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PRECISION INSTRUMENTATION

TRUE RMS DIGITAL PROTECTION RELAY
OMICRON VA
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Multifunction Meters

Transducers & Isolators

Temperature Controllers

Converters & Recorders

Digital Panel Meters

Current Transformers

Analogue Panel Meters

Shunts

Digital Multimeters

Clamp Meters

Insulation Testers

OMICRON RELAY (VOLTAGE PROTECTION RELAY & CURRENT PROTECTION RELAY)

User Manual - Issue 1.0

SUBJECT TO CHANGE WITHOUT NOTICE

This manual superseded all previous versions – please keep for future reference



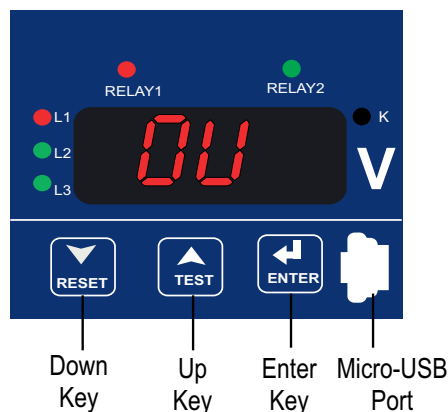
DIGITAL PROTECTION RELAY

Programmable Multi-function Relay

Installation & Operating Instructions

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1. INTRODUCTION

Voltage Protection Relay: -

The Multifunction Voltage Protection Relay measures electrical parameters like AC voltage, Frequency in 3 ph 4 wire, 3 ph 3 wire, 1 ph 2 wire Network and can be used to protect against Over voltage, Under voltage, Phase unbalance, Phase sequence detection, Phase failure detection, Under frequency, Over frequency conditions.

Current Protection Relay: -

The Multifunction Current Protection Relay measures electrical parameters like AC Current, Frequency in 3 ph 4 wire, 3 ph 3 wire, 1 ph 2 wire Network and can be used to protect against Over Current, Under Current, Current unbalance, Current loss.

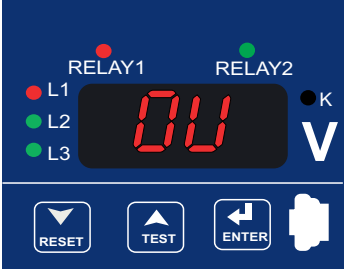
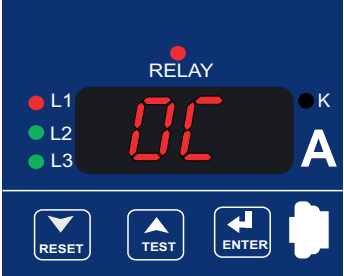
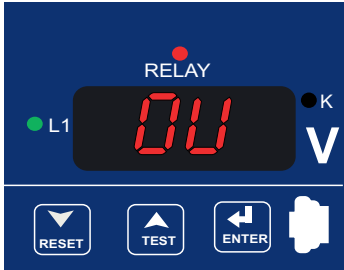
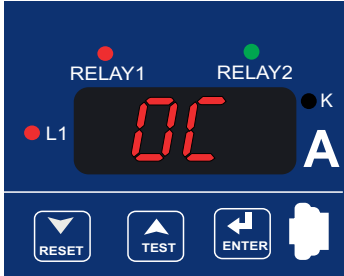
The Voltage / Current Protection relay integrates accurate measurement technology & measures distorted waveform up to 15th harmonics with 4 Digit 7 Segment LED Display.

Voltage / Current Protection Relay can be configured & Programmed on site for system type, PT / CT Primary, PT / CT Secondary in 3 Phase 3W, 3 Phase 4W, 1 Phase 2W System.

The front panel has three push button keys namely Reset / Down, Test / Up, Enter.

The Micro-USB port must be used for Modbus communication via USB-based PRKAB.

1.1 Display and Operating Elements

Meter Front	Element	Colour	Significance
Three Phase:   Single Phase  	L1 L2 L3	Bi-colour (Green / Red)	Phase 1 LED indication Phase 2 LED indication Phase 3 LED indication LED States - Green - Healthy State Green (Flashing) - Reset Delay Red - Fault present on particular phase Red (Flashing) - Trip Delay OFF - Input Absent
	RELAY 1 RELAY 2 RELAY	Bi-colour (Green / Red)	RELAY 1 LED (1CO+1CO only) RELAY 2 LED (1CO+1CO only) RELAY LED (1CO/2CO only) LED States - Green - Healthy State Red - Fault / Alarm present
	K	Red	X1000 Indication
	RESET / ▼	-	RESET / DOWN Key (< 3 sec): Decrement values, move downwards in menu RESET / Down Key (> 3 sec): Reset relay in manual reset mode
	TEST / ▲	-	TEST / UP Key (< 3 sec): Increment values, move upwards in menu TEST / UP Key (> 3 sec): Switch relay contacts, resets to initial position when released
	ENTER / ↵	-	ENTER Key (< 3 sec): Confirm values, menu level changes ENTER Key (> 3 sec): Enter Setup mode

2. MEASUREMENT PARAMETERS

In normal operation, the user is presented with one of the measurement reading screens out of several screens. These screens may be scrolled through one at a time in incremental order by pressing the "▲" key and in decremental order by pressing "▼" key.

TABLE 1 (A):

Measured Parameters of Current Protection Relay System Wise:

Measured Parameters	Units	3P 3W	3P 4W	1P 2W
System Current	Ampere	✓	✓	×
Current L1,L2,L3	Ampere	✓	✓	✓(Only L1)
System Frequency	Hz	✓	✓	✓
High / Low System Current	Ampere	✓	✓	✓
High / Low System Frequency	Hz	✓	✓	✓

TABLE 1 (B):

Measured Parameters of Voltage Protection Relay System Wise:

Measured Parameters	Units	3P 3W 3	P 4W	1P 2W
System Voltage	Voltage	✓	✓	×
Voltage VL1-N, VL2-N, VL3-N	Voltage	×	✓	✓(Only L1-N)
Voltage VL1-VL2, VL2-VL3, VL3-VL1	Voltage	✓	✓	×
System Frequency	Hz	✓	✓	✓
High / Low System Voltage	Voltage	✓	✓	✓
High / Low System Frequency	Hz	✓	✓	✓

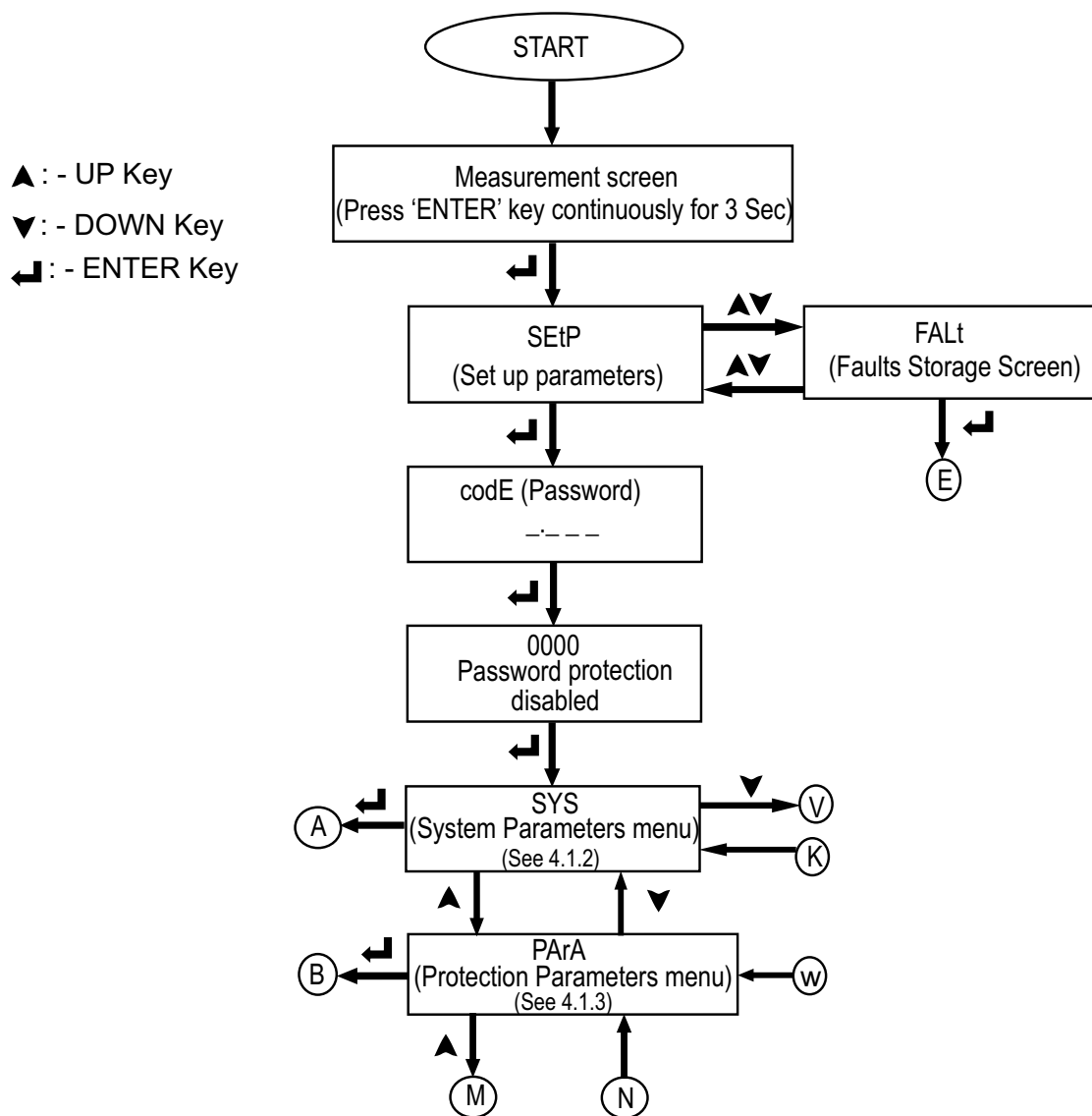
✓ Available

× Not available

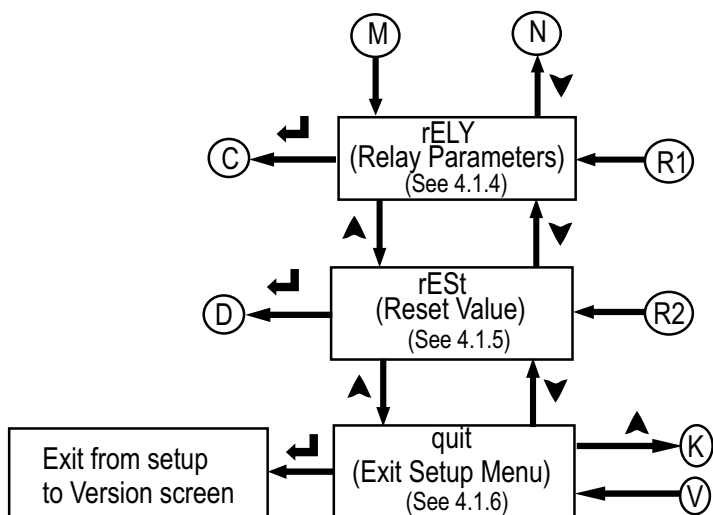
3. FLOW DIAGRAMS

3.1 Voltage Protection Relay

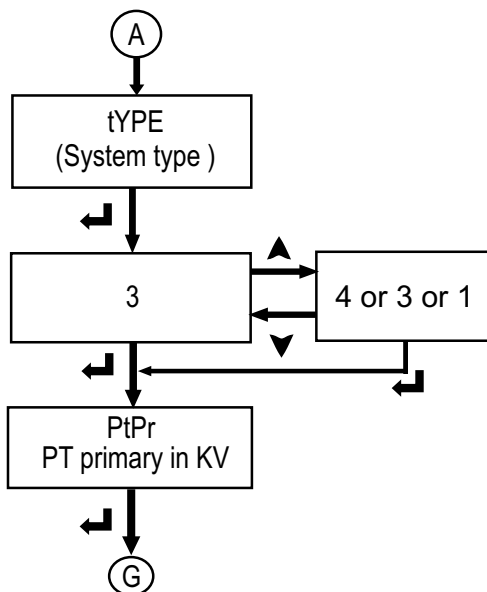
3.1.1 Set up Parameters screen



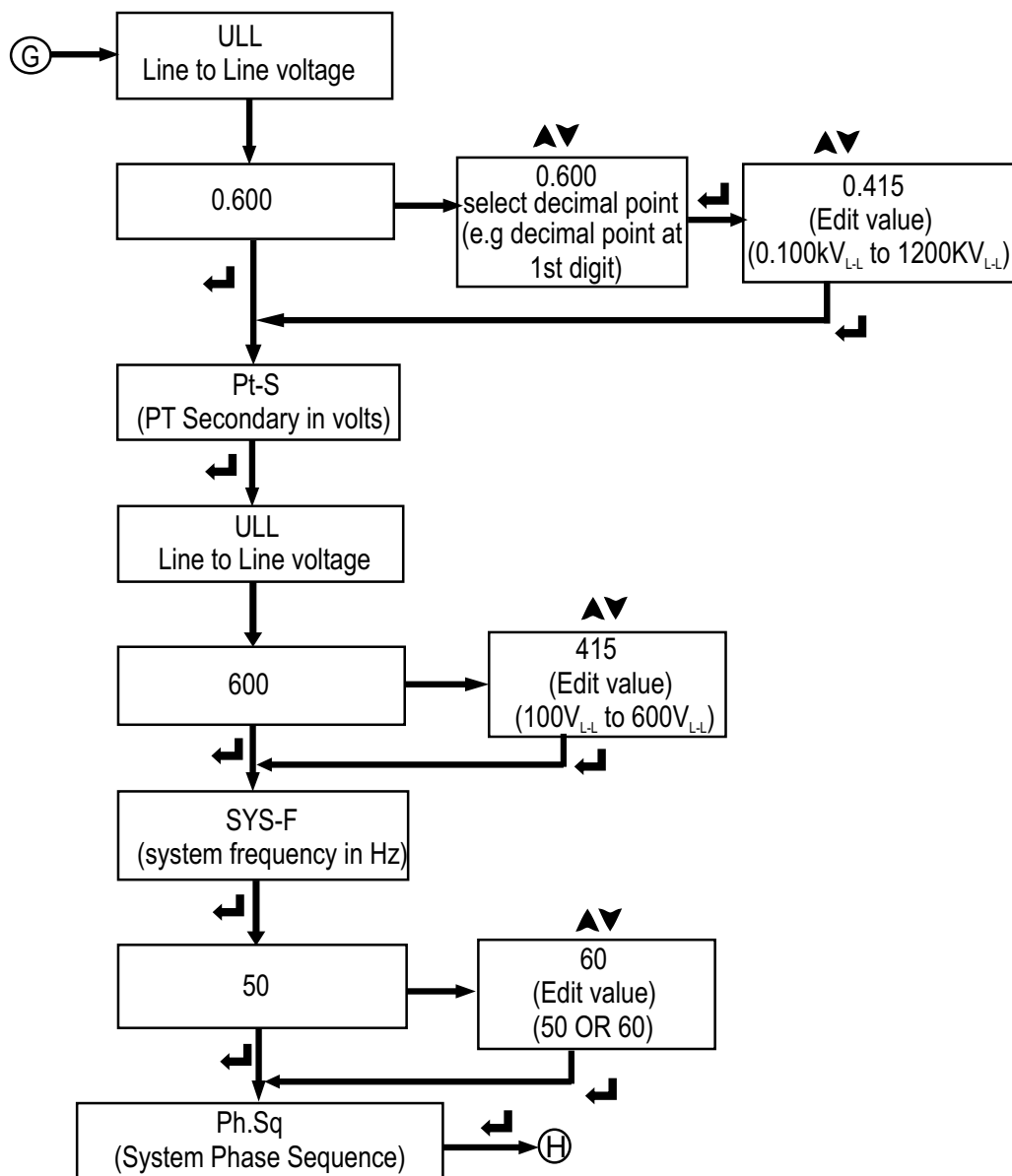
Continued....



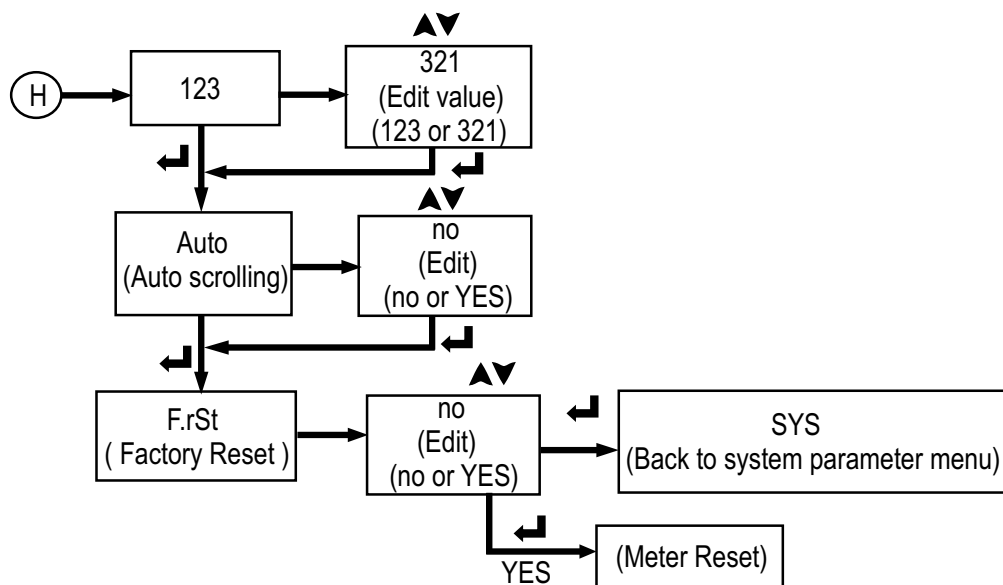
A] SYS (System Parameters Menu)



