NUMERICAL CAPACITOR BANK PROTECTION RELAY
ANC 303[AN SERIES]

User Manual

ALUMINIUM INDUSTRIES LIMITED
RELAYS DIVISION
THIRUVANANTHAPURAM

ANC 303

Numerical Capacitor Bank Protection Relay

CONTENTS

SAFETY REQUIREMENTS

INTRODUCTION

HANDLING INSTALLATIONS & CASE DIMENSIONS

USER GUIDE

TECHNICAL DATA & CHARACTERISTIC CURVES

TROUBLE SHOOTING

COMMUNICATION

ALUMINIUM INDUSTRIES LIMITED
Relays Division

SAFETY REQUIREMENTS

ALUMINIUM INDUSTRIES LIMITED
Relays Division

CONTENTS

INTRODUCTION

HEALTH AND SAFETY

SYMBOLS AND EXTERNAL LABELS ON THE RELAY

INSTALLING, COMMISSIONING AND SERVICING

DECOMMISSIONING AND DISPOSAL

TECHNICAL SPECIFICATION FOR SAFETY

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."

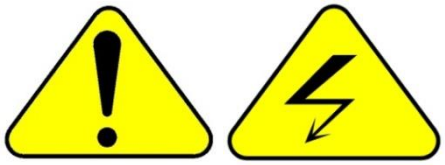
The following requirements must be met, in the order given, before circuits or equipments are re-energized, even temporarily.

- 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 equipments 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.

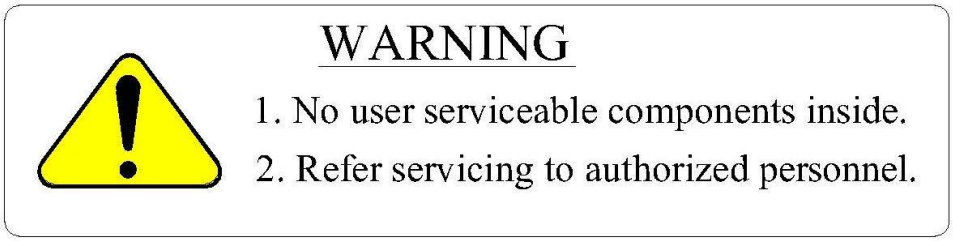
SYMBOLS AND LABELS USED IN THE RELAY

1. FRONT SIDE



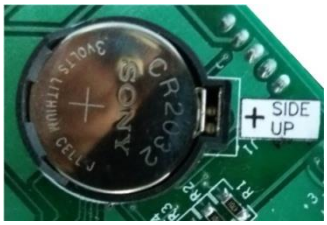
Caution: refer to equipment documentation Caution: risk of electric shock

2. REAR SIDE



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.

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 any such cases, warranty may be affected.

DECOMMISIONING 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 minsource.

INTRODUCTION

CONTENTS

AN SERIES DESCRIPTION

PREVIOUS HISTORY OF CAPACITOR BANK PROTECTION RELAYS

BRIEF DESCRIPTION OF ANC 303

MAIN FUNCTIONS

GENERAL FUNCTIONS

AN SERIES (ALIND NUMERICAL SERIES)

- Advanced Digital Fourier Transform based Numerical algorithm design using 16-bit Digital Signal Controller (DSC).
- Compact Construction covering several protection modules saving panel space.
- Man-Machine Communication through 20x4 character LCD display and LEDs.
- Self supervision of both hardware and software units.
- Interface ability with SCADA is achieved through IEC 60870-5-103 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 waveforms (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 through SCADA at RCC.
- Relay Indication (LED) reset from RCC.
- Suitable password protection.
- IP 54 grade enclosure protection.
- GPS time Synchronization Facility.
- Settable CT and PT ratios.
- CB close and open command initiation from relay through RCC.

PREVIOUS HISTORY OF CAPACITOR BANK RELAYS

AFC 204 (OCR)

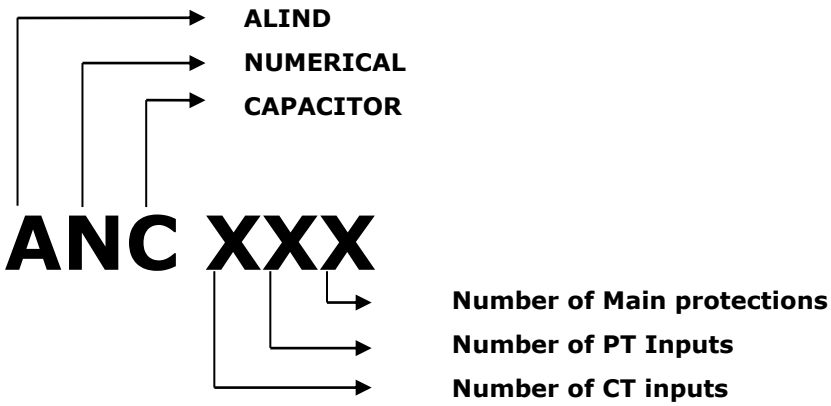
Numerical Capacitor Bank relay

Disturbance & event recorder.

Built in counter facility.

ANC 303

The relay is the modified version of our ANC 214 (AN Series) relay.



ANC 303

The relay is the modified version of our AFC 204(AN Series) relay.

The relay conforms to RDSO SPEC No. TI/SPC/PROTCT/6071 & letter no. ETR/252/RE/OT/03/2014-2015 dated 19.02.2015. ANC 303 (AN Series) relay is a comprehensive Capacitor Bank Protection relay for the protection of shunt capacitor bank.

MAIN FUNCTIONS

Sl No.	PARTICULARS	ANC 303
1.	**MAIN PROTECTIONS**	
1.1	IDMT OC Protection	✓
1.2	Switching IN Protection	✓
1.3	Switching Out Protection	✓
1.4	Unbalance Protection	✓
1.5	Time Delay Relay	✓
1.6	LBB	✓
1.7	Relay Fail	✓
2.	**STATUS INPUTS**	
2.1	AP/GP LOW ALARM	✓
2.2	AP/GP LOW TRIP & LOCK	✓
2.3	BRKR STATUS NC	✓
2.4	BRKR STATUS NO	✓
2.5	RCC RESET	✓
2.6	TIME SYNC	✓
2.7	UNBALANCE RESET	✓

GENERAL FUNCTIONS

Sl No.	PARTICULARS	ANC 303
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	Mini USB
5.2	Isolated RS 485 Interface	✓
5.3	Communication Protocol Interface- IEC 60870-5-103	✓
5.4	GPS Time Sync Facility	✓
5.5	Date/time synchronization through PC	✓
5.6	Relay programming through Mini USB port	✓
6.	**MONITORING**	
6.1	Line Current (IDMT)	✓
6.2	Feeder Current (Switching)	✓
6.3	Unbalance Current	✓
6.4	Counters for each element (IDMT, UB &LBB)	✓
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

CONTENTS

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.
- Do not apply CT inputs when auxiliary supply is switched OFF.
- 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.

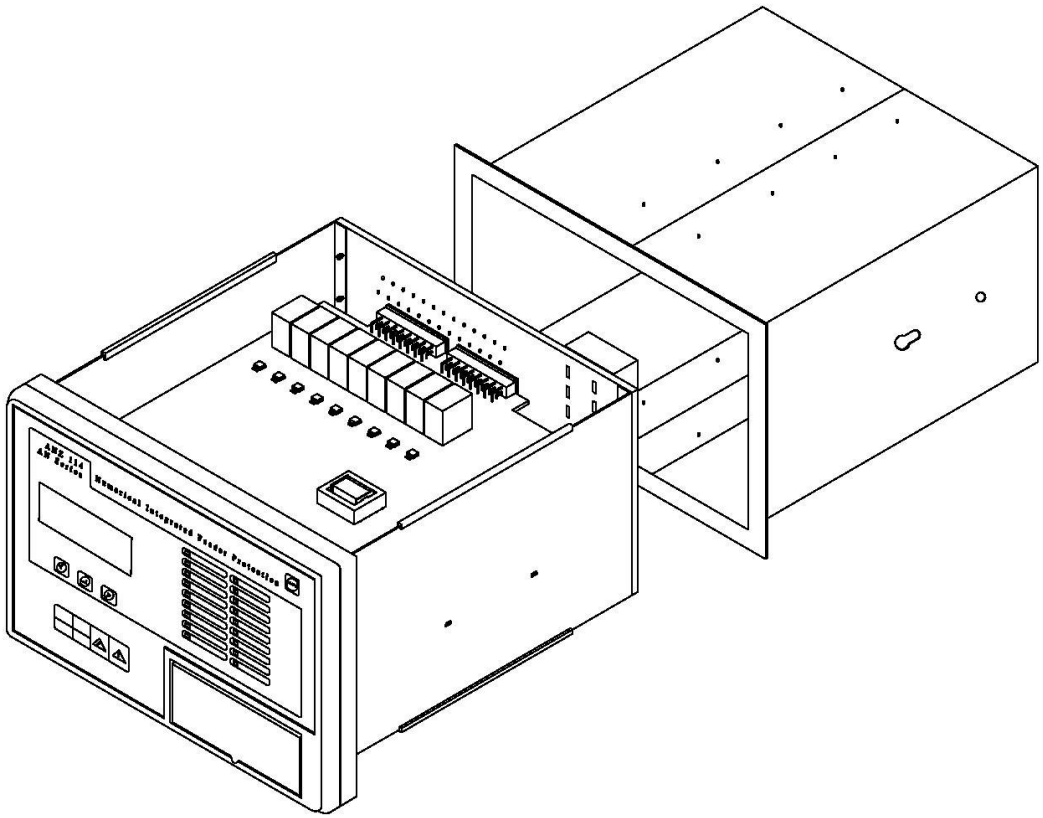
The relay is shipped from factory after detailed testing by our Quality Control Department. However, according to the customer requirement the relay settings/ functions can be verified before commissioning at respective sites with proper testing kits.

