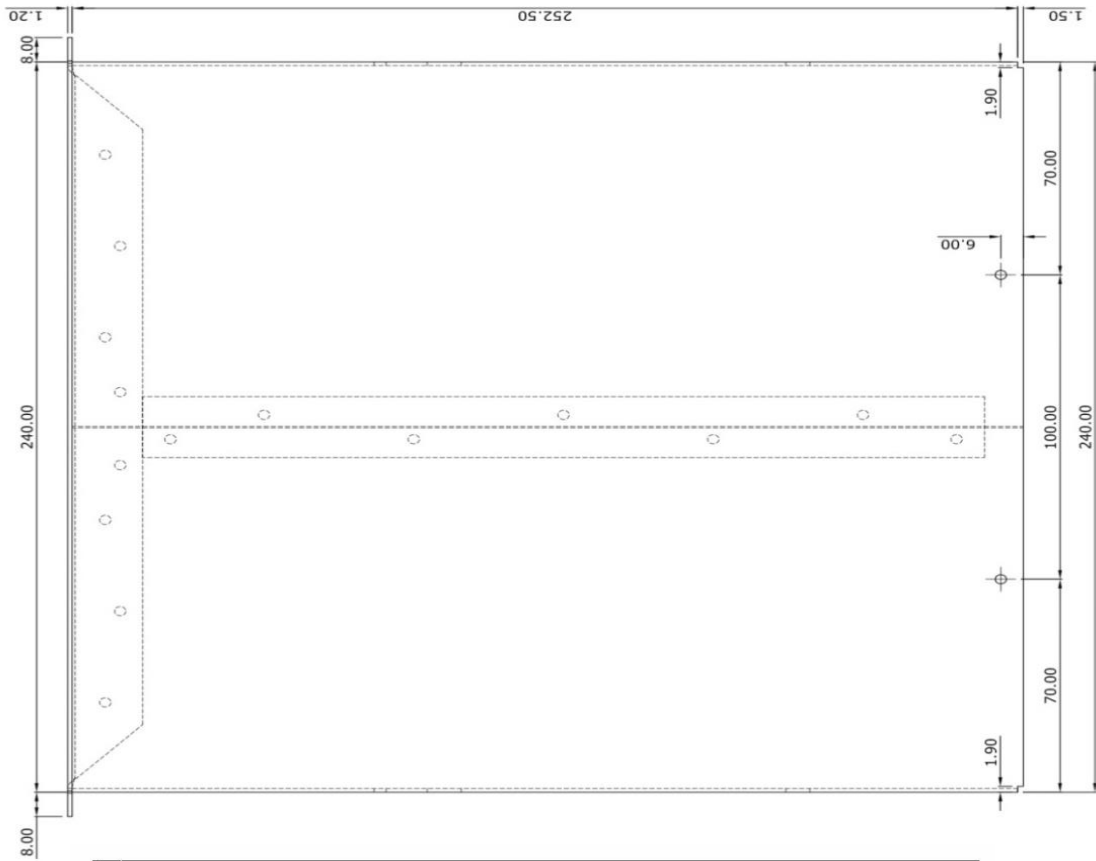
If relays are not to be installed immediately upon receipt they should be stored in a place free from dust and moisture in their original boxes. At most care should be taken while storage.

Storage temperature: -25°C to +55°C.

RELAY AND RACK MOUNTING



CASE DIMENSIONS



CUT OUT DETAILS

USER GUIDE

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FRONT PANEL INDICATIONS

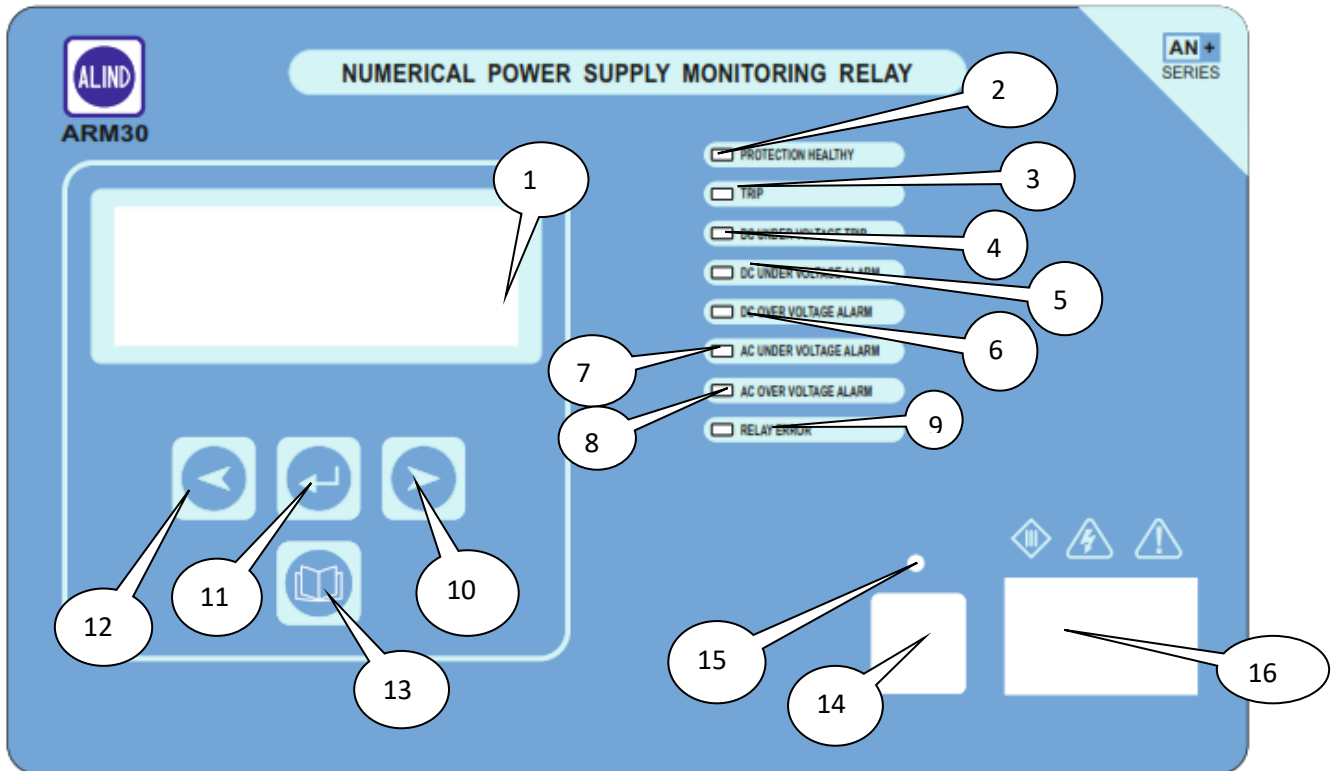
INTERNAL ARCHITECTURE AND BLOCK DIAGRAM

ENERGIZING THE RELAY

PCB DESCRIPTION

RELAY SETTINGS AND ALGORITHM

FRONT PANEL INDICATIONS



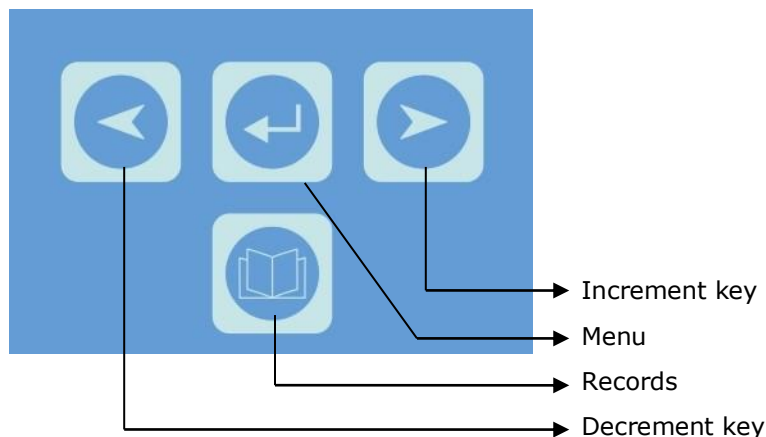
| | Legend | ANSM 022 |
|-----|----------------------------------|----------|
| 1. | LCD DISPLAY | ✓ |
| 2. | PROTECTION HEALTHY (Green/Amber) | ✓ |
| 3. | TRIP (RED) | ✓ |
| 4. | DC Under Voltage Trip (RED) | ✓ |
| 5. | DC Under Voltage Alarm(RED) | ✓ |
| 6. | DC Over voltage Alarm (RED) | ✓ |
| 7. | AC Under Voltage Alarm (RED) | ✓ |
| 8. | AC Over Voltage Alarm (RED) | ✓ |
| 9. | Relay Error (Red) | ✓ |
| 10. | > | ✓ |
| 11. | ← | ✓ |
| 12. | < | ✓ |
| 13. | RECORDS | ✓ |
| 14. | RJ45 | ✓ |
| 15. | H.RST | ✓ |
| 16. | NAME PLATE | ✓ |

LCD DISPLAY

A 20 x 4 LCD display is provided for easy viewing of parameters, relay settings, fault event records, date& time, error counter etc. The display backlit can be made ON by pressing any push button key and the display backlit ON time is settable.

Navigation Keys

The relay is provided with four switches.



Menu key

- * Main key for entering relay setting mode.
- * If you want to select anything in the setting mode, we can use this key.
- * To reset the relay from tripping mode.

Increment key

- * If you want to raise any particular setting, we can use this option.
- * For saving any particular changes in the relay, you can hire this key.
- * For viewing new options in the relay, we can use this key.