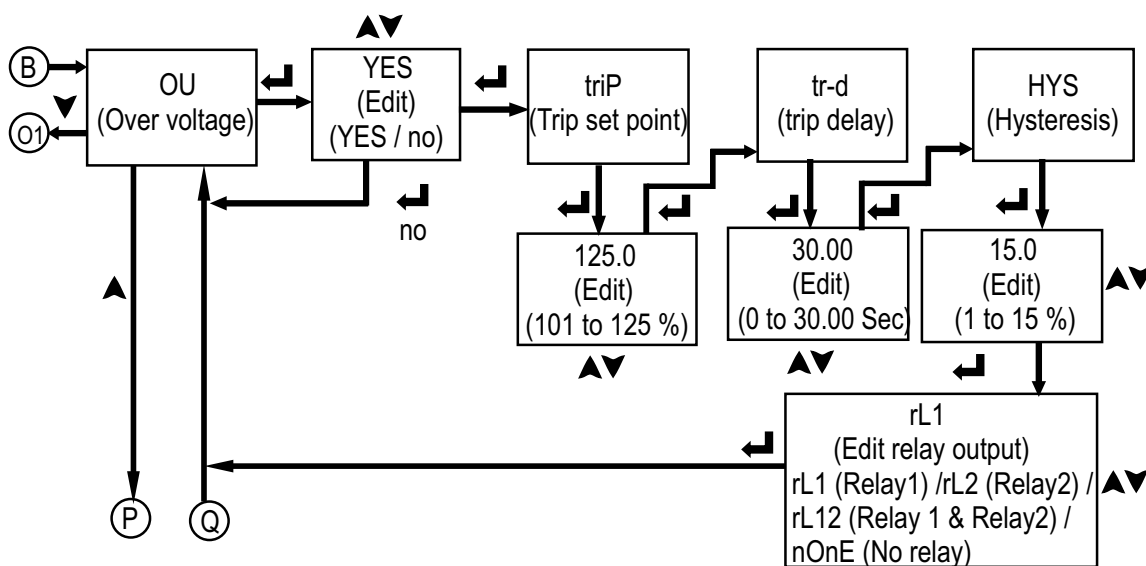
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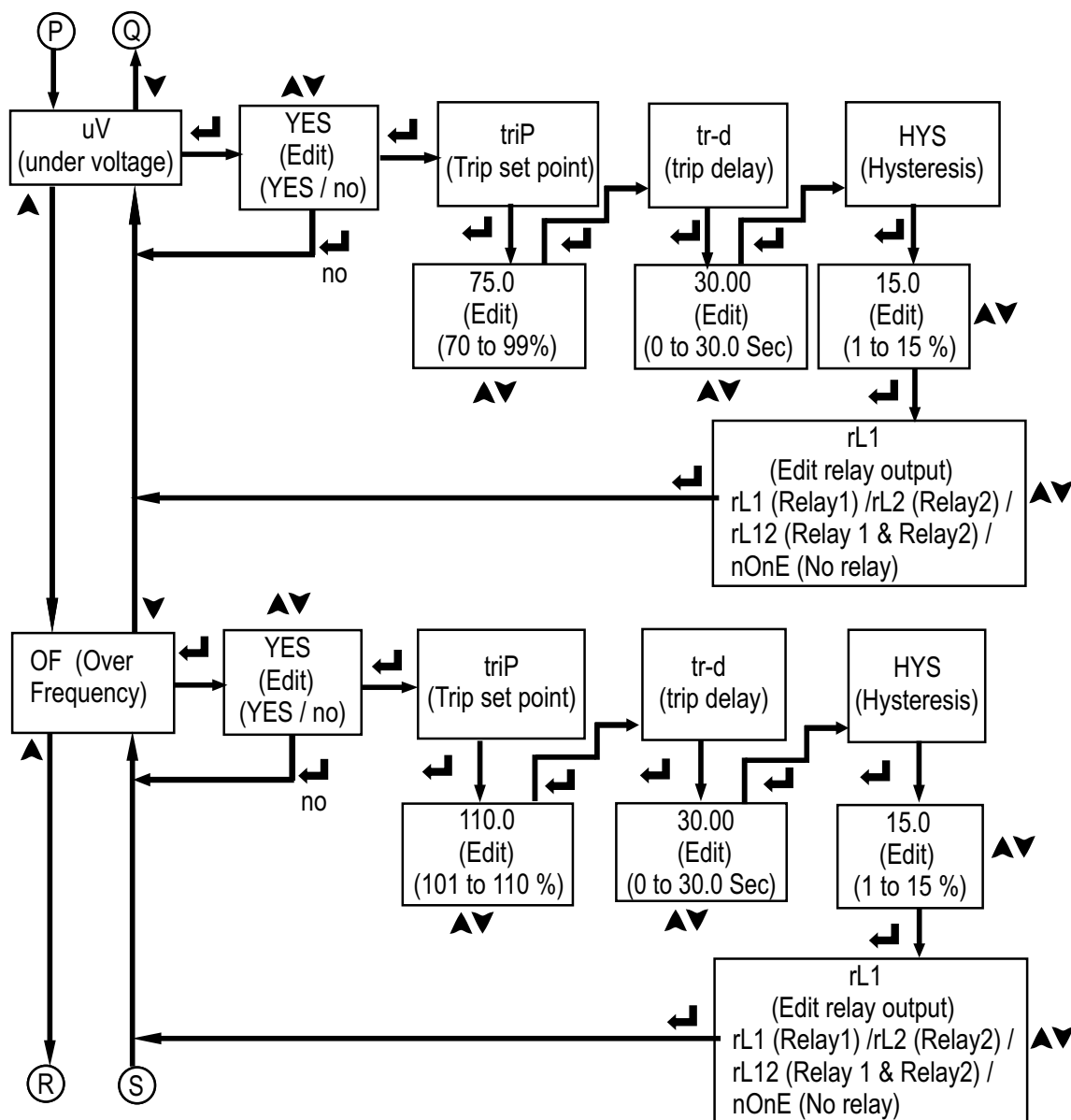
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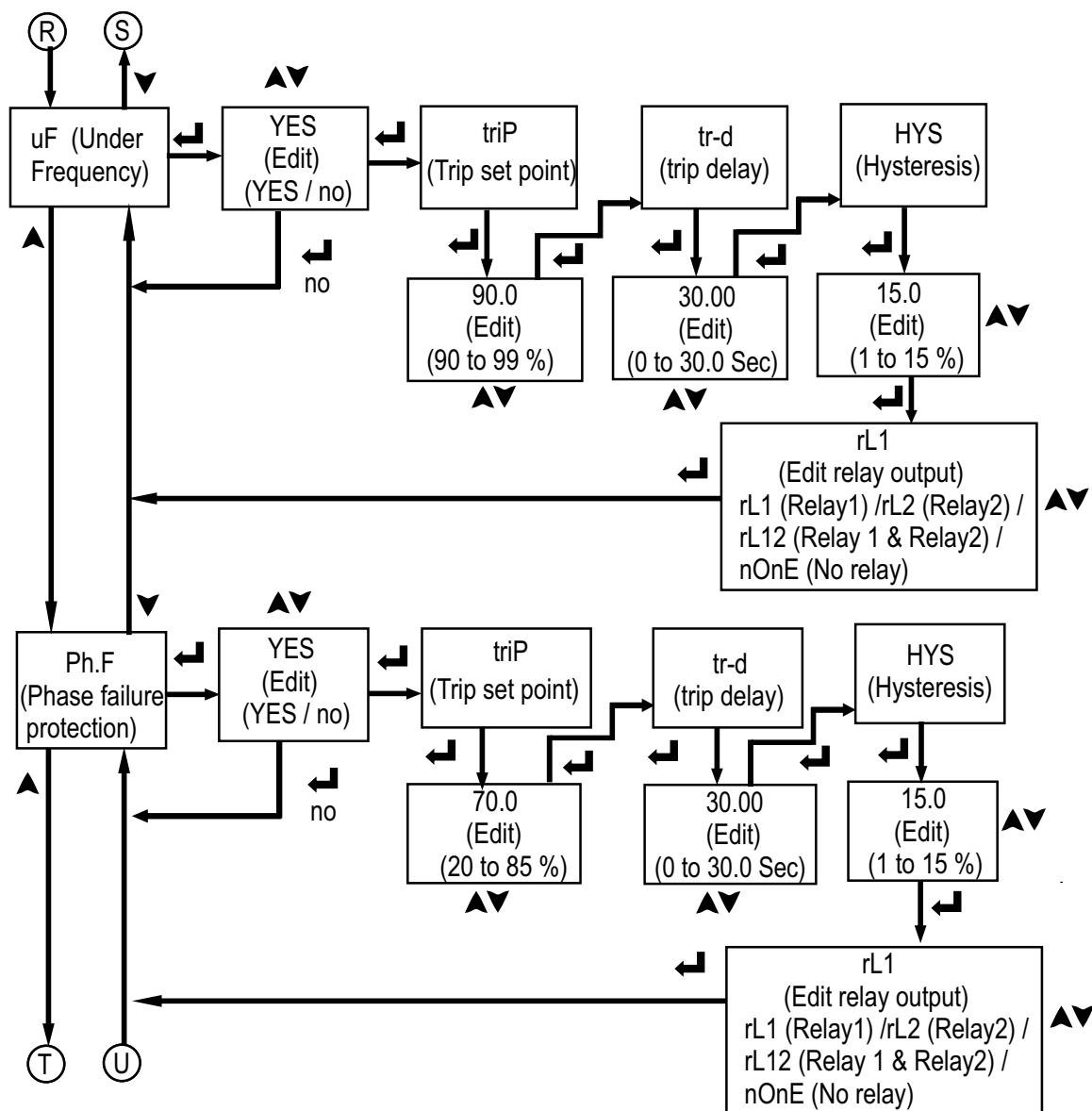
B] PArA (Protection Parameters Menu)



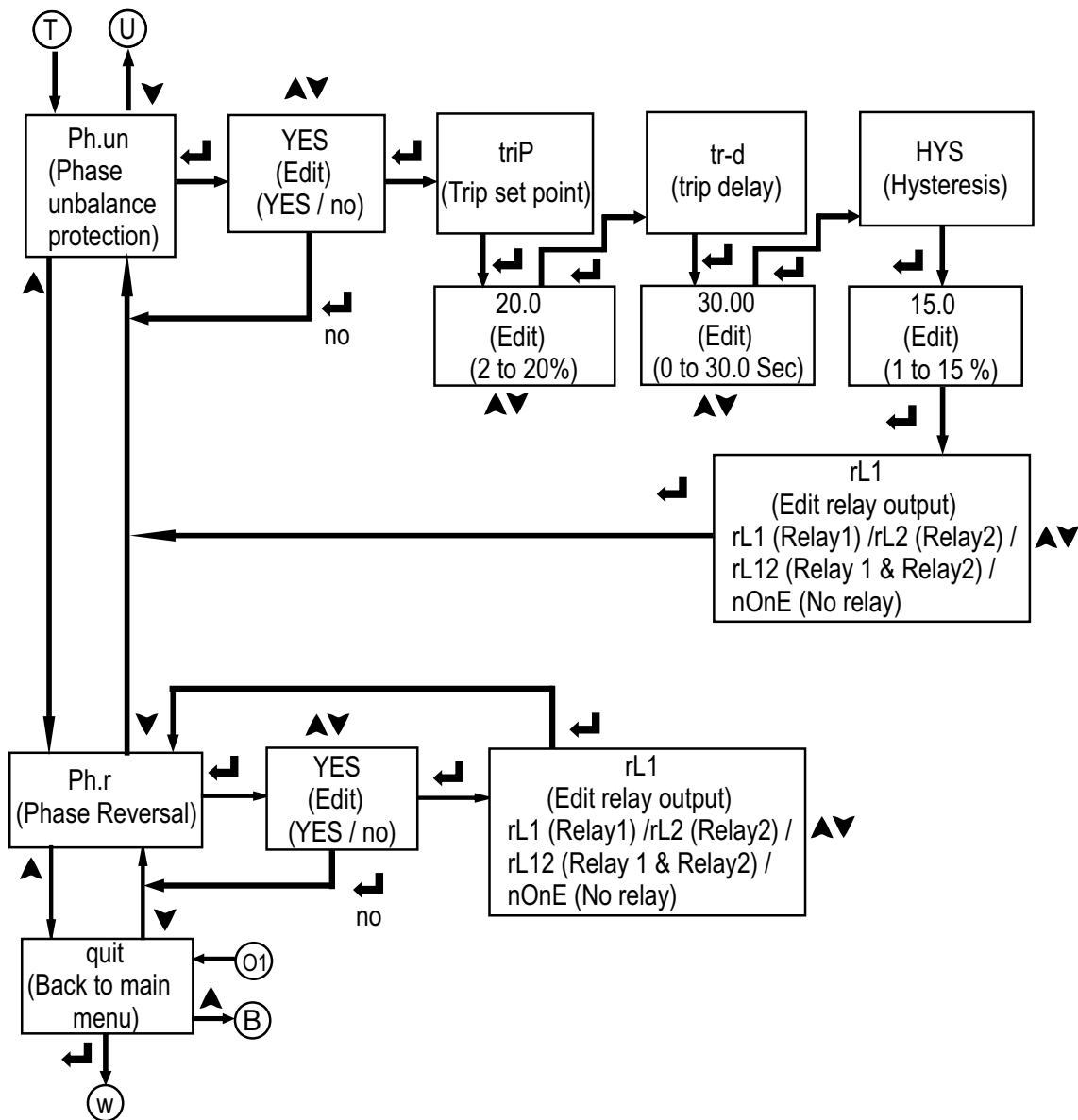
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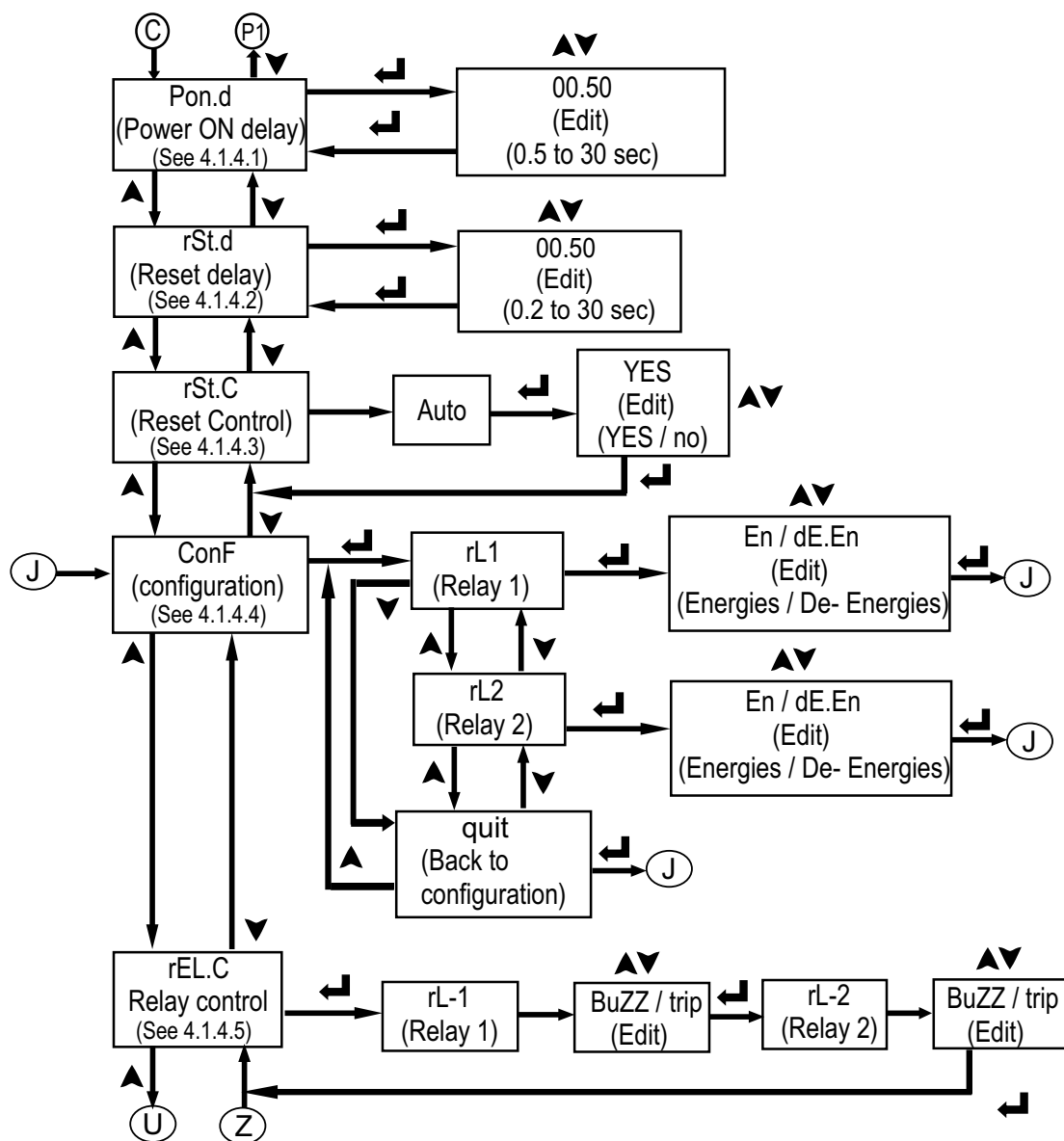
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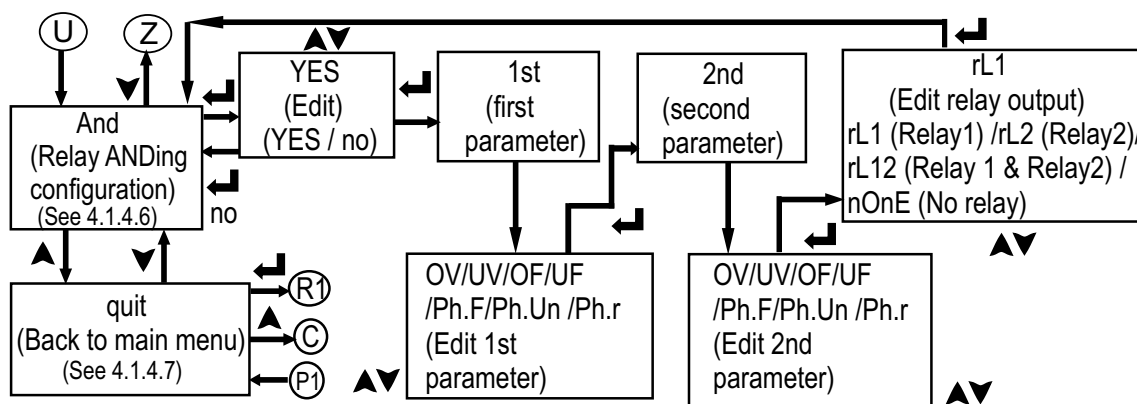
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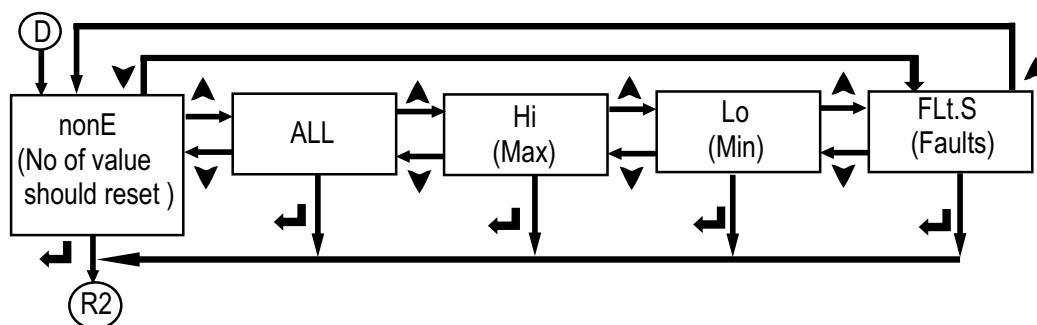
C] rELY (Relay Parameters)



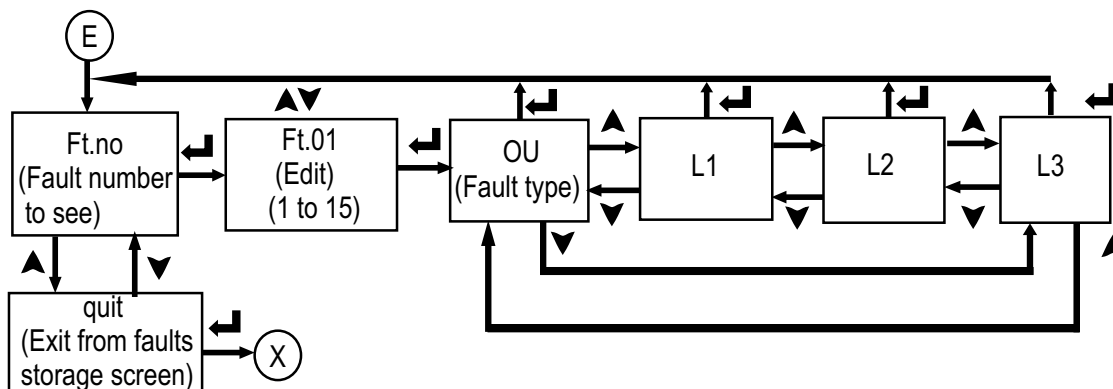
Continued....