STORAGE

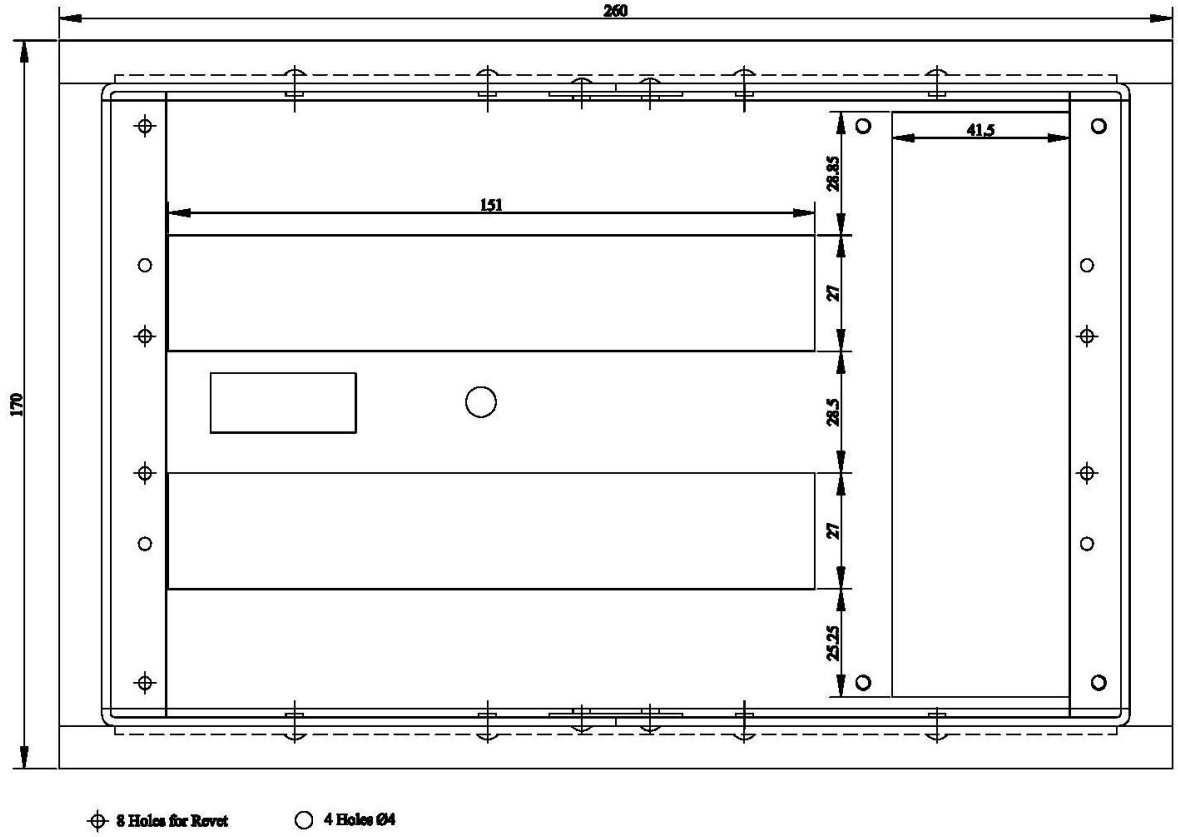
If relays are not to be installed immediately upon receipt they should be stored in a place free from dust and moisture in their original boxes.At most care should be taken while storage.

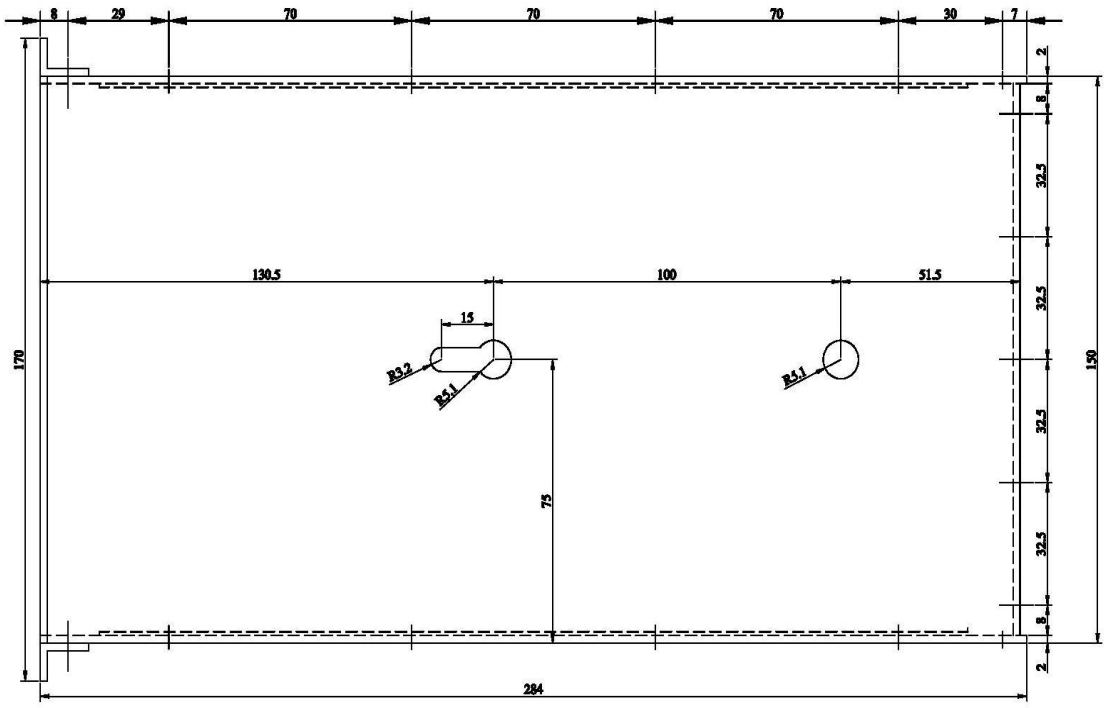
Storage temperature: -25ºC to +70ºC.