Decrement key

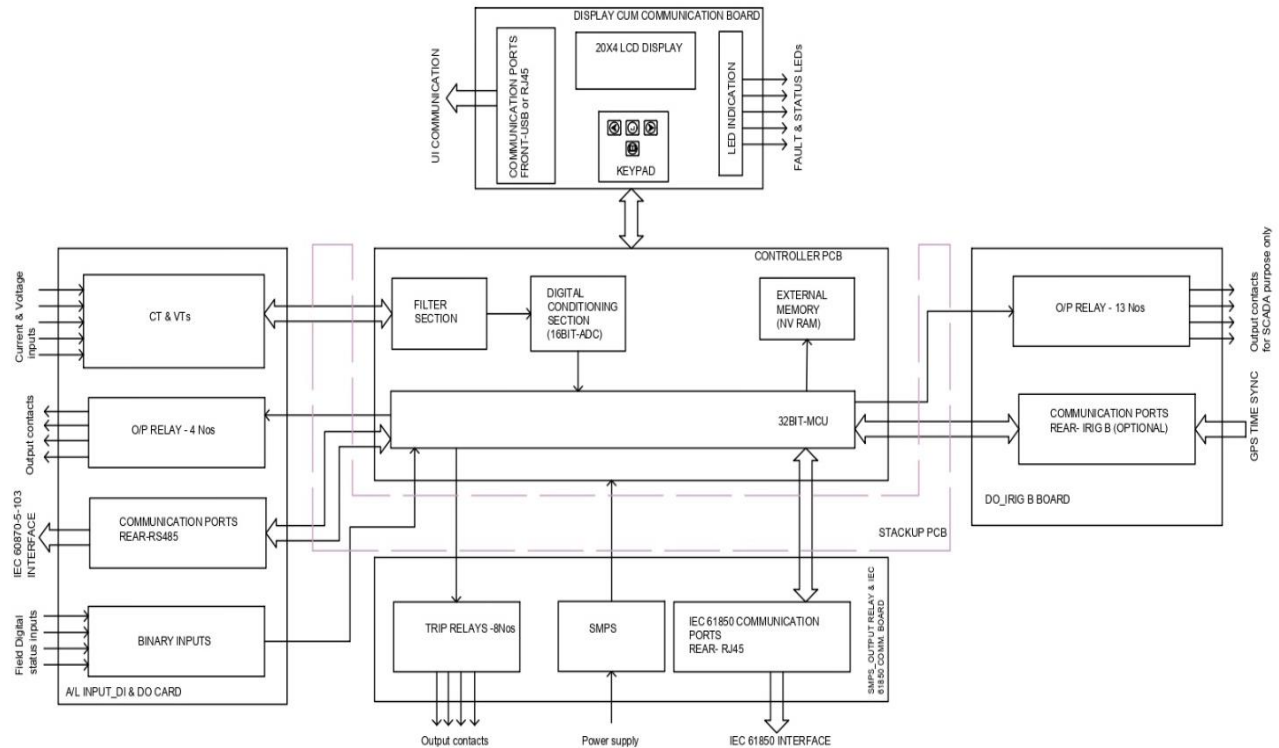
- * If you want to lower any particular setting, we can use this option.
- * No need to save any unwanted mistakes in the relay you can use this key.
- * If you want to verify any previous settings in the relay, you can opt this key.

Records key

- * If you want to check the logs and data stored in the relay memory, you can use this key.

INTERNAL SYSTEM LEVEL ARCHITECTURE

The internal system level architecture of relay including card to card architecture in brief is shown below.



1. DSP Controller

The 32bit MCU (Digital Signal Controller) machine that combines the control advantages of a high-performance 32-bit microcontroller with the high computation speed of a fully implemented Digital Signal Processor (DSP).

The MCU controller continuously monitors the currents. Based on this the controller performs different calculations and whenever an abnormal condition occurs it distinguishes the type of fault and issues trip command to the circuit breaker.

2. Data Acquisition

The Current signals are scaled and isolated using Current Transformer (CT). These isolated analog signals are filtered to minimize the effects of electromagnetic interference and noise in the high frequency range.

The analog signals are then fed to the Analog to Digital Converter which has a 16 bit resolution. The DSP controller will take the 32 samples per cycles of Current for the computational purpose. If any fault occurs the parameters will be stored in to the non-volatile memory with date and time stampings and this can be downloaded for further analysis in the disturbance recorder.

3. Power Supply Module

This module gives the necessary regulated voltages like +5V, -5V, and +24V to various cards in the module. The normal operating voltage range is 45 VDC to 170 VDC. The +24V is used for driving the output relays in the I/O card and O/P relay card. The +5V and -5V is supplied to the processor, I/O card and Display PCB for normal relay operations. The isolated +5V is dedicated to the communication ports of the relay.

4. Communication Module

The relay is having three communications port, Front port: RJ45, Rear port: ETHERNET & RS485. The relay is using IEC 60870-5-103 & IEC 61850-communication protocol for communication through RS485 & ETHERNET.

Front Port:

1) Communication Port

RJ 45 port shall be provided for uploading/downloading relay settings and events.

Rear Port:

a) RS 485 Communication Port

RS 485 port shall be provided for SCADA connectivity. Using RS485 port fault online data of critical parameters, disturbance record, and event record (Trip data) etc shall be downloaded. The communication protocol shall comply to IEC 60870-5-103 protocol.

b) Ethernet Communication Port

Ethernet port shall be provided for IEC 61850 connectivity. Using Ethernet port fault online data of critical parameters, disturbance record, event record (Trip data) etc. shall be downloaded. SNTP time synchronization is possible through the same. Ethernet port can either be copper/fiber depending upon the tender requirement.

5. Man Machine Interface

Man Machine Interface is through a 20x4 LCD display and keys in the front panel of the relay. Necessary LEDs are provided in front panel for indicating the operation of different element.

6. Disturbance Recorder

The relay has the facility to record 50 cycles (45 pre-fault and 5 post faults) of fault waveforms. Latest 200 waveforms of Current can be stored in the relay. This data is retrievable through front and rear communication ports using UI software and SCADA respectively.

7. Event Recorder & Disturbance Recorder

The relay is capable of storing 5000 number of events with date and time stamping of 1ms accuracy. The event data comprise of:

Tripping of different protection elements (I, Fault clearing time, Fault date & time)

Trip circuit supervision

Relay pick up

Relay reset

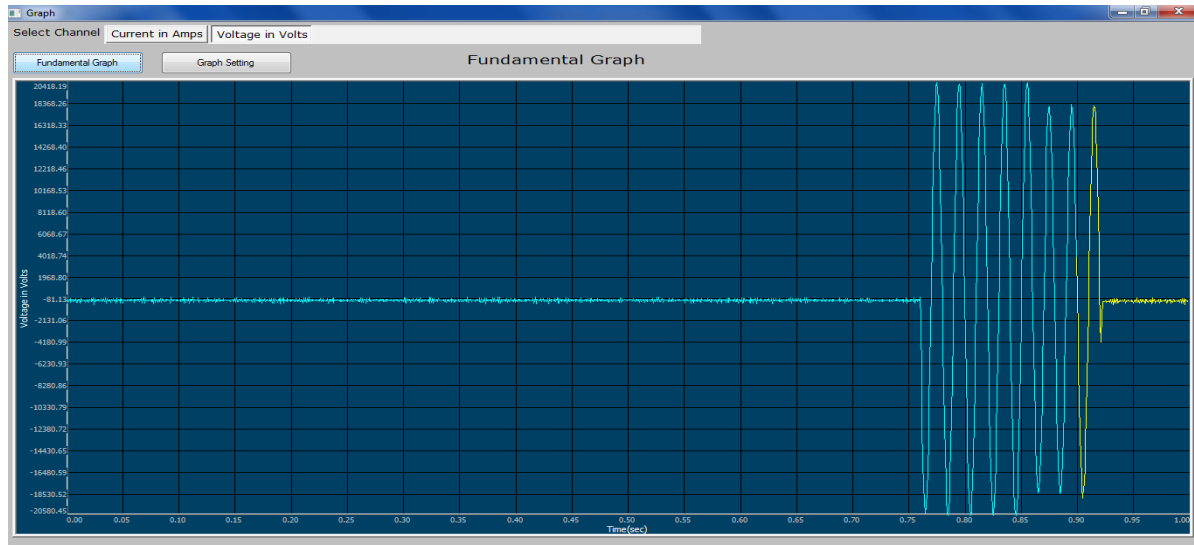
CB Trip

CB Close

Change of status input

Relay setting changed (GUI & Keypad)

Relay Error.



ENERGIZING THE RELAY

1. Before turning ON the relay, proper earthing should be provided.
2. Visual Inspection for any physical damage in housing, display etc. shall be checked.
3. Operating voltage range: **45 to 170 VDC**. Rated Operating voltage: **110 V DC**.
4. Prefer regulated power supply of 110VDC.
5. Auxiliary power supply shall be provided to the corresponding terminals with the help of an MCB.
6. Switch on the power supply. Measure the voltage between the corresponding terminals and ensure that the voltage is within the normal operating range.
7. After the relay is powered ON, the following shall be noticed.

Protection healthy LED glow green in color which indicates that the relay is functioning OK, otherwise it goes amber.

PCB DESCRIPTION

The relay comprises of the following hardware.

Main PCBs. –Display PCB, Controller PCB, Stack PCB, status & CT, PT PCB, SMPS & trip relay PCB, Tele Annu PCB, Back panel PCB

Display cum Communication PCB (640 261): The Display PCB is mounted at the front plate of the unit. It consists of the 20x4 LCD, LED indications, Keyboard circuits, LED controller and front RJ 45 communication port.

Controller PCB (640 262): The Controller PCB is mount on the backside of the Display PCB. This PCB consists of major components such as DSP controllers, ADC and its filter circuits, Memory ICs, RTC etc. The Analog signal get filtered and digitized in this board. The DSP takes decision based on this digital samples and initiates necessary commands.

Stack PCB (640 263): Internal communications between the PCB's are ensured with the help of stack PCB.

Status & CT,PT PCB (640 264): All the CTs, PTs and Input status lines are assembled in this board. IEC 60870-5-103 communication port also provided in this PCB.

SMPS & Trip Relay PCB (640 265): The SMPS PCB provides the necessary Power supply voltages to the different PCBs mounted inside the relay. The SMPS provides +24V, +5V, -5V and isolated +5 V. The +24 V supply is used for the driving the output relays. The +5V and -5V is supplied to the controller PCB, Display PCB, and I/O PCB for normal operations. The isolated +5V is dedicated to the communications ports of the relay.

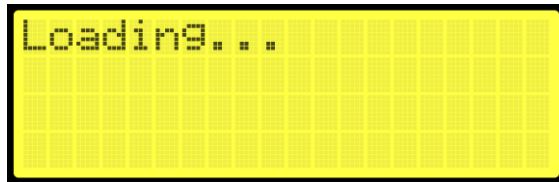
This board (trip relay PCB) will give necessary trip commands to the master trip relay or breaker, which is installed in the yard. Necessary relay initiating signals are wired to these output relays from the Controller Board.