D] rEst (Reset Values)

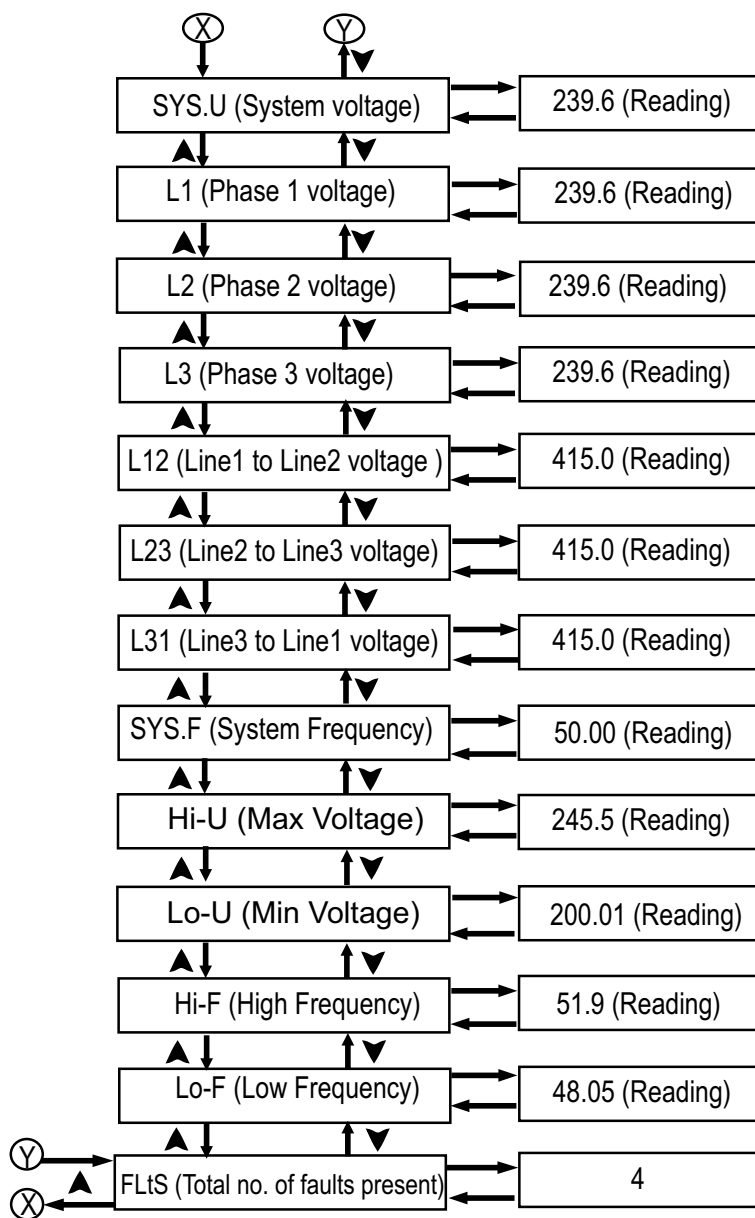


E] FALt (Faults Storage Screen)

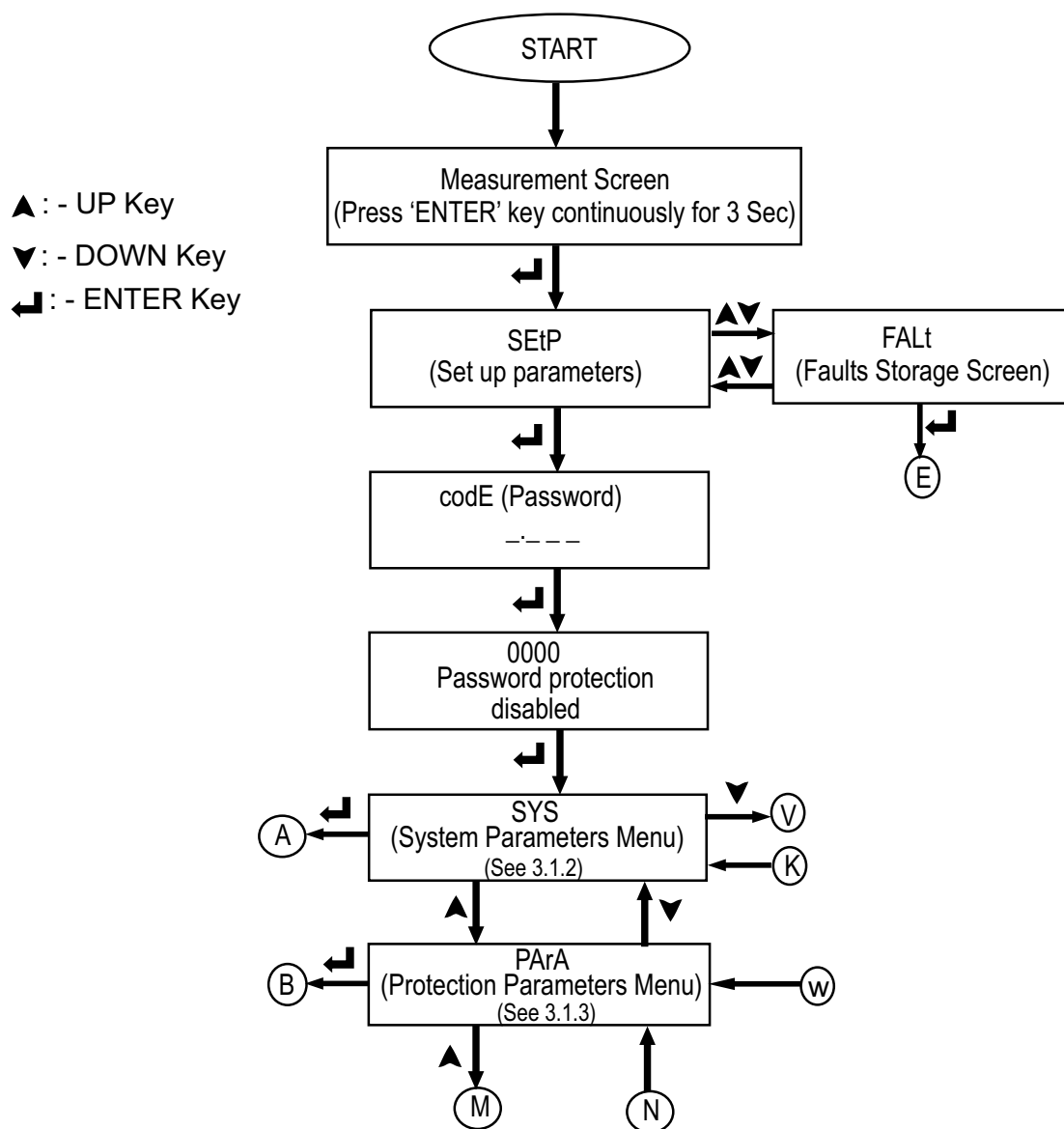


Continued....

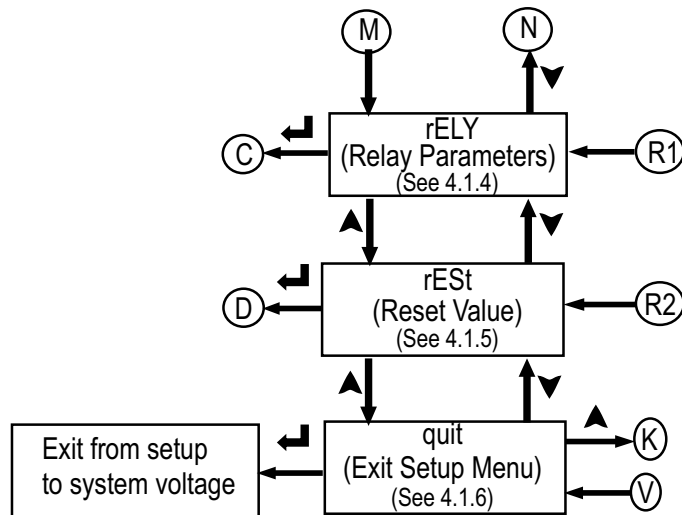
3.1.2 Measuring Parameters screens



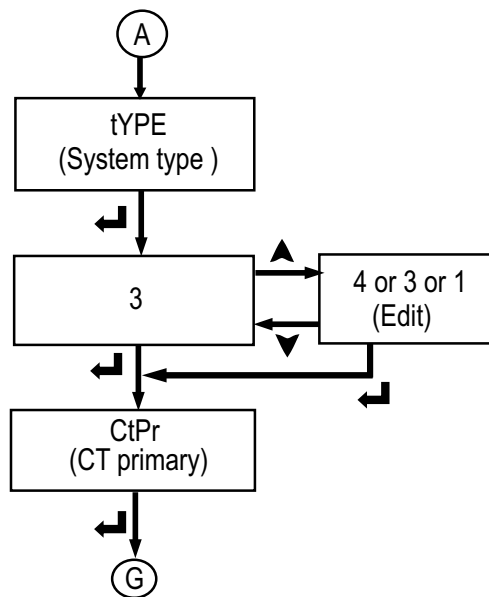
3.2 Current Protection Relay: -
3.2.1 Set up Parameters screen



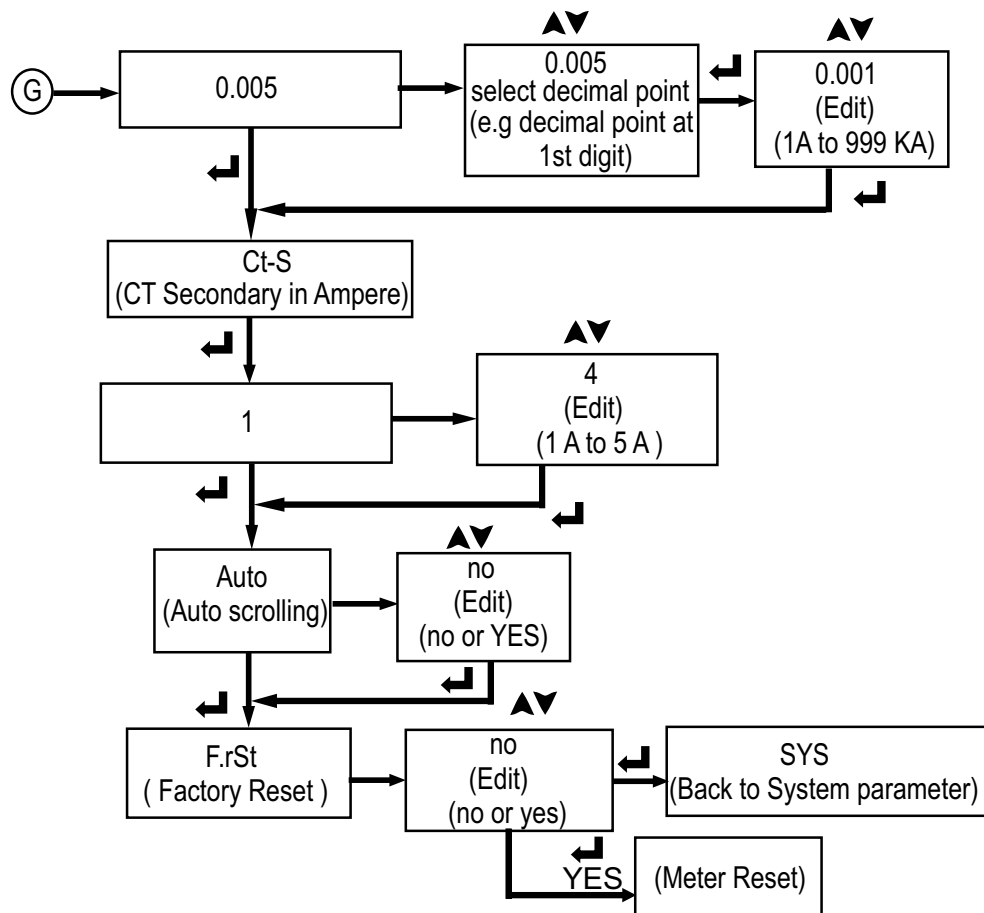
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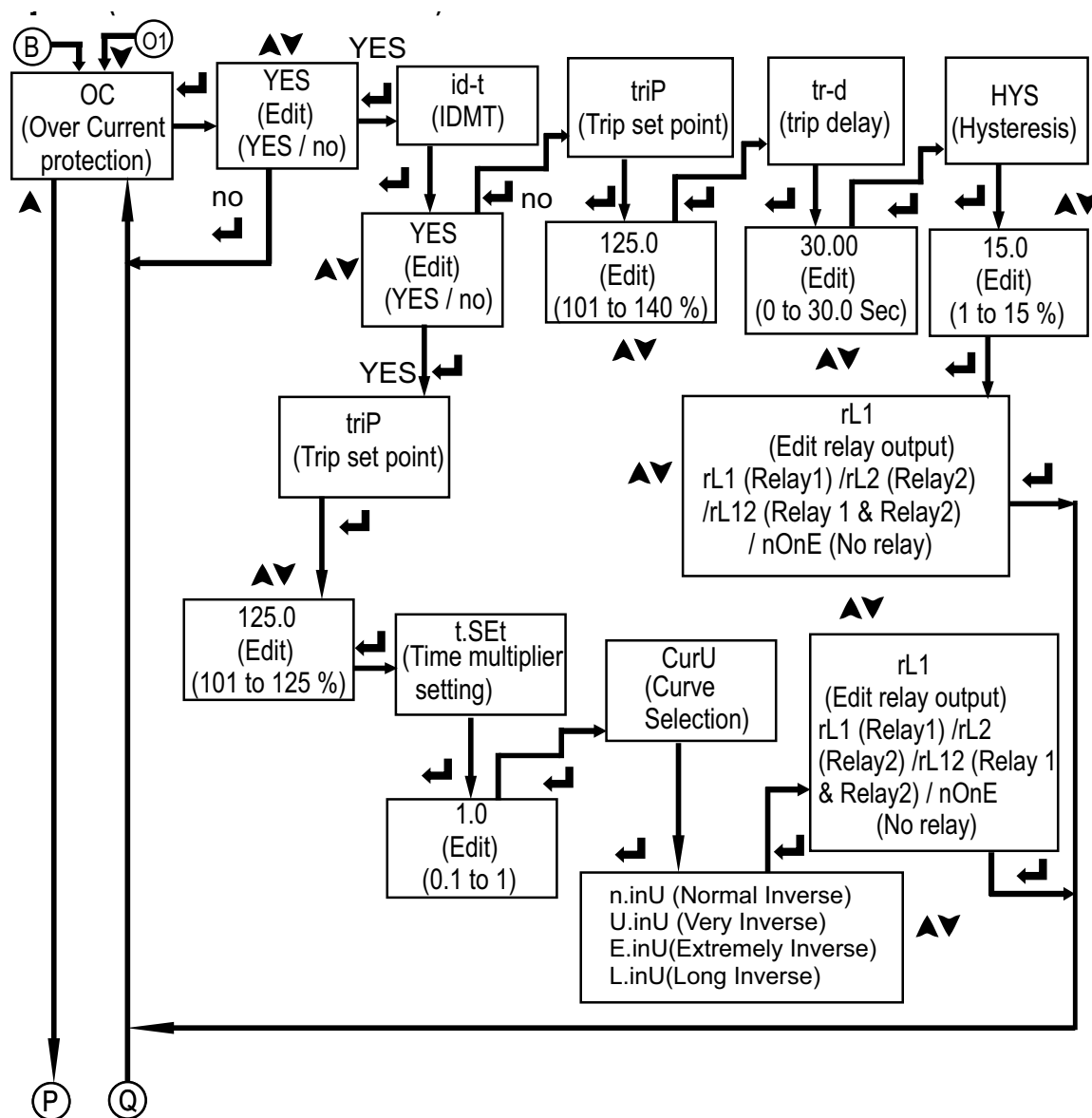
A] SYS (System Parameters Menu)

