# Operating Manual

# RISH RELAY


**VOLTAGE PROTECTION RELAY**


**CURRENT PROTECTION RELAY**

**2-60-006-00-00589_Rev.B - 02/2015**

# DIGITAL PROTECTION RELAY
## Programmable Multi-function Relay
## Installation & Operating Instructions

**Section** **Contents**

# 1. INTRODUCTION

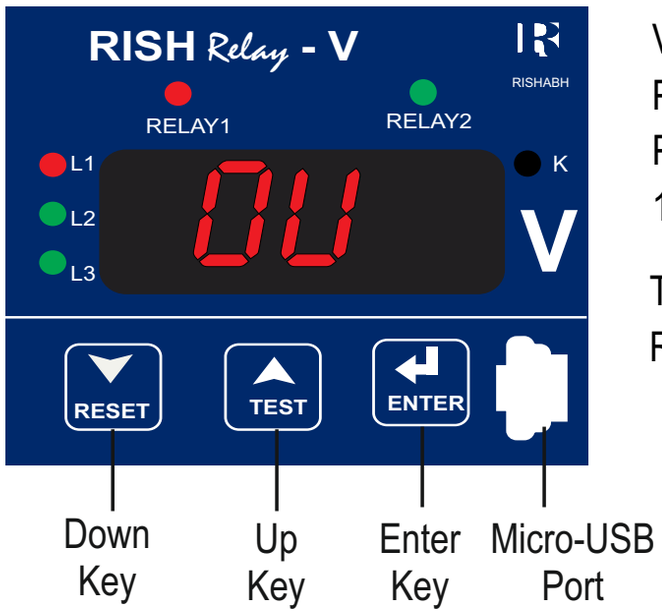
**Voltage Protection Relay: -**

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 15$^{th}$ harmonics with 4 Digit 7 Segment LED Display.

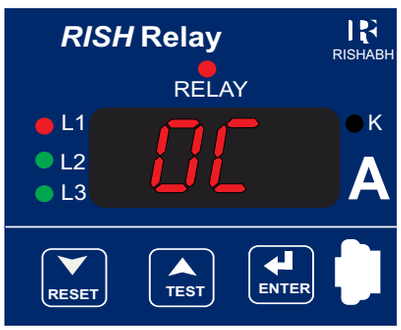
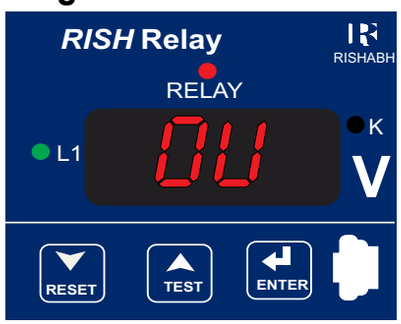
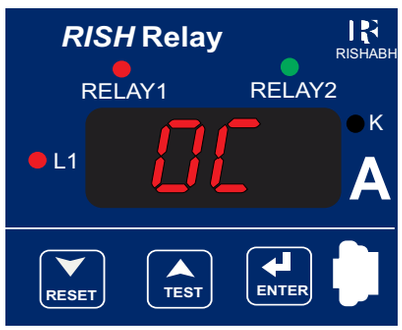



Voltage / Current Protection Relay can be configured & Programmed on site for system type, PT / CT Primary, PT / CT Secondary in 3 Phase 3W, 3 Phase 4W, 1 Phase 2W System.

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:**<br>  <br><br>  <br><br>**Single Phase:**<br>  <br><br>  <br> | L1<br>L2<br>L3 | Bi-colour<br>(Green / Red) | Phase 1 LED indication<br>Phase 2 LED indication<br>Phase 3 LED indication<br><br>**LED States -**<br>Green - Healthy State<br>Green (Flashing) - Reset Delay<br>Red - Fault present on particular phase<br>Red (Flashing) - Trip Delay<br>OFF - Input Absent |
| | RELAY 1<br>RELAY 2<br>RELAY | Bi-colour<br>(Green / Red) | RELAY 1 LED (1CO+1CO only)<br>RELAY 2 LED (1CO+1CO only)<br>RELAY LED (1CO/2CO only)<br><br>**LED States -**<br>Green - Healthy State<br>Red - Fault / Alarm present |
| | K | Red | X1000 Indication |
| | RESET / ▼ | - | RESET / DOWN Key (< 3 sec): Decrement values, move downwards in menu<br>RESET / Down Key (> 3 sec): Reset relay in manual reset mode |
| | TEST / ▲ | - | TEST / UP Key (< 3 sec): Increment values, move upwards in menu<br>TEST / UP Key (> 3 sec): Switch relay contacts, resets to initial position when released |
| | ENTER / ↵ | - | ENTER Key (< 3 sec): Confirm values, menu level changes<br>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 | ✓ | ✓ | X |
| 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 | 3P 4W | 1P 2W |
|---|---|---|---|---|
| System Voltage | Voltage | ✓ | ✓ | X |
| Voltage VL1-N, VL2-N, VL3-N | Voltage | X | ✓ | ✓(Only L1-N) |
| Voltage VL1-VL2, VL2-VL3, VL3-VL1 | Voltage | ✓ | ✓ | X |
| System Frequency | Hz | ✓ | ✓ | ✓ |
| High / Low System Voltage | Voltage | ✓ | ✓ | ✓ |
| High / Low System Frequency | Hz | ✓ | ✓ | ✓ |