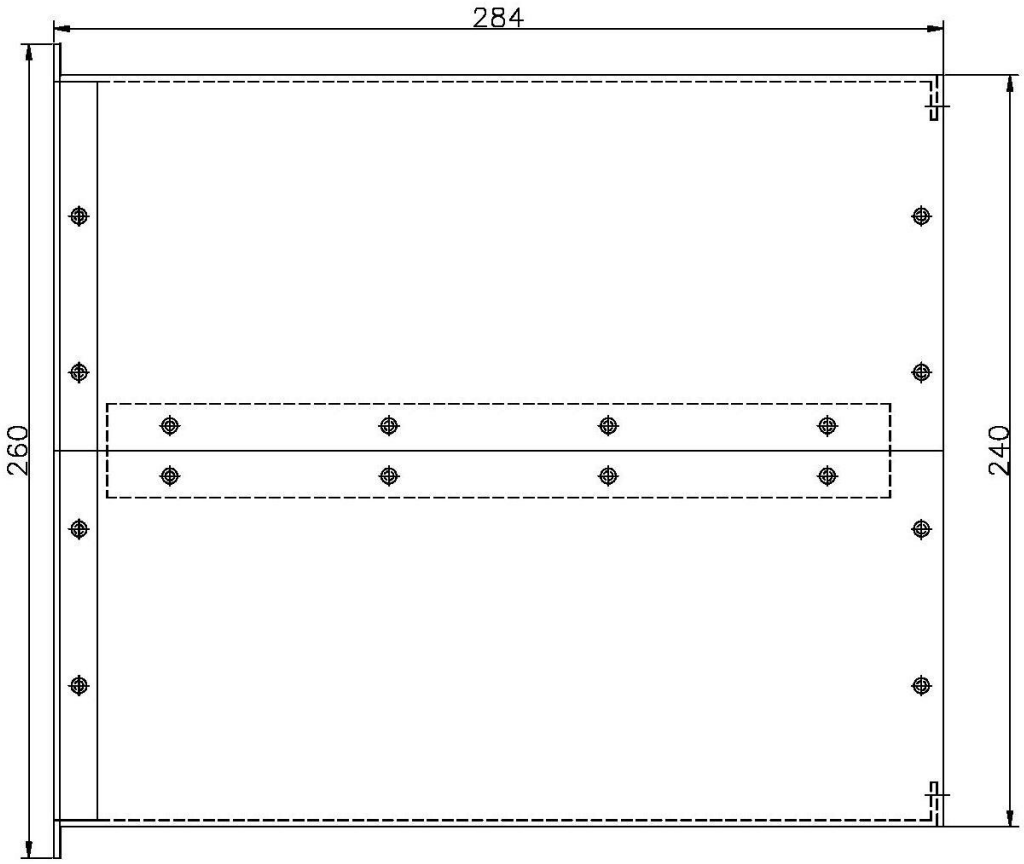
RELAY AND RACK MOUNTING



CASE DIMENSIONS




8
29
70
70
70
30
7
2
8
32.5
32.5
32.5
32.5
8
2
130.5
100
51.5
15
R3.2
R5.1
R5.1
75
170
150
284



TOP VIEW

USER GUIDE

ALUMINIUM INDUSTRIES LIMITED
Relays Division

CONTENTS

FRONT PANEL INDICATIONS

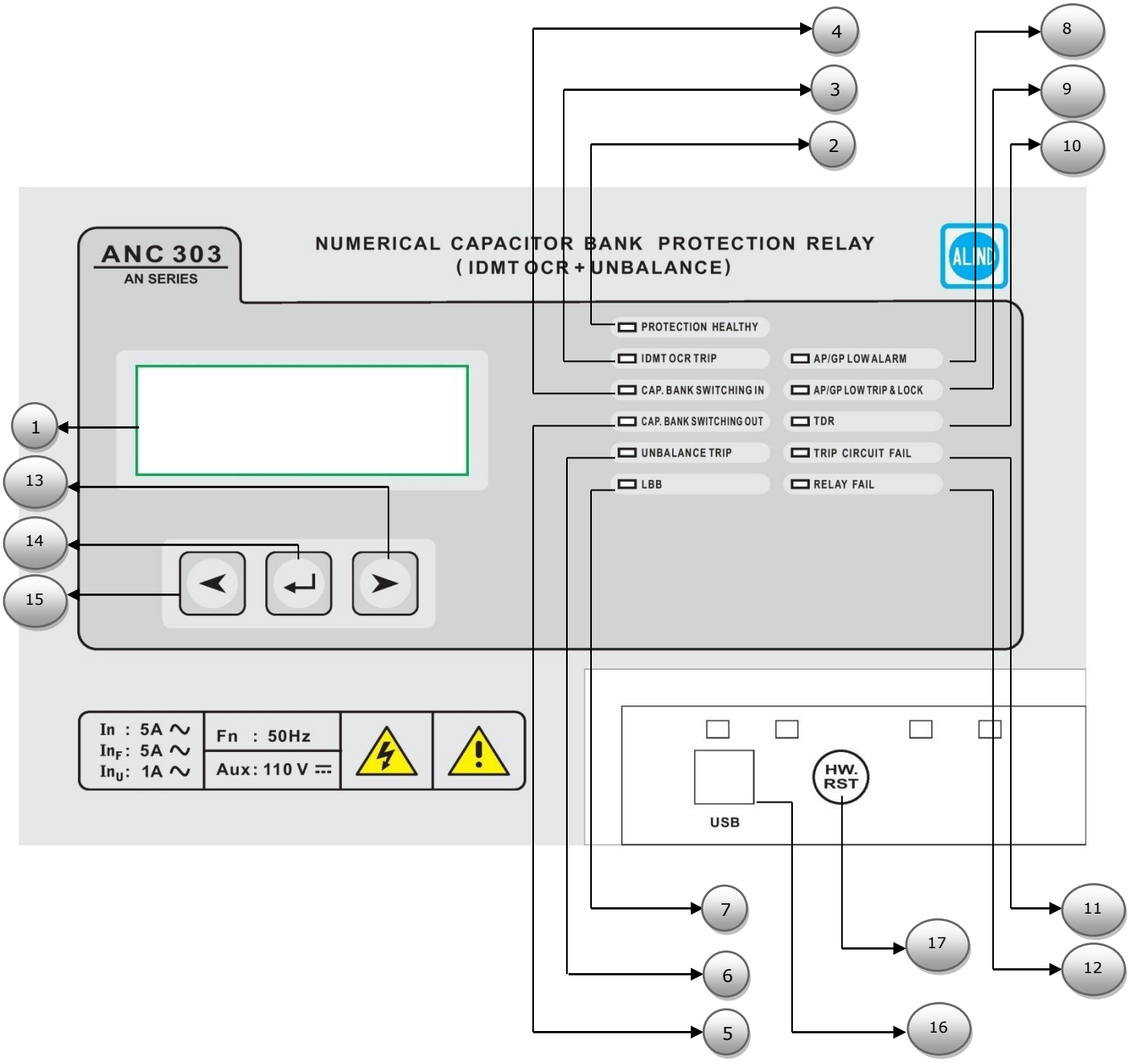
INTERNAL ARCHITECTURE AND BLOCK DIAGRAM

ENERGIZING THE RELAY

PCB DESCRIPTION

RELAY SETTINGS AND ALGORITHM

FRONT PANEL INDICATIONS



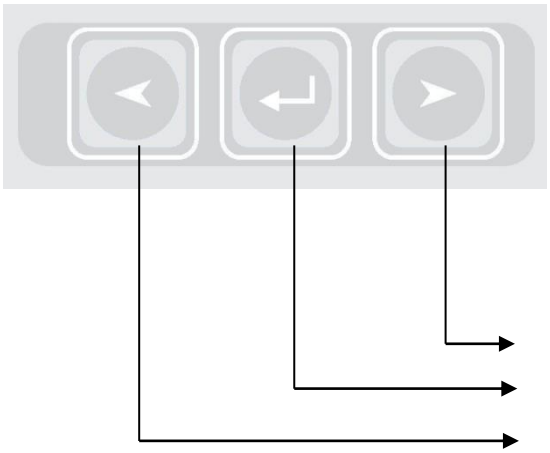
No	Legend	ANC 303
1.	LCD DISPLAY	✓
2.	PROTECTION HEALTHY (Green/Amber)	✓
3.	IDMT OCR TRIP (Red)	✓
4.	SWITCHING IN (Red)	✓
5.	SWITCHING OUT (RED)	✓
6.	UNBALANCE TRIP (RED)	✓
7.	LBB (Red)	✓
8.	AP/GP LOW ALARM (Red)	✓
9.	AP/GP LOW TRIP & LOCK(Red)	✓
10.	TDR(Red)	✓
11.	TRIP CIRCUIT FAIL(Red)	✓
12.	RELAY FAIL(Red)	✓
13.	**>**	✓
14.	↵	✓
15.	**<**	✓
16.	USB	✓
17.	H.RST	✓

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 except H.Rst key and the display backlit leaves for about 20 seconds. Backlit automatically turns on when any tripping occurs on the relay.

Navigation Keys

The relay is provided with four switches.



Hardware Reset

Menu key

* Menu 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.

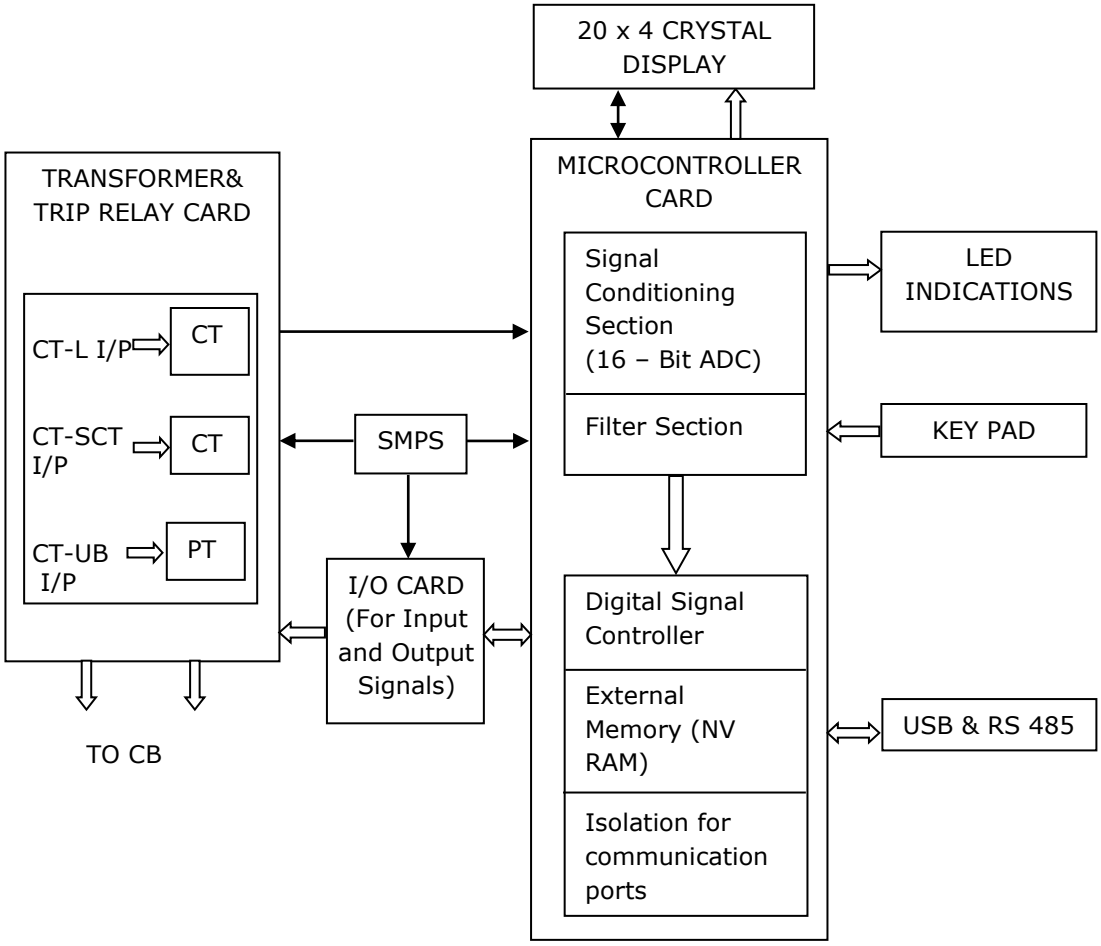
Decrement key

* 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 use this key.