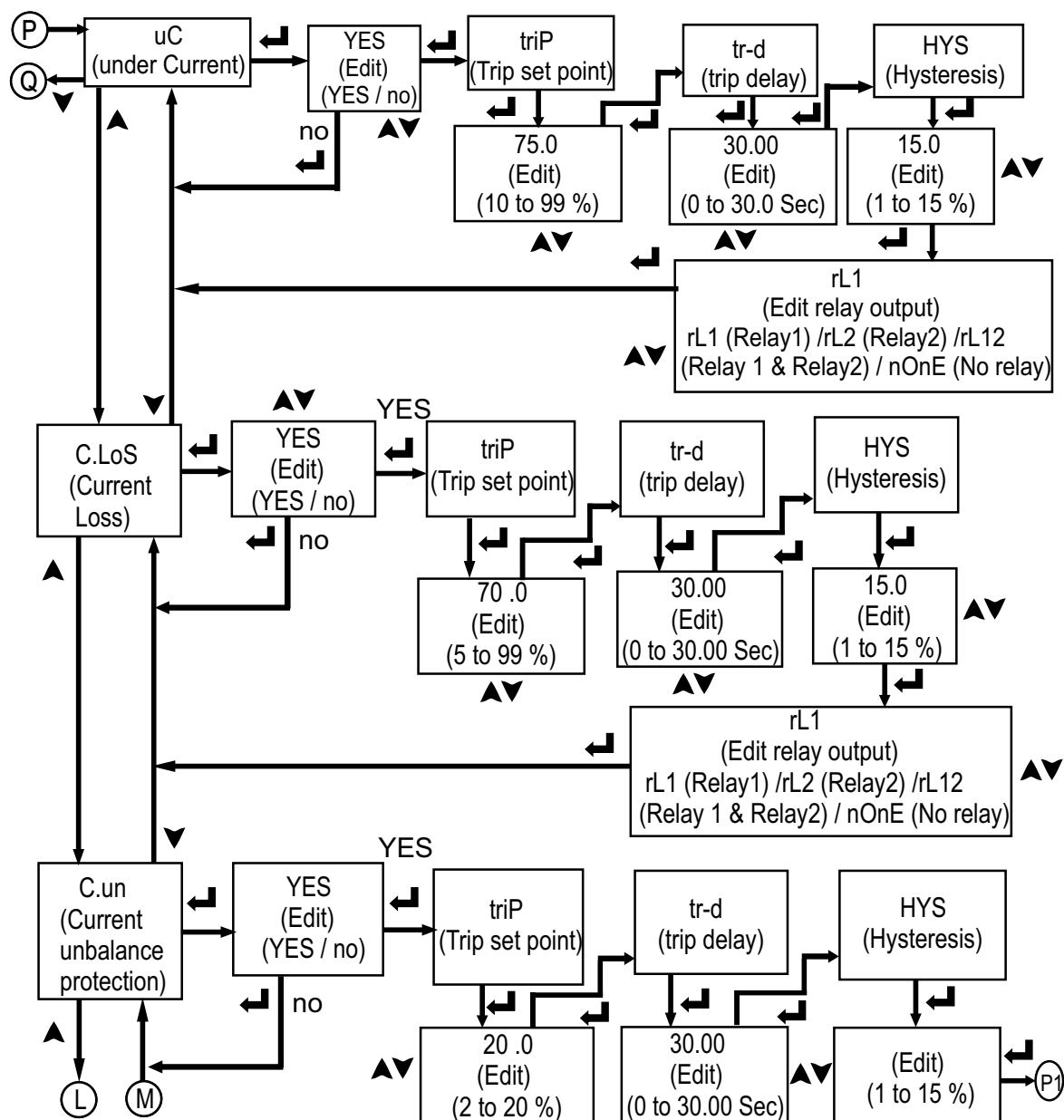


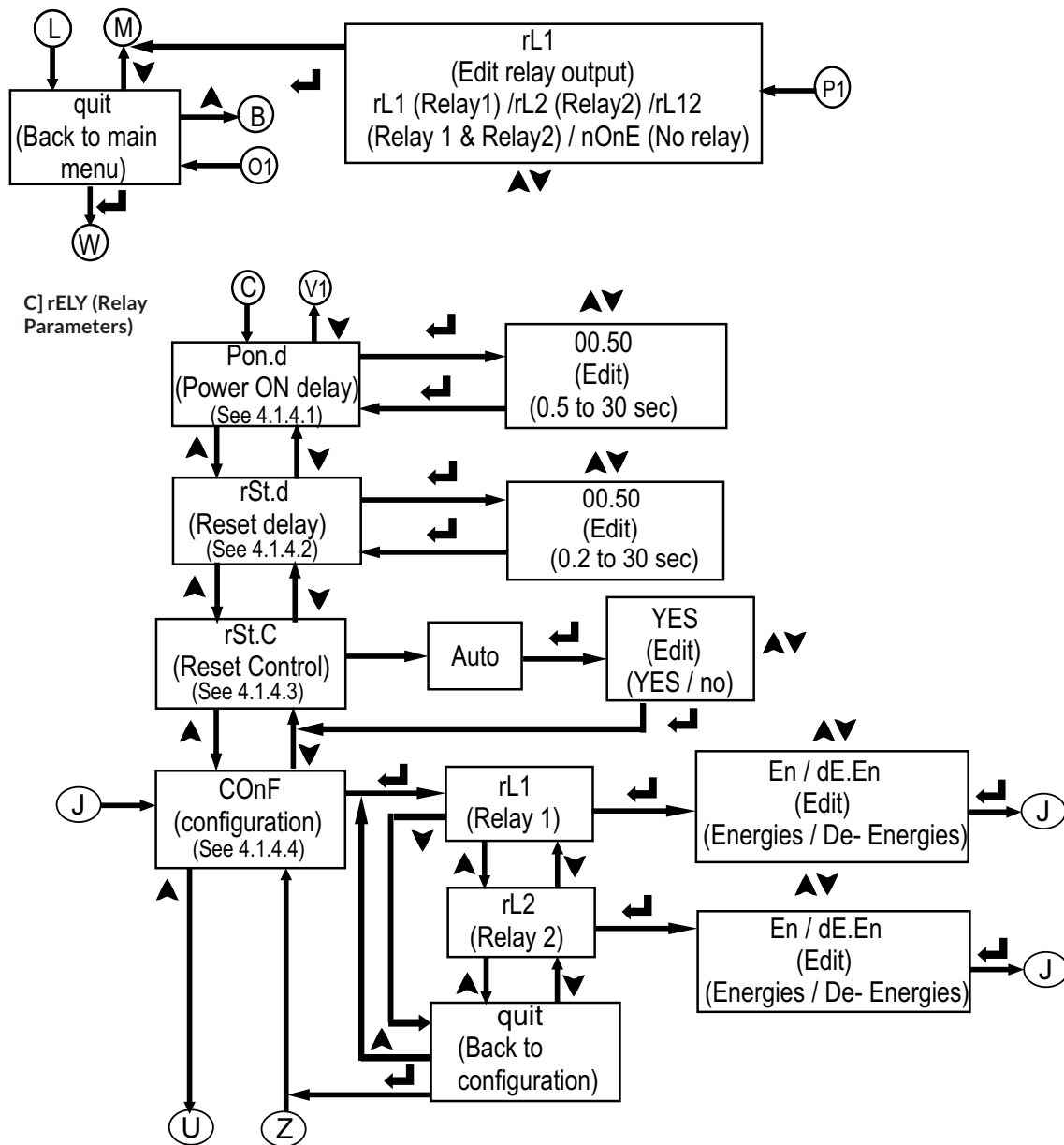
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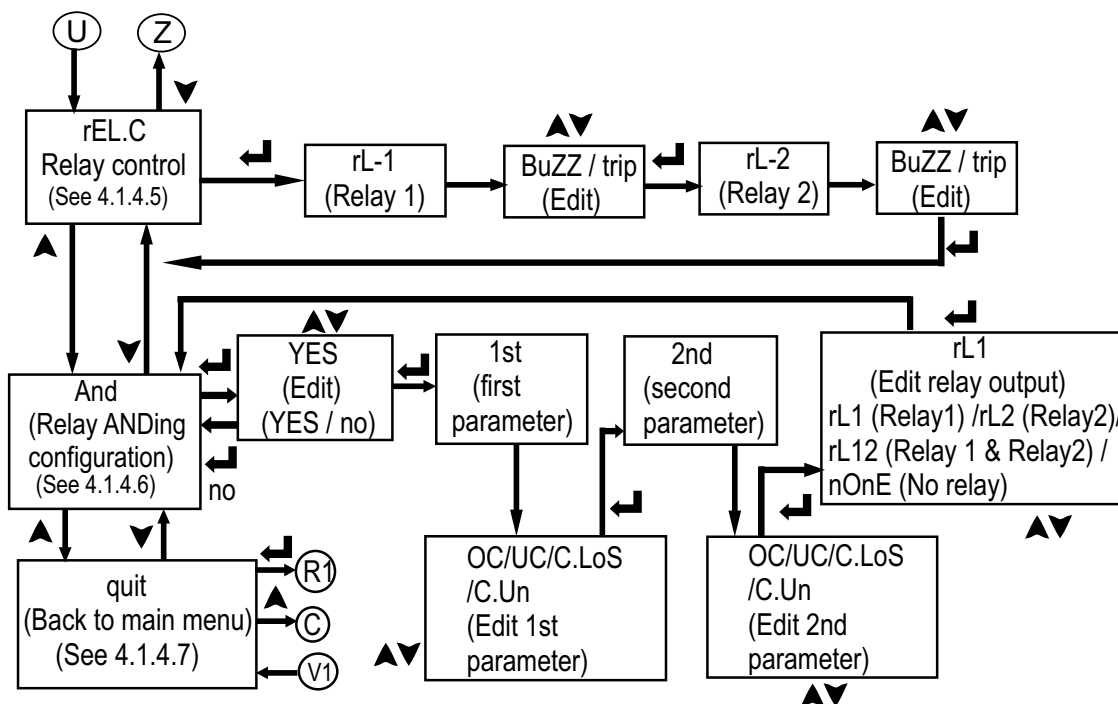


B] PArA (Protection Parameters Menu)

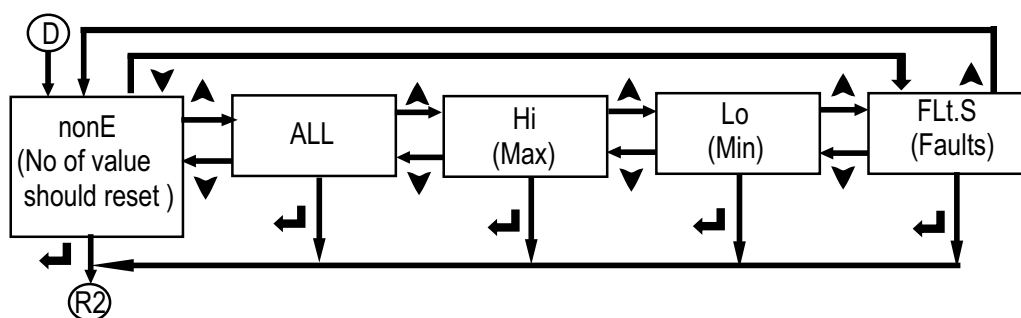




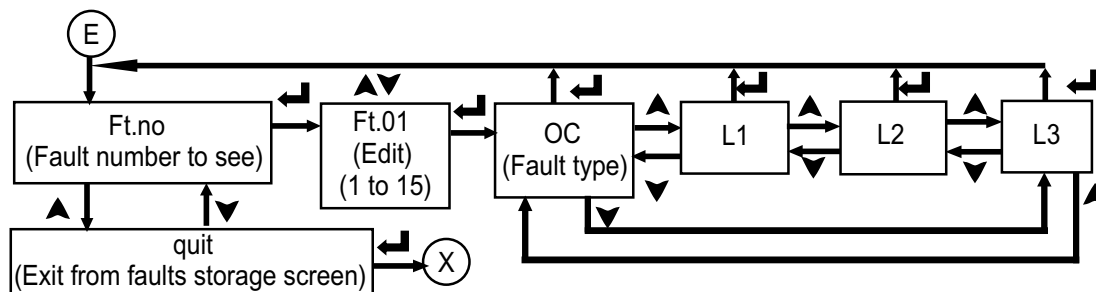




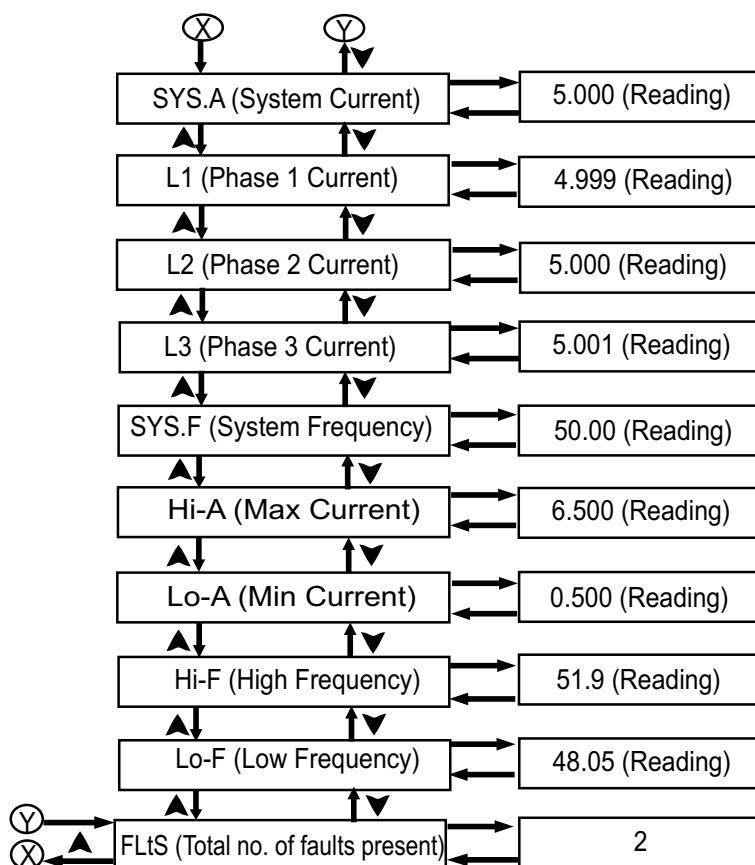
D] rESt (Reset Values)



E] FALt (Faults Storage Screen)



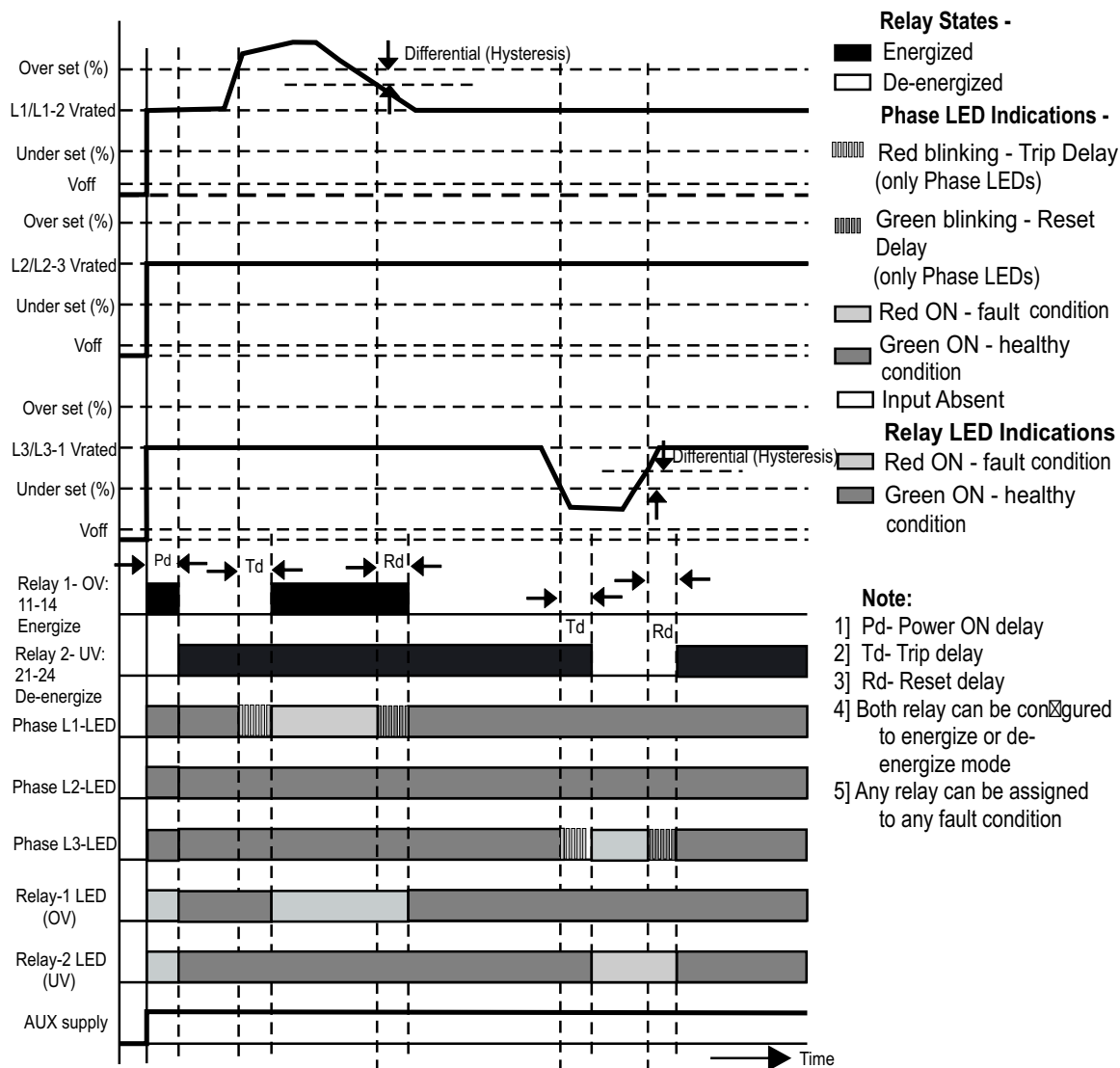
3.2.2 Measuring Parameters screens



Note: - Display will toggle between Measuring parameter name and it's value.

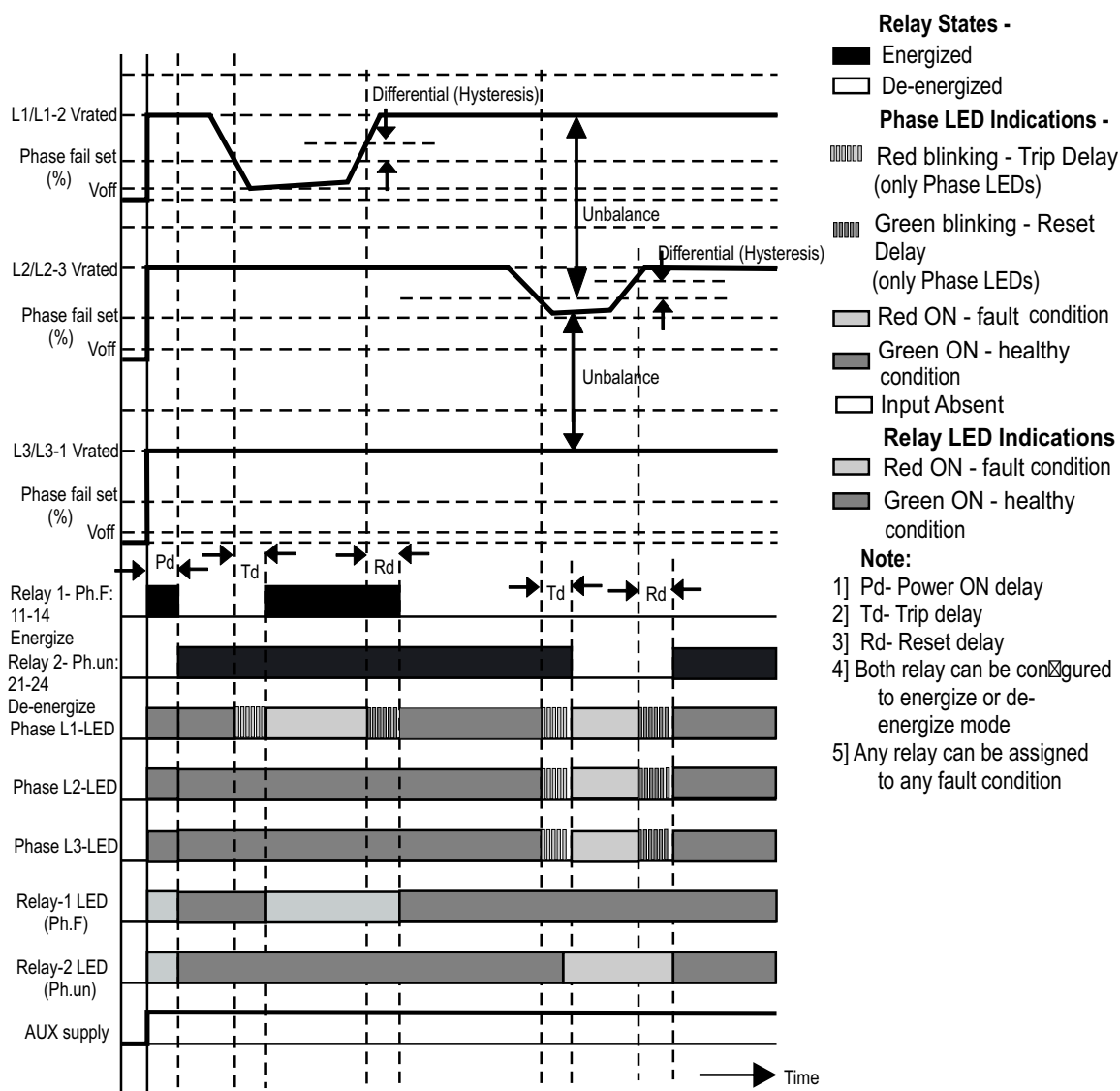
3.3 Timing Diagrams

Over (OV) and Under (UV) voltage



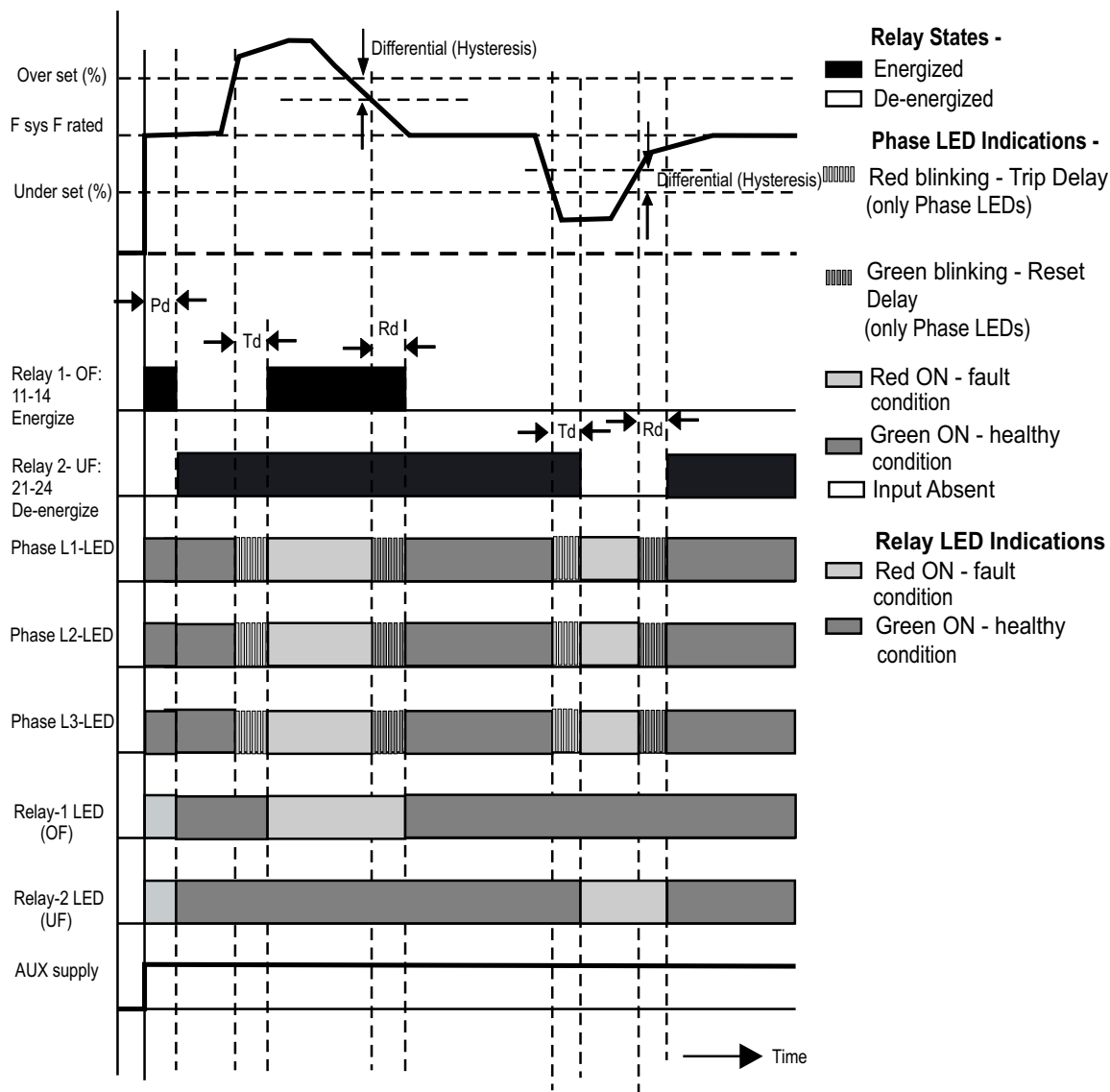
Note: - For safety reasons, if relay has already tripped then it will not reset unless all phases are healthy i.e above or below hysteresis value (as the case may be). This is to prevent unrequired relay chattering.

Phase Failure (Ph.F) and Phase Unbalance (Ph.un)



Note: - For safety reasons, if relay has already tripped then it will not reset unless all phases are healthy i.e above or below hysteresis value (as the case may be). This is to prevent unrequired relay chattering.