✓ Available
X Not available

# 3. FLOW DIAGRAMS

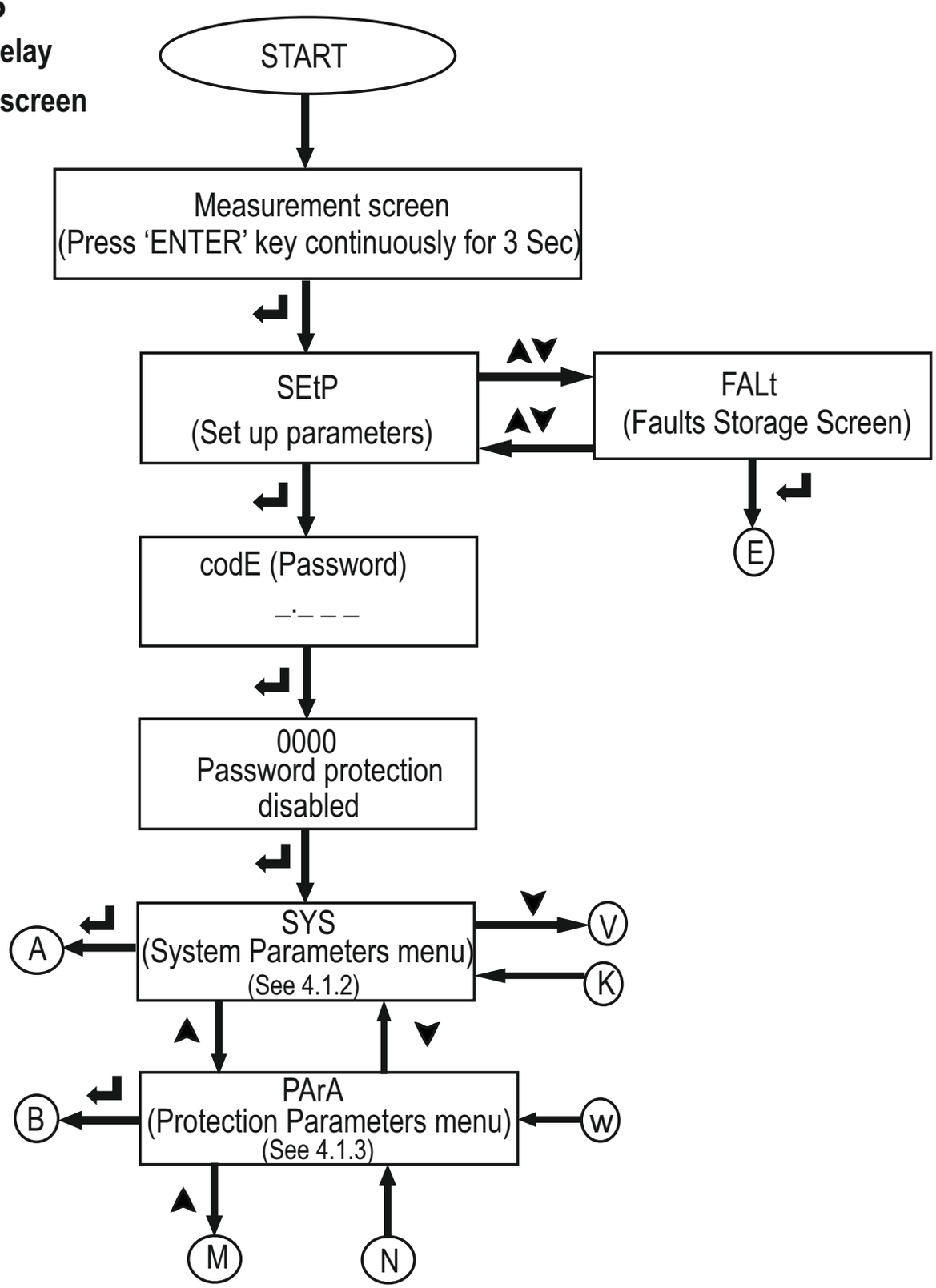
## 3.1 Voltage Protection Relay

### 3.1.1 Set up Parameters screen

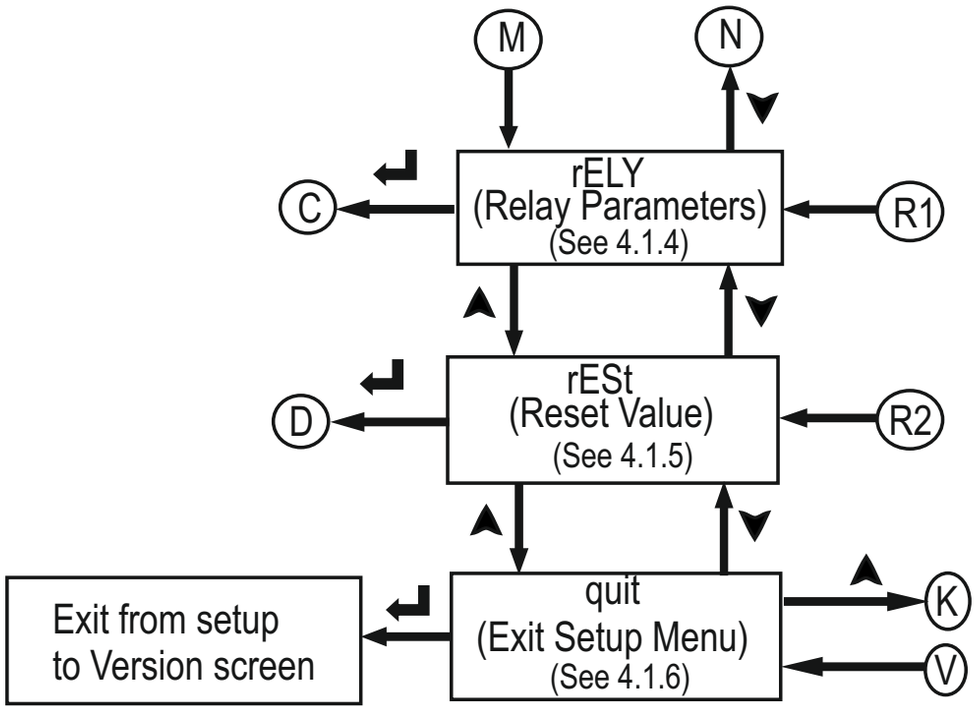
▲ : - UP Key

▼ : - DOWN Key

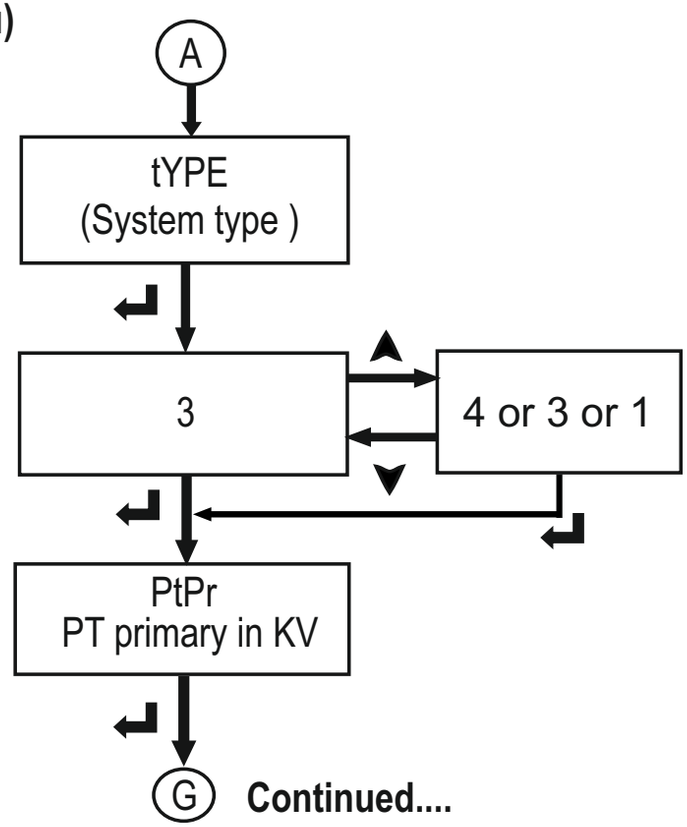
↵ : - ENTER Key



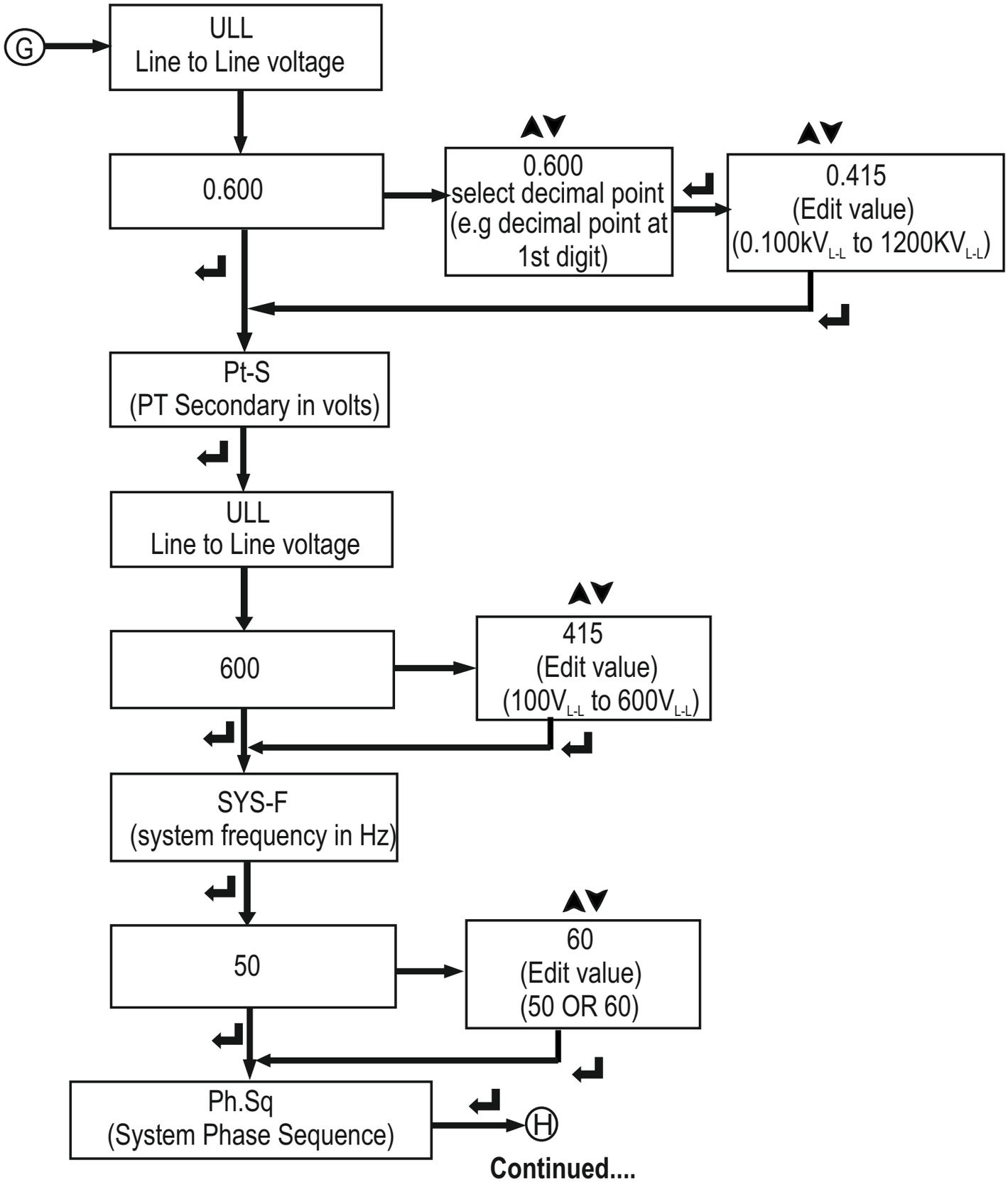

**Continued....**



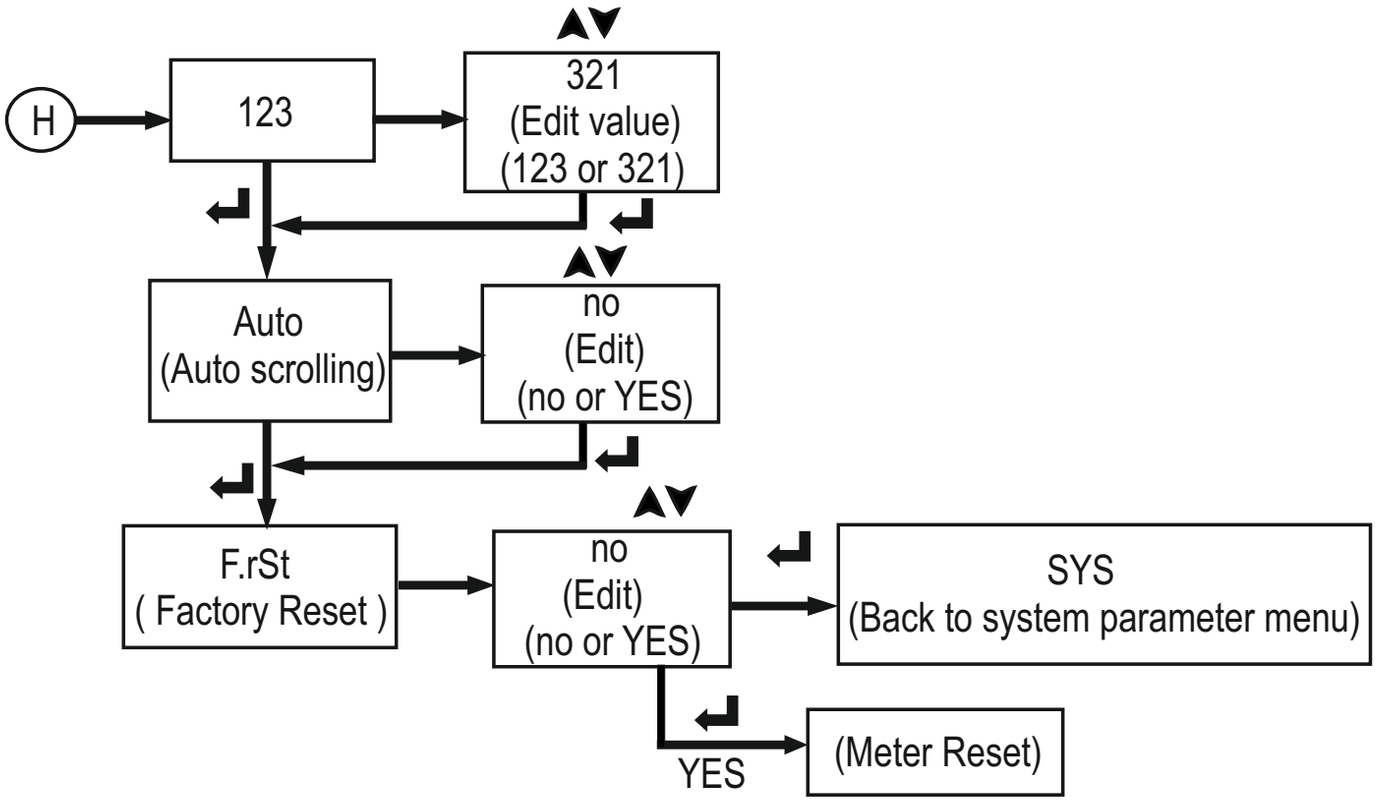

**A] SYS (System Parameters Menu)**



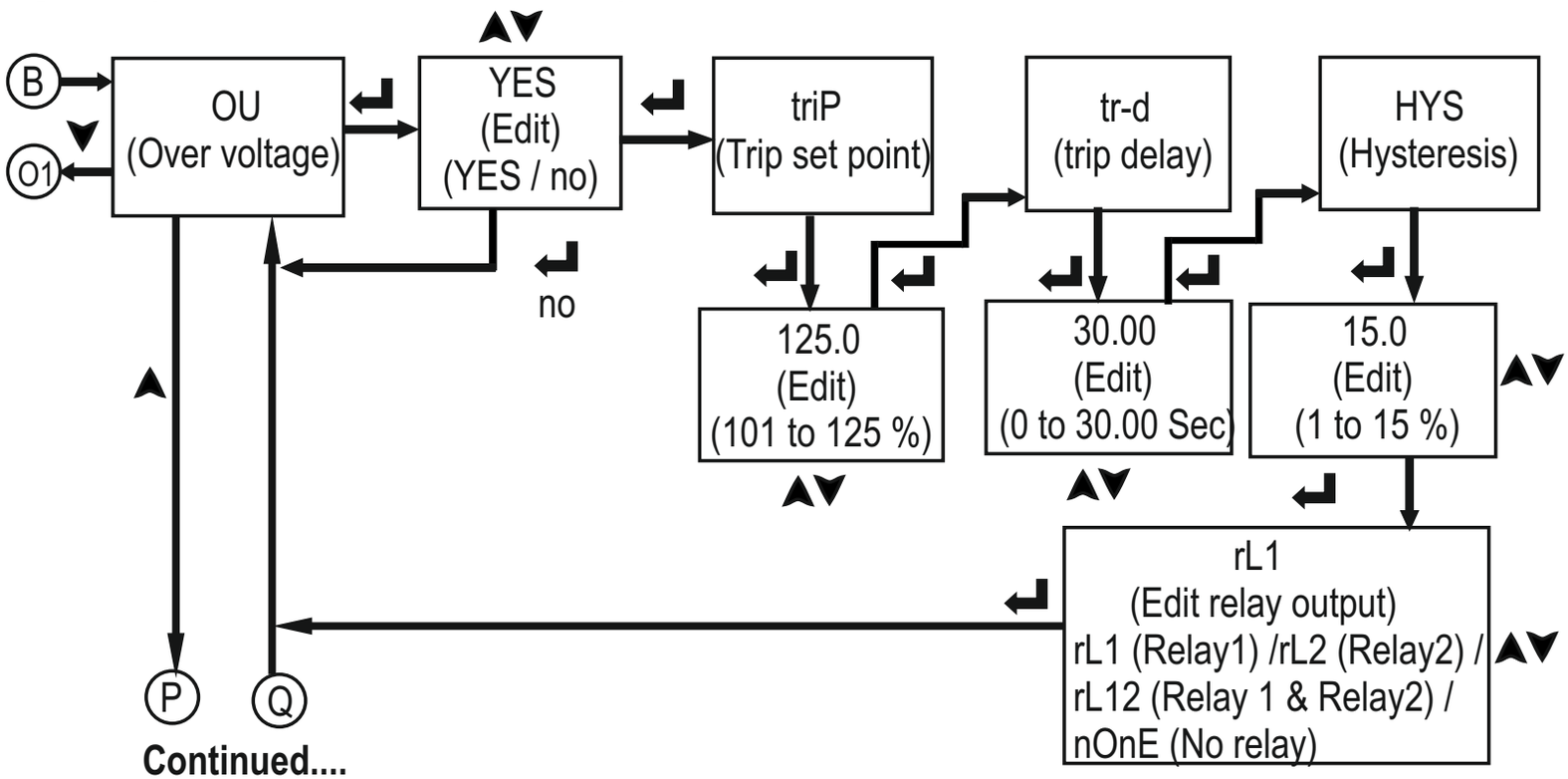

**Continued....**


G
ULL
Line to Line voltage
0.600
0.600
select decimal point
(e.g decimal point at
1st digit)
0.415
(Edit value)
(0.100kV L-L to 1200KV L-L)
Pt-S
(PT Secondary in volts)
ULL
Line to Line voltage
600
415
(Edit value)
(100V L-L to 600V L-L)
SYS-F
(system frequency in Hz)
50
60
(Edit value)
(50 OR 60)
Ph.Sq
(System Phase Sequence)
H