Tele Annu PCB (640 266): All the Telesignalling output circuits are assembled in this PCB. IRIG B circuit also provided in this PCB.

Back Panel PCB (640 267): This PCB consists of terminal blocks for external interface with the site and power connectors, which connects SMPS, I/O and CT PT PCB's. The RS 485 port is also mounted in this PCB. The terminal block (TB-A) is having CT shorting facility. Since the rack with Terminal Blocks is having the CT shorting facility, the relay can be withdrawn.

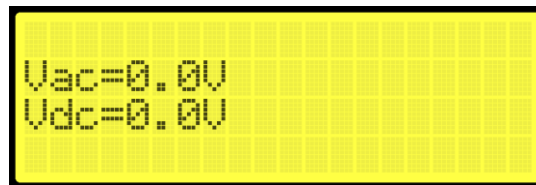
RELAY ONLINE DISPLAY PARAMETERS

After Power ON, the relay boot screen shows



Then comes the online parameter display

Window:



Setting Mode

Press and hold **↵** for 5 seconds

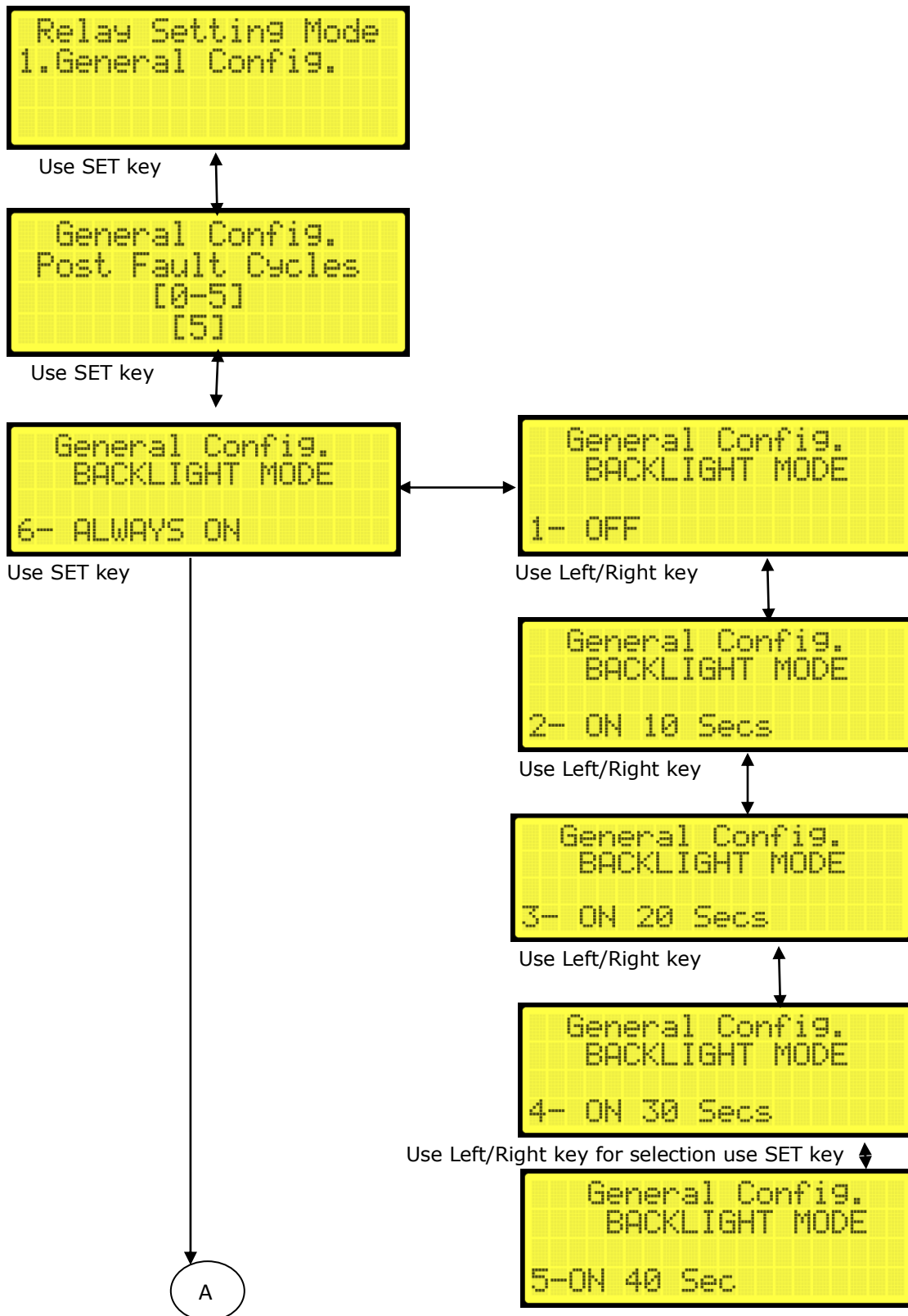
Relay will enter to setting mode.

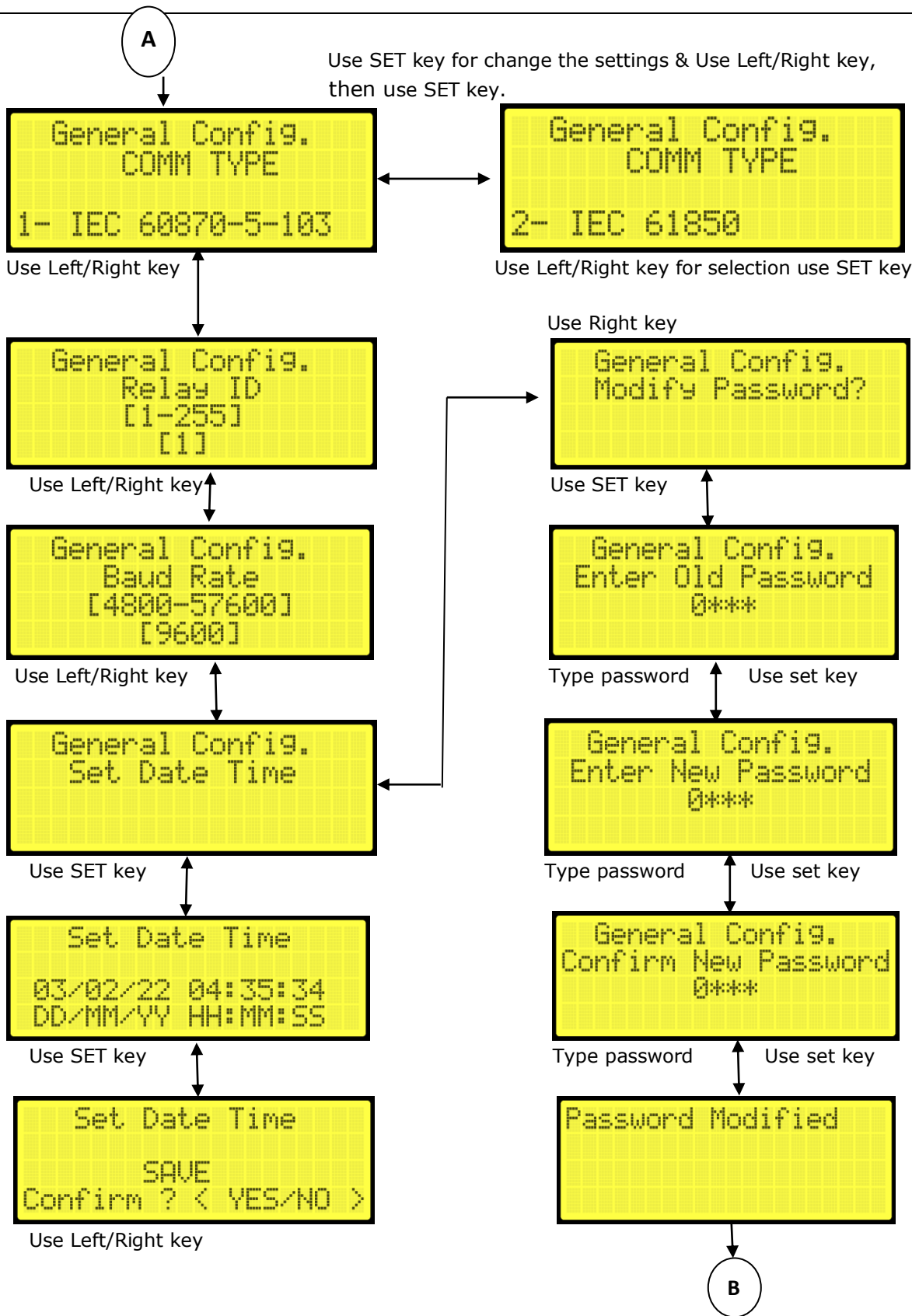
Enter the password and press **↵** key. The default password setting is '1000'

To change settings:

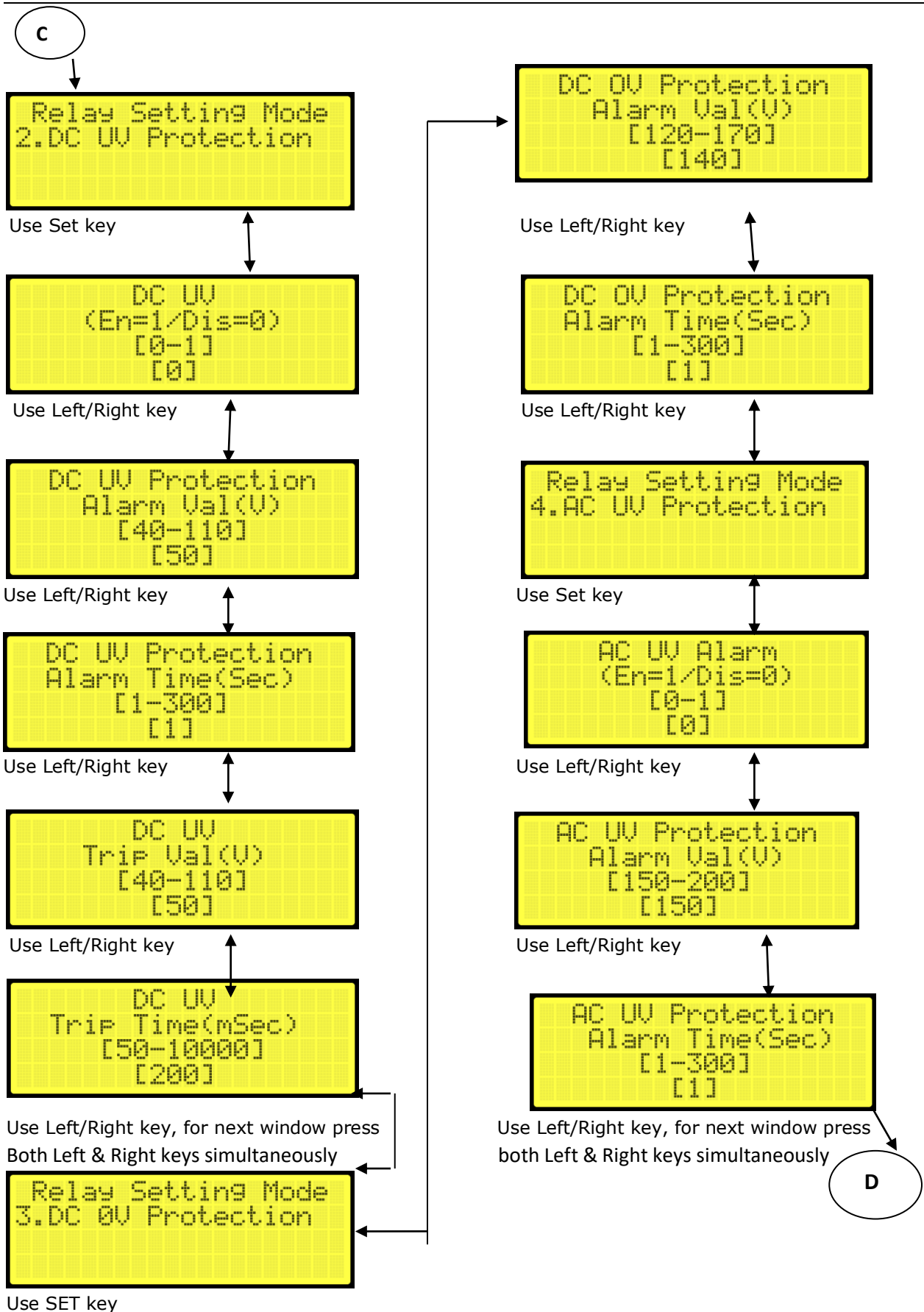
- Press **↵** to change the settings.
- Press **Right** key to increment
- Press **Left** key to decrement
- Press **↵** to accept change.
- To coming back to main **MENU** while operating, press **Left** and **Right** key simultaneously.
- Repeat the process for all settings
- After completing the settings, the relay shows the message '**SETTINGS UPDATED**' and returns to the operating mode.