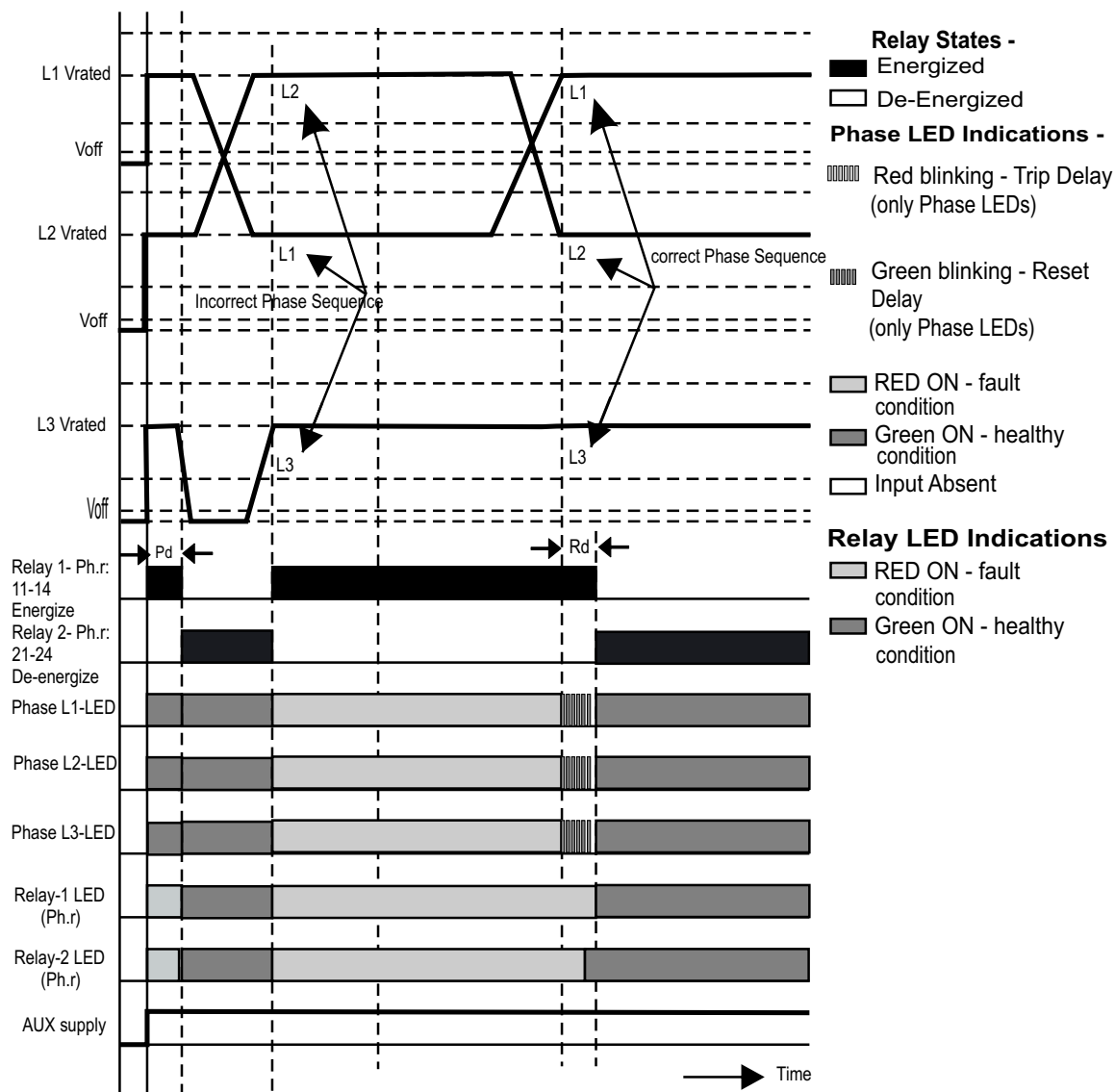
Over (OF) and Under (UF) Frequency



Note:

- 1] Pd- Power ON delay
- 2] Td- Trip delay
- 3] Rd- Reset delay
- 4] Both relay can be configured to energize or deenergize mode
- 5] Any relay can be assigned to any fault condition

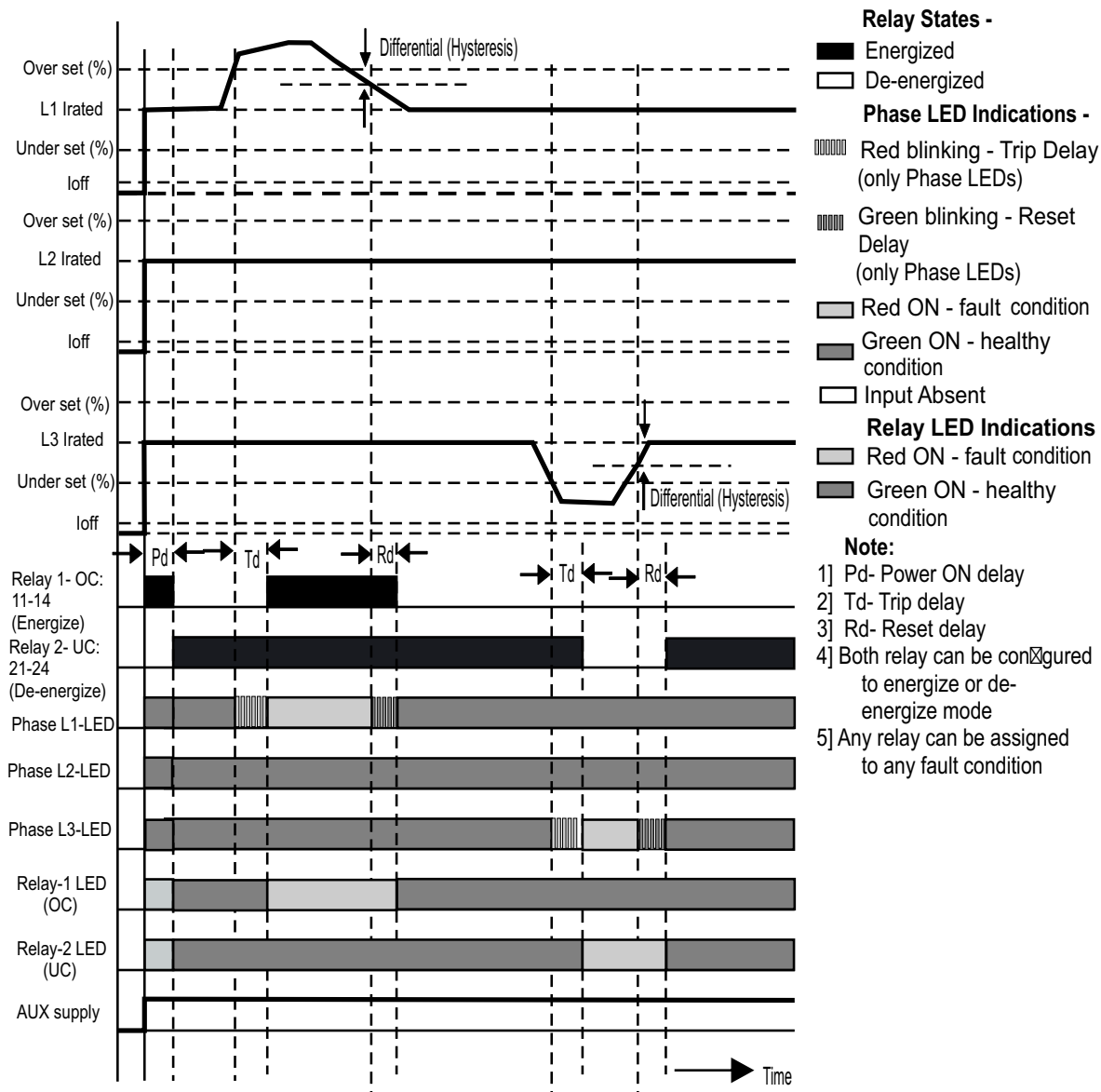
Phase sequence (Ph.r)



Note:

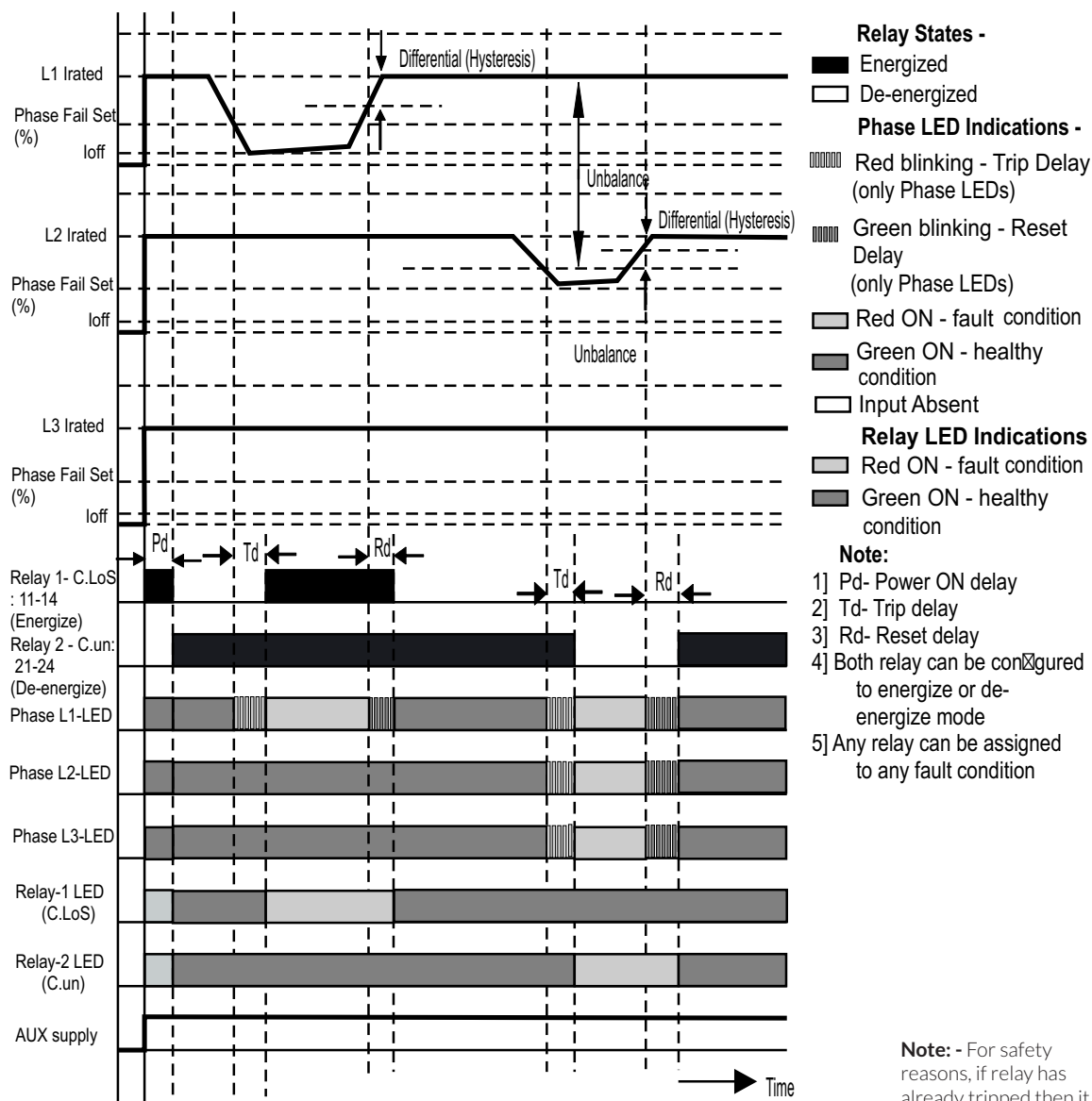
- 1] Pd- Power ON delay
- 2] Td- Trip delay
- 3] Rd- Reset delay
- 4] Both relay can be configured to energize or deenergize mode
- 5] Any relay can be assigned to any fault condition

Over (OC) and Under (UC) Current



Note: - For safety reasons, if relay has already tripped then it will not reset unless all phases are healthy i.e above or below hysteresis value (as the case may be). This is to prevent unrequired relay chattering.

Current Loss (C.LoS) and Current Unbalance (C.un)



Note - For safety reasons, if relay has already tripped then it will not reset unless all phases are healthy i.e above or below hysteresis value (as the case may be). This is to prevent unrequired relay chattering.

4. PROGRAMMING

4.1 Menu Selection

The following sections comprise step by step procedures for configuring the Omicron Voltage / Current protection relay according to individual user requirement.

4.1.1 Password Protection

To access the Set-Up menu press and hold "ENTER" key for 3 Seconds, the screen is shown in fig 1.



Fig No: - 1

On pressing "ENTER" key, meter will ask for password shown in fig 2.



Fig No: - 2

Then meter will enter into edit mode as shown in fig 3 (*Denotes decimal Point is flashing).

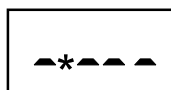


Fig No: - 3

Press "ENTER" key, by default password is set to "0000" as shown in fig 4.



Fig No: - 4

New Password Setting

Pressing "▼" key decrements digit value from 9 to 0. Value will wrap from 0 to 9.

Pressing "▲" key increments digit value from 0 to 9, then value will wrap from 9 to 0.

Example: - For Setting New password "1234" follow the procedure.

Press "▲" key or "▼" key once, to enter into password edit mode, screen is shown in

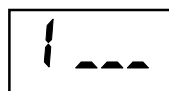


Fig No: - 5

fig 3 (*Denotes decimal Point is flashing).

Press "▲" key to increment first digit to '1' as shown in fig 5. Press "ENTER" key to confirm number 1, decimal point will shift to next digit.

Press "▲" key to increment second digit to '2' as shown in fig 6.

Press "ENTER" key to confirm digit 2.



Fig No: - 6

Press "▲" key to increment third digit to "3" as shown in fig 7. Press "ENTER" key to confirm digit "3".

Press "▲" key to increment fourth digit to "4" as shown in fig 8. Press "ENTER" key to confirm digit "4".



Fig No: - 7

On pressing "ENTER" key new password will be set as shown in fig 9. On again pressing "ENTER" key meter will confirm new password & will go to SET UP menu.



Fig No: - 8

For changing password at screen shown in fig 9, Press "▲" key or "▼" key and start from "New Password Setting: -"



Fig No: - 9

SET UP menu



Fig No: - 10

Press "▲" key or "▼" key to move through set up menu.

"SYS" (System) menu allows user to select different system parameters like "System Type", "PT / CT primary", "PT / CT Secondary", "System Frequency", "Phase Sequence", "Auto", "Factory Reset". (Refer Section 4.1.2.1 to 4.1.2.9)



Fig No: - 11

"PARA" (Parameter) menu allows user to select different fault parameters like "OV" (Over Voltage), "UV" (Under Voltage), "OF" (Over Frequency), "UF" (Under Frequency), "ph.un" (Phase Unbalance), "Ph.F" (Phase Failure), "Ph.r" (**Phase Reversal**) for **Voltage Protection Relay** (Refer Section 4.1.3)

OR

"OC" (Over Current), "UC" (Under Current), "C.LoS" (Current Loss), "C.un" (Current Unbalance) for **Current Protection Relay**. (Refer Section 4.1.3)

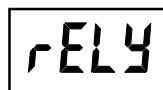


Fig No: - 12

"rELY" (Relay) menu allows user to select different Relay related parameters like "Pon.d" (Power ON delay), "rSt.d" (Reset delay), "rSt.C" (Reset Control), "COnF" (Relay Configuration), "rEL.C" (Relay Control), "And" (AND). (Refer section 4.1.4)

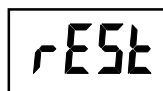


Fig No: - 13

"rESr" (Reset) menu allows user to reset different parameters like "ALL" (all Voltage / Current, Frequency), "Hi" (High Voltage / Current, Frequency), "Lo" (Low Voltage / Current, Frequency), "FLt.S" (Faults). (Refer section 4.1.5)



Fig No: - 14

"quit" (Quit) menu allows user to quit from SET UP menu. (Refer section 4.1.6)

4.1.2 System Parameter Selection Menu

4.1.2.1 System Type



Fig No: - 15

"SYS" (System) menu allows user to set system parameters.

On pressing "ENTER" key meter will enter into system parameters & ask for system type selection as shown in fig 16.



Fig No: - 16

This screen is used to set the system type (only for 3 phase meter), 3 for 3P3W, 4 for 3P4W & 1 for 1P2W.

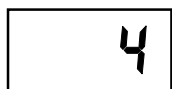


Fig No: - 17

Now the screen will show previously stored system type "4" as shown in fig: - 17.

Setting New system Type: -



Fig No: - 18

Pressing "▲" or "▼" key, meter will enter into edit mode.

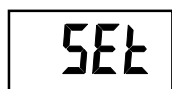


Fig No: - 19

Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value.

Example: -

For Setting new system type "3" follow the procedure: - Press "▲" key or "▼" key to get number "3" as shown in fig 18.

On pressing "ENTER" key new system type will be set as shown in fig 19. On again pressing "ENTER" key meter will confirm new system type & will go to PT primary setting (for **Voltage Protection Relay**) (refer Section 4.1.2.2) or to CT primary setting (for **Current protection relay**) (refer Section 4.1.2.4)

4.1.2.2 Potential Transformer (PT) Primary V-Line to Line Voltage Protection Relay: -



Fig No: - 20



Fig No: - 21

This Screen allows user to set Potential Transformer's primary value in KV. K is indicated by annunciation of 'K' LED. The PT primary can be set from 0.100 KV to 1200 KV . L-L L-L

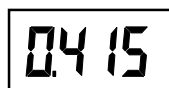


Fig No: - 22

"PtPr" (Potential transformer primary) is shown in fig 20 & "VLL" (Line to Line Voltage) is shown in fig 21.



Fig No: - 23

After VLL, meter will show previously stored PtPr value "0.415" (415 VL-L) as shown in fig 22 and "K" LED will be lit which indicate that the PT primary is in KV .

Setting New Potential transformer's Primary Value.

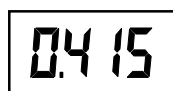


Fig No: - 24

Pressing "▲" or "▼" key, meter will enter into edit mode. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value.



Fig No: - 25

Example: - For setting new PtPr value to 0.230KV, follow the steps: pressing "▲" key or "▼" key first time, meter will edit position of decimal point.

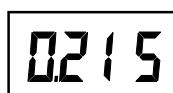


Fig No: - 26

As shown in fig 22 decimal point is adjusted. Pressing "ENTER" key will start blinking decimal point & editing of value as shown in fig 23.



Fig No: - 27

Press "ENTER" key to advance to next digit as shown in fig No 24. (*Denotes decimal Point is flashing).



Fig No: - 28

Press "ENTER" key to advance to next digit as shown in fig 26. Now press "▲" key to increment digit to "3", as shown in fig 27. Press "ENTER" key to advance to next digit as shown in fig 28.



Fig No: - 29



Fig No: - 30

Press "▼" key to decrement digit to "0" as shown in fig 29.

On pressing "ENTER" key new PT primary will be set as shown in fig 30. On again pressing "ENTER" key, meter will confirm new PT primary & will go to Potential transformer's secondary setting refer section 4.1.2.3

4.1.2.3 Potential Transformer (PT) Secondary V-Line to Line

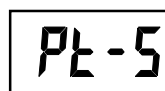


Fig No: - 31

This screen allows user to set potential transformer's secondary value in V. The PT secondary can be set from 100 V to 600 V . L-L L-L



Fig No: - 32

"Pt-S" (Potential transformer's secondary) is shown in fig 31 "VLL" (Line to Line Voltage) is shown in fig 32. After VLL meter will show previously stored PT secondary value. (*Denotes decimal Point is flashing).

Setting New Potential transformer's Secondary Value:

Pressing "▲" or "▼" key, meter will enter into edit mode. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value. Pressing "ENTER" key will advance to next digit. After setting Pt-S value meter will go to System frequency setting menu. (Refer Section 4.1.2.6)

4.1.2.4 Current Transformer (CT) Primary (Current Protection Relay only)



Fig No: - 33

This Screen "CtPr " (Current Transformer Primary) allows user to set Current transformer's primary value in KA.

Kilo is indicated by annunciation of K LED. CT primary can be set from 1A to 999 KA.

After CtPr meter will show previously stored CT Primary value.