INTERNAL ARCHITECTURE AND BLOCK DIAGRAM

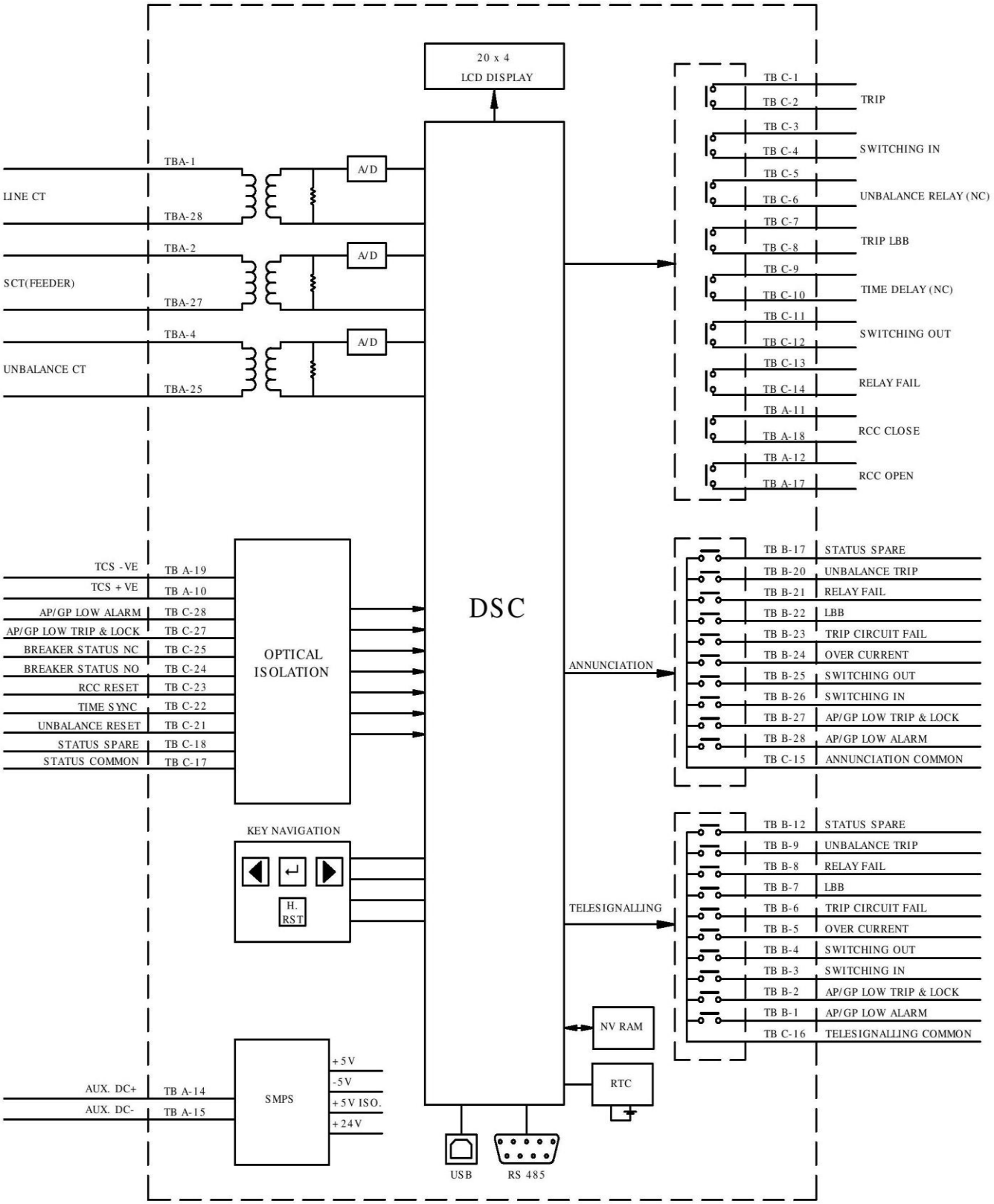
INTERNAL SYSTEM LEVEL ARCHITECTURE

The internal system level architecture of ANC 303 relay including card to card architecture in brief is shown below.



BLOCK DIAGRAM

ANC 303



1. DSP Controller

The dsPIC DSC (Digital Signal Controller) is a 16-bit modified Harvard RISC (Reduced Instruction Set Computer) machine that combines the control advantages of a high-performance 16-bit microcontroller with the high computation speed of a fully implemented Digital Signal Processor (DSP).

The DSP controller continuously monitors the currents and voltages. 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 each 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 2 communications port, USB and RS 485. The relay is using IEC 60870-5-103 communication protocol for communication through RS485 and USB (Proprietary).

USB Communication Port

USB port is provided for uploading/downloading relay settings and events.

1. The software is capable of analyzing the peak, RMS & average values of current, Harmonic analysis of current waveforms and determination of fault clearing time.
2. Waveform pointed by user displays the current & sample value of the particular point.

RS 485 Communication Port

RS 485 port is provided for SCADA connectivity. Using RS485 port online fault data of critical parameters, disturbance record(Waveform), event record(Trip data),Automatic Supervision and Control(healthiness of Relay),Alarm and Event Handling, Data Acquisition, Calculating and Reporting, Parameter Setting, Resetting Indicating LEDs, Trip Circuit supervision, Relay Fail Indication etc can be downloaded. The communication complies with IEC 60870-5-103 protocol.

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 USB & RS485 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 Fail.

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**
   Operating Voltage: **110 VDC**
4. Prefer regulated power supply of 110VDC.
5. Auxiliary power supply shall be provided to the terminals 14 & 15 of TB-A with the help of an MCB.
6. Switch on the power supply. Measure the voltage between the terminals 14 & 15 of TB-A, and ensure that the voltage is within the normal operating range.
7. After the relay is powered ON, the following shall be noticed.
8. 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, Communication PCB, Controller PCB, Stack PCB, Trip relay &transformer PCB, SMPS PCB,I/O& status PCB, Back panel PCB.

Display PCB: The Display PCB is mounted at the front plate of the unit. It consists of the 20x4 LCD, LED indications, Keyboard circuits, and LED controller.

Controller PCB: The Controller PCB is mounted on the back side of the Display PCB. This PCB consists of major components such as DSP controllers, ADC and its filter circuits, Memory ICs, RTC. The Analog signals are filtered and digitized in this board. The DSP takes decision based on this digital samples and initiates necessary commands.

Communication PCB: The communication PCB is mounted at the front side. This PCB supports the communication through USB for data exchange. Also the Hardware Reset Switch is mounted in this PCB.

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

Trip relay &Transformer PCB: All the CTs, PTs and Tripping Relays are assembled in this board. This board 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.

SMPS PCB: The SMPS PCB provides the necessary Power supply voltages to the different PCBs mounted inside the relay. The SMPS is a DC-DC converter. The SMPS provides +24V, +5V, -5V and isolated +5 V. The +24 V supply is used for the driving the output relays in the I/O PCB and Trip Relay PCB. 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.

I/O& status PCB: The I/O PCB deals with the necessary I/O lines such as Input status lines and Digital Output contacts. A separate controller provided in this board performs the necessary I/O operations in conjunction with the DSP controller in the Processor PCB. The I/O PCB is mounted vertically on to the stack PCB.

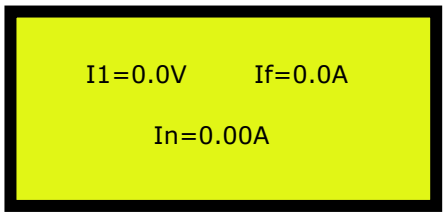
Back PCB: This PCB consists of terminal blocks for external interface with the site and power connector which connects SMPS, I/O and CT PT PCB's. The RS 485 port is also mounted in this PCB. The terminal block (TB-A) is having CT shorting facility. Since the rack with Terminal Blocks is having the CT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

RELAY SETTINGS AND ALGORITHM

ANC 303

After Power ON, the relay boot screen shows

Then comes the online parameter display



To scroll between online displays, press **Right** key after holding ↵ key.