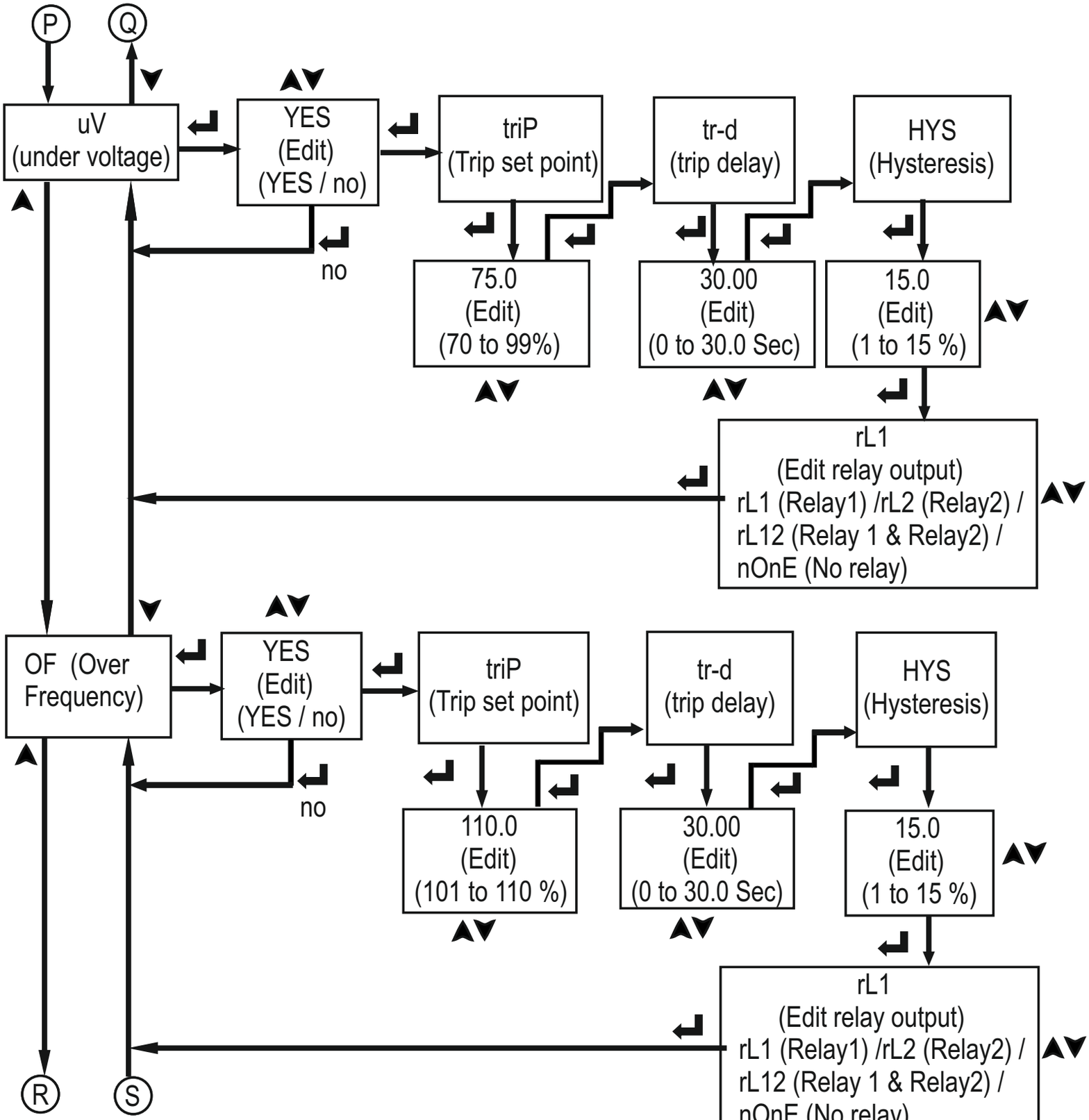
**Continued....**



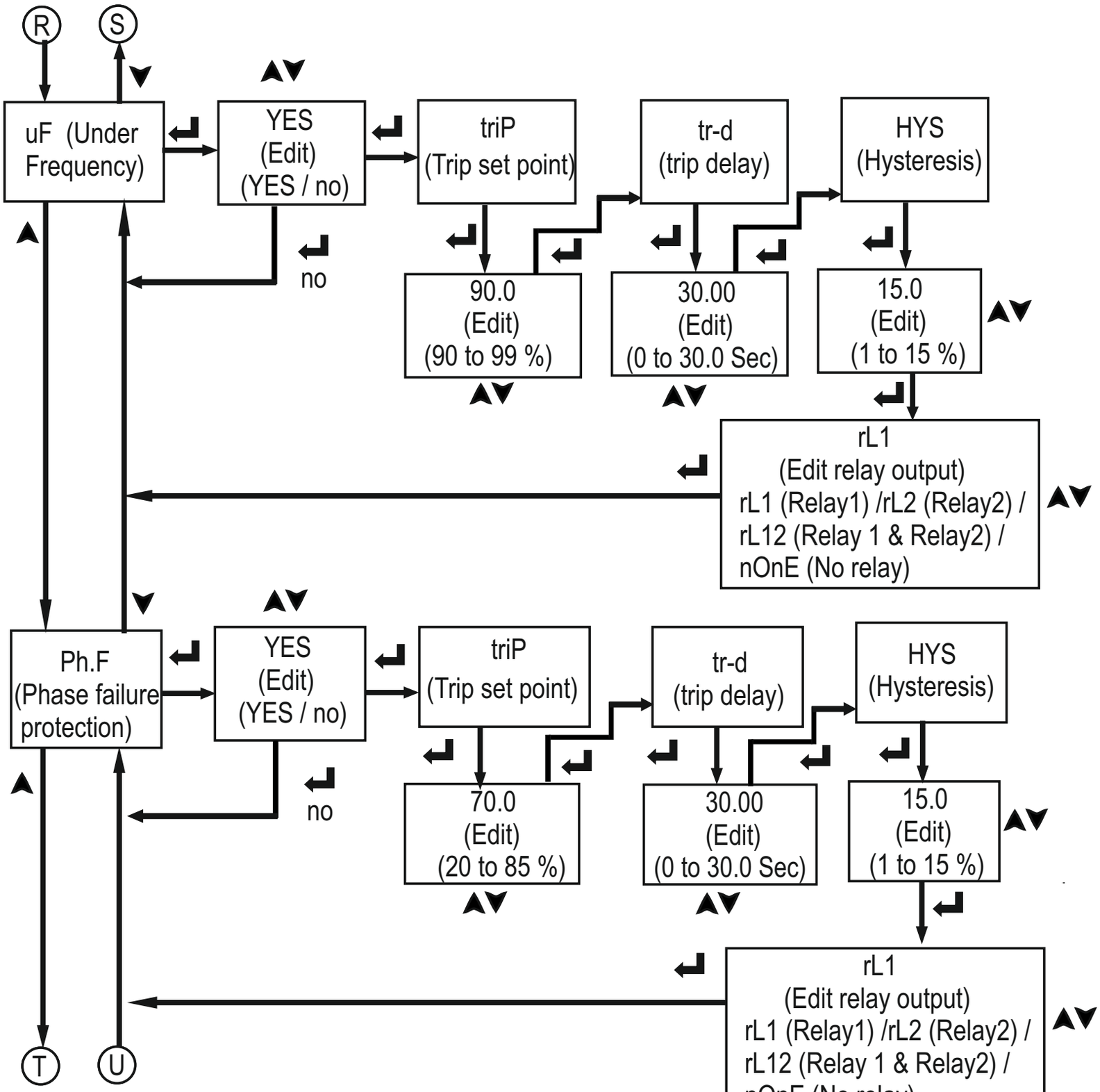

**B] PArA (Protection Parameters Menu)**



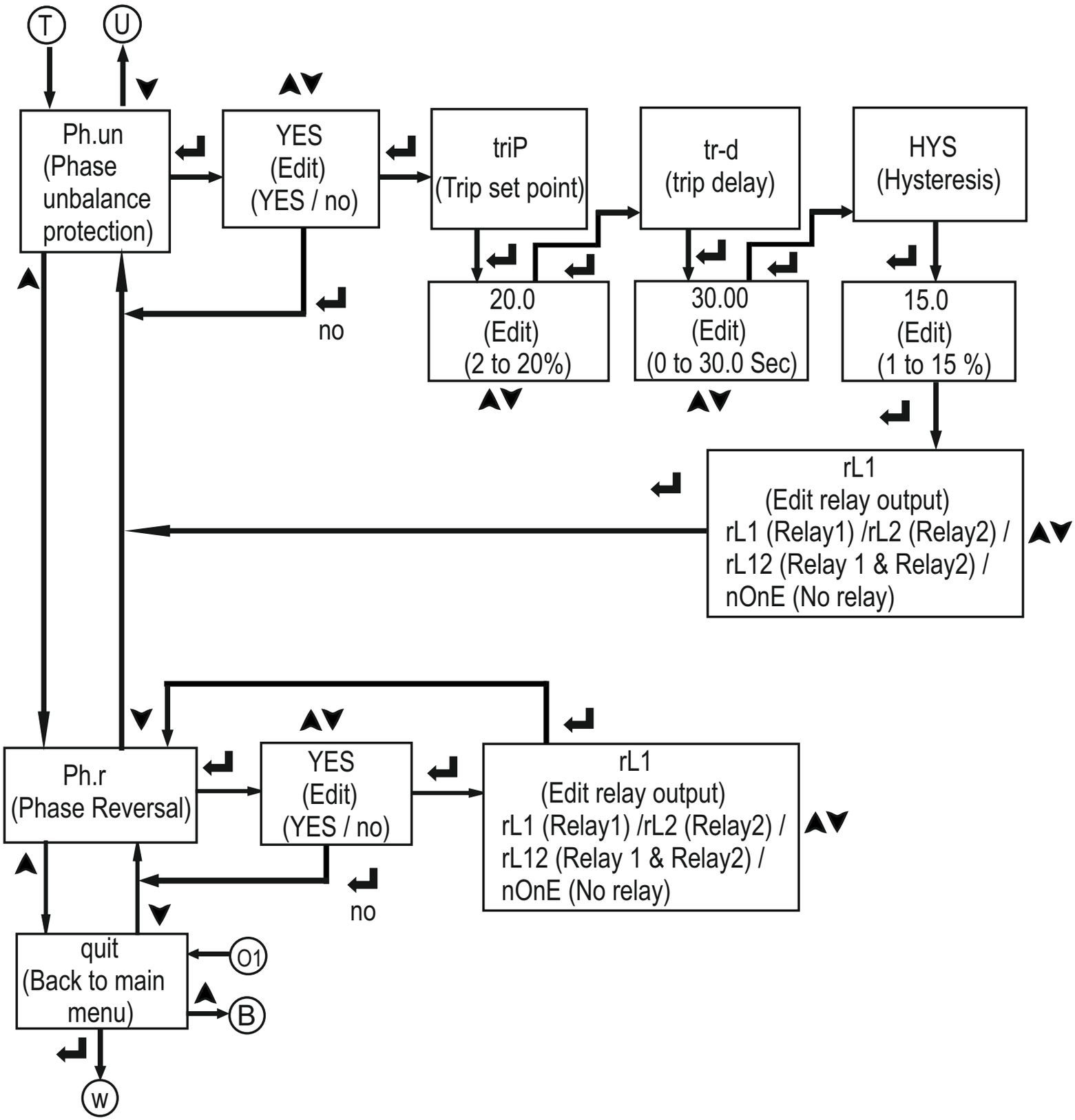

**Continued....**


P
Q
uV
(under voltage)
YES
(Edit)
(YES / no)
triP
(Trip set point)
tr-d
(trip delay)
HYS
(Hysteresis)
no
75.0
(Edit)
(70 to 99%)
30.00
(Edit)
(0 to 30.0 Sec)
15.0
(Edit)
(1 to 15 %)
rL1
(Edit relay output)
rL1 (Relay1) /rL2 (Relay2) /
rL12 (Relay 1 & Relay2) /
nOnE (No relay)
OF (Over
Frequency)
YES
(Edit)
(YES / no)
triP
(Trip set point)
tr-d
(trip delay)
HYS
(Hysteresis)
no
110.0
(Edit)
(101 to 110 %)
30.00
(Edit)
(0 to 30.0 Sec)
15.0
(Edit)
(1 to 15 %)
rL1
(Edit relay output)
rL1 (Relay1) /rL2 (Relay2) /
rL12 (Relay 1 & Relay2) /
nOnE (No relay)
R
S