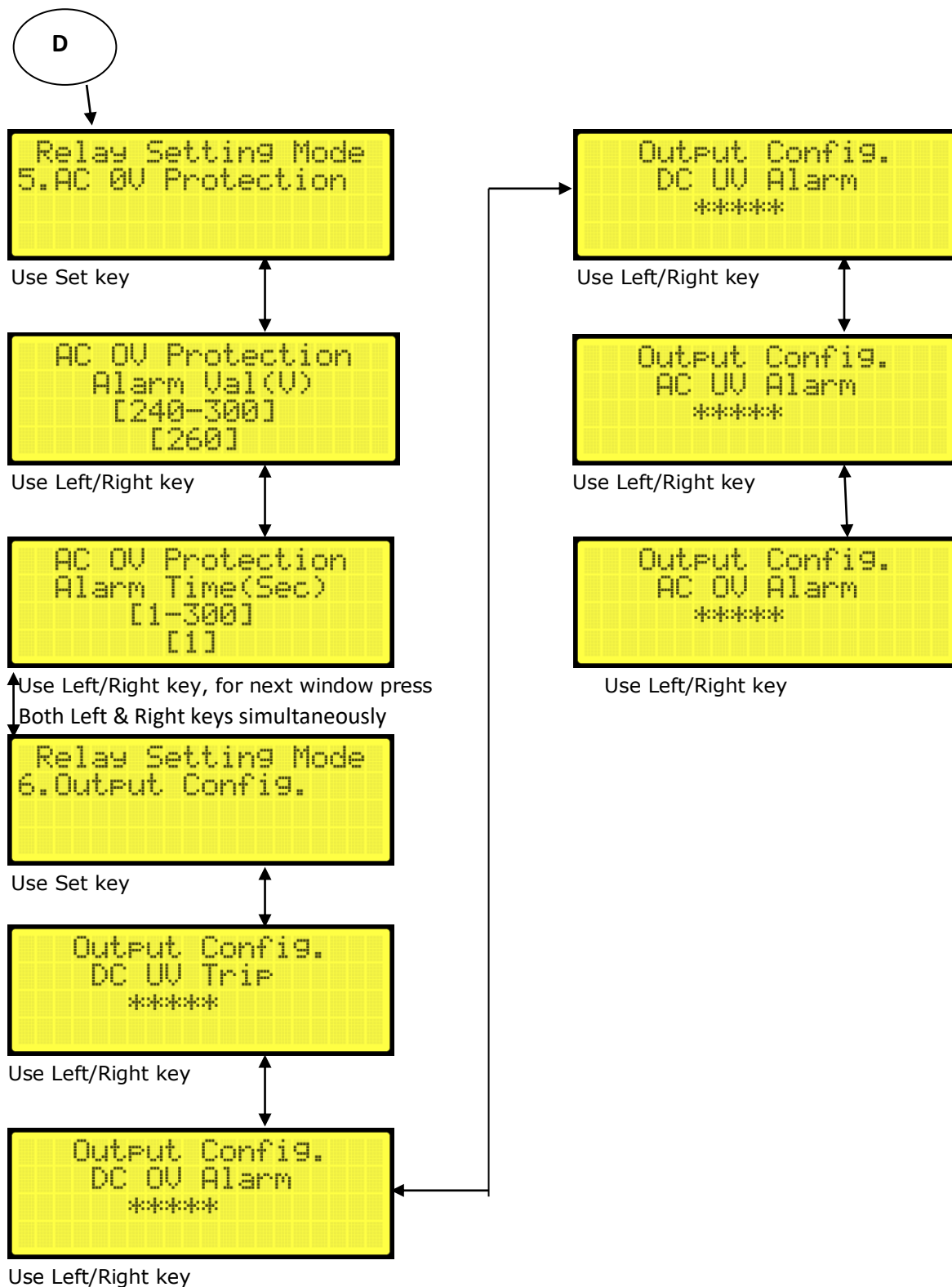
Relay Settings Algorithm





Use Left/Right key, for next window press both Left & Right keys simultaneously

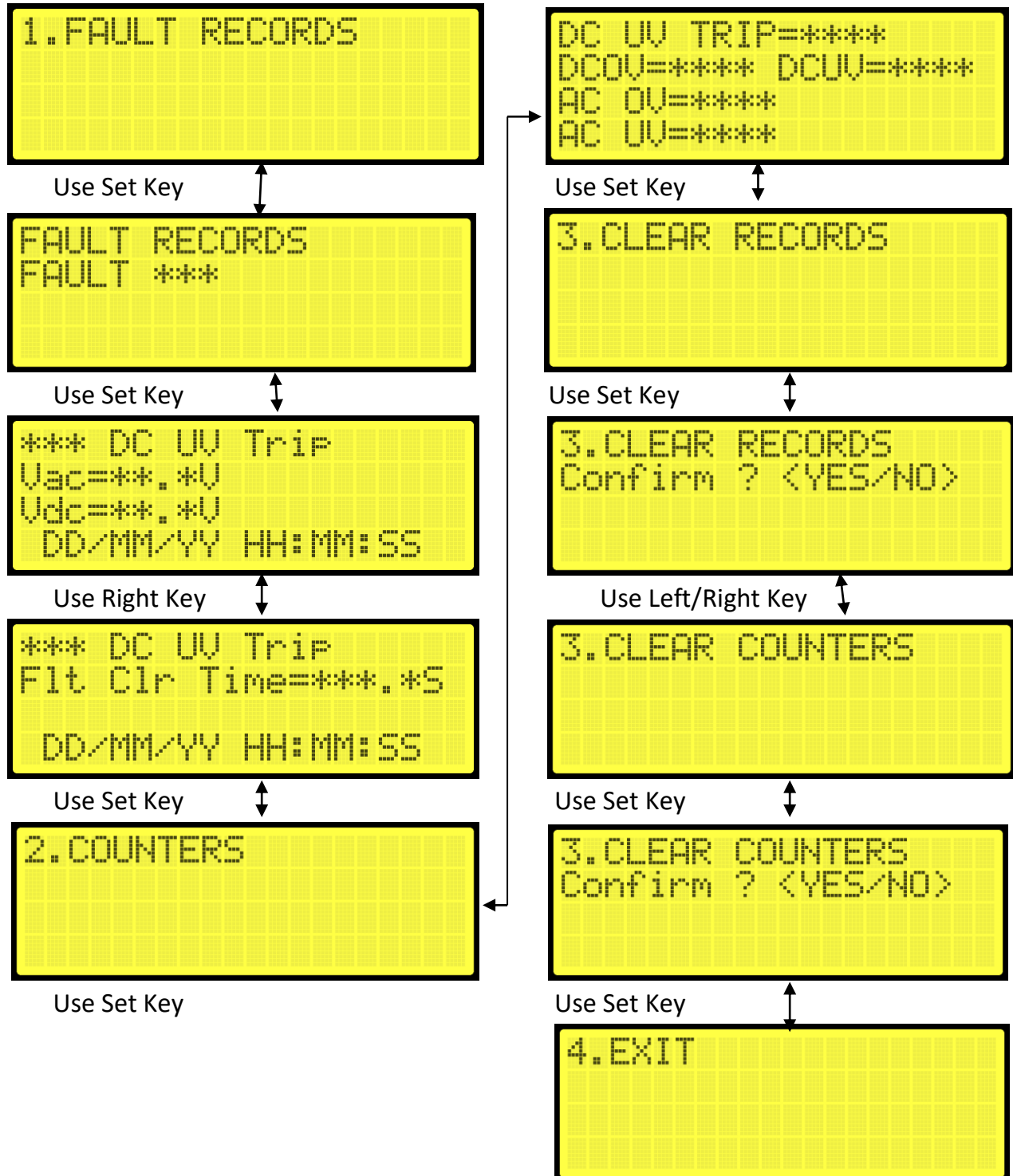




To access & clear logs

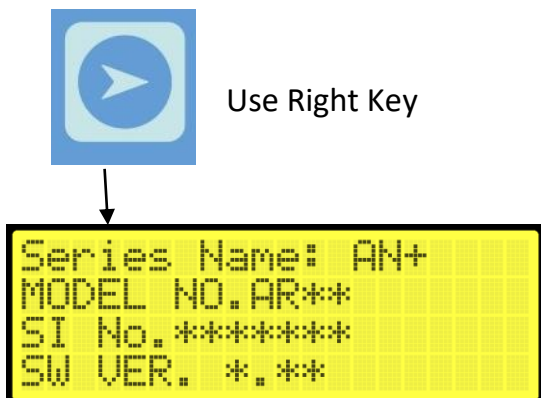


Use this key

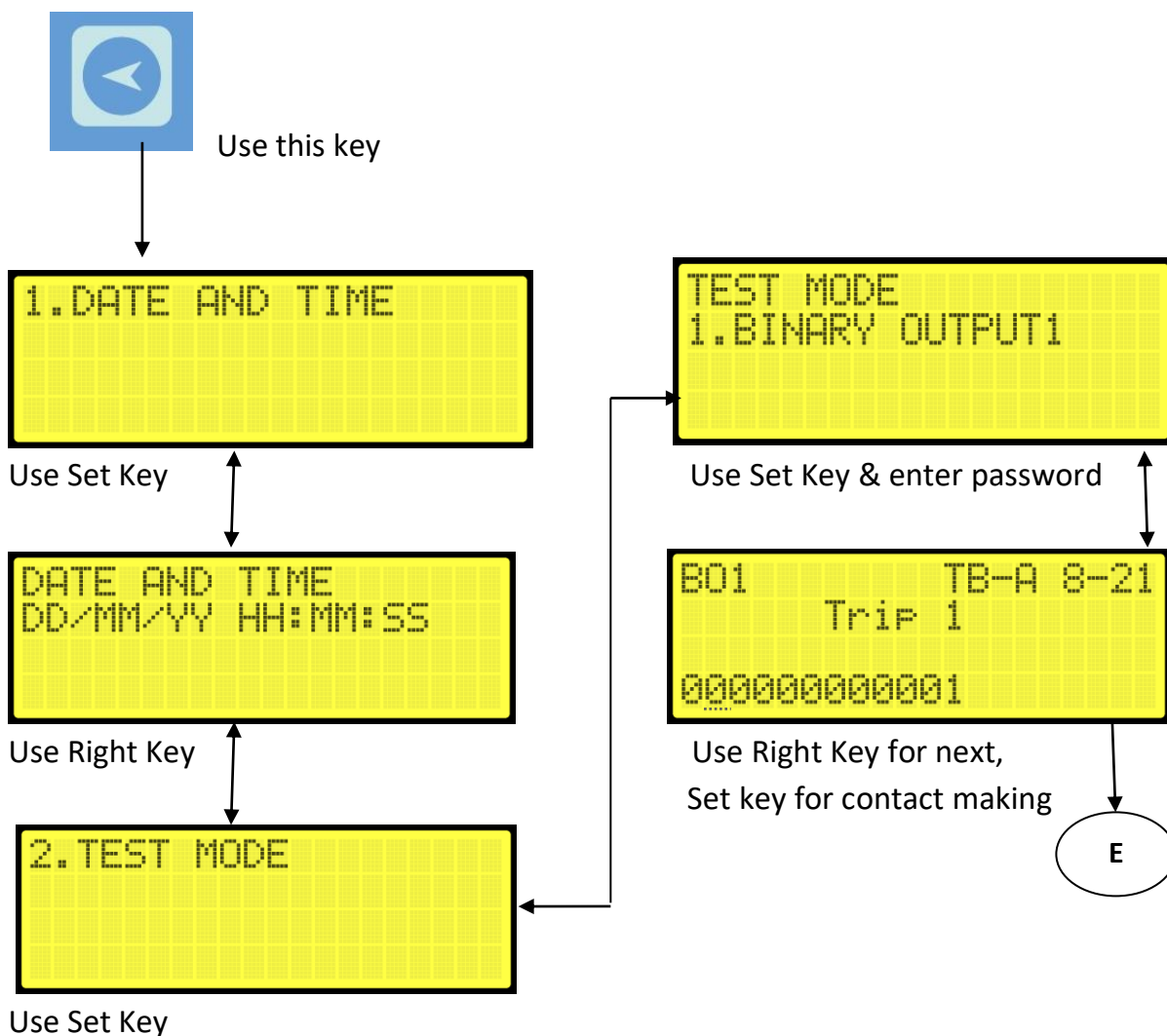


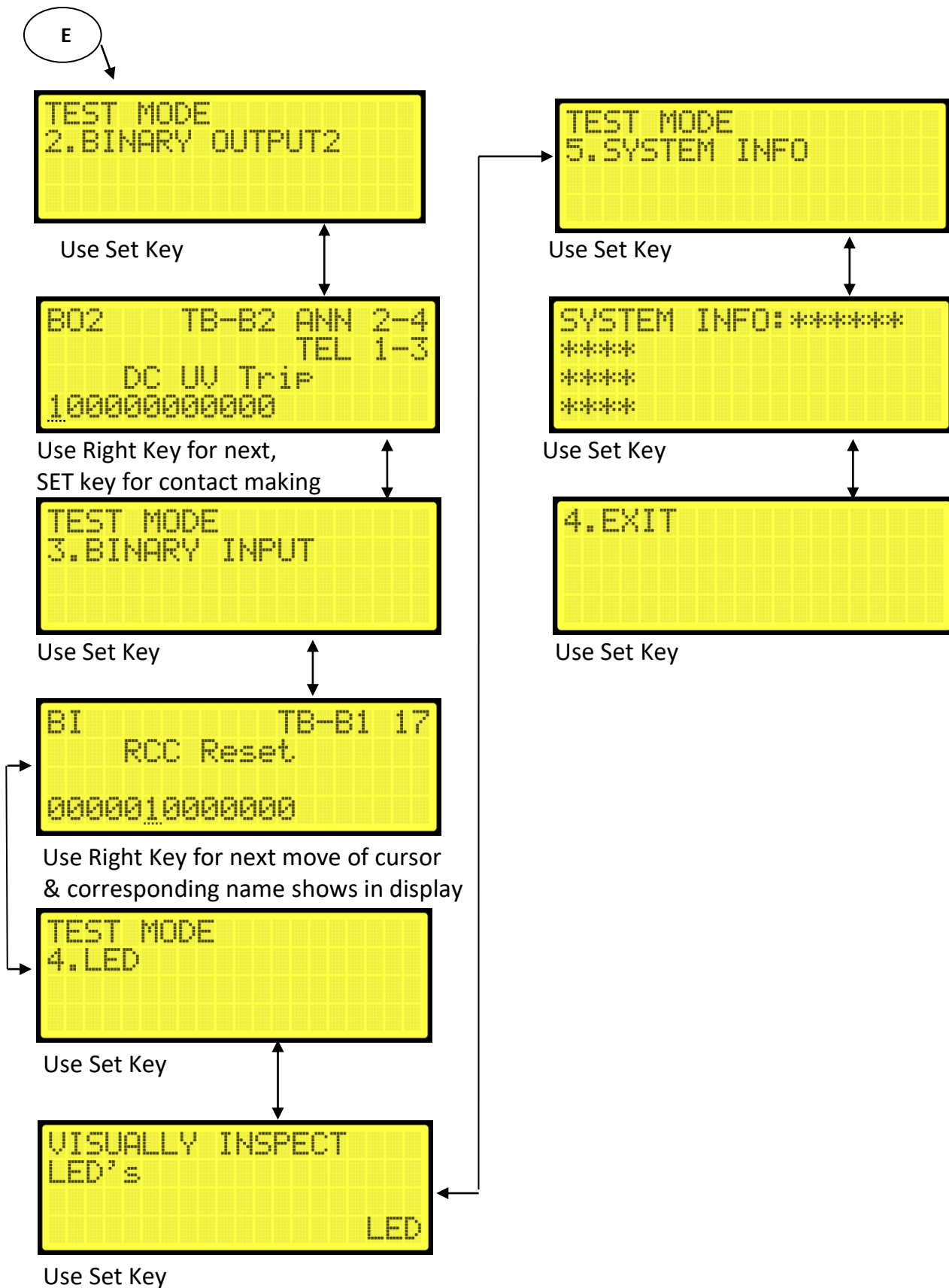
Use Set Key

To view device Info.