Setting Mode

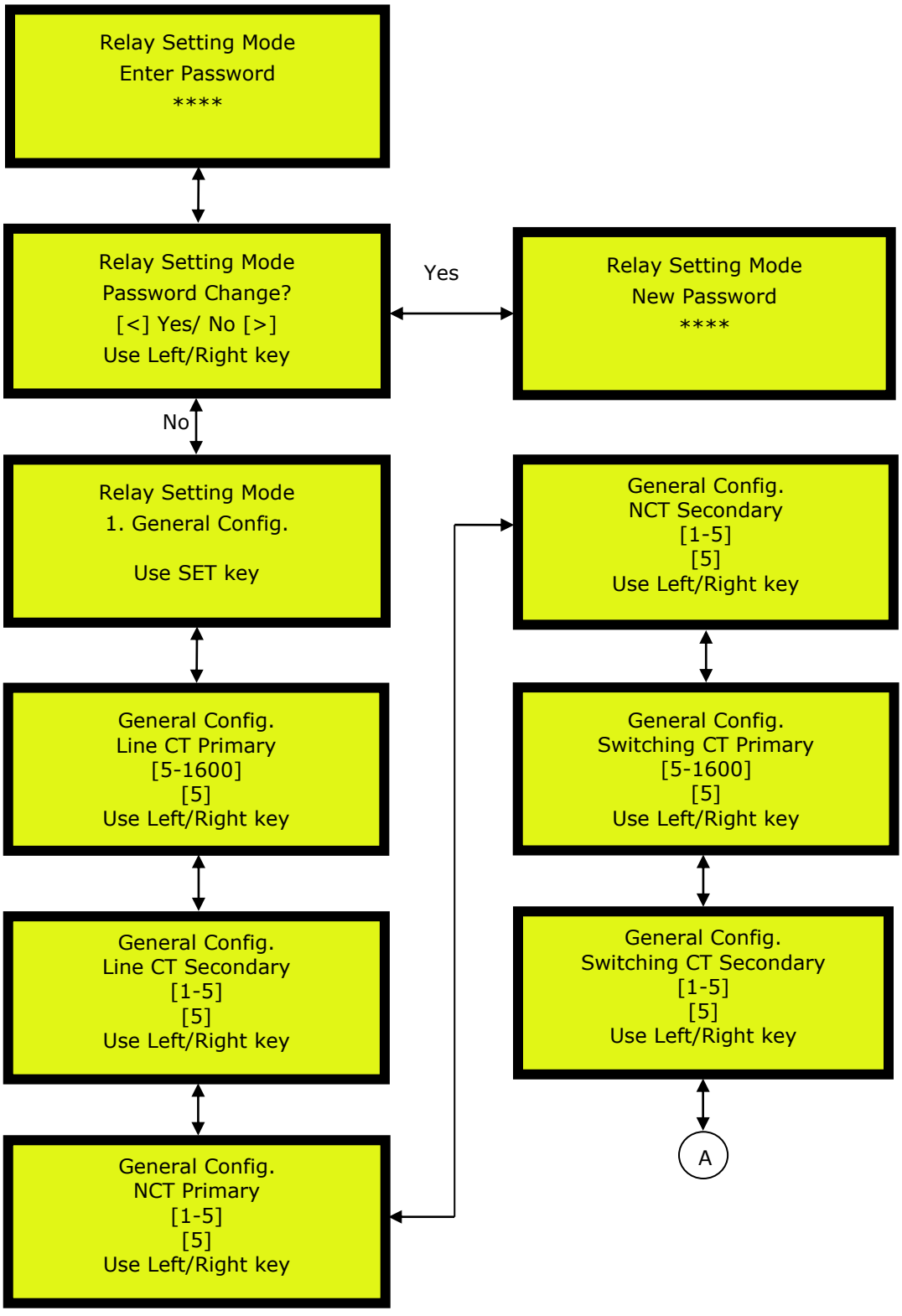
Press and hold ↵ for 5 seconds
Relay will enter to setting mode.
Enter the password and press ↵ key. The default password setting is '1000'

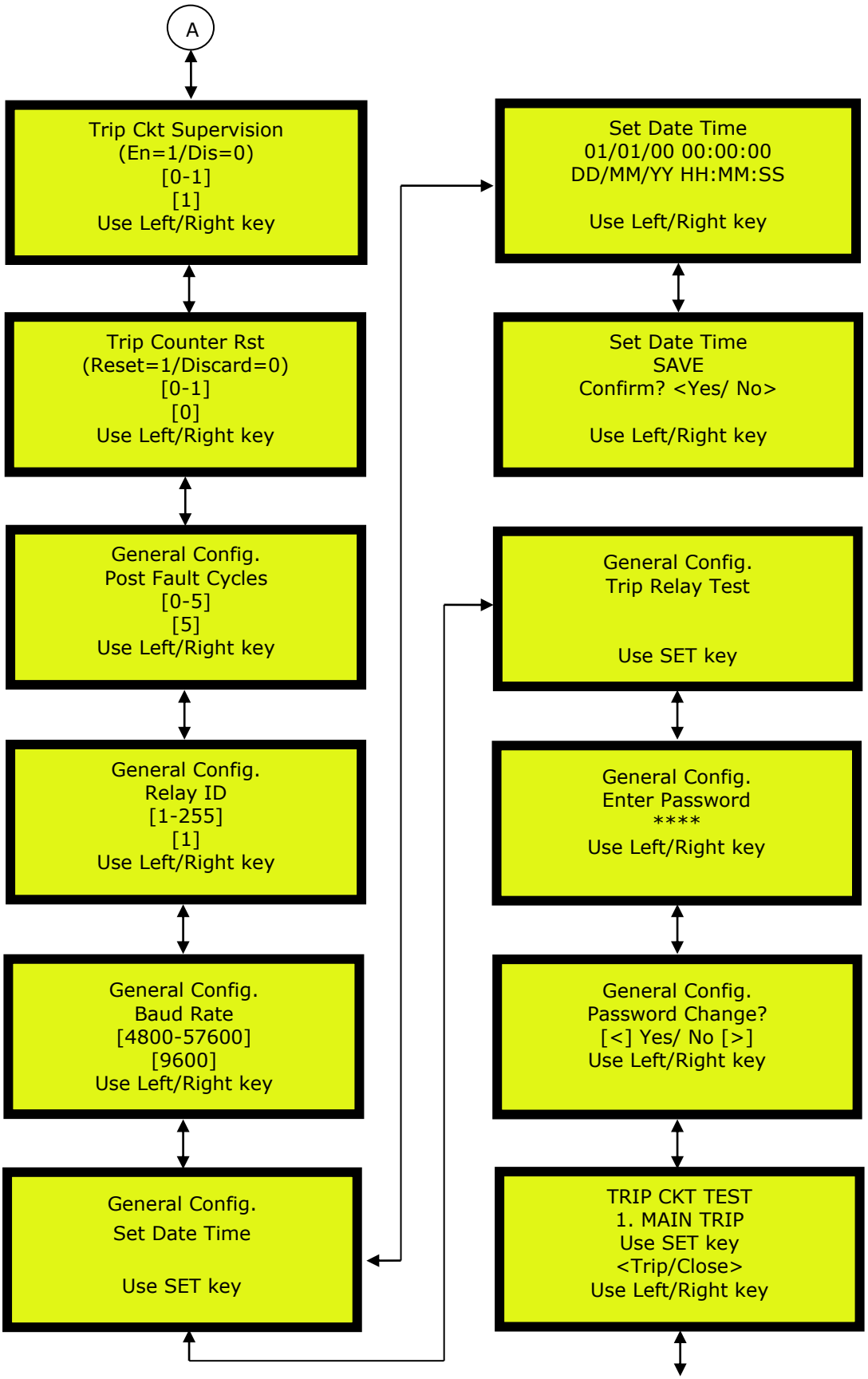
To change settings:

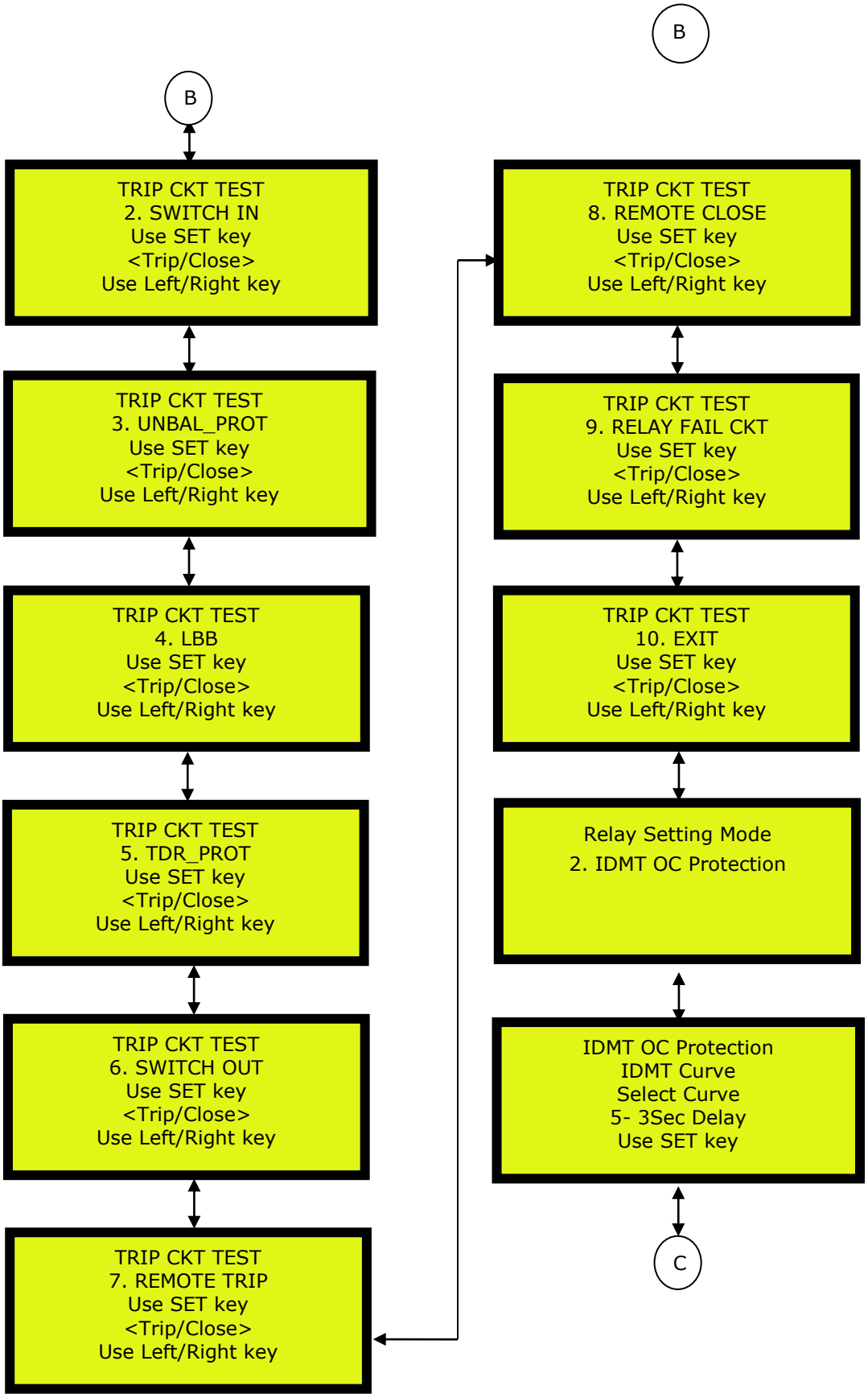
a) Press ↵ to change the settings.
b) Press **Right** key to increment
c) Press **Left** key to decrement
d) Press ↵ to accept change.
e) To coming back to main **MENU** while operating, press **Left** and **Right** key simultaneously.
f) Repeat the process for all settings
g) After completing the settings,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