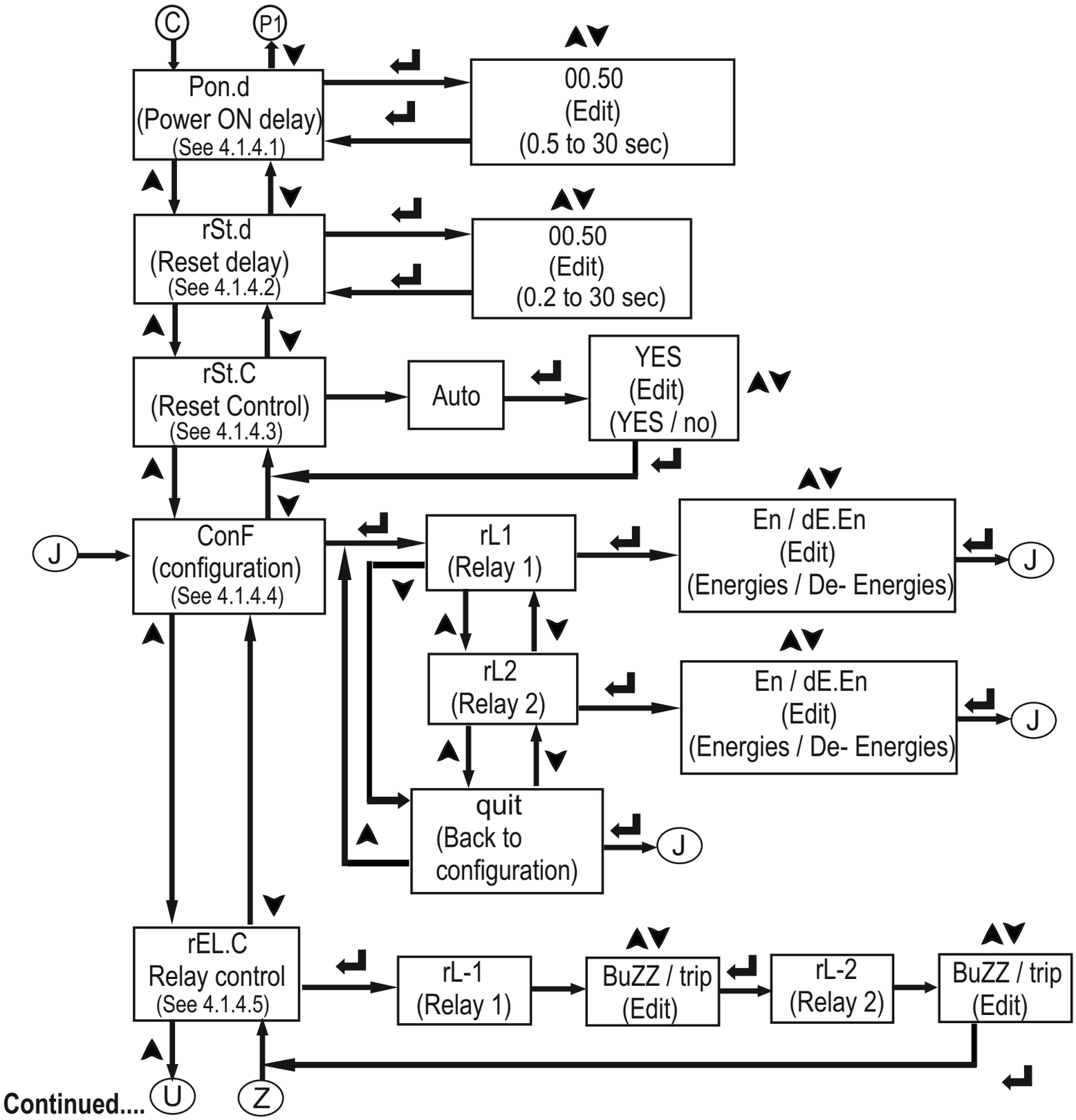
**Continued....**


R
S
uF (Under Frequency)
YES (Edit) (YES / no)
triP (Trip set point)
tr-d (trip delay)
HYS (Hysteresis)
no
90.0 (Edit) (90 to 99 %)
30.00 (Edit) (0 to 30.0 Sec)
15.0 (Edit) (1 to 15 %)
rL1 (Edit relay output) rL1 (Relay1) /rL2 (Relay2) / rL12 (Relay 1 & Relay2) / nOnE (No relay)
Ph.F (Phase failure protection)
YES (Edit) (YES / no)
triP (Trip set point)
tr-d (trip delay)
HYS (Hysteresis)
no
70.0 (Edit) (20 to 85 %)
30.00 (Edit) (0 to 30.0 Sec)
15.0 (Edit) (1 to 15 %)
rL1 (Edit relay output) rL1 (Relay1) /rL2 (Relay2) / rL12 (Relay 1 & Relay2) / nOnE (No relay)
T
U

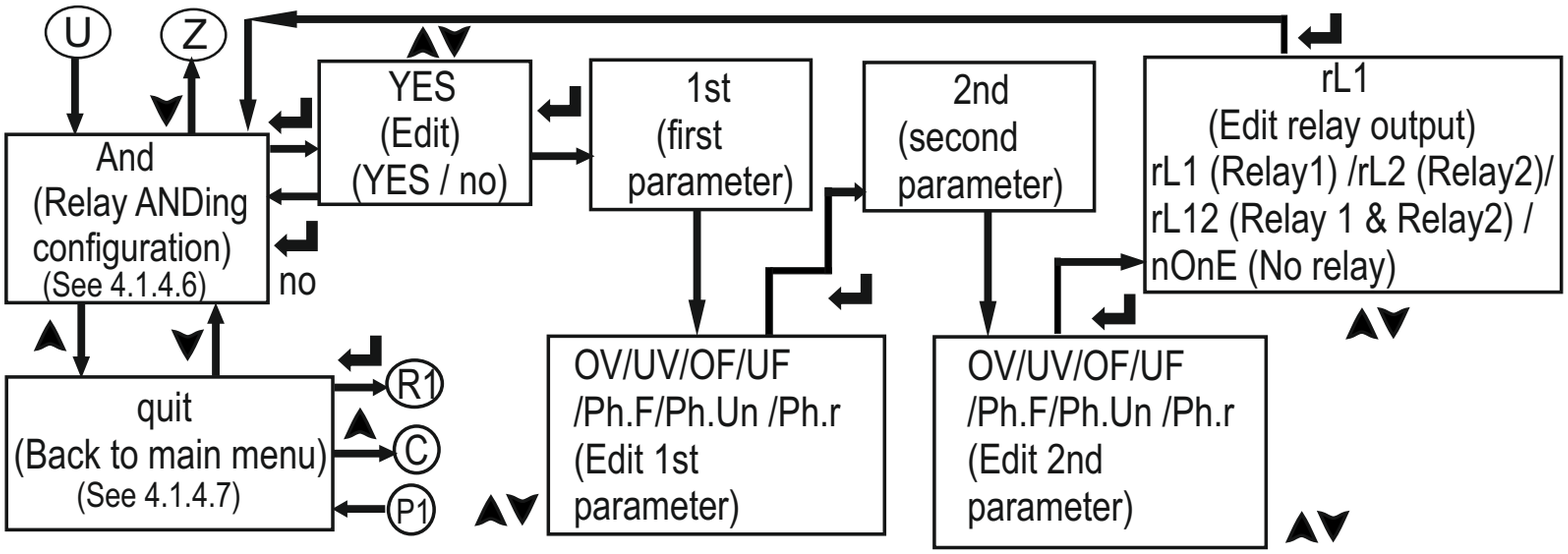
**Continued....**


T
U
Ph.un
(Phase
unbalance
protection)
YES
(Edit)
(YES / no)
triP
(Trip set point)
tr-d
(trip delay)
HYS
(Hysteresis)
no
20.0
(Edit)
(2 to 20%)
30.00
(Edit)
(0 to 30.0 Sec)
15.0
(Edit)
(1 to 15 %)
rL1
(Edit relay output)
rL1 (Relay1) /rL2 (Relay2) /
rL12 (Relay 1 & Relay2) /
nOnE (No relay)
Ph.r
(Phase Reversal)
YES
(Edit)
(YES / no)
rL1
(Edit relay output)
rL1 (Relay1) /rL2 (Relay2) /
rL12 (Relay 1 & Relay2) /
nOnE (No relay)
no
quit
(Back to main
menu)
O1
B
w

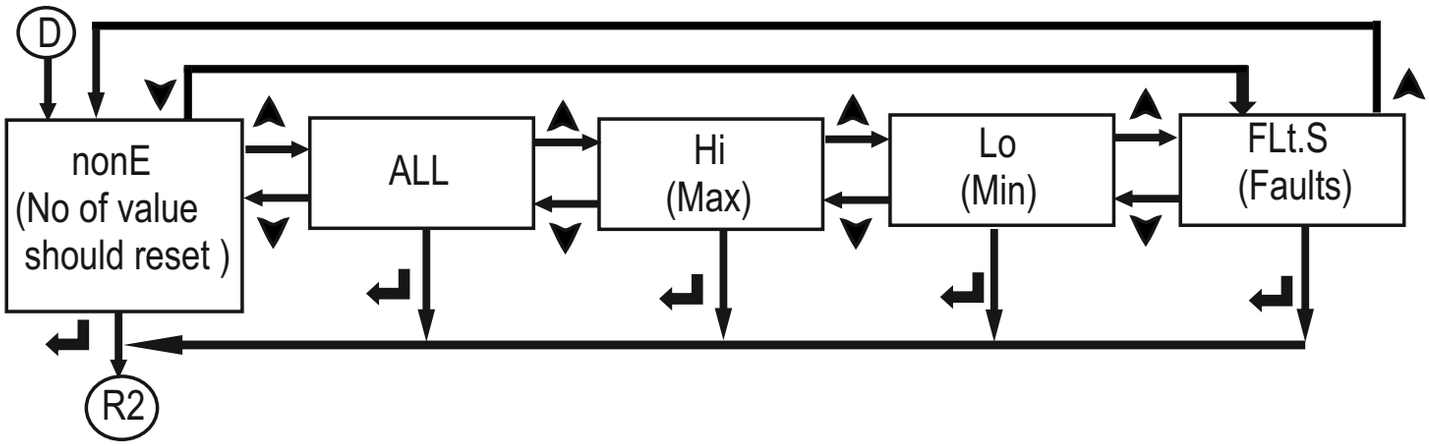
## C] rELY (Relay Parameters)