Setting New Current transformer's Primary Value:

Pressing "▲" or "▼" key, meter will enter into edit mode.

Pressing "▲" or "▼" key first time, meter will edit position of decimal point.

Pressing "ENTER" key will start decimal point blinking. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value. Pressing "ENTER" key will advance to next digit.

After setting Ct-Pr value meter will go to Current transformer's secondary setting refer section 4.1.2.5

4.1.2.5 Current Transformer (CT) Secondary

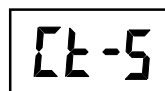


Fig No: - 34

Press " " key to decrement digit to "0" as shown in fig 29.

On pressing "ENTER" key new PT primary will be set as shown in fig 30. On again pressing "ENTER" key, meter will confirm new PT primary & will go to Potential transformer's secondary setting refer section 4.1.2.3

Setting New Current transformer's Secondary Value

Pressing "▲" or "▼" key, meter will enter into edit mode. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value.

Pressing "ENTER" key will set new CT secondary. On again pressing "ENTER" key meter will confirm new CT secondary.

After setting Ct-S value meter will go to the Auto scrolling mode refer section 4.1.2.8

4.1.2.6 System Frequency

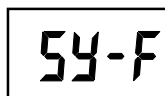


Fig No: - 35

This Screen " SY-F " (System frequency) allows user to set System frequency value as 50 OR 60 Hz.

After "SY-F" Screen will show previously stored system frequency value.

Setting New System frequency Value.

Pressing "▲" or "▼" key, meter will enter into edit mode. Again Pressing "▲" or "▼" key meter will show 50 Hz or 60 Hz.

Pressing "ENTER" key meter will set new System frequency. On again pressing "ENTER" key meter will confirm new system frequency.

After setting "SY-F" value meter will go to Phase sequence setting (for voltage protection relay refer section 4.1.2.7).

4.1.2.7 System Phase Sequence: - (Voltage Protection Relay only)

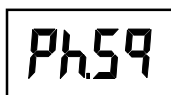


Fig No: - 36

This Screen " Ph.Sq " (Phase sequence) allows user to set system phase sequence as 123 or 321.

After "Ph.Sq" meter will show previously stored Phase sequence.

Setting New Phase sequence:

Pressing "▲" or "▼" key, meter will enter into edit mode. Again Pressing "▲" or "▼" key meter will show "123" OR "321".

Pressing "ENTER" key meter will set new Phase Sequence. On again pressing "ENTER" key meter will confirm new Phase Sequence.

After setting "Ph.Sq" meter will go to Auto scrolling mode (refer section 4.1.2.8) 4.1.2.8 Auto Scroll



Fig No: - 37

This Screen " Auto" allows user to enable screen scrolling.

After "Auto" meter will show previously stored auto scrolling mode. (YES \ NO)

Setting Auto scrolling mode:

Pressing "▲" or "▼" key, meter will enter into edit mode.

Press "▲" or "▼" key to get "YES".

On pressing " ENTER " key Auto scrolling mode will be set. On again pressing "ENTER" key meter will confirm newly changed auto scrolling mode & go to Factory reset (refer section 4.1.2.9)

Note: - If faults are present auto scrolling mode will not work.

4.1.2.9 Factory Reset

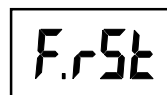


Fig No: - 38

This Screen " F.rst " (Factory Reset) allows user to reset meter to factory default setting. 4.1.2.9 Factory Reset

Factory Resetting :- To Reset meter to factory default setting follow the procedure: -

Pressing “▲” or “▼” key, meter will enter into edit mode.

4.1.3.2 YES / NO

Example: - Press “▲” key to get “YES”. On pressing “ENTER” key Meter will be reset to default setting (Refer section 6 for Default settings).

4.1.3 Parameter Selection Menu

4.1.3.1 Parameters selection

“PArA” (Parameters selection) allows user to select 7 different parameters (For **Voltage Protection Relay**) & 4 different parameters (For **Current Protection Relay**).

Press “ENTER” key to enter into parameters selection screen.

Press “▲” key or “▼” key to move through parameter selection menu.

By pressing “ENTER” key User can select the desired parameters (refer section 4.1.3.2).

The available parameters are “OV” (Over Voltage), “UV” (Under Voltage), “OF” (Over Frequency), “UF” (Under Frequency), “Ph.un” (Phase Unbalance), “Ph.F” (Phase Failure),

“Ph.r” (Phase Reversal) for **Voltage Protection Relay** and “OC” (Over Current), “UC” (Under Current), “C.LoS” (Current Loss), “C.un” (Current Unbalance) for **Current Protection Relay**.



Fig No: - 39

This screen is used to activate OR Deactivate a parameter. By default all parameters are disabled as shown in fig 39

Parameters Enable mode :- To enabled parameters follow the steps: -



Fig No: - 40

Pressing or “▲” or “▼” key, meter will enter into edit mode.

Example: - Press “▲” key to get “YES” on screen as shown in fig 40.



Fig No: - 41

On pressing “ENTER” key Selected parameters will be enabled as shown in fig 41.

On again pressing “ENTER” key enabled parameters will be confirm & go to (“trip” Trip point refer section 4.1.3.3 or “IDMT” for “OC” (Over Current parameter) refer section 4.1.3.8

Note: - Phase Failure is enabled by default . It can not be disabled.

4.1.3.3 Trip Point

Pressing “▲” or “▼” key, meter will enter into edit mode. Pressing “▲” key increments digit value & Pressing “▼” key decrements digit value.

Pressing “ENTER” key will confirm new trip point. After setting new trip point if IDMT (for current

protection relay) is enabled meter will goto TMS setting refer section 4.1.3.9.1 & if IDMT is disabled meter will go to Trip delay (refer section 4.1.3.4)

TABLE 2 (A): Voltage Protection Relay

Parameters	Upper Limit	Lower limit
OV (Over Voltage)	125%	101%
OF (Over Frequency)	110%	101%
UV (Under Voltage)	99%	70%
UF (Under Frequency)	99%	90%
Ph.F (Phase Fail)	85%	20%
Ph.un (Phase Unbalance)	20%	2%

TABLE 2 (B): Current Protection Relay

Parameters	Upper Limit	Lower limit
OC (Over Current)	140%	101%
C.LoS (Current Loss)	99%	5%
UC (Under Voltage)	99%	10%
C.un (Current Unbalance)	20%	2%

Note: Upper limit for IDMT is 125%.

4.1.3.4 Trip Delay

Pressing “▲” or “▼” key, meter will enter into edit mode. Pressing “▲” key increments digit value & Pressing “▼” key decrements digit value.

Pressing “ENTER” key will confirm new trip Delay.

After setting new trip Delay meter will goto Hysteresis (refer section 4.1.3.5)

TABLE 3 (A): Voltage Protection Relay

Parameters	Upper Limit	Lower limit
OV (Over Voltage)	30 Sec	0 Sec
OF (Over Frequency)	30 Sec	0 Sec
UV (Under Voltage)	30 Sec	0 Sec
UF (Under Frequency)	30 Sec	0 Sec
Ph.F (Phase Fail)	30 Sec	0 Sec
Ph.un (Phase Unbalance)	30 Sec	0 Sec

TABLE 3 (B): Current Protection Relay

Parameters	Upper Limit	Lower limit
OC (Over Current)	30 Sec	0 Sec
C.LoS (Current Loss)	30 Sec	0 Sec
UC (Under Voltage)	30 Sec	0 Sec
C.un (Current Unbalance)	30 Sec	0 Sec

4.1.3.5 Hysteresis

Pressing “▲” or “▼” key, meter will enter into edit mode. Pressing “▲” key increments digit value & Pressing “▼” key decrements digit value.

Pressing “ENTER” key will confirm new hysteresis.

After setting new Hysteresis meter will goto Relay assignment (refer section 4.1.3.6)

If “Ph.un” (Phase Unbalance) / “C.un” (Current Unbalance) trip point is greater than 15% then hysteresis upper limit will be 15% & lower limit will be 1%.

TABLE 4 (A): Voltage Protection Relay

Parameters	Upper Limit	Lower limit
OV (Over Voltage)	15%	1%
OF (Over Frequency)	15%	1%
UV (Under Voltage)	15%	1%
UF (Under Frequency)	15%	1%
Ph.F (Phase Fail)	15%	1%

TABLE 4 (B): Current Protection Relay

Parameters	Upper Limit	Lower limit
OC (Over Current)	15%	1%
C.LoS (Current Loss)	15%	1%
UC (Under Voltage)	15%	1%

If "Ph.un" (Phase Unbalance) / "C.un" (Current Unbalance) trip point is less than 15% then hysteresis upper limit will be "trip point - 1" & lower limit will be 1%.

Example: -

For "OV" (Over Voltage)
PT Secondary = 100 VL-L.
Trip point = 105% (105 V) L-L
Hysteresis = 2% (2 V) L-L.
Relay Reset = Trip point - Hysteresis
= 105 - 2
= 103 VL-L.

Example: -

For "Ph.un" (Phase Unbalance)
PT Secondary = 100 VL-L.
Trip point = 10% (10 V)

Hysteresis = 2% (2 V) L-L.

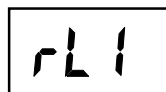
Relay Reset = Trip point - Hysteresis
= 10 - 2
= 8 V L-L.

Note: - For safety reasons, if relay has already tripped then it will not reset unless all phases are healthy i.e above or below hysteresis value (as the case may be). This is to prevent unrequired relay chattering.

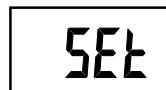
4.1.3.6 Relay Assignment

Fig No: - 42

This screen allows user to assign any fault to any relay options like "none" (No), "rL1" (Relay 1), "rL2" (Relay2), "rL12" (Relay with two change Over Contacts).


Fig No: - 43

Pressing "▲" or "▼" key, meter will enter into edit mode.


Fig No: - 44

Example: - To assign Relay 1 to any fault parameter follow the steps.

When on screen (fig) 42 press "▲" key to get "rL1" (Relay 1) as shown in fig 43. On pressing "ENTER" key Relay 1 will be assigned as shown in fig 44.

On again pressing "ENTER" key meter will confirm newly assigned relay & go to "quit" (quit from parameter selection menu) refer section 4.1.3.7

4.1.3.7 Quit



Fig No: - 45

On pressing "ENTER" key meter will quit (Exit) from parameter selection menu.

C = Constant for relay characteristics.
 α = Constant representing inverse time type ($\alpha > 0$).

4.1.3.8 IDMT (Inverse Definite Minimum Time)

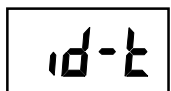


Fig No: - 46

This Screen (Fig) 46 "id-t" (IDMT) allows user to assign IDMT to only "OC" (Over Current) fault parameter.

For IDMT curves refer Table 5

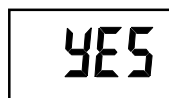


Fig No: - 47

On pressing "ENTER" key meter will show previously enabled or disabled IDMT.



Fig No: - 48

To enable IDMT follow the steps: -

Pressing "▲" or "▼" key, meter will enter into edit mode Press "▲" key to get "YES" on screen as shown in fig 47.

TABLE 5:

Relay Characteristics type	α	c
Standard Inverse (n.inU)	0.02	0.14
Very Inverse (U.inU)	1	13.5
Extremely Inverse (E.inU)	2	80
Long Inverse (L.inU)	1	120

To calculate Relay Operating time when IDMT is enabled, use the following formula.

$$T = \frac{C}{\left(\frac{I}{I_s}\right)^\alpha - 1} \times TMS$$

Where,

T = Time in Sec (Operating time of relay).

I = Input Current.

I_s = Secondary Current.

TMS = Time multiplier setting.

On pressing "ENTER" key IDMT will be enabled as shown in fig 48.

On again pressing "ENTER" key enabled parameters will be confirm & go to ("trip" Trip point setting refer section 4.1.3.3

4.1.3.8.1 TMS (Time multiplier setting)



Fig No: - 49

Screen (Fig) 49 "t.SET" (Time multiplier setting) allows user to Set TMS value ranging from 0.1 to 1.

On pressing "▲" or "▼" key, meter will enter into edit mode. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value.

TABLE 6:

	Upper limit	Lower limit
TMS	1	0.1

After setting TMS value meter will go to curve selection refer section 4.1.3.8.2

4.1.3.8.2 Curve selection



Fig No: - 50

Screen (Fig) 50 "CurU" (Curve selections) allows user to select 4 different Curves for only "OC" (Over Current) fault parameter.

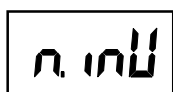


Fig No: - 51

After "CurU" meter will show previously stored curve as shown in fig 51.

Curve Selection mode:- Pressing "▲" or "▼" key, meter will enter into edit mode.

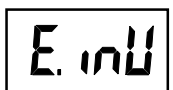


Fig No: - 52

Example: - For Selecting extremely inverse curve, follow the steps: -

Press "▲" key to get "E.inV" (Extremely inverse curve) as Fig No: - 53 shown in fig 52.



Fig No: - 53

On pressing "ENTER" key Extremely inverse curve will be selected as shown in fig 53.

On again pressing "ENTER" key meter will confirm selected curve & go to (Relay selection mode refer section 4.1.3.5)

Note: When a curve is selected the corresponding, C constants get assigned automatically.

4.1.4 Relay Setup Menu



Fig No: - 54

This menu "rELY" (Relay) allows user to configure different relay related parameters.

When on "rELY" menu as shown in fig 54. Press "ENTER" key to enter into relay related parameters selection screen.

Press "▲" key or "▼" key to move through relay related parameters

By pressing "ENTER" key User can select the desired parameters.

Different options in this menu are "Pon.d" (Power ON delay) (refer section 4.1.4.1), "rSt.d" (Reset delay) (refer section 4.1.4.2), "rSt.C" (Reset Control) (refer section 4.1.4.3), "COnF" (Relay Configuration) (refer section 4.1.4.4), "rEL.C" (Relay Control) (refer section 4.1.4.5), "And" (AND) (refer section 4.1.4.6).

4.1.4.1 Power ON Delay

This screen allows user to set Power ON delay from 0.5 Sec to 30 Sec.



Fig No: - 55

Pressing "▲" key or "▼" key, meter will enter into edit mode. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value.

Pressing "ENTER" key will confirm new Power ON delay.

Power ON Delay will be applicable only once when the meter is powered ON, and both relays rL1 & rL2 remain in tripped state during delay.

After setting new Power On delay meter will go back to Power on delay screen (refer section 4.1.4.1)

TABLE 7:

	Upper Limit	Lower limit
Power ON Delay	30	0.5

4.1.4.2 Reset Delay

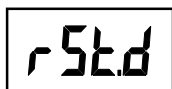


Fig No: - 56

This screen allows user to set Reset Delay from 0.2 Sec to 30 Sec.

The Reset delay starts when a relay is in tripped state and no fault is present on that particular relay, the faulty state of relay is maintained for the set Reset delay and then relay contacts switch to initial state.

Pressing "▲" or "▼" key, meter will enter into edit mode. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value.

Pressing "ENTER" key will confirm new Reset delay. After setting new Reset delay meter will go back

to Reset delay screen (refer section 4.1.4.2)

TABLE 8:

	Upper Limit	Lower limit
Reset Delay	30	0.2

4.1.4.3 Reset Control

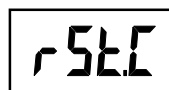


Fig No: - 57

Screen (Fig) 57 " rSt.C " (Reset Control) allows user to set whether relay should reset Automatically or wait for manual reset by user.

In Auto mode Meter will automatically reset relay in healthy condition only.



Fig No: - 58

In manual mode user can manually reset relay.



Fig No: - 59

On pressing "ENTER" key meter will show previously stored Auto / manual mode. As shown in fig 59 Auto mode is enabled.

Example: - Assign Relay Reset control in manual mode. Pressing "▲" or "▼" key, meter will enter into edit

mode. To disable Relay reset control in auto mode follow the steps. Press "▲" key to get "no" as shown in fig 60.



Fig No: - 60

On pressing "ENTER" key Relay Reset control will be in manual mode. After setting new Relay Reset control meter will go back to Relay reset control screen (refer section 4.1.4.3)

4.1.4.5 Relay Control

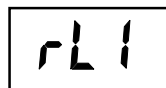


Fig No: - 62

This screen allows user to assign individual relay to trip mode or to buzzer mode.

On pressing Reset key / ▼, if meter is in trip mode the relay will reset only when no fault is present, whereas in buzzer mode the particular relay will reset immediately even if fault is present.

4.1.4.4 Relay Configuration



Fig No: - 61

This menu allows user to configured relay in energized or de-energized mode. On Pressing "ENTER" key meter will show previously configured relay.

Example: - Assign relay in energized mode. Pressing "▲" or "▼" key, meter will enter into edit mode. Press "▲" key to get "En" (energized mode) as shown in fig 61. On pressing "ENTER" key Relay will be configured in energized mode After setting new Relay configuration meter will go back to Relay configuration screen (refer section 4.1.4.4)

Note: - similarly user can configure relay in "dE.En" de- energized mode.



Fig No: - 63

On Pressing "ENTER" key meter will show "rL1" (relay 1) as shown in fig 62 & previously configured relay control mode.

Example: - After "rL1", for Assigning relay1 to trip mode follow the steps. Pressing "▲" or "▼" key, meter will enter into edit mode.

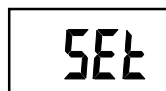


Fig No: - 64

Press "▲" key to get "trip" (trip mode) as shown in fig 63.

On pressing "ENTER" key, relay 1 will be assigned to trip mode as shown in fig 64. After setting new Relay control mode meter will go back to Relay control screen (refer section 4.1.4.5)

4.1.4.6 AND



Fig No: - 65

Screen (Fig) 65 " And " (AND) function allows user to assign ANDing between two fault parameters i.e Relay will trip only if both faults are present.

Press "ENTER" key screen will show previously stored enabled or disabled AND function.

To enable AND function press "▲" key to get "YES" on screen as shown in fig 66.



Fig No: - 66

Example: - For Voltage Protection Relay For assigning "OV" as first input to anding function and "OF" as second input to anding function

OR

For Current Protection Relay For assigning "OC" as first input to anding function and "C.un" as second input to anding function follow the steps: -

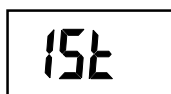


Fig No: - 67

On pressing " ENTER " key screen will show "1St" (First) as shown in fig 67.



Fig No: - 68

This screen allows to set first parameter for anding. After this meter will show first fault parameter

Press "▲" key to get "OV" (Over Voltage) as shown in fig 68 or "OC" (Over current) as shown in fig 69.



Fig No: - 69

On pressing " ENTER " key "OV" or "OC" will be assigned as first input to anding function shown in fig 70.

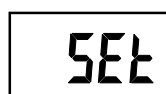


Fig No: - 70

On again pressing "ENTER" key meter will confirm first anding input & go to "2nd" (Second input) as shown in fig 71. This screen allows user to set second parameter for anding.



Fig No: - 71

Press "▲" key to get "OF" (Over Frequency) as shown in fig 72 or "C.un" (Current unbalance) shown in fig 73.



Fig No: - 72

On pressing " ENTER " key "OF" or "C.un" will be assigned as second input



Fig No: - 73

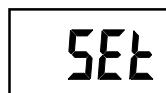


Fig No: - 74

to anding function shown in fig 74. After setting two fault parameters to AND function meter will go back to AND (refer section 4.1.4.6)

Note:- 1. Only the enabled parameters will be available for AND function. 2. In case of AND function, if two ANDing faults occur at the same time the trip delay will be maximum of the two. 3. If any one ANDing parameter is disabled, then AND function will get disabled & Relay will be Reset.

4.1.4.7 Quit

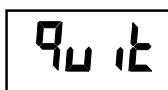


Fig No: - 75

On pressing "ENTER" key meter will quit (Exit) from Relay SET UP menu .

4.1.5 Reset menu

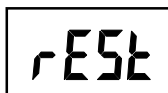


Fig No: - 76

Screen (Fig) 76 "rEst" (Reset) function allows user to reset High, Low voltage OR current values, Frequency, stored faults.



Fig No: - 77

Press "ENTER" key screen will show "none" (No) as shown in fig 77.



Fig No: - 78

Press "▲" key or "▼" key to move through options in Reset Menu.

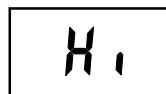


Fig No: - 79



Fig No: - 80



Fig No: - 81

Options in Reset menu are: -

none: - No
ALL - All values.
Hi - High values.
Lo - Low values.
FLtS - Stored Faults.