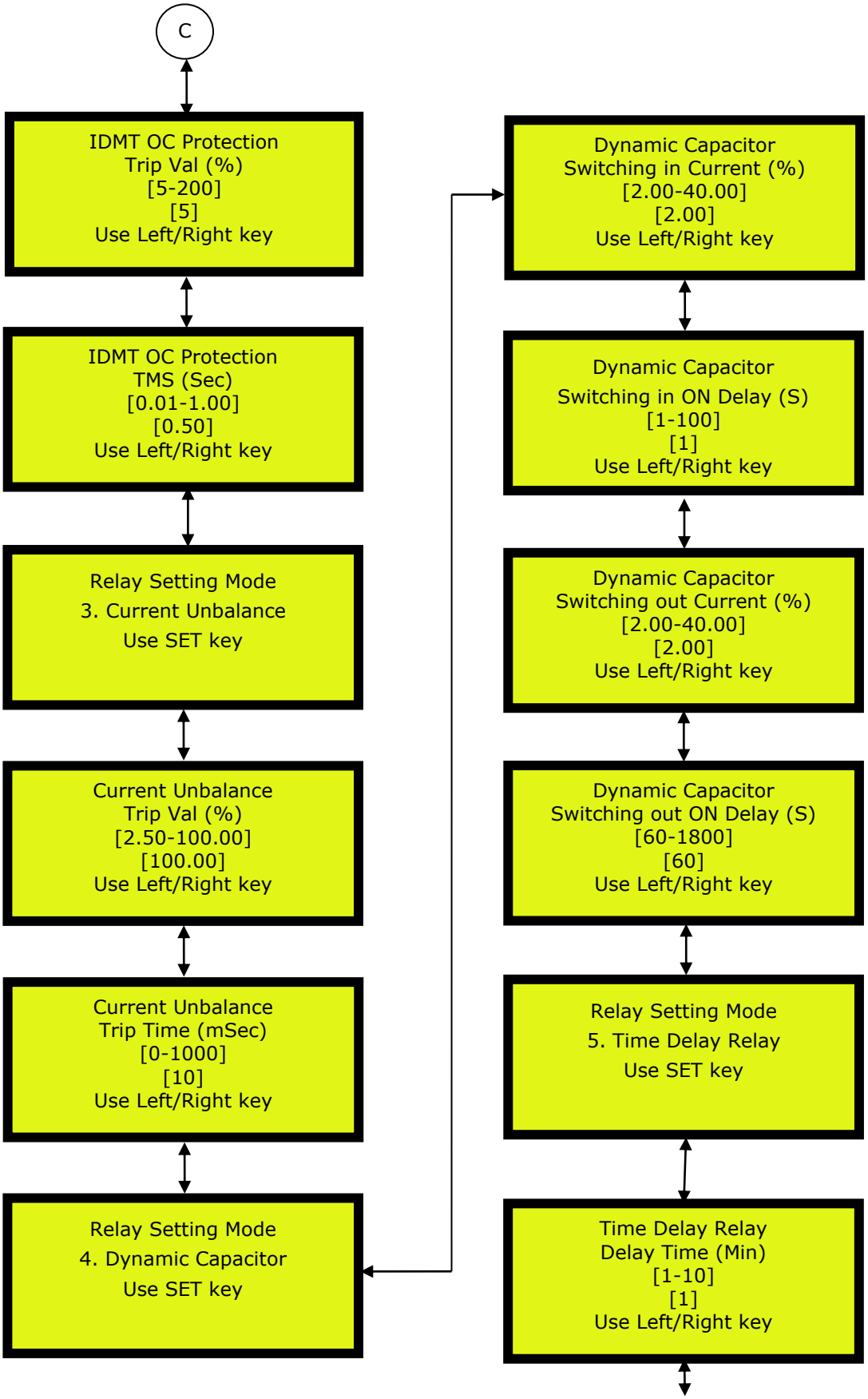
Relay Settings Algorithm

ANC 303

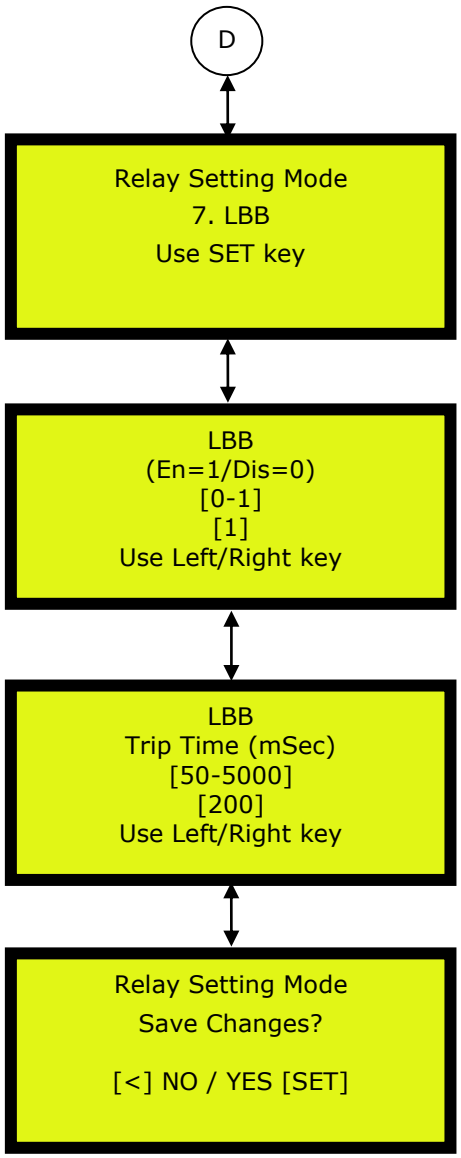



A
Trip Ckt Supervision
(En=1/Dis=0)
[0-1]
[1]
Use Left/Right key
Trip Counter Rst
(Reset=1/Discard=0)
[0-1]
[0]
Use Left/Right key
General Config.
Post Fault Cycles
[0-5]
[5]
Use Left/Right key
General Config.
Relay ID
[1-255]
[1]
Use Left/Right key
General Config.
Baud Rate
[4800-57600]
[9600]
Use Left/Right key
General Config.
Set Date Time
Use SET key
Set Date Time
01/01/00 00:00:00
DD/MM/YY HH:MM:SS
Use Left/Right key
Set Date Time
SAVE
Confirm? <Yes/ No>
Use Left/Right key
General Config.
Trip Relay Test
Use SET key
General Config.
Enter Password
****
Use Left/Right key
General Config.
Password Change?
[<] Yes/ No [>]
Use Left/Right key
TRIP CKT TEST
1. MAIN TRIP
Use SET key
<Trip/Close>
Use Left/Right key


B
B
TRIP CKT TEST
2. SWITCH IN
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
3. UNBAL_PROT
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
4. LBB
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
5. TDR_PROT
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
6. SWITCH OUT
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
7. REMOTE TRIP
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
8. REMOTE CLOSE
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
9. RELAY FAIL CKT
Use SET key
<Trip/Close>
Use Left/Right key
TRIP CKT TEST
10. EXIT
Use SET key
<Trip/Close>
Use Left/Right key
Relay Setting Mode
2. IDMT OC Protection
IDMT OC Protection
IDMT Curve
Select Curve
5- 3Sec Delay
Use SET key
C


C
IDMT OC Protection
Trip Val (%)
[5-200]
[5]
Use Left/Right key
IDMT OC Protection
TMS (Sec)
[0.01-1.00]
[0.50]
Use Left/Right key
Relay Setting Mode
3. Current Unbalance
Use SET key
Current Unbalance
Trip Val (%)
[2.50-100.00]
[100.00]
Use Left/Right key
Current Unbalance
Trip Time (mSec)
[0-1000]
[10]
Use Left/Right key
Relay Setting Mode
4. Dynamic Capacitor
Use SET key
Dynamic Capacitor
Switching in Current (%)
[2.00-40.00]
[2.00]
Use Left/Right key
Dynamic Capacitor
Switching in ON Delay (S)
[1-100]
[1]
Use Left/Right key
Dynamic Capacitor
Switching out Current (%)
[2.00-40.00]
[2.00]
Use Left/Right key
Dynamic Capacitor
Switching out ON Delay (S)
[60-1800]
[60]
Use Left/Right key
Relay Setting Mode
5. Time Delay Relay
Use SET key
Time Delay Relay
Delay Time (Min)
[1-10]
[1]
Use Left/Right key

D


D
Relay Setting Mode
7. LBB
Use SET key
LBB
(En=1/Dis=0)
[0-1]
[1]
Use Left/Right key
LBB
Trip Time (mSec)
[50-5000]
[200]
Use Left/Right key
Relay Setting Mode
Save Changes?
[<] NO / YES [SET]