For Relay healthiness check & I/O Verification

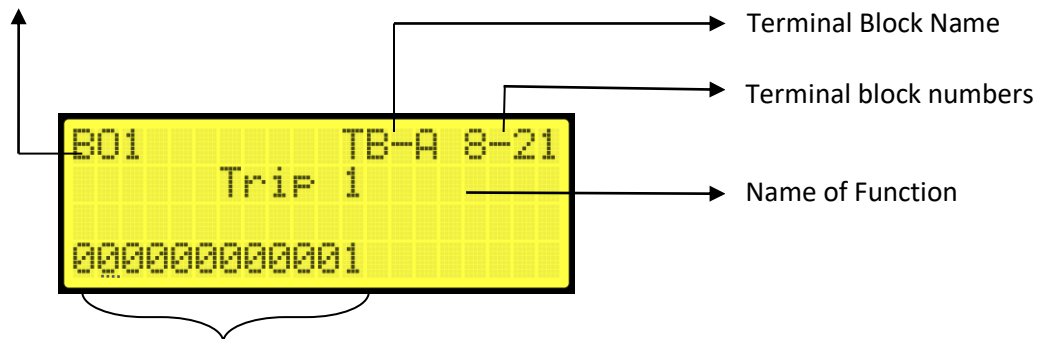




Binary Output & Input Details

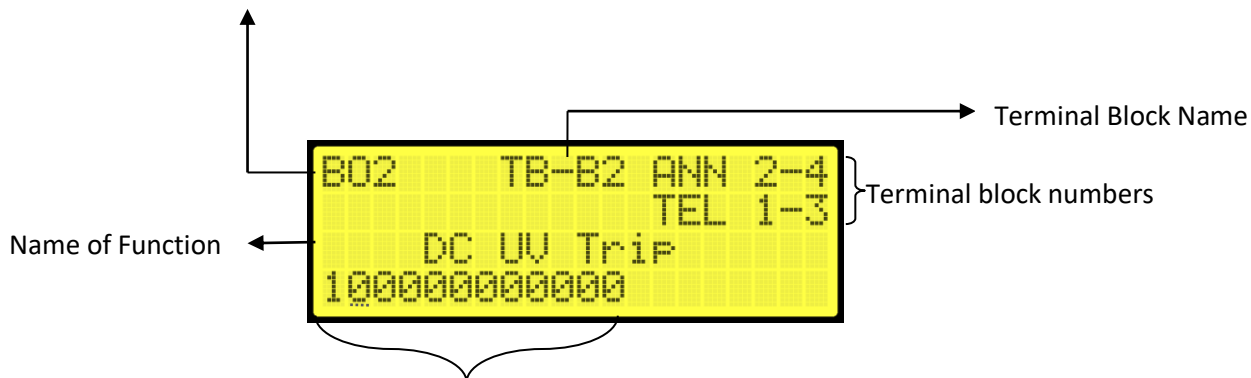
| Binary Output 1 | | | Binary Output 2 | | | Binary Input | | |
|-----------------|-------------|---------------|-----------------|-------------|-------------------------|--------------|-----------|------------|
| BO1 | NAME | TB NUMBER | BO2 | NAME | TB NUMBER | BI | NAME | TB NUMBER |
| 1 | NIL | | 1 | DC UV Trip | TB B2 - 1 & 3 , 2 & 4 | 1 | NIL | |
| 2 | Trip 1 | TB A - 8 & 21 | 2 | DC UV Alarm | TB B2 - 1 & 5 , 2 & 6 | 2 | NIL | |
| 3 | Trip 2 | TB A- 9 & 20 | 3 | DC OV Alarm | TB B2 - 1 & 7 , 2 & 8 | 3 | NIL | |
| 4 | Trip 3 | TB A- 10 & 19 | 4 | AC UV Alarm | TB B2 - 1 & 9 , 2 & 10 | 4 | NIL | |
| 5 | Trip 4 | TB A- 11 & 18 | 5 | AC OV Alarm | TB B2 - 1 & 11 , 2 & 12 | 5 | NIL | |
| 6 | Trip 5 | TB A- 12 & 17 | 6 | NIL | | 6 | RCC Reset | TB B1 - 17 |
| 7 | SPARE 1 | TB A- 13 & 16 | 7 | NIL | | 7 | NIL | |
| 8 | SPARE 2 | TB A- 14 & 15 | 8 | NIL | | 8 | NIL | |
| 9 | SPARE 3 | TB B1 - 3 & 4 | 9 | NIL | | 9 | NIL | |
| 10 | SPARE 4 | TB B1 - 5 & 6 | 10 | NIL | | 10 | NIL | |
| 11 | SPARE 5 | TB B1 - 7 & 8 | 11 | NIL | | 11 | NIL | |
| 12 | Relay Error | TB B1 - 1 & 2 | 12 | NIL | | 12 | NIL | |
| | | | | | | 13 | NIL | |

Binary Output 1



Binary Output Contacts. Use Left</>Right key for selecting previous or next contact & moving cursor also change the corresponding name in display. For make & reset contact use SET (↵) key.

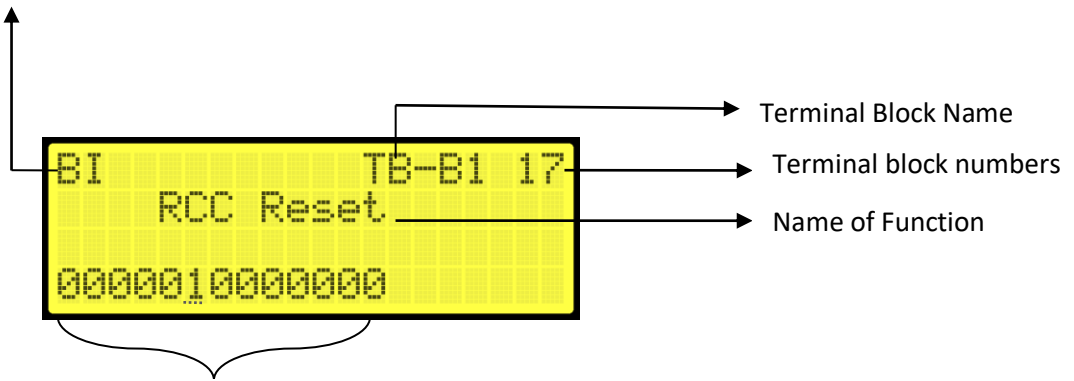
Binary Output 2



Binary Output Contacts. Use left</>Right key for selecting previous or next contact & moving cursor also change the corresponding name in display. For make & reset contact use SET (↵) key.

NOTE: TB B2 – 1 TELE COMMON (+110Vdc)
 TB B2 – 2 ANNU COMMON (+ve common from annunciator)

Binary Input



Use left</>Right key for selecting previous or next contact & moving cursor also change the corresponding name in display. When 110 DC (-ve) permanently supplied to the TB-B1-23 as status common and 110 DC (+ve) is given to the status pulse corresponding TB numbers in TB-B1.

TECHNICAL DATA & CHARACTERISTIC CURVES

CONTENTS

DESCRIPTION OF PROTECTION FUNCTIONS

TECHNICAL SPECIFICATIONS

GENERAL SETTINGS

TB DETAILS

RELAY CONFORMING STANDARDS

DESCRIPTION OF PROTECTION FUNCTIONS

The relay will continuously monitor the DC voltage levels. Whenever there is a DC under voltage the relay will provide a pre-trip alarm. If the fault is persisting over the set time delay a trip command will be initiated by the relay. If the DC voltage exceeds the set limit, the relay gives an over voltage alarm after the set time delay.

The relay also monitors AC voltage from the battery charger input supply. When voltage measured by the relay is less than the under voltage setting or more than the over voltage setting, an alarm will be initiated.

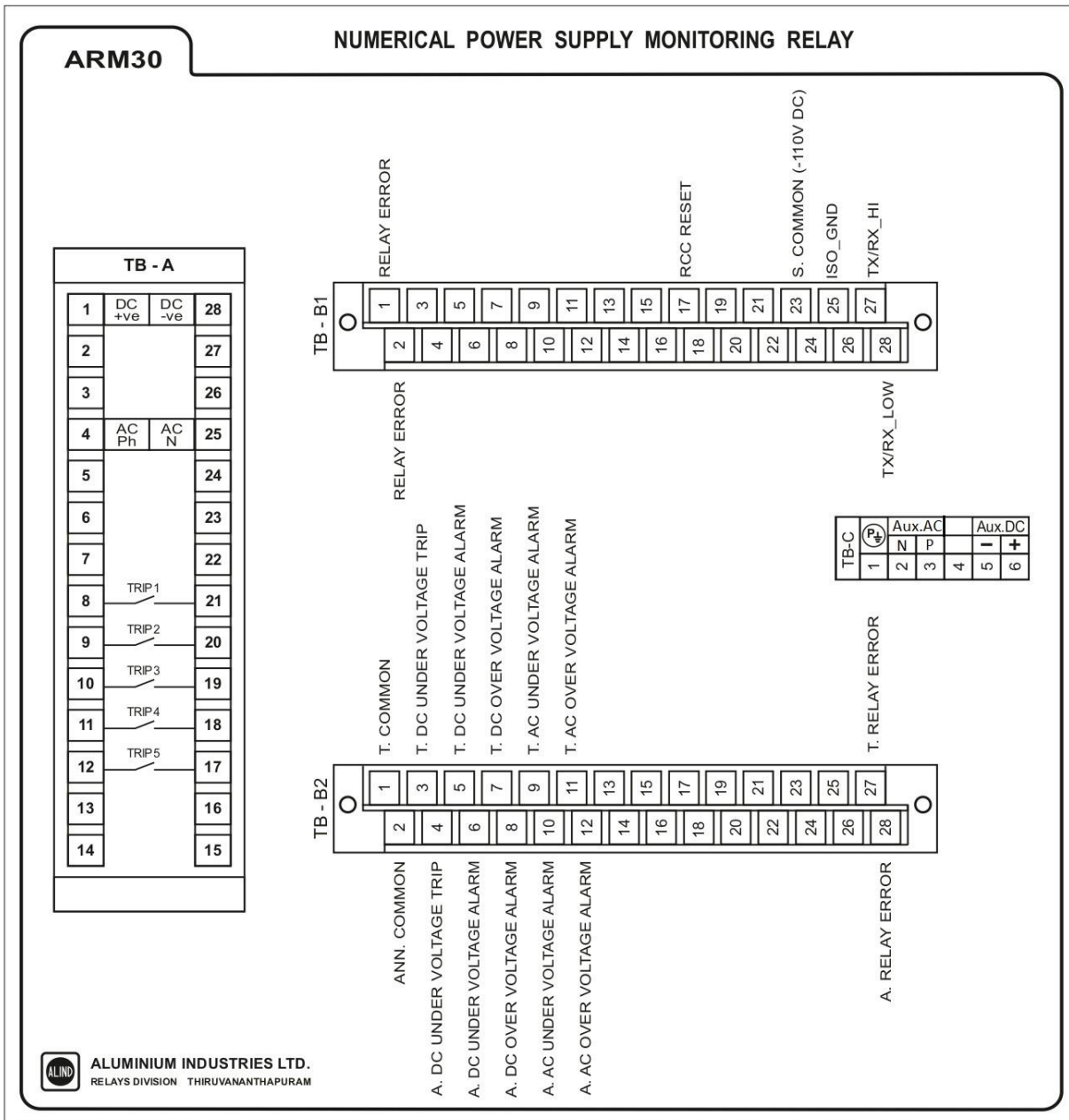
TECHNICAL SPECIFICATIONS

| Sl.No | Specification | REF. | Particulars |
|-------|---|-----------------|---|
| 1. | Auxiliary Supply | V _{DC} | 30 to 260VDC |
| 2. | Voltage Input (rated) | V | 230V AC, 110V DC |
| 3. | Frequency | Fn | 50 Hz |
| 4. | VA burden on Aux (110V DC) | | Less than 15 Watts (for energized condition) Less than 10 Watts (for de-energized condition) |
| 5. | Operating Temp Range | | -25°C to + 55 °C |
| 6. | Max. & Minimum relative humidity | | 5% to 95% |
| 7. | Contact details | | |
| 8. | a)Current carrying capacity | | Continuously ≥ 5 Amps at 110 V DC Short time ≥30 Amps for 200 ms at 110 V DC |
| | b) Making capacity at 110V DC | | ≥ 1000 W at L/R = 40ms |
| | c)Breaking Capacity at 110V DC | | ≥ 30 W at L/R = 40ms |
| 9. | Type of communication ports | | RJ45 (front) and RS485& RJ45/Fiber (Rear) |
| 10. | Overall dimensions | | Width 263 mm Height 173 mm Depth 300 mm |
| 11. | Weight | | 5.6 kg approx. |