By pressing "ENTER" key User can Reset values from the selected options.

4.1.6 Quit Screen

On pressing "ENTER" key meter will quit (Exit) from main menu.

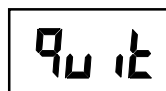


Fig No: - 82

4.2 Faults

4.2.1 Fault Number



Fig No: - 83

Screen (Fig) 83 "FALt" (Fault) shows stored faults & corresponding response value.

When on "FALt" menu as shown in fig 83,

Pressing "▲" key OR "▼" will go to "quit" (quit) menu refer section 4.2.2 as shown in fig 86. When on "quit" menu as shown in fig 86. Pressing "▲" key OR "▼" will go to "FAlt" (Fault) menu refer section 4.2.1 as shown in fig 83.

When on fault menu, pressing "ENTER" key meter will show "Ft.no" (Fault numbers) as shown in fig 84. This function will show Last 15 faults



Fig No: - 84

Example: - To know the name of first fault & it's details follow the steps: - Pressing "▲" or "▼" key, meter will enter into edit mode. Pressing "▲" key increments digit value & Pressing "▼" key decrements digit value.

To access this Set Up Press "Enter" key, meter will show "Ft.01" (Fault 1) as shown in fig 85. (* denotes decimal point is flashing).



Fig No: - 85

On pressing "ENTER" key meter will show fault name.

Pressing "▲" or "▼" key, meter will show all fault parameters values.

4.2.2 Quit

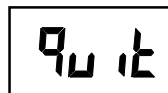


Fig No: - 86

Note: - Faults are stored in **First In First Out (FIFO)** order which means the latest fault is always stored on first location and previous faults get shifted downwards.

On pressing "ENTER" key meter will quit (Exit) from fault menu & go to measurement parameters menu.

4.3 Other Indications

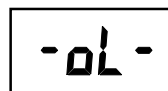


Fig No: - 87

When input exceeds 127% of PT Secondary in **voltage protection relay** OR 145% of CT Secondary in , meter will show "-OL-" (Over Load) as shown in fig 87.

If no input is present and Hi / Lo parameters are reset, then High frequency & Low frequency will show "----" as shown in fig 88.

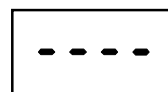


Fig No: - 88

Caution: - Input should not exceed upper limits of Current OR Voltage specified above.

5. OTHER FEATURES

5.1 Test Relay operations

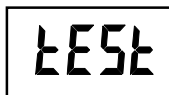


Fig No: - 89

"tEst" (Test) feature allows user to test relay operation when healthy inputs are applied i.e no fault is present.

To Test relay operations follow the steps: -

On pressing "TEST / ▲" for 3 seconds, all relay contacts will switch positions & Relay1, Relay2 LEDs will turn ON, and on releasing will return to initial state.

5.2 Manual Reset

When "Reset / ▼" key is pressed continuously for 3 Sec the manual reset will be acknowledged and when the fault condition is no longer present,

the relay will automatically reset.

TABLE 9 (B): Voltage Protection Relay

Parameters	Default values
System Type	3
System Nominal Voltage	600
PT primary / Secondary	415
System Frequency 5	0
Phase Sequence	1-2-3
Over Voltage Trip point	110
Trip Delay	1
Under Voltage Trip point	80
Over Frequency Trip point	105
Under Frequency Trip point	95
Phase Failure Trip point	20
Phase unbalance Trip point	20
Hysteresis	1
Power ON Delay	1
Reset Delay	1
Fault activation	0
Relay assignment	1

Note :-

1. User can not disable Phase failure parameter.
2. 0: Disabled
1: Enabled

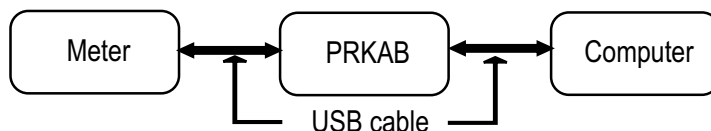
6. DEFAULT SETTINGS / ON Factory RESET

TABLE 9 (A): Current Protection Relay

Parameters	Default values
System Type	3
CT Secondary	5
CT Primary	5
System Frequency	50
Over Current Trip point	110
Trip Delay	1
Hysteresis	1
Under Current Trip point	80
Current Loss Trip point	20
Current Unbalance Trip point	20
Power ON Delay	1
Reset Delay	1
Fault activation	0
Relay assignment	1
System Nominal Current	5

7. MODBUS OUTPUT

The Multifunction Relay supports MODBUS RTU protocol (2-wire). Modbus Communication can be established with the meter via USB-based PRKAB. The PRKAB adjusts the signal level and provides electrical isolation between PC and Meter. A micro-usb cable must be used to connect the meter to PRKAB.



The maximum latency time of the meter is 200ms i.e. this is the amount of time that can pass before the first response character is output.

After sending any query through software (of the Master), it must allow 200ms of time to elapse before assuming that the Meter is not going to respond. If slave does not respond within 200 ms, Master can ignore the previous query and can issue fresh query to the slave.

The each byte in RTU mode has following format:

	8-bit binary, hexadecimal 0-9, A-F 2 hexadecimal characters contained in each 8-bit field of the message 4 bytes (32 bits) per parameter.
Format of Data Bytes	Floating point format (to IEEE 754) Most significant byte first (Alternative least significant byte first)
Error Checking Bytes	2 byte Cyclical Redundancy Check (CRC) 1 start bit, 8 data bits, least significant bit sent first
Byte format	1 bit for even/odd parity 1 stop bit if parity is used; 1 or 2 bits if no parity

Communication Baud Rate is fixed 19200 bps.

Function code :

04	Read input Registers	Read content of read only location (3X)
03	Read Holding Registers	Read content of read / write location (4X)
16	Presets Multiple Registers	Set the content of read / write locations (4X)

Exception Cases : An exception code will be generated when Meter receives ModBus query with valid parity & error check but which contains some other error (e.g. Attempt to set floating point variable to an invalid value) The response generated will be "Function code" ORed with HEX (80H). The exception codes are listed below

01	Illegal function	The function code is not supported by Meter
02	Illegal Data Address	Attempt to access an invalid address or an attempt to read or write part of a floating point value
03	Illegal DataValue	Attempt to set a floating point variable to an invalid value

7.1 Accessing 3 X register for reading measured values:

Two consecutive 16 bit registers represent one parameter. Refer **TABLE 10** for the addresses of 3X registers (Parameters measured by the instruments). Each parameter is held in the 3X registers. Modbus Code 04 is used to access all parameters.

Note : Number of registers = Number of parameters x 2

Each Query for reading the data must be restricted to 20 parameters or less. Exceeding the 20 parameter limit will cause a ModBus exception code to be returned.

Query :

01 (Hex)	04 (Hex)	00 (Hex)	04(Hex)	00 (Hex)	02(Hex)	30 (Hex)	0A (Hex)
Device Address	Function Code	Start Address High	Start Address Low	Number of Registers Hi	Number of Registers Lo	CRC Low	CRC High

Response: Volt3 (219.25V)

01 (Hex)	04 (Hex)	04 (Hex)	43 (Hex)	5B (Hex)	41 (Hex)	21 (Hex)	6F (Hex)	9B (Hex)
Device Address	Function Code	Byte Count	Data Register1 High Byte	CRC High	Data Register1 Low Byte	Data Register2 High Byte	Data Register2 Low Byte	CRC Low

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)

TABLE 10 : 3 X register addresses (measured parameters)

Address (Register)	Parameter No.	Parameter	Modbus Start	Address Hex	3P 4W	3P 3W	1P 2W
			High Byte	Low Byte			
30001	1	VL 1 (Volts)	00	0	✓	✗	✓
30003	2	VL 2 (Volts)	00	2	✓	✗	✗
30005	3	VL 3 (Volts)	00	4	✓	✗	✗
30007	4	I1 (Ampere)	00	6	✓	✓	✓
30009	5	I2 (Ampere)	00	8	✓	✓	✗
30011	6	I3 (Ampere)	00	A	✓	✓	✗
30013	7	Frequency (Hz)	00	C	✓	✓	✓
30015	8	Voltage sum (Volts)	00	E	✓	✓	✓
30017	9	Current sum (Ampere)	00	10	✓	✓	✓
30019	10	System Voltage (Volts)	00	12	✓	✓	✓
30021	11	System Current (Ampere)	00	14	✓	✓	✓
30023	12	Max voltage (Volts)	00	16	✓	✓	✓
30025	13	Min voltage (Volts)	00	18	✓	✓	✓
30027	14	Max Current (Ampere)	00	1A	✓	✓	✓
30029	15	Min Current (Ampere)	00	1C	✓	✓	✓
30031	16	Max frequency (Hz)	00	1E	✓	✓	✓
30033	17	Min frequency (Hz)	00	20	✓	✓	✓
30035	18	VL1-2 (Volts)	00	22	✓	✓	✗
30037	19	VL2-3 (Volts)	00	24	✓	✓	✗
30039	20	VL3-1 (Volts)	00	26	✓	✓	✗
30041	21	Fault 1	00	28	✓	✓	✓
30043	22	L1	00	2A	✓	✓	✓
30045	23	L2	00	2C	✓	✓	✗
30047	24	L3	00	2E	✓	✓	✗
30049	25	Fault 2	00	30	✓	✓	✓
30051	26	L1	00	32	✓	✓	✓
30053	27	L2	00	34	✓	✓	✗
30055	28	L3	00	36	✓	✓	✗

TABLE 10 : Continued

Address (Register)	Parameter No.	Parameter	Modbus Start Address Hex		3P 4W	3P 3W	1P 2W
			High Byte	Low Byte			
30057	29	Fault 3	00	38	✓	✓	✓
30059	30	L1	00	3A	✓	✓	✓
30061	31	L2	00	3C	✓	✓	X
30063	32	L3	00	3E	✓	✓	X
30065	33	Fault 4	00	40	✓	✓	✓
30067	34	L1	00	42	✓	✓	✓
30069	35	L2	00	44	✓	✓	X
30071	36	L3	00	46	✓	✓	X
30073	37	Fault 5	00	48	✓	✓	✓
30075	38	L1	00	4A	✓	✓	✓
30077	39	L2	00	4C	✓	✓	X
30079	40	L3	00	4E	✓	✓	X
30081	41	Fault 6	00	50	✓	✓	✓
30083	42	L1	00	52	✓	✓	✓
30085	43	L2	00	54	✓	✓	X
30087	44	L3	00	56	✓	✓	X
30089	45	Fault 7	00	58	✓	✓	✓
30091	46	L1	00	5A	✓	✓	✓
30093	47	L2	00	5C	✓	✓	X
30095	48	L3	00	5E	✓	✓	X
30097	49	Fault 8	00	60	✓	✓	✓
30099	50	L1	00	62	✓	✓	✓
30101	51	L2	00	64	✓	✓	X
30103	52	L3	00	66	✓	✓	X
30105	53	Fault 9	00	68	✓	✓	✓
30107	54	L1	00	6A	✓	✓	✓
30109	55	L2	00	6C	✓	✓	X
30111	56	L3	00	6E	✓	✓	X

TABLE 10 : Continued

Address (Register)	Parameter No.	Parameter	Modbus Start Address Hex		3P 4W	3P 3W	1P 2W
			High Byte	Low Byte			
30113	57	Fault 10	00	70	✓	✓	✓
30115	58	L1	00	72	✓	✓	✓
30117	59	L2	00	74	✓	✓	X
30119	60	L3	00	76	✓	✓	X
30121	61	Fault 11	00	78	✓	✓	✓
30123	62	L1	00	7A	✓	✓	✓
30125	63	L2	00	7C	✓	✓	X
30127	64	L3	00	7E	✓	✓	X
30131	66	L1	00	82	✓	✓	✓
30133	67	L2	00	84	✓	✓	✓
30135	68	L3	00	86	✓	✓	X
30137	69	Fault 13	00	88	✓	✓	X
30139	70	L1	00	8A	✓	✓	✓
30141	71	L2	00	8C	✓	✓	✓
30143	72	L3	00	8E	✓	✓	X
30145	73	Fault 14	00	90	✓	✓	X
30147	74	L1	00	92	✓	✓	✓
30149	75	L2	00	94	✓	✓	✓
30151	76	L3	00	96	✓	✓	X
30129	65	Fault 12	00	80	✓	✓	X
30153	77	Fault 15	00	98	✓	✓	✓
30155	78	L1	00	9A	✓	✓	✓
30157	79	L2	00	9C	✓	✓	X
30159	80	L3	00	9E	✓	✓	X

Note: - 1. In 3P3W Voltage Protection Relay, L1,L2,L3 denote L1-2, L2-3, L3-1 respectively.

2. Over Load Parameters are indicated by value "10000000".

3. When any fault will occur, meter shows following values.

1: Over voltage 2: Under voltage 3: Over Frequency 4: Under frequency 5: Phase Failure

6: Phase Unbalance 7: Phase sequence in Voltage protection relay.

1: Over Current 2: Under Current 3: Current Loss 4: Current unbalance in Current protection relay.

7.2 Accessing 4 X register for Reading & Writing Settings:

Each setting is held in the 4X registers. ModBus code 03 is used to read the current setting & code 16 is used to write/change the setting. Refer TABLE 11 for 4X Register addresses.

Example: Reading System type

System type:

Start address = 0A (Hex)

Number of registers = 02

Note: Number of registers = Number of Parameters x 2

Query :

Device Address	01 (Hex)
Function Code	03 (Hex)
Start Address High	00 (Hex)
Start Address Low	0A (Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02 (Hex)
CRC Low	E4 (Hex)
CRC High	09 (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Response: System Type (3phase 4 wire = 3)

Device Address	01 (Hex)
Function Code	03 (Hex)
Byte Count	04 (Hex)
Data Register1 High Byte	40 (Hex)
Data Register1 Low Byte	40 (Hex)
Data Register2 High Byte	00 (Hex)
Data Register2 Low Byte	00 (Hex)
CRC Low	EE (Hex)
CRC High	27 (Hex)

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)

Example : Writing System type

System type : Start address = 0A (Hex)

Number of registers = 02

Query: (Change System type to: 3phase 3wire = 2)

Device Address	01 (Hex)
Function Code	10 (Hex)
Starting Address Hi	00 (Hex)
Starting Address Lo	0A(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
Byte Count	04 (Hex)
Data Register-1 Low Byte	40 (Hex)
Data Register-2 High Byte	00(Hex)
Data Register-1High Byte	00(Hex)
Data Register-2 Low Byte	00(Hex)
CRC Low	66 (Hex)
CRC High	10 (Hex)

Byte Count : Total number of data bytes received.

Data register 1 High Byte : Most significant 8 bits of

Data register 1 of the parameter requested.

Data register 1 Low Byte : Least significant 8 bits of

Data register 1 of the parameter requested.

Data register 2 High Byte : Most significant 8 bits of

Data register 2 of the parameter requested.

Data register 2 Low Byte : Least significant 8 bits of

Data register 2 of the parameter requested.

(Note : Two consecutive 16 bit register represent one parameter.)
Response:

Device Address	01 (Hex)
Function Code	10 (Hex)
Start Address High	00 (Hex)
Start Address Low	0A(Hex)
Number of Registers Hi	00 (Hex)
Number of Registers Lo	02(Hex)
CRC Low	61 (Hex)
CRC High	CA (Hex)

Start Address High : Most significant 8 bits of starting address of the parameter requested.

Start Address low : Least significant 8 bits of starting address of the parameter requested.

Number of register Hi : Most significant 8 bits of Number of registers requested.

Number of register Lo : Least significant 8 bits of Number of registers requested.

(Note : Two consecutive 16 bit register represent one parameter.)

TABLE 11 : 4 X register addresses

Address (Register)	Parameter No.	Parameter	Modbus Start Address Hex		Read / Write	Relay V	Relay I
			High Byte	Low Byte			
40007	1	Sys nominal voltage (600)	00	6	R	✓	✗
40009	2	Sys nominal current (5)	00	8	R	✗	✓
40011	3	System type (3) *4	00	A	R/Wp	✓	✓
40013	4	System frequency (50)	00	C	Wp	✓	✗
40015	5	Reset parameters (0)	00	E	R/Wp	✓	✓
40017	6	System phase sequence (1)	00	10	R/Wp	✓	✗
40023	7	Reset option (Auto / Manual) (1)	00	16	R/Wp	✓	✓
40025	8	Relay control mode relay1 (en/de-en) (1)	00	18	R/Wp	✓	✓
40027	9	Relay control mode relay2 (en/de-en) (1)	00	1A	R/Wp	✓	✓
40029	10	Reset delay (1)	00	1C	R/Wp	✓	✓
40031	11	Power on delay (1)	00	1E	R/Wp	✓	✓
40033	12	PT primary (415)	00	20	R/Wp	✓	✗
40035	13	CT primary (5)	00	22	R/Wp	✗	✓
40041	14	Register order (0)	00	28	R/Wp	✓	✓
40043	15	CT secondary (5)	00	2A	R/Wp	✗	✓
40045	16	PT secondary (415)	00	2C	R/Wp	✓	✗
40051	17	Select Feature For editing (0)	00	32	R/Wp	✓	✓
40053	18	Enable / Disable (0)	00	34	R/W	✓	✓
40055	19	Trip setpoint (110)	00	36	R/Wp	✓	✓
40057	20	Trip delay (1)	00	38	R/Wp	✓	✓
40059	21	Hysteresis (1)	00	3A	R/Wp	✓	✓

TABLE 11 : Continued

Address (Register)	Parameter No.	Parameter	Modbus Start Address Hex		Read / Write	Relay V	Relay I
			High Byte	Low Byte			
40061	22	Relay assignment (1)	00	3C	R/Wp	✓	✓
40063	23	Relay 1 - trip / buzzer (0)	00	3E	R/Wp	✓	✓
40065	24	Relay 2 - trip / buzzer (0)	00	40	R/Wp	✓	✓
40067	25	Relay 1 Status & Tripping	00	42	R/Wp	✓	✓
40069	26	Relay 2 Status & Tripping	00	44	R/Wp	✓	✓
40071	27	Password (0)	00	46	R/W	✓	✓
40073	28	Meter Restart Disable	00	48	R/Wp	✓	✓
40077	30	Auto scroll (0)	00	4C	R/Wp	✓	✓
40079	31	IDMT enable/disable (0)	00	4E	R/Wp	✗	✓
40081	32	Pickup current setting for IDMT (125)	00	50	R/Wp	✗	✓
40083	33	Time Multiplier setting IDMT (1)	00	52	R/Wp	✗	✓
40085	34	Curve selection for IDMT (0)	00	54	R/Wp	✗	✓
40087	35	Anding enable/disable (0)	00	56	R/Wp	✓	✓
40089	36	Anding parameter 1 (7) *5	00	58	R/Wp	✓	✓
40091	37	Anding parameter 2 (7)	00	5A	R/Wp	✓	✓
40093	38	Anding Relay (1)	00	5C	R/Wp	✓	✓
40095	39	Factory Reset (0)	00	5E	Wp	✓	✓
40097	40	Serial number (0)	00	60	R	✓	✓
40099	41	Model No.	00	62	R	✓	✓
40101	42	Version No.	00	64	R	✓	✓

Note: - 1. Wp - Write Protected

2. R - Read Only

3. R / Wp - Read & Write Protected

4. System type can be changed in 3 phase system only.

5. ANDing parameters are assigned to 'none' by default. In voltage, none is denoted by 7, and in current, it is denoted by 4.