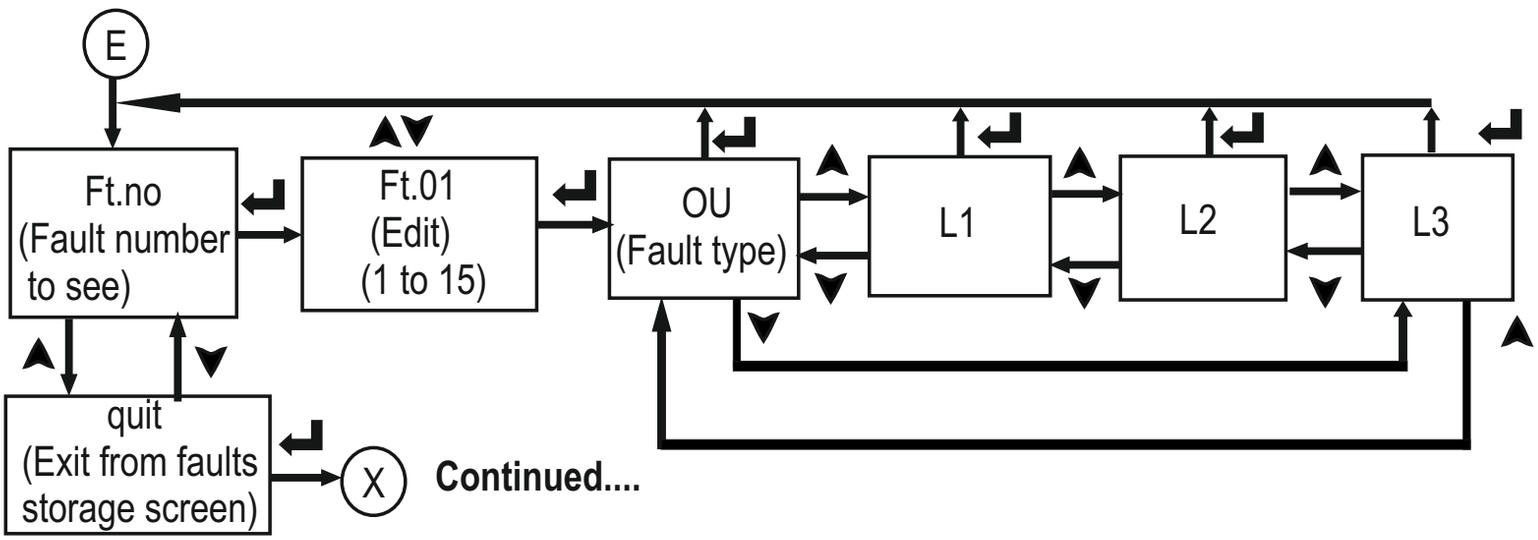

**Continued....**




**D] rESt (Reset Values)**

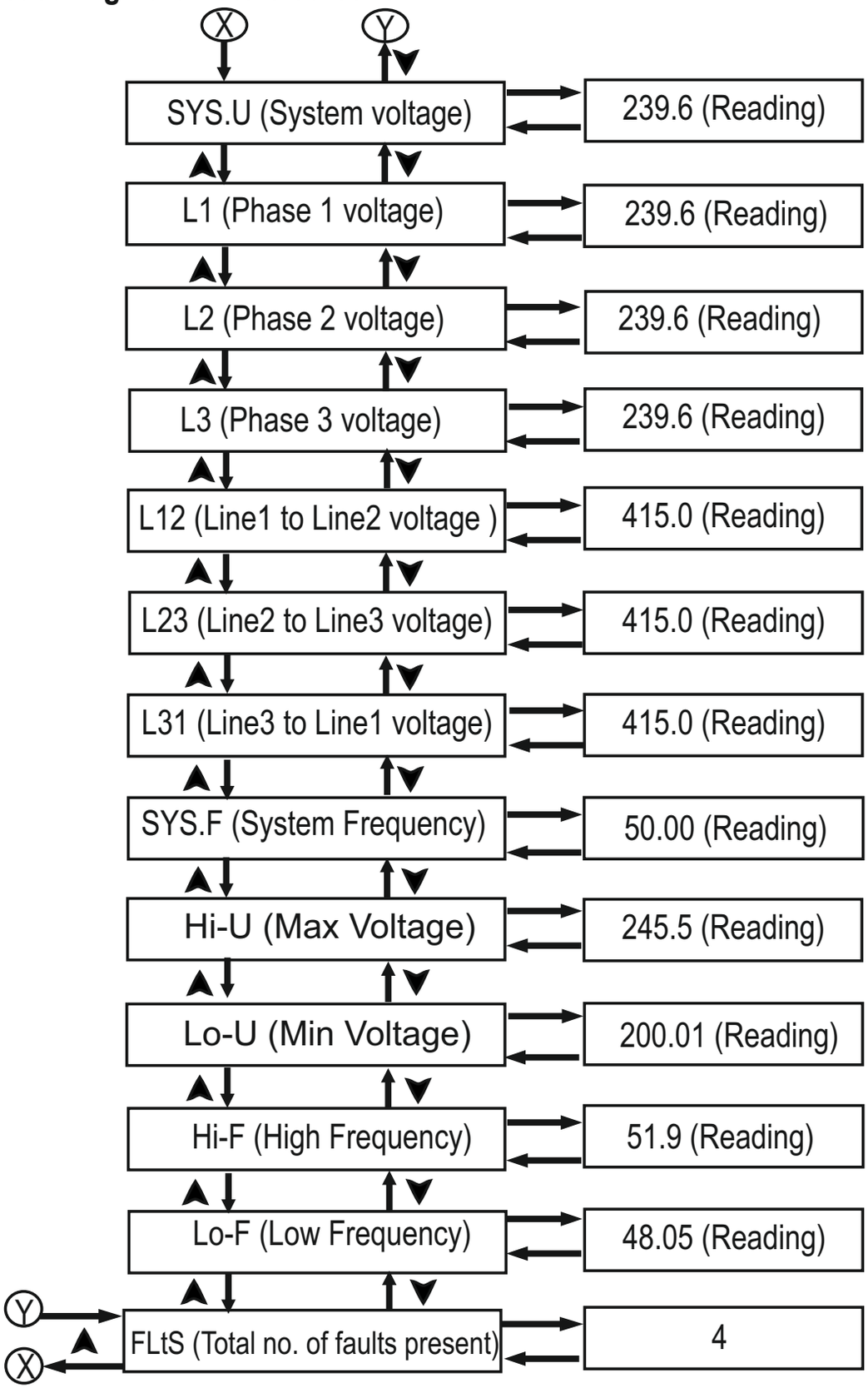



**E] FALt (Faults Storage Screen)**




**Continued....**

### 3.1.2 Measuring Parameters screens




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

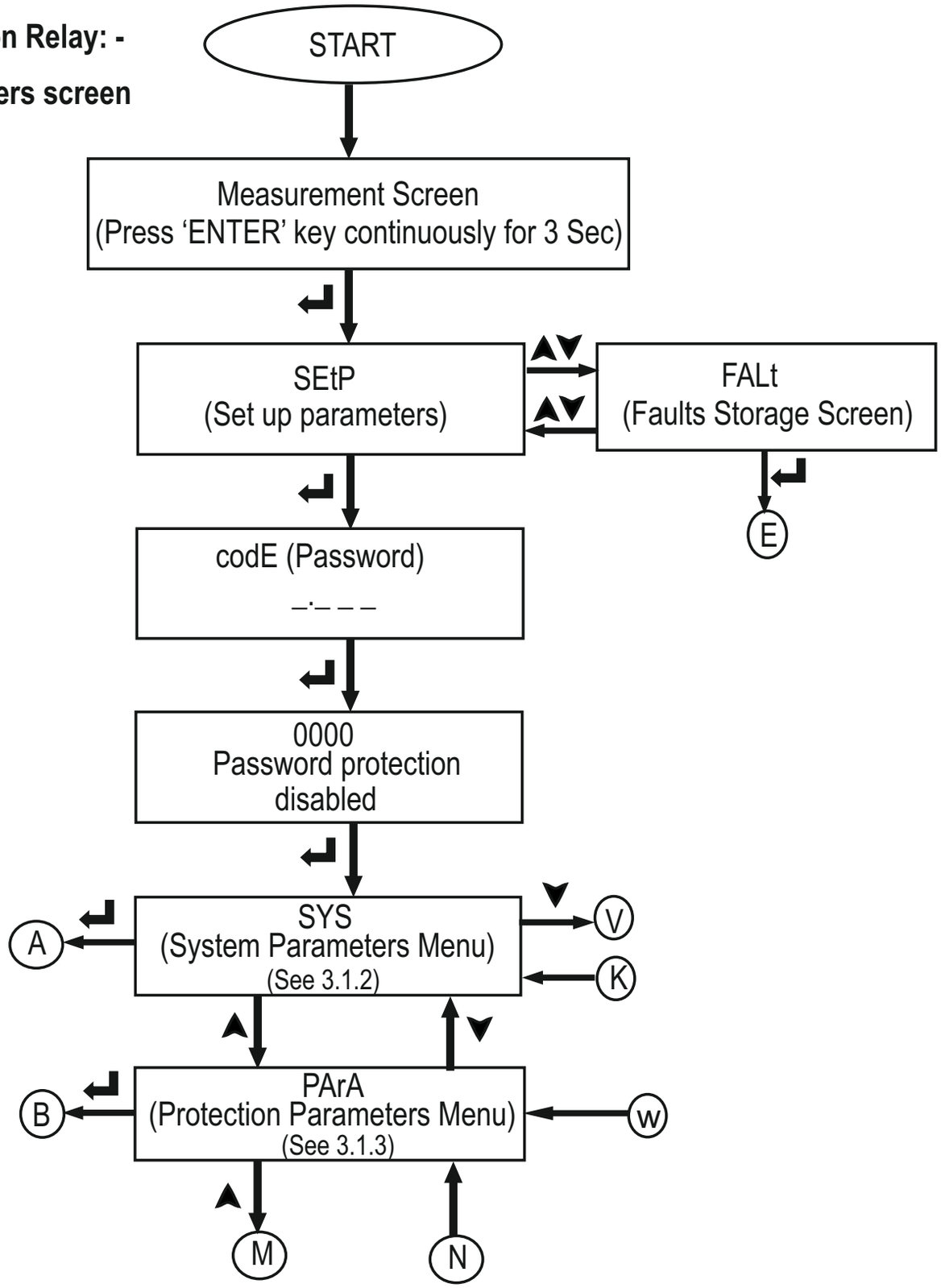
### 3.2 Current Protection Relay: -

### 3.2.1 Set up Parameters screen

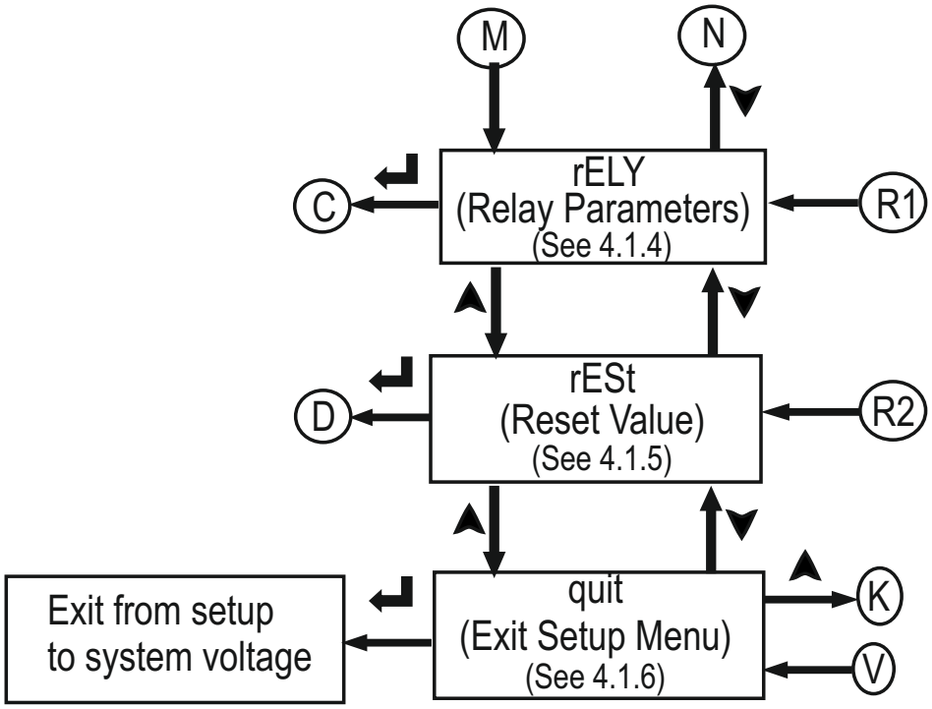
▲ : - UP Key

▼ : - DOWN Key

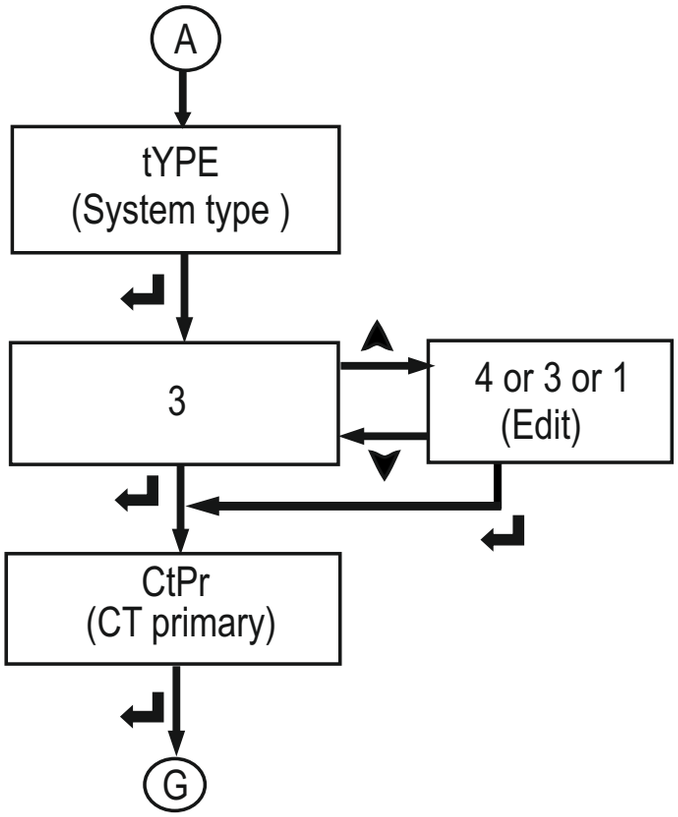
↵ : - ENTER Key



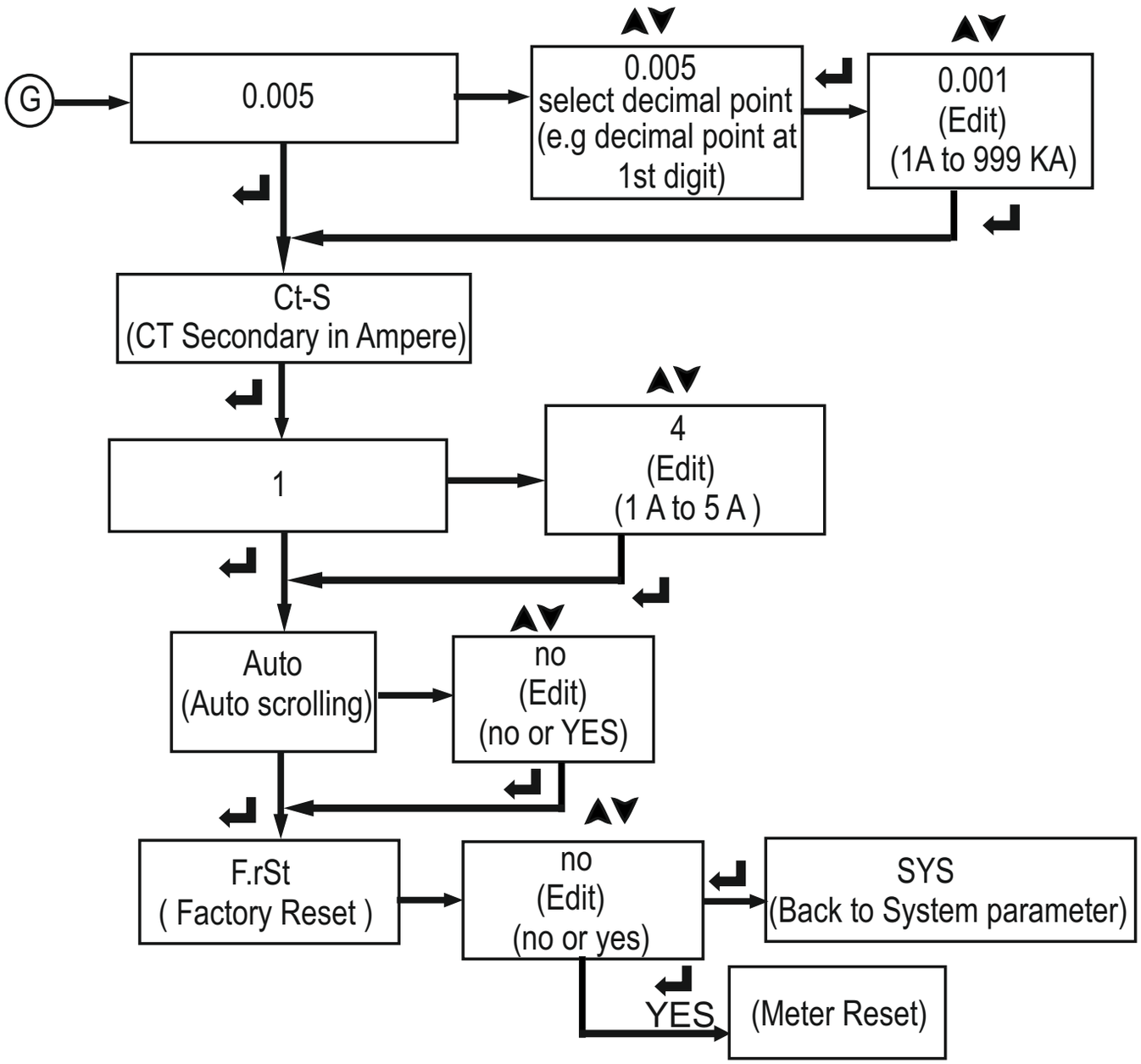

**Continued....**



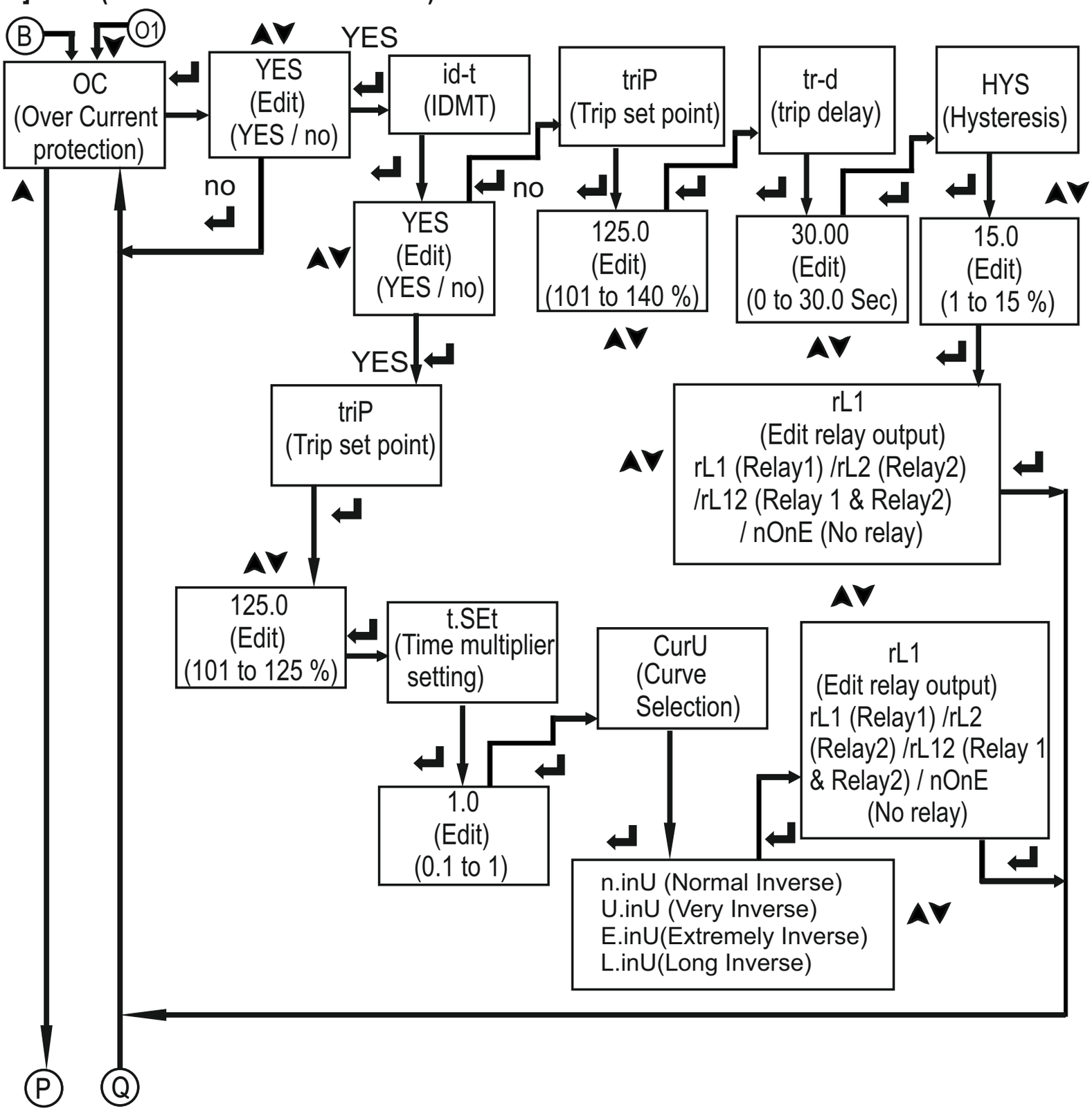