RELAY SETTINGS

| Settings | Particulars |
|-------------------------------------|--|
| Password protection (YES/NO) | 0000-9999 |
| 1. General configuration | |
| Post fault cycles | 0-5 in steps of 1 |
| Back light (Sec) | 1 – 10S 2 – 20S 3 – 30S 4 – 40S |
| Communication Type | 1 – IEC 60870-5-103 2 – IEC 61850 |
| Relay ID | 1-255 in steps of 1 |
| Baud Rate | 4800-57600 in steps of 200 |
| Set Date & Time | DD MM YYYY HH MM SS |
| Modify Password | |
| 2. DC UV Protection | |
| DC UV | EN/DIS |
| Alarm Val (V) | 40 to 110V in steps of 1 |
| Alarm Time (Sec) | 1 to 300 sec in steps of 1 |
| Trip Val (V) | 40 to 110V in steps of 1 |
| Trip Time (mSec) | 50 to 10,000 in steps of 50 |
| 3. DC OV Protection | |
| Alarm Val (V) | 120 to 170V in steps of 1 |
| Alarm Time (Sec) | 1 to 300 sec in steps of 1 |
| 4. AC UV Protection | |
| AC UV Alarm | En/Dis |
| Alarm Val (V) | 150 to 200V in steps of 5 |
| Alarm Time (Sec) | 1 to 300 sec in steps of 1 |
| 5. AC OV Protection | |
| Alarm Val (V) | 240 to 300V in steps of 5 |
| Alarm Time (Sec) | 1 to 300 sec in steps of 1 |

TB DETAILS



RELAY CONFORMING STANDARDS

The relay conforms to the following standards:

| SI No. | Standards | Description |
|--------|--------------------------|---|
| I. | IEC 60255-151 | FUNCTIONAL REQUIREMENTS FOR OVER/UNDER CURRENT PROTECTION. |
| II. | IEC 60255-5 | INSULATION COORDINATION OF MEASURING RELAYS AND PROTECTION EQUIPMENT- REQUIREMENTS AND TESTS. |
| III. | IEC 60255-1 | MEASURING RELAYS AND PROTECTION EQUIPMENT- COMMON REQUIREMENTS. |
| IV. | IEC 60255-21-1 | VIBRATION TESTS (SINUSOIDAL) |
| V. | IEC 60255-21-2 | SHOCK AND BUMP TESTS |
| VI. | IEC 60255-21-3 | SEISMIC TESTS |
| VII. | IEC 60255-27 | PRODUCT SAFETY REQUIREMENT. |
| VIII. | IEC 60255-26 | ELECTROMAGNETIC COMPATIBILITY REQUIREMENT. |
| IX. | IEC 60529 | DEGREES OF PROTECTION PROVIDED BY ENCLOSURES (IP CODE) |
| X. | IEC 61810-2 | RELIABILITY. |
| XI. | IS 2705(PART II, III&IV) | PROTECTIVE CURRENT TRANSFORMERS. |
| XII. | IS 3231(PART 1 TO 3) | ELECTRICAL RELAYS FOR POWER SYSTEM PROTECTION. |
| XIII. | IS 8686 | STATIC PROTECTIVE RELAYS. |
| XIV. | IEC 60068-2 | ENVIRONMENTAL TESTS. |
| XV. | IEC 60870-5-103 | COMMUNICATION PROTOCOL |
| XVI. | IEC 61850 | COMMUNICATION PROTOCOL |

TROUBLESHOOTING

Under normal working conditions, the 'PROTECTION HEALTHY LED' provided in the front panel of the relay glows green. The same LED turns amber to recognize any fault inside the relay itself.

Following are certain guidelines for the relay to identify the nature of fault and necessary checking procedures to be adopted at site so that relay can be rectified suitably.

| SI. No. | Faults | Checks | Causes |
|---------|--|---|---|
| 1 | No power ON Indication or No display. | <ol style="list-style-type: none"> 1. Check the auxiliary DC supply to the relay rear terminals 2. Check the continuity of the output terminal, after disconnecting the wires. | <ol style="list-style-type: none"> 1. Due to power supply failure, the LED turns off. 2. The varistor may short circuited to protect internal circuitry on transients |
| 2 | Current Not reading/ Out of tolerance limit. | <ol style="list-style-type: none"> 1. Refer TB sticker for CT inputs. 2. Check for the earthing of CT. 3. Check if the terminals of TB-A is connected properly or for any lose contact. 4. Check CT ratio and multiplying factor if any. 5. Check the continuity of the output terminal, after disconnecting the wires. <p>After checking of the above, measure the current using calibrated Clamp-On meter. If not OK, intimate to works.</p> | <ol style="list-style-type: none"> 1. The CT connector is having shorting facility. If the connector is not tight, CT secondary may get some low resistance path through the connector itself. 2. If CT is not properly earthed, there is a chance of leakage current that may cause error in CT reading. |
| 4 | Relay Error Indication | <ol style="list-style-type: none"> 1. Intimate to works. 2. Press H.RST key in the relay front panel. | <ol style="list-style-type: none"> 1. Supply variation to internal PCB's. 2. DC supply fail. |

**SCADA COMMUNICATION INTERFACE AS PER IEC
60870-5-103 PROTOCOL**

VERSION 1.00

TYPE – ARM 30

**RELAY DESIGNED AS PER RDSO SPECIFICATION NO.
TI/SPC/PSI/PROTCT/7101**



**ALUMINIUM INDUSTRIES LIMITED
RELAYS DIVISION**

PROTOCOL MAPPING**SYSTEM FUNCTIONS IN MONITOR DIRECTIONS**

| DESCRIPTION | GI | ASDU TYPE | FUN | INF | COT | COM |
|------------------------------|----|-----------|-----|-----|-----|-----------------------|
| End of general interrogation | - | 8 | 255 | 0 | 10 | GLB |
| Time synchronization | - | 6 | 255 | 0 | 8 | GLB |
| Reset FCB | - | 5 | 122 | 2 | 3 | According to main FUN |
| Reset CU | - | 5 | 122 | 3 | 4 | According to main FUN |
| Reset CU/Start/Restart | - | 5 | 122 | 4 | 5 | According to main FUN |

STATUS INDICATIONS IN MONITOR DIRECTION

| DESCRIPTION | GI | ASDU TYPE | FUN | INF | COT | COM |
|-----------------------------------|----|-----------|-----|-----|-----|-----|
| Protection Healthy/Active | - | 1 | 122 | 18 | 1 | ↑↓ |
| RCC Reset | - | 1 | 122 | 19 | 1 | ↑ |
| Local Parameter Settings (Change) | - | 1 | 122 | 22 | 1 | ↑ |
| Relay Error | - | 1 | 122 | 40 | 1 | ↑ |

FAULT INDICATIONS IN (MONITOR DIRECTIONS)

| DESCRIPTION | GI | ASDU TYPE | FUN | INF | COT | COM |
|-------------------------------------|----|-----------|-----|-----|-----|-----|
| Start/pickup AC Over Voltage Alarm | X | 2 | 122 | 225 | 1,9 | ↑↓ |
| Start/pickup AC Under Voltage Alarm | X | 2 | 122 | 226 | 1,9 | ↑↓ |
| Start/pickup DC Over Voltage Alarm | X | 2 | 122 | 227 | 1,9 | ↑↓ |
| Start/pickup DC Under Voltage Alarm | X | 2 | 122 | 228 | 1,9 | ↑↓ |
| Start/pickup DC Under Voltage Trip | X | 2 | 122 | 229 | 1,9 | ↑↓ |
| AC Over Voltage Alarm acted | - | 2 | 122 | 230 | 1 | ↑↓ |
| AC Under Voltage Alarm acted | - | 2 | 122 | 239 | 1 | ↑↓ |
| DC Over Voltage Alarm acted | - | 2 | 122 | 237 | 1 | ↑↓ |
| DC Under Voltage Alarm acted | - | 2 | 122 | 234 | 1 | ↑↓ |
| DC Under Voltage Trip acted | - | 2 | 122 | 238 | 1 | ↑↓ |

MEASURANDS IN MONITOR DIRECTION

| DESCRIPTION | GI | ASDU TYPE | FUN | INF | COT |
|--------------------------|----|-----------|-----|-----|-----|
| Measurand supervision DC | - | 9 | 122 | 148 | 2 |
| Measurand supervision AC | - | 9 | 122 | 149 | 2 |

TIME TAGGED MEASURANDS IN MONITOR DIRECTIONS

| DESCRIPTION | GI | ASDU TYPE | FUN | INF | COT |
|----------------------------|----|-----------|-----|-----|-----|
| Auxiliary AC fault Voltage | - | 4 | 122 | 151 | 1 |
| Auxiliary DC fault Voltage | - | 4 | 122 | 152 | 1 |

STANDARD INFORMATION NUMBERS IN CONTROL DIRECTION**SYSTEM FUNCTIONS IN CONTROL DIRECTION**

| DESCRIPTION | GI | ASDU TYPE | FUN | INF | COT | COM |
|-------------------------------------|----|-----------|-----|-----|-----|-----|
| Initiation of general interrogation | - | 7 | 255 | 0 | 9 | GLB |
| Time Synchronization | - | 6 | 255 | 0 | 8 | GLB |