TECHNICAL DATA & CHARACTERISTIC CURVES

CONTENTS

DESCRIPTION OF PROTECTION FUNCTIONS

TECHNICAL SPECIFICATIONS

GENERAL SETTINGS

TB DETAILS

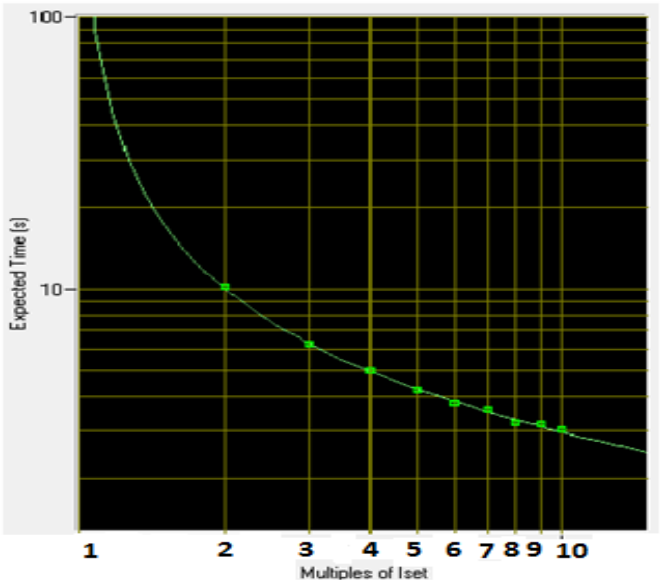
RELAY CONFORMING STANDARDS

DESCRIPTION OF PROTECTION FUNCTIONS

ANC 303 (AN Series) relay is a functional relay (Current unbalance protection and IDMT Over current protection etc) designed to be used for the protection of capacitor banks. Capacitor banks are used in the power system for compensating the reactive power and for filtering harmonics. The capacitor banks are usually protected against overload caused by internal faults in the bank. Protection against unintentional reconnection of a charged capacitor to an energized network is also to be included. All these functions are incorporated in the capacitor bank protection relay.

1. IDMT over Current Protection

The IDMT element use standard inverse of characteristics (3 sec Delay Curve). Its graphical representation as shown in Figure.



3 sec Delay Curve

t =3k/log [PSM]

Where,

k= Time Multiplier Setting (TMS)

t = Operating time in second

TMS = Time multiplier setting

PSM=Fault Current/Plug Setting

2. Current unbalance Protection

The capacitor bank is protected by means of an unbalance current protection. The capacitor bank is connected as a bridge and an unbalance sensing current transformer is provided. The current is settable from 2.5 to 100% in steps of 0.50 % and operating time from 0 to 1 sec in steps of 1ms.

3. Capacitor Bank Switching IN/OUT

Microcontroller based Intelligent Automatic Power Factor Controller/Regulator/Correction Relay with on-line monitoring of Feeder current. The Unit uses one of the tried and time tested intelligent algorithms to switch the capacitor banks, in a most optimum combination in a shortest time for any dynamic load conditions without the need to select the switching by user.

Capacitor banks can be connected to the system based on the load pattern. Switches on/off the necessary capacitor banks depending upon the load current, the target power factor can be achieved effectively.

TECHNICAL SPECIFICATIONS

Sl.No	Specification	REF.	Particulars
1.	**Auxiliary Supply**	V_{DC}	45 to 170 VDC
2.	**Current Input (rated)**	In	5A AC
3.	**Unbalance Current Input (rated)**	Inu	1A AC
4.	**Frequency**	Fn	50 Hz
5.	**VA Burden on CT**		Less than 0.5 VA
6.	**VA burden on Aux**		Less than 15 Watts(energized) Less than 10 watts(de-energized)
7.	**Operating Temp Range**		-10°C to + 60 °C
8.	**Max. & Minimum relative humidity**		100% & 22%
9.	**Continuous Current Carry Capacity of CT**		3In; 15A
10.	**Thermal Withstand for CT**		40In for 1 sec
11.	**Contact details**		
	a)Current carrying capacity		5A
	b) Making and carry for 3 sec at 250V,50Hz		30A
	c) Making capacity at 250V,50-60Hz AC		5A
	d)Breaking Capacity AC 220V, 50-60Hz, CosØ=0.4 DC 220V, L/R= 45ms		 5A 0.5A
12.	**Type of communication ports**		USB and RS485
13.	**Overall dimensions** Width Height Depth		 263 mm 173 mm 330 mm
14.	**Weight**		6.9 kg approx.

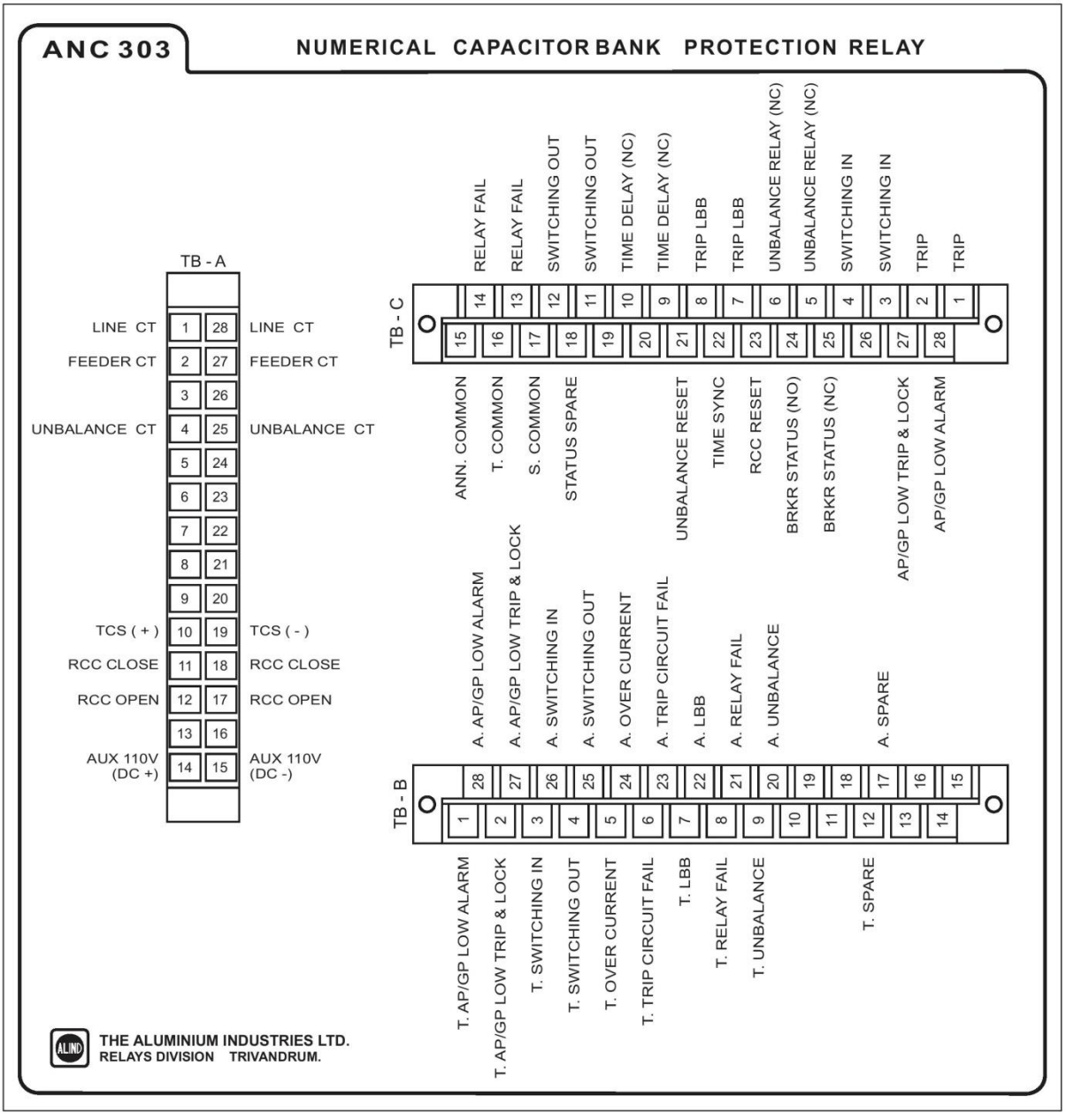
RELAY SETTINGS

ANC 214

	Settings	Particulars
1.	**General config.**	
1.1	Trip Ckt Supervision (EN/DIS)	
1.2	Line CT Primary	5 to 1600A in steps of 5A
1.3	Line CT Secondary	1 to 5A in steps of 1A
1.4	Unbalance CT Primary	1 to 5A in steps of 1A
1.5	Unbalance CT Secondary	1 to 5A in steps of 1A
1.6	Switching CT Primary	5 to 1600A in steps of 5A
1.7	Switching CT Secondary	1 to 5A in steps of 1A
1.8	Trip counter Reset	Reset/Discard
1.9	Post fault cycle	0 to 5 in steps of 1
1.10	Relay ID	1 to 255 in steps of 1
1.11	Baud Rate	4800-57600 in steps of 200
1.12	Set Date Time	(Yes/No) DD/MM/YYHH:MM:SS
1.13	Trip Relay Test	
2.	**IDMT OC Protection**	
2.1	IDMT Current	5 to 200% in steps of 1%
2.2	IDMT TMS	0.01 to 1 sec in steps of 0.01 sec
3.	**Current Unbalance**	
3.1	Current Unbalance	2.5 to 100% in steps of 0.5%
3.2	Unbalance time	0 to 1000ms in steps of 1 ms
4.	**Dynamic capacitor switching element**	
4.1	Switching in current	2 to 40% in steps of 0.1%
4.2	Switching in ON delay	1 to 100sec in steps of 1 sec
4.3	Switching out current	2 to 40% in steps of 0.1%
4.4	Switching out ON delay	60 to 1800sec in steps of 30 sec
5.	**Time Delay Relay**	
5.1	TDR relay	0 to 600 sec in steps of 20 sec
6.	**Local Breaker Backup**	
6.1	LBB (EN/DIS)	
6.3	LBB Time	0 to 5000ms in steps of 1 ms