**A] SYS (System Parameters Menu)**

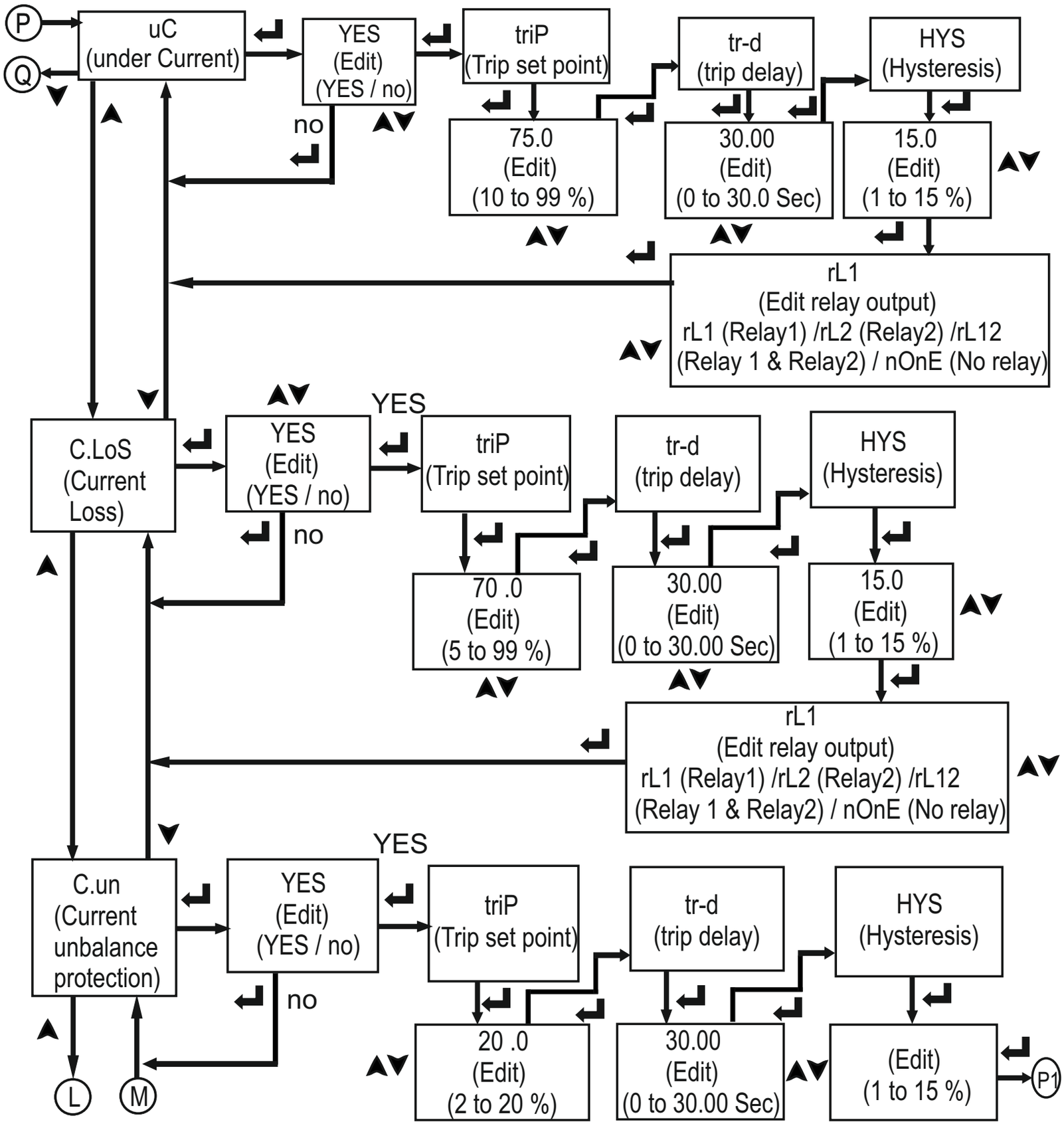


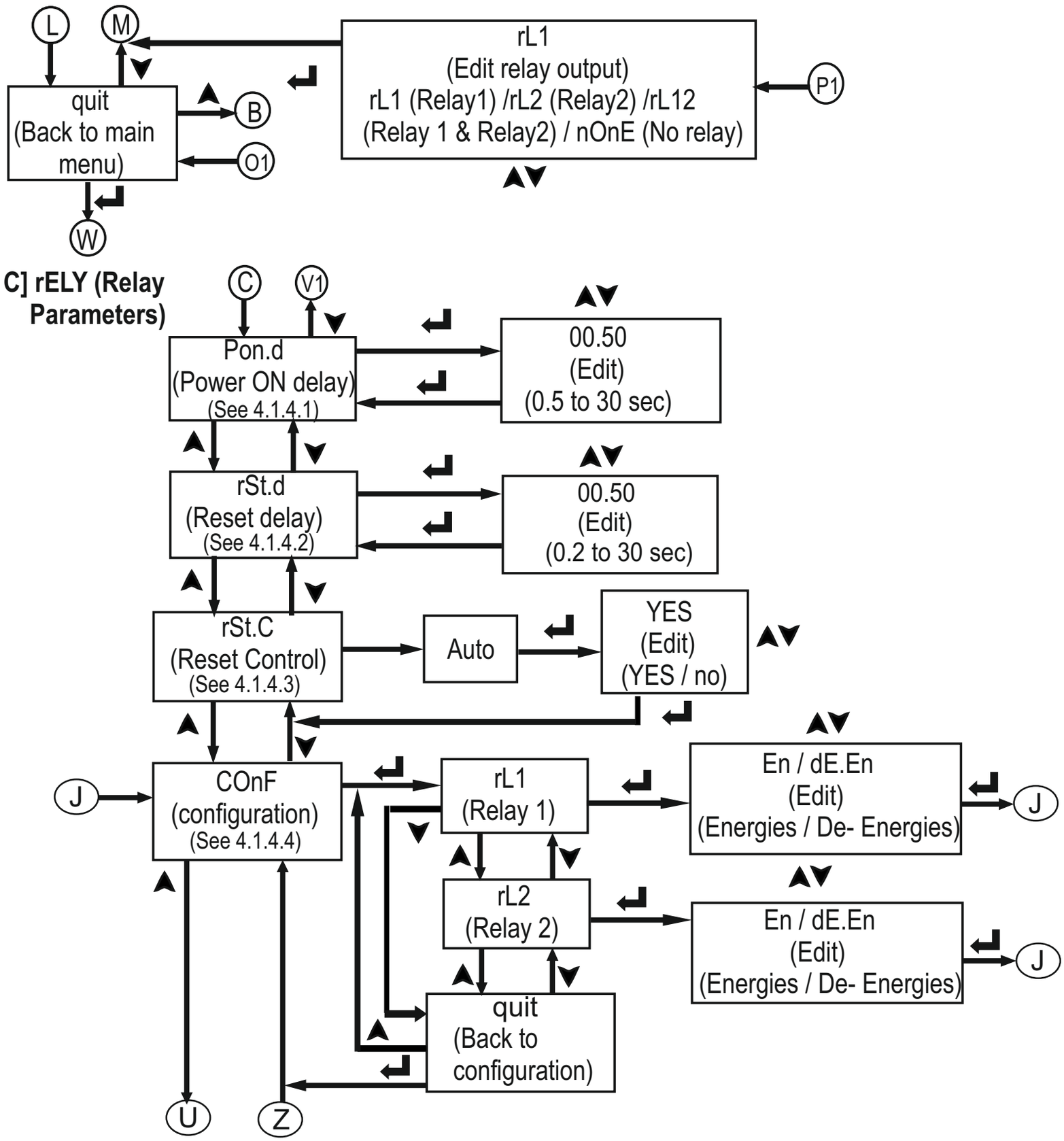

**Continued....**

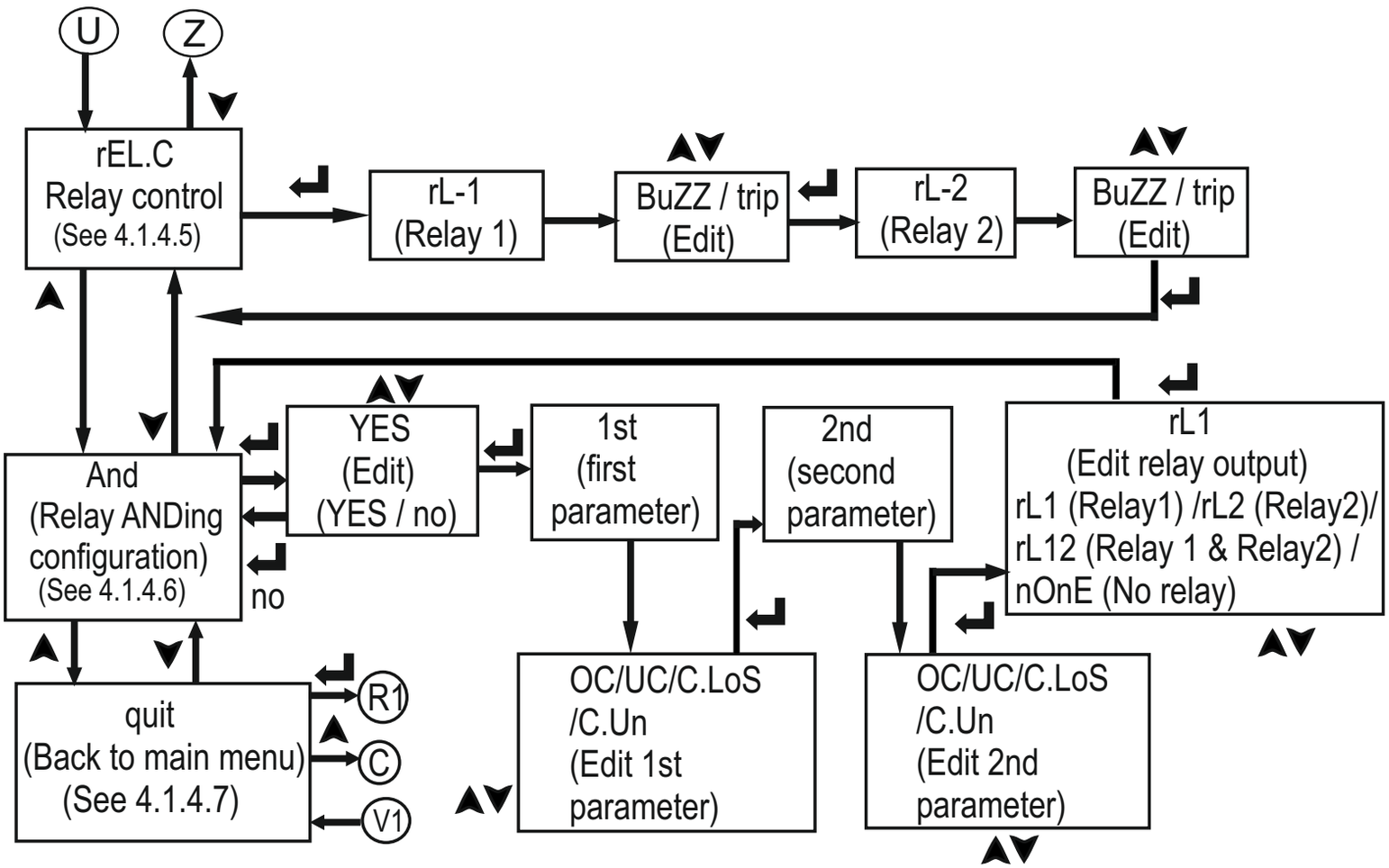

G
0.005
0.005
select decimal point
(e.g decimal point at
1st digit)
0.001
(Edit)
(1A to 999 KA)
Ct-S
(CT Secondary in Ampere)
1
4
(Edit)
(1 A to 5 A )
Auto
(Auto scrolling)
no
(Edit)
(no or YES)
F.rSt
( Factory Reset )
no
(Edit)
(no or yes)
SYS
(Back to System parameter)
YES
(Meter Reset)

**B] PArA (Protection Parameters Menu)**

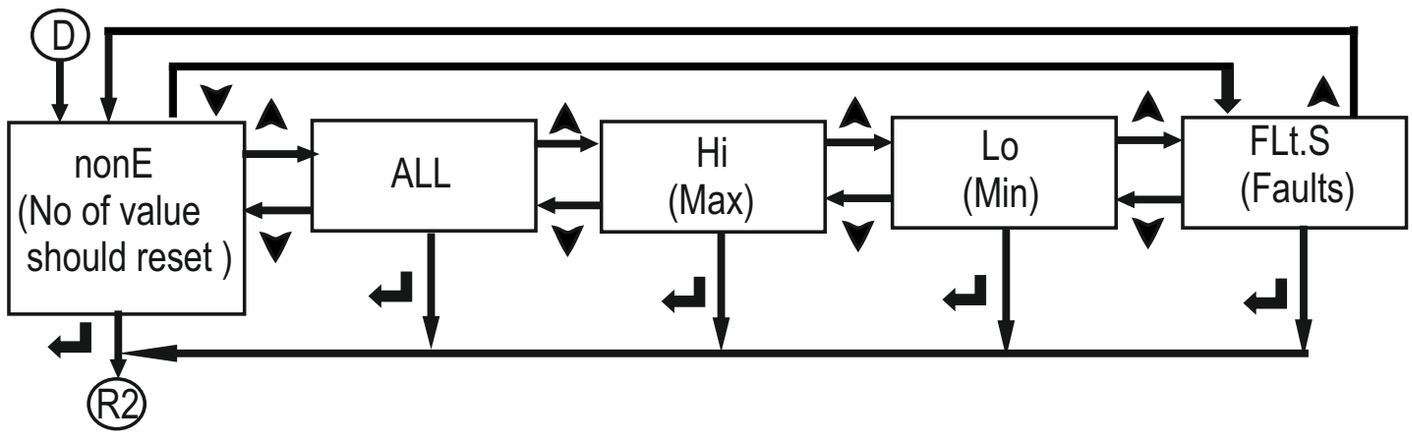



P
Q
uC
(under Current)
YES
(Edit)
(YES / no)
no
triP
(Trip set point)
75.0
(Edit)
(10 to 99 %)
tr-d
(trip delay)
30.00
(Edit)
(0 to 30.0 Sec)
HYS
(Hysteresis)
15.0
(Edit)
(1 to 15 %)
rL1
(Edit relay output)
rL1 (Relay1) /rL2 (Relay2) /rL12
(Relay 1 & Relay2) / nOnE (No relay)
C.LoS
(Current
Loss)
YES
(Edit)
(YES / no)
no
YES
triP
(Trip set point)
70 .0
(Edit)
(5 to 99 %)
tr-d
(trip delay)
30.00
(Edit)
(0 to 30.00 Sec)
HYS
(Hysteresis)
15.0
(Edit)
(1 to 15 %)
rL1
(Edit relay output)
rL1 (Relay1) /rL2 (Relay2) /rL12
(Relay 1 & Relay2) / nOnE (No relay)
C.un
(Current
unbalance
protection)
YES
(Edit)
(YES / no)
no
YES
triP
(Trip set point)
20 .0
(Edit)
(2 to 20 %)
tr-d
(trip delay)
30.00
(Edit)
(0 to 30.00 Sec)
HYS
(Hysteresis)
(Edit)
(1 to 15 %)
L
M
P1