6. Values in (*) denotes default values.

Explanation for 4 X register :

Address	Parameter	Description
40007	System Voltage	This address is read only and displays System nominal Voltage
40009	System Current	This address is read only and displays System nominal Current
40011	System Type	This address is used to set the System type. Write one of the following value to this address. 1: 1 Phase 2 Wire 2: 3 Phase 3 Wire 3: 3 Phase 4 Wire. Writing any other value will return error .
40013	System frequency	This address is used to set System Frequency in voltage protection relay. Writing any other value will return error. Write one of the following to this address. 50: 50 Hz 60: 60 Hz
40015	Reset Paramters	This address is used to reset different parameters. Write specific value to this register to reset the corresponding parameter. Writing any other value will return an error. Write one of the following to this address. 0: None 1: ALL 2: Max voltage, Max frequency (Voltage Protection Relay) Max current, Max frequency (Current Protection Relay) 3: Min voltage, Min frequency (Voltage Protection Relay) Min current, Min frequency (Current Protection Relay) 4: stored faults
40017	System Phase sequence	This address is used to set the System Phase sequence in voltage protection relay in 3 ph 3w, 3ph 4w. Writing any other value will return error. Write one of the following to this address. 0: 3-2-1 1: 1-2-3
40023	Reset option (Auto / Manual)	This register is used to Reset relays in auto mode or in manual mode. Writing any other value will return error. Write one of the following to this address. 0: Manual 1: Auto
40025	Relay control mode relay 1	This address is used to set relay 1 operation in Energize or De-energize mode. Writing any other value will return an error. Write one of the following to this address. 0: Energize 1: De-energize
40027	Relay control mode relay 2	This address is used to set relay 2 operation in Energize or De-energize mode. Writing any other value will return an error. Write one of the following to this address. 0: Energize 1: De-energize

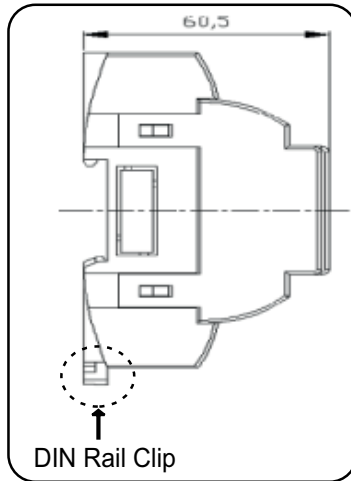
40029	Reset delay	This address allows the user to set reset delay in between 0.2 Sec to 30 Sec.
40031	Power on delay	This address allows the user to set Power ON delay in between 0.5 Sec to 30 Sec.
40033	PT Primary	This address allows the user to set PT Primary value (in terms of V). L-L The settable range is 0.100 KVL-L to 1200 KV for all system types.
40035	CT Primary	This address allows the user to set CT Primary value. The settable range is 1A to 999 KA for all system types.
40041	Register order / Word order	Word Order controls the order in which Omicron relay receives or sends floating - point numbers:- normal or reversed register order . In normal mode, the two registers that make up a floating point numbers are sent most significant bytes first. In reversed register mode , the two registers that make up a floating point numbers are sent least significant bytes first. To set the mode, write the value '2141.0' into this register-the instrument will detect the order used to send this value and set that order for all ModBus transaction involving floating point numbers.
40043	CT Secondary	This address allows the user to set CT Secondary value. The settable range is 1A to 5A for all system types.
40045	PT Secondary	This address allows the user to set CT Secondary value (in terms of V). L-L The settable range is 100 V to 600V for all system types.
40051	Select Feature For editing	This address allows the user to select one out of 7 different parameters for editing in Voltage protection relay. Writing any other value will return error. Write one of the following to this address. 0: Over voltage 1: Under voltage 2: Over Frequency 3: Under frequency 4: Phase Failure 5: Phase Unbalance 6: Phase sequence This address allows the user to select one out of 4 different parameters for editing in Current protection relay. Writing any other value will return error. Write one of the following to this address. 0: Over Current 1: Under Current 2: Current Loss 3: Current unbalance
40053	Enable / Disable	This address allows the user to enable or disable parameter selected in address 40051. 0: Disable 1: Enable
40055	Trip setpoint	This address allows the user to set trip point of selected parameter. Refer section 4.1.3.3 for Trip Point Setting of parameters.
40057	Trip Delay	This address allows the user to set trip delay of selected parameter. Refer section 4.1.3.4 for Trip Delay setting of parameters. This address allows the user to set hysteresis of selected parameter. Refer section 4.1.3.5 for Hysteresis setting of parameters.
40061	Relay assignment	This address is used to assign the Relay to selected parameters. Writing any other value will return error. Write one of the following to this address. 0: None 1: Relay 1 2: Relay 2 3: Relay 1 & Relay 2

40063	Relay 1 - trip / buzzer	This address allows the user to set Relay 1 in trip mode or in buzzer mode. Writing any other value will return error. Write one of the following to this address. 0: Trip 1: Buzzer
40065	Relay 2 - trip / buzzer	This address allows the user to set Relay 2 in trip mode or in buzzer mode. Writing any other value will return error. Write one of the following to this address. 0: Trip 1: Buzzer
40067	Relay 1 Status & Tripping	This address shows the status of Relay 1 contacts and also allows the user to change the state. Writing any other value will return error. Write one of the following to this address. 0: Relay De-energize 1: Relay Energize
40069	Relay 2 Status & Tripping	This address shows the status of Relay 2 contacts and also allows the user to change the state. Writing any other value will return error. Write one of the following to this address. 0: Relay De-energize 1: Relay Energize
40071	Password	This address is used to set & reset the password. Valid Range of Password can be set is 0000 - 9999 . 1) If password lock is present & if this location is read it will return zero. 2) If Password lock is absent & if this location is read it will return One. 3) If password lock is present & to disable this lock first send valid password to this location then write "0000" to this location 4) If password lock is present & to modify 4X parameter first send valid password to this location so that 4X parameter will be accessible for modification. 5) If for in any of the above case invalid password is send then meter will return exceptional error 2.
40073	Meter Restart Disable	Writing '0' to this register restarts meter & when '1' is written, on changing any one of the Parameters mentioned in NOTE 1, meter will not restart immediately but will restart automatically after 1 min if no write query is sent.
40077	Auto scroll	This address is used to activate or de-activate the auto scrolling. Writing any other value will return error. Write one of the following to this address. 0: Deactivate 1: Activate
40079	IDMT enable/ disable	This address is used to activate or de-activate IDMT. (This feature is only applicable to "OC" (Over Current)). Writing any other value will return error. Write one of the following to this address. 0: Deactivate 1: Activate
40081	Pickup current setting for IDMT	This address allows the user to set the pick up current in between 101% to 125%. This feature is applicable only to Current protection relay for "OC" (Over Current) fault parameter.
40083	Time Multiplier setting IDMT	This address allows the user to set the TMS value in between 0.1 to 1.

40085	Curve selection for IDMT	This address allows the user to set any one out of 4 different curves. Writing any other value will return error. Write one of the following to this address. Writing any other value will return an error. 0: Normal inverse 1: Very inverse 2: Extremely Inverse 3: Long time Inverse
40087	ANDing Enable / Disable	This address is used to enable or disable AND function. Writing any other value will return error. Write one of the following to this address. Writing any other value will return an error. 0: Disable 1: Enable Note: - if any one ANDing parameter is disabled then ANDing function will get disabled
40089	ANDing para1	Voltage Protection Relay: - This address allows the user to set any one out of 7 different parameters as input 1 to AND function. Write one of the following to this address. 0: "OV" (Over Voltage), 1: "UV" (Under Voltage), 2: "OF" (Over Frequency), 3: "UF" (Under Frequency), 4: "Ph.F" (Phase Failure), 5: "Ph.un" (Phase Unbalance), 6: "Ph.r" (Phase Reversal) Current Protection Relay: - This address allows the user to set any one out of 4 different parameters as input 1 to AND function. Write one of the following to this address. 0: "OC" (Over Current), 1: "UC" (Under Current), 2: "C.LoS" (Current Loss), 3: "C.un" (Current Unbalance)
40091	ANDing para 2	Voltage Protection Relay: - This address allows the user to set any one out of 7 different parameters as input 2 to AND function. Write one of the following to this address. 0: "OV" (Over Voltage), 1: "UV" (Under Voltage), 2: "OF" (Over Frequency), 3: "UF" (Under Frequency), 4: "Ph.F" (Phase Failure), 5: "Ph.un" (Phase Unbalance), 6: "Ph.r" (Phase Reversal) Current Protection Relay: - This address allows the user to set any one out of 4 different parameters as input 2 to AND function. Write one of the following to this address. 0: "OC" (Over Current), 1: "UC" (Under Current), 2: "C.LoS" (Current Loss), 3: "C.un" (Current Unbalance)
40093	ANDing Relay	This address allows the user to set any one Relay to AND function. Write one of the following to this address. 0: None 1: Relay 1 2: Relay 2 3: Relay 1 & Relay 2
40095	Factory Reset	Writing 100 at this address will reset the meter to factory default settings.
40097	Serial Number	This address is read only and displays the serial number of the meter.
40099	Model Number	This address is read only and displays the model number of the meter.
40101	Version Number	This address is read only and displays the version number of the meter.

NOTE 1: When one of the following parameter is changed, meter will restart : System type, System sequence, PT primary, CT primary, CT secondary, PT secondary, Tripping Parameter Enable/Disable, Relay assignment, ANDing enable/disable, ANDing para1, ANDing para2, ANDing relay.

8. INSTALLATION



Caution

- 1. In the interest of safety and functionality this product must be installed by a qualified engineer, abiding by any local regulations.**
- 2. Voltages dangerous to human life are present at some of the terminal connections of this unit. Ensure that all supplies are de-energized before attempting any connection or disconnection.**
- 3. These products do not have internal fuses therefore external fuses must be used to ensure safety under fault conditions.**

Protection Relay can be mounted on a top-hat rail or directly on to wall by mounting plate. The front of the enclosure conforms to IP 20. The terminals of the product should be protected from liquids.

The Meter should be mounted in a reasonably stable ambient temperature and where the operating temperature is within the range -10 to 55°C. Vibration should be kept to a minimum and the product should not be mounted where it will be subjected to excessive direct sunlight.

8.1 EMC Installation Requirements: -

This product has been designed to meet the certification of the EU directives when installed to a good code of practice for EMC in industrial environments, e.g.

1. Screened output and low signal input leads or have provision for fitting RF suppression components, such as ferrite absorbers, line filters etc., in the event that RF fields cause problems.

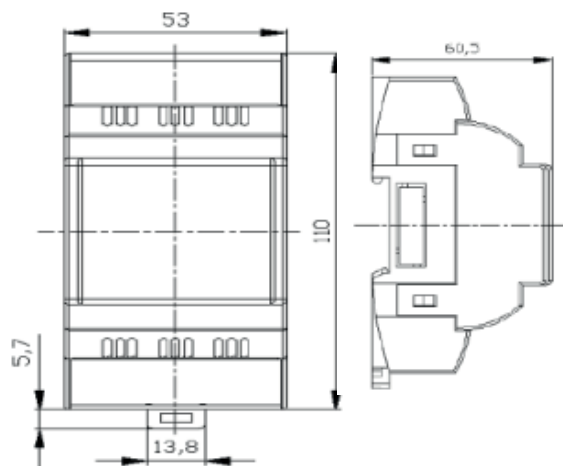
Notet It is good practice to install sensitive electronic instruments that are performing critical functions, in EMC enclosures that protect against electrical interference which could cause a disturbance in function.

2. Avoid routing leads alongside cables and products that are, or could be, a source of grounded interference.

3. To protect the product against permanent damage, surge transients must be limited to 2kV pk. It is good EMC practice to suppress differential surges to 2kV at the source. The unit has been designed to automatically recover in the event of a high level of transients. In extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 5 seconds to restore correct operation. The Current inputs of these products are designed for connection in to systems

via Current Transformers only, where one side is grounded. 4. ESD precautions must be taken at all times when handling this product.

8.2 Case Dimension & Panel Cut Out



8.3 Wiring

Input connections are made directly to screw-type terminals with indirect wire pressure. Numbering is clearly marked on the connector. Choice of cable should meet local regulations. Terminal for both Current and Voltage inputs will accept upto 4mm² (12AWG) solid or 2.5 mm² stranded cable.

Note : It is recommended to use wire with lug for connection with meter.

8.4 Auxiliary Supply

Meter should ideally be powered from a dedicated supply, however powered from the signal source, provided the source remains within it may be the limits of the Chosen auxiliary voltage range.

8.5 Fusing

It is recommended that all voltage lines are fitted with 1 Amp HRC fuse.

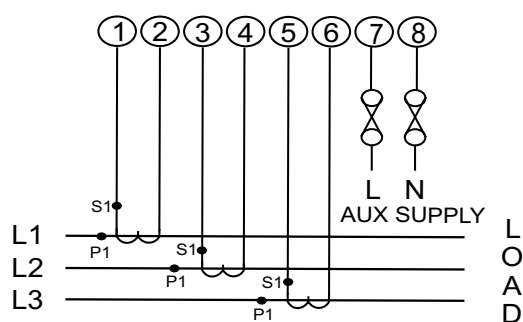
8.6 Earth/Ground Connections

For safety reasons, CT secondary connections should be grounded in accordance with local regulations.

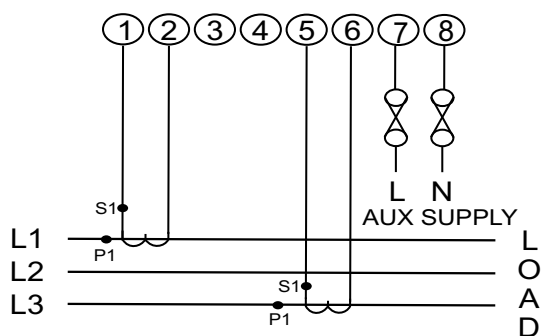
9. CONNECTION DIAGRAMS

Current Protection Relay

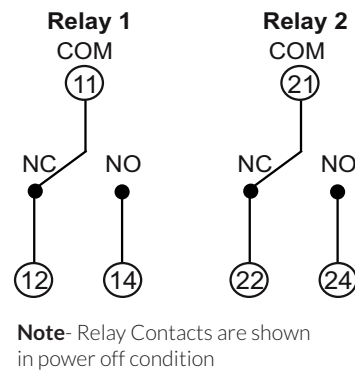
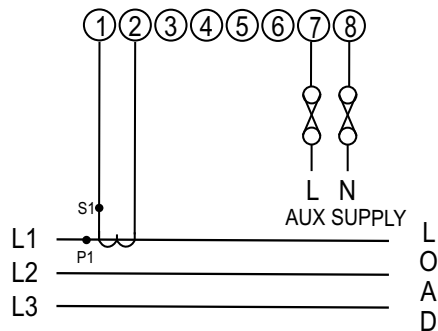
For 3 Phase 4 Wire Unbalanced Load



For 3 Phase 3 Wire Unbalanced Load

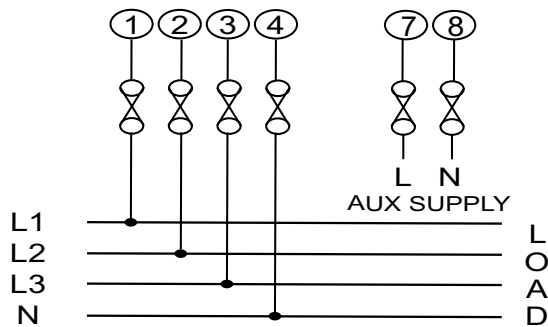


For 1 Phase 2 Wire Load

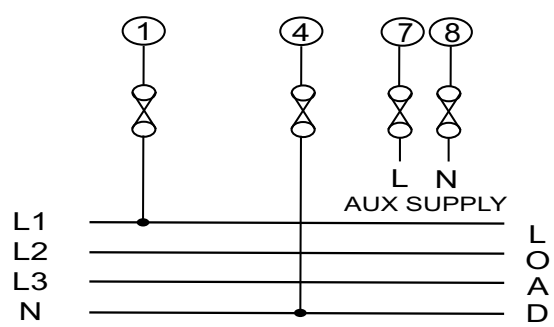


Voltage Protection Relay

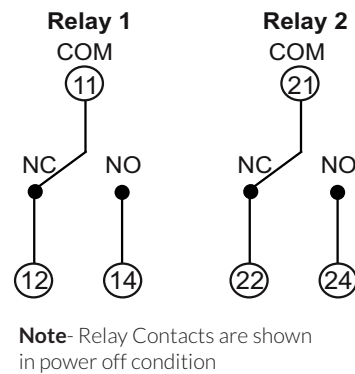
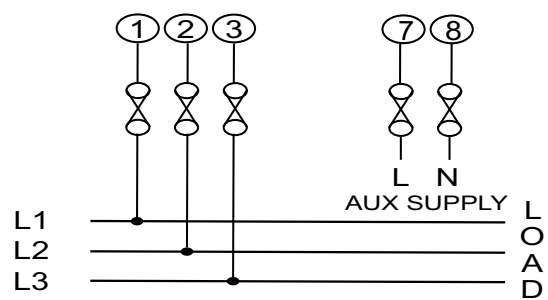
For 3 Phase 4 Wire Unbalanced Load



For 1 Phase 2 Wire Load



For 3 Phase 3 Wire Unbalanced Load



10. TECHNICAL SPECIFICATIONS

Input Voltage

Nominal input voltage (AC RMS)	600 VL-L (346.42VL-N)
System PT Primary Values	100VL-L to 1200 KVL-L programmable on site
System PT Secondary value	100VL-L to 600 VL-L programmable on site
Max continuous input voltage	127% of PT Secondary
Nominal frequency	50 / 60 Hz (programmable on site)
Input voltage burden	< 0.6VA approx.

Input Current

Nominal input current (AC RMS)	5 A
System CT Primary Values	From 1A to 999 KA programmable on site
System CT Primary Values	1A to 5A programmable on site
Max continuous input current	145% of CT Secondary
Input current burden	< 0.25 VA approx. per phase

Auxiliary Supply

External Higher Aux	60 V – 300V AC-DC
Higher Aux Nominal value	230 V AC/DC 50/60 Hz for AC Aux OR
External Lower Aux	20 V – 60 VDC / 20 V – 40 VAC
Lower Aux Nominal value	48 VDC / 24 VAC 50/60 Hz for AC Aux
Aux supply frequency	45 to 66 Hz range
Aux supply burden	< 4VA approx.

Overload Withstand

Voltage	2x rated value for 1 second, repeated 10 times at 10 seconds
Current	20x rated value for 1 second, repeated 5 times at 5 min

Operating Measuring Ranges

Voltage Range	20...125% of PT Secondary
Current Range	5...140% of CT Secondary
Frequency	40...70Hz

Reference condition for Accuracy :

Reference Condition	23°C +/- 2°C
Input waveform	Sinusoidal (distortion factor 0.005)
Input Frequency	50 or 60 Hz ±2%
Auxiliary supply voltage	Nominal Value ±1%
Auxiliary supply frequency	Nominal Value ±1%

Accuracy :

Voltage	±0.5% of nominal value
Input Current	±0.5% of nominal value
Frequency	±0.2 Hz
Power ON, Trip, Reset Delays	±140 msec or ±5% of Set Delay, Whichever is Greater (WIG)

Influence of Variations:

Temperature coefficient :	0.025%/°C for Voltage
Temperature coefficient :	0.05%/°C for Current

Applicable Standards:

EMC	IEC 61326 - 1
Immunity	IEC 61000-4-3. 10V/m min – Level 3 industrial Low level
Safety	IEC 61010-1-2010 , Permanently connected use
IP for water & dust	IEC60529
Installation category:	300V CAT III / 600V CAT II
Pollution degree: 2	
High Voltage Test	2.2 kV AC, 50Hz for 1 minute between all Electrical circuits.

Environmental :

Operating temperature	-10 to +55°C
Storage temperature	-25 to +70°C
Relative humidity	0... 90% non condensing
Shock	15g in 3 planes
Vibration	10... 55 Hz, 0.15mm amplitude
Enclosure	IP20 (front face only)

Relay Contacts :

Types of output	1CO, 2CO, 1CO+1CO
Contact Ratings (Res. Load)	5A/250VAC/30VDC
Mechanical Endurance	1x10 ⁷ OPS
Electrical Endurance	NO- 3x10 ⁴ OPS NC- 1x10 ⁴ OPS for 1CO / 1CO+1CO relay 1x10 ⁵ OPS for 2CO relay

Mechanical Attributes :

Weight	300g Approx.
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NOTE:

The information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, 'manufacturer' has no control over the field conditions which influence product installation. It is user's responsibility to determine the suitability of installation method in the user's field condition, 'manufacturer' only obligations are responsibility to determine suitability of the installation method in the user's field conditions. 'Manufacturer' only obligations are those in manufacturer standard conditions. 'Manufacturer' only obligations are those in 'Manufacturer' standard condition of sale for this product and in no case will 'Manufacturer' be liable for any other incidental, indirect or consequential damages arising from the use or misuse of the products.

Contact**Sifam Tinsley Instrumentation Ltd**

1 Warner Drive
Springwood Industrial Estate
Braintree, Essex
CM7 2YW

Tel: 01376 335271
E-mail: sales@sifamtinsley.com

www.sifamtinsley.co.uk