TB DETAILS

ANC 214



RELAY CONFORMING STANDARDS

The relay conforms to the following standards:

Sl 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 3156 (Part II/III)	Measuring/Protective Voltage Transformers.
XIII.	IS 3231 (Part 1 to 3)	Electrical Relays For Power System Protection.
XIV.	IS 8686	Static Protective Relays.
XV.	IEC 60068-2	Environmental Tests.
XVI.	IEC 60870-5-103	Communication Protocol

TEST REPORT

ALUMINIUM INDUSTRIES LIMITED
Relays Division

1. RELAY CHARACTERISTICS & OPERATING VALUE TEST

1.1 OPERATING VALUE TEST FOR IDMT OCR

IDMT setting	Operating Value (A)	Drop off value (A)	Drop off / pick up (%)
20% = 1.0A			
100% = 5A			
120% = 6A			

Allowable tolerance limit is ±5%

1.2 CURRENT UNBALANCE PROTECTION

Current Unbalance Setting	Operating Value (A)
10% = 0.1A	
50% = 0.5A	
100% = 1A	

Allowable tolerance limit is ±5%

1.3 SWITCH IN CURRENT

IDMT setting	Operating Value (A)	Drop off value (A)	Drop off / pick up (%)
20% = 1.0A			
30% = 1.5A			
40% = 2A			

Allowable tolerance limit is ±5%

1.4 SWITCH OUT CURRENT

IDMT setting	Operating Value (A)	Drop off value (A)	Drop off / pick up (%)
20% = 1.0A			
30% = 1.5A			
40% = 2A			

Allowable tolerance limit is ±5%

2. OPERATING TIME MEASURING TEST

2.1 IDMT PROTECTION

IDMT setting	TMS setting	Current Injected	Expected Time from curve	Observed Time in sec
20%	0.1	4A	0.50	
20%	0.5	10A	1.50	
20%	0.01	10A	0.03	
20%	1	10A	3.00	

Allowable tolerance limit is ±5%

2.2 **CURRENT UNBALANCE PROTECTION**

Current unbalance setting	Current Injected	Delay in ms	Observed Time in ms
2.5%	0.5A	20	
40%	1A	100	
80%	2A	500	

Allowable tolerance limit is ±5%

2.3 **SWITCH IN CURRENT**

S/In setting	Current Injected	Delay in Sec	Observed Time in Sec
20% = 1.0A	1.01	1	
30% = 1.5A	1.52	45	
40% = 2A	2.02	70	

Allowable tolerance limit is ±5%

2.4 **SWITCH OUT CURRENT**

S/Out setting	Current Injected	Delay in Sec	Observed Time in Sec
20% = 1.0A	0.90	60	
30% = 1.5A	1.20	210	
40% = 2A	1.5	360	

Allowable tolerance limit in operating time is ±5%

2.5 **TIME DELAY RELAY**

TDR setting in min	TDR observed(Sec)
1	
3	
10	

Allowable tolerance limit in operating time is ±5%

2.6 **Local Breaker Backup (LBB) Trip**:Settings: OCR setting = 50%

LBB time setting	Current Injected	Breaker status	LBB Status	LBB time (ms)
100ms	15A	Not operated Operated	Operated Not operated	
500ms	10A	Not operated Operated	Operated Not operated	

Allowable tolerance limit in operating time is ±5%

3. STATUS VERIFICATION

Short TB-A 16 & TB-B 14

STATUS	STATUS INPUT	OUTPUT CONTACT VERIFICATION
FDR BRKR AP/GP LOW ALARM	Short TB-C 28&17	
FDR BRKR AP/GP TRIP & LOCK	Short TB- C 27&17	
TRIP CIRCUIT FAIL	Apply 110VDC TBA 10&19	

TROUBLESHOOTING

ALUMINIUM INDUSTRIES LIMITED
Relays Division

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.

Sl. No.	Faults	Checks	Causes
1.	No power ON Indication or No display.	1. Check the auxiliary DC supply to the relay rear terminals TB A-14: +110VDC TB A-15: -110VDC 2. Check the continuity of the output terminal, after disconnecting the wires.	1. Due to power supply failure, the LED turns off. The varistor may Short circuited to protect internal circuitry on transients.
2.	Relay Fail Indication	1. Intimate to works. 2. Press H.RST key in the relay Front panel.	1. Supply variation to internal PCB's. 2. DC supply fail.

1. 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	180	2	3	According to main FUN
Reset CU	-	5	180	3	4	According to main FUN
Reset CU/Start/Restart	-	5	180	4	5	According to main FUN

STATUS INDICATION IN MONITOR DIRECTION

DESCRIPTION	GI	ASDU TYPE	FUN	INF	COT	COM
Protection Healthy/Active	-	1	180	18	1	↑
LED Reset	-	1	180	19	1	↑
Local Parameter Settings (Change)	-	1	180	22	1	↑
AP/GP Low Alarm	X	1	180	29	1,9	↑↓
AP/GP Trip & Lock	X	1	180	30	1,9	↑↓
Spare	X	1	180	26	1,9	↑↓
CB NC (FDR CB OPEN)	X	1	180	136	1,9	↑↓
CB NO (FDR CB CLOSE)	X	1	180	137	1,9	↑↓
RCC-Unbalance Reset	-	1	180	27	1	↑
TDR (Time Delay Relay)	X	1	180	34	1,9	↑↓
Relay Fail	-	1	180	40	1	↑

SUPERVISION INDICATIONS IN MONITOR DIRECTION

DESCRIPTION	GI	ASDU TYPE	FUN	INF	COT	COM
Trip circuit supervision	X	1	180	36	1,9	↑↓

FAULT INDICATION IN (MONITOR DIRECTIONS)

DESCRIPTION	GI	ASDU TYPE	FUN	INF	COT	COM
Breaker Failure (LBB)	X	2	180	85	1,9	↑↓
Start/pickup IDMT	X	2	180	64	1,9	↑↓
Start/pickup Switch In	X	2	180	65	1,9	↑↓
Start/pickup Switch Out	X	2	180	66	1,9	↑↓
Start/pickup Unbalance	X	2	180	63	1,9	↑↓
IDMT Trip	-	2	180	103	1	↑
Switch In	-	2	180	104	1	↑
Switch Out	-	2	180	105	1	↑
Unbalance Trip	-	2	180	146	1	↑

MEASURAND IN MONITOR DIRECTION

DESCRIPTION	GI	ASDU TYPE	FUN	INF	COT	COM
Measurand supervision Line CT	-	9	180	148	2	↑↓
Measurand supervision Unbalance CT	-	9	180	148	2	↑↓
Measurand supervision Switching CT	-	9	180	148	2	↑↓

TIME TAGED MEASURAND IN MONITOR DIRECTIONS

DESCRIPTION	GI	ASDU TYPE	FUN	INF	COT	COM
Fault Current – I	-	4	180	141	1	↑↓
Unbalance Fault Current – I	-	4	180	142	1	↑↓
Switching Fault Current – I	-	4	180	145	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 RESET	-	20	180	19	20	↑ (PULSE)
Unbalance Reset	-	20	180	35	20	↑ (PULSE)
CB Open	-	20	180	124	20	↑ (PULSE)
CB Close	-	20	180	125	20	↑ (PULSE)

2. ANALOG CHANNEL INFORMATION IN ANC 303

ANC 303		
FUN	ACC	PARAMETER
180	**1**	**I**
180	**2**	**If**
180	**3**	**In**
180	4	x
180	5	x
180	6	x
180	7	x
180	8	x

3. DIGITAL CHANNEL(TAGS) INFORMATION IN ANC 303

ANC 303			
TAG POSSITION	FUN/INF NUMBER	SEMANTICS ACCORDING TO TAG POSSITION	INPUT/ OUTPUT
0	180/84	GENERAL PICKUP	OUTPUT
1	180/68	GENERAL TRIP	OUTPUT
2	180/103	IDMT TRIP	OUTPUT
3	180/104	SWITCH IN TRIP	OUTPUT
4	180/105	SWITCH OUT TRIP	OUTPUT
5	180/146	UNBALANCE TRIP	OUTPUT
6	180/85	LBB	OUTPUT
7	180/27	UNBALANCE RESET - LOG I/P - 1	INPUT
8	255/0	TIME SYNC - LOG I/P - 2	INPUT
9	180/19	LED RESET - LOG I/P - 3	INPUT
10	180/136	CB NC (OPEN) - LOG I/P - 4	INPUT
11	180/137	CB NO (CLOSE) - LOG I/P - 5	INPUT
12	180/30	AP/GP LOW TRIP & LOCK - LOG I/P - 6	INPUT
13	180/29	AP/GP LOW ALARM - LOG I/P - 7	INPUT
14	180/34	TDR - LOG I/P - 8	INPUT
15	180/36	TRIP CIRCUIT SUPERVISION - LOG I/P - 9	INPUT

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