GENERAL COMMANDS IN CONTROL DIRECTION

| DESCRIPTION | GI | ASDU TYPE | FUN | INF | COT | COM |
|-----------------|----|-----------|-----|-----|-----|-----------|
| LED (RCC) RESET | - | 20 | 122 | 19 | 20 | ↑ (PULSE) |

ANALOG CHANNEL INFORMATION IN ARM 30

| ARM 30 | | |
|--------|-----|-----------|
| FUN | ACC | PARAMETER |
| 122 | 1 | X |
| 122 | 2 | X |
| 122 | 3 | X |
| 122 | 4 | X |
| 122 | 5 | V AC |
| 122 | 6 | V DC |
| 122 | 7 | X |
| 122 | 8 | X |


DIGITAL CHANNEL (TAGS) INFORMATION IN ARM 30

| ARM 30 | | | |
|---------------------|-----------------------|--|---------------------|
| TAG POSITION | FUN/INF NUMBER | SEMANTICS ACCORDING TO TAG POSITION | INPUT/OUTPUT |
| 0 | 122/84 | GENERAL PICKUP | OUTPUT |
| 1 | 122/68 | GENERAL TRIP | OUTPUT |
| 2 | 122/230 | AC OVER VOLTAGE ALARM | OUTPUT |
| 3 | 122/239 | AC UNDER VOLTAGE ALARM | OUTPUT |
| 4 | 122/237 | DC OVER VOLTAGE ALARM | OUTPUT |
| 5 | 122/234 | DC UNDER VOLTAGE ALARM | OUTPUT |
| 6 | 122/238 | DC UNDER VOLTAGE TRIP | OUTPUT |
| 7 | 122/19 | RCC RESET | INPUT |

Model Implementation Conformance Statement
for the IEC 61850 interface in ALIND ARM 30 relay version 1.0

Based on
UCA International Users Group
Testing Sub Committee

Template version 1.0
Date: April 24, 2008

| | | |
|---|--|-----|
| TITLE: MICS DOCUMENT FOR ARM 30 RELAY | MICS Ver. | 1.0 |
| | DATE: 22 SEPTEMBER 2021 | |
|  | ALUMINIUM INDUSTRIES LTD RELAYS DIVISION, THIRUVANANTHAPURAM | |

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1. Introduction

This model implementation conformance statement is applicable for ALIND ARM 30 relay. The definitions of all used Logical Devices, Logical Nodes and their associated Common Data Classes, components and associated enumerated values are also included for completeness.

This MICS document specifies the modelling including extensions compared to IEC 61850 Edition 2.

2. Logical Device

| Logical Device | Description |
|----------------|----------------------|
| CONTROL | Controls Domain |
| MEASUREMENT | Measurements Domain |
| PROTECTION | Protection Domain |
| RECORDS | Fault Records Domain |
| SYSTEM | System Domain |

Logical Device data model

| Logical Device | Logical Node Instance | Logical Node type | Description |
|----------------|-----------------------|-------------------|------------------------------------|
| CONTROL | LLN0 | LLN01 | LLN0 for Logical Device CONTROL |
| | CNTRL_GGIO1 | GGIO_AUX_1C | IED control 1 no. |
| MEASUREMENT | LLN0 | LLN02 | LLN0 for Logical Device MEASURAND |
| | MTR_MMXN1 | MMXN_AUX_MTR | Measurand Value VDC, VAC |
| | FLT_MMXN3 | MMXN_AUX_FLT | Fault Values VDC, VAC |
| PROTECTION | LLN0 | LLN03 | LLN0 for Logical Device PROTECTION |
| | OAC_PTOV1 | PTOV_AUX | AC Over Voltage Alarm |
| | ODC_PTOV2 | PTOV_AUX | DC Over Voltage Alarm |
| | UAC_PTUV1 | PTUV_AUX | AC Under Voltage Alarm |
| | UDC_PTUV2 | PTUV_AUX | DC Under Voltage Alarm |
| | UDCT_PTUV3 | PTUV_AUX | DC Under Voltage Trip |
| RECORDS | LLN0 | LLN04 | LLN0 for Logical Device RECORDS |
| | RDRE1 | RDRE_AUX | Disturbance recorder |
| SYSTEM | LLN05 | LLN0_SYSTEM | LLN0 for Logical Device SYSTEM |
| | LPHD | LPHD_AUX | Physical Device Information |
| | ALM_GGIO1 | GGIO_AUX_ALM3 | Alarms |
| | IND_GGIO2 | GGIO_AUX_BI1 | Binary Inputs |

3. Logical Node List

Following list contains list of logical node classes implemented in device

| | |
|--|--|
| G: Logical Nodes for generic references | |
| GGIO (Generic Process I/O) | |
| L: System Logical Nodes | |
| LLNO (Logical device LN) | |
| LPHD (Physical device LN) | |
| M: Logical Nodes for metering and measurement | |
| MMXN (Non-Phase Related Measurements) | |
| P: Logical Nodes for protection functions | |
| PTOV (Over Voltage) | |
| PTUV (Under Voltage) | |
| R: Logical nodes for protection related functions | |
| RDRE (Disturbance Recorder Function) | |

4. Logical Nodes

The following table use

- M: Data object is mandatory in the IEC 61850-7-4 ED.2.
- O: Data object is optional in the IEC 61850-7-4 ED.2 and is used in the device

4.1 Logical Node: GGIO_AUX_1C

Description: Generic Process I/O

LN Class: GGIO

| Data Object | CDC type | Description | M/O |
|--|----------|---|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Controls | | | |
| SPCSO1 | SPC | Generic single point controllable status output (RCC Reset) | O |

4.2 Logical Node: GGIO_AUX_ALM3

Description: Generic Process I/O

LN Class: GGIO

| Data Object | CDC type | Description | M/O |
|--|----------|--|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Status Information | | | |
| Alm1 | SPS | General Single Alarm (Protection Healthy) | O |
| Alm2 | SPS | General Single Alarm (Local Parameter Settings Change) | O |
| Alm3 | SPS | General Single Alarm (Relay Error) | O |

4.3 Logical Node: GGIO_AUX_BI1

Description: Generic Process I/O

LN Class: GGIO

| Data Object | CDC type | Description | M/O |
|--|----------|--------------------------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Status Information | | | |
| Ind1 | SPS | General Indication (RCC reset) | O |

4.4 Logical Node: LLN01**Description:** Logical Node Zero**LN Class:** LLN0

| Data Object | CDC type | Description | M/O |
|--|----------|-------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Mod | ENC | Mode | M |
| Health | ENS | Health | M |
| NamPlt | LPL | Name Plate | M |

4.5 Logical Node: LLN02**Description:** Logical Node Zero**LN Class:** LLN0

| Data Object | CDC type | Description | M/O |
|--|----------|-------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Mod | ENC | Mode | M |
| Health | ENS | Health | M |
| NamPlt | LPL | Name Plate | M |

4.6 Logical Node: LLN03**Description:** Logical Node Zero**LN Class:** LLN0

| Data Object | CDC type | Description | M/O |
|--|----------|-------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Mod | ENC | Mode | M |
| Health | ENS | Health | M |
| NamPlt | LPL | Name Plate | M |

4.7 Logical Node: LLN04**Description:** Logical Node Zero**LN Class:** LLN0

| Data Object | CDC type | Description | M/O |
|--|----------|-------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Mod | ENC | Mode | M |
| Health | ENS | Health | M |
| NamPlt | LPL | Name Plate | M |

4.8 Logical Node: LLN05

Description: Logical Node Zero

LN Class: LLN0

| Data Object | CDC type | Description | M/O |
|--|----------|-------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Mod | ENC | Mode | M |
| Health | ENS | Health | M |
| NamPlt | LPL | Name Plate | M |

4.9 Logical Node: LPHD_AUX

Description: Physical Device Information

LN Class: LPHD

| Data Object | CDC type | Description | M/O |
|---------------------------|----------|---|-----|
| Descriptions | | | |
| PhyNam | DPL | Device Name Plate | M |
| Status Information | | | |
| PhyHealth | ENC | Device Health | M |
| Proxy | ENS | Indicates if this Logical Node is Proxy | M |

4.10 Logical Node: MMXN_AUX_MTR

Description: Measurand Values

LN Class: MMXN

| Data Object | CDC type | Description | M/O/E |
|--|----------|-----------------------|-------|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Measured and Metered Values | | | |
| Vol1 | MV | Measurand Voltage VDC | E |
| Vol2 | MV | Measurand Voltage VAC | E |

4.11 Logical Node: MMXN_AUX_FLT

Description: Fault Values

LN Class: MMXN

| Data Object | CDC type | Description | M/O/E |
|--|----------|-------------------|-------|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Measured and Metered Values | | | |
| Vol1 | MV | Fault Voltage VDC | E |
| Vol2 | MV | Fault Voltage VAC | E |

4.12 Logical Node: PTOV_AUX**Description:** Over Voltage Protection**LN Class:** PTOV

| Data Object | CDC type | Description | M/O |
|--|----------|-------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Status Information | | | |
| Str | ACD | Start | M |
| Op | ACT | Operate | O |

4.13 Logical Node: PTUV_AUX**Description:** Under Voltage Protection**LN Class:** PTUV

| Data Object | CDC type | Description | M/O |
|--|----------|-------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Status Information | | | |
| Str | ACD | Start | M |
| Op | ACT | Operate | O |

4.14 Logical Node: RDRE_AUX**Description:** Disturbance Recorder Function**LN Class:** RDRE

| Data Object | CDC type | Description | M/O |
|--|----------|---------------------------------------|-----|
| Common Logical Node Information | | | |
| Beh | ENS | Behavior | M |
| Status Information | | | |
| RcdMade | SPS | TRUE = disturbance recording complete | M |
| FltNum | INS | Fault Number | M |

5. Enum types

Enum types are listed in this clause.

5.1 Mod

| Value | Description |
|-------|--------------|
| 1 | on |
| 2 | blocked |
| 3 | test |
| 4 | test/blocked |
| 5 | off |

5.2 ctlModel

| Value | Description |
|-------|-------------------------------|
| 0 | status-only |
| 1 | direct-with-normal-security |
| 2 | sbo-with-normal-security |
| 3 | direct-with-enhanced-security |
| 4 | sbo-with-enhanced-security |

5.3 Health

| Value | Description |
|-------|-------------|
| 1 | Ok |
| 2 | Warning |
| 3 | Alarm |



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