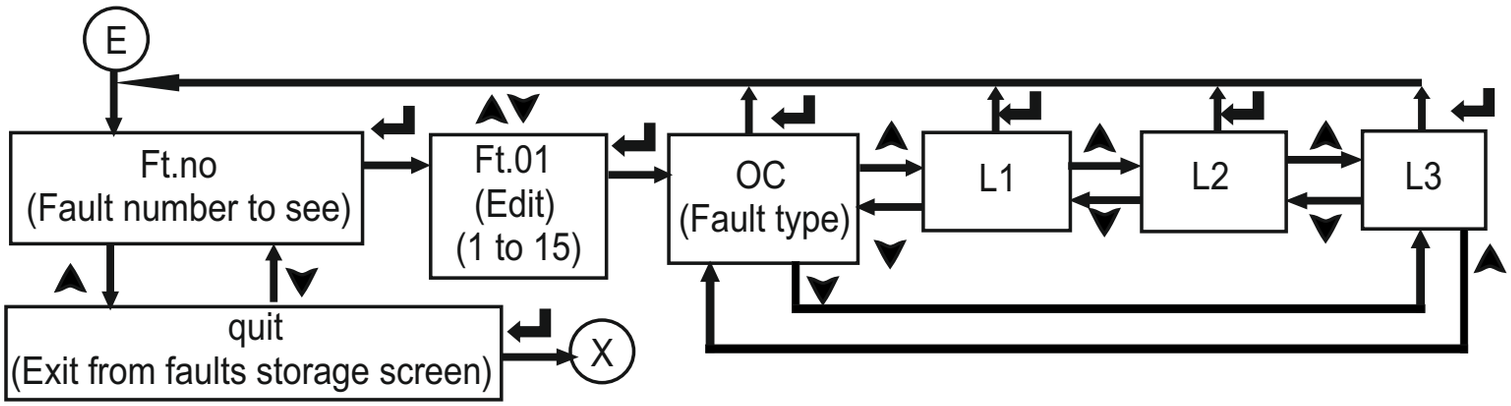

L
M
quit
(Back to main menu)
B
O1
W
rL1
(Edit relay output)
rL1 (Relay1) /rL2 (Relay2) /rL12
(Relay 1 & Relay2) / nOnE (No relay)
P1
C] rELY (Relay Parameters)
C
V1
Pon.d
(Power ON delay)
(See 4.1.4.1)
00.50
(Edit)
(0.5 to 30 sec)
rSt.d
(Reset delay)
(See 4.1.4.2)
00.50
(Edit)
(0.2 to 30 sec)
rSt.C
(Reset Control)
(See 4.1.4.3)
Auto
YES
(Edit)
(YES / no)
J
COnF
(configuration)
(See 4.1.4.4)
rL1
(Relay 1)
rL2
(Relay 2)
quit
(Back to configuration)
En / dE.En
(Edit)
(Energies / De- Energies)
J
En / dE.En
(Edit)
(Energies / De- Energies)
J
U
Z



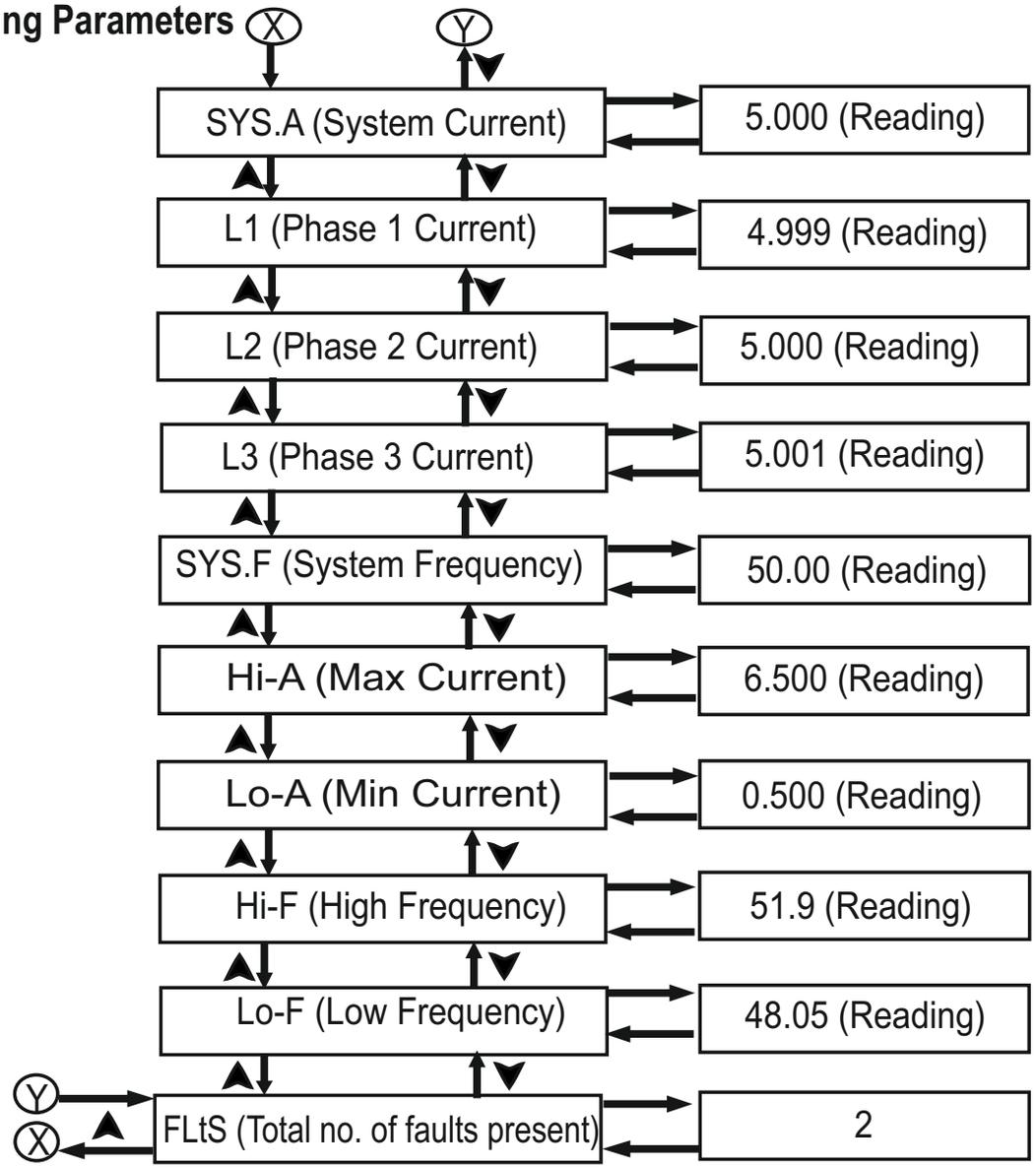

**D] rESt (Reset Values)**



**E] FALt (Faults Storage Screen)**



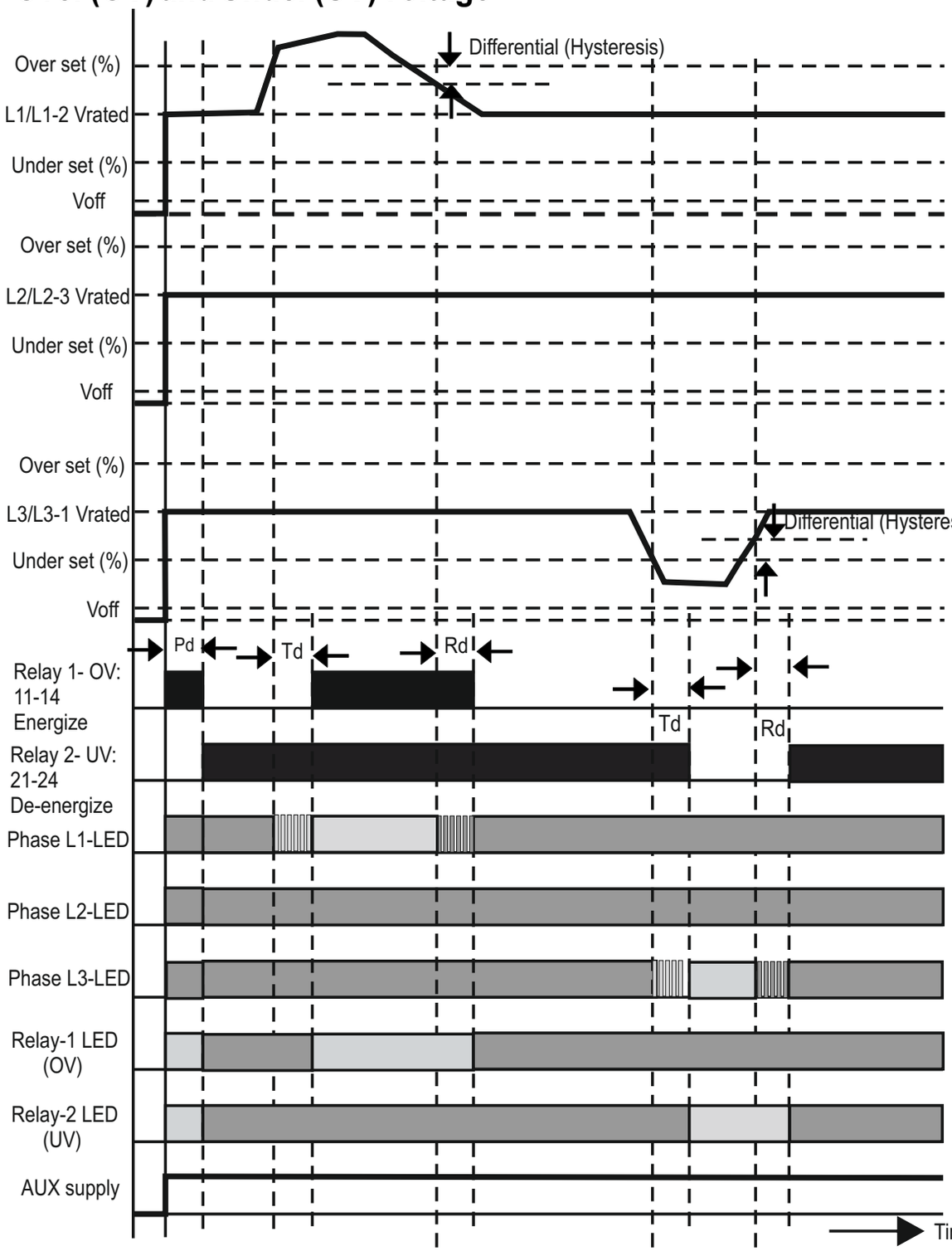

**3.2.2 Measuring Parameters screens**




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

## 3.3 Timing Diagrams

### Over (OV) and Under (UV) voltage




**Relay States -**

Energized

De-energized

**Phase LED Indications -**

Red blinking - Trip Delay (only Phase LEDs)

Green blinking - Reset Delay (only Phase LEDs)

Red ON - fault condition

Green ON - healthy condition

Input Absent

**Relay LED Indications**

Red ON - fault condition

Green ON - healthy condition

**Note:**

1] Pd- Power ON delay

2] Td- Trip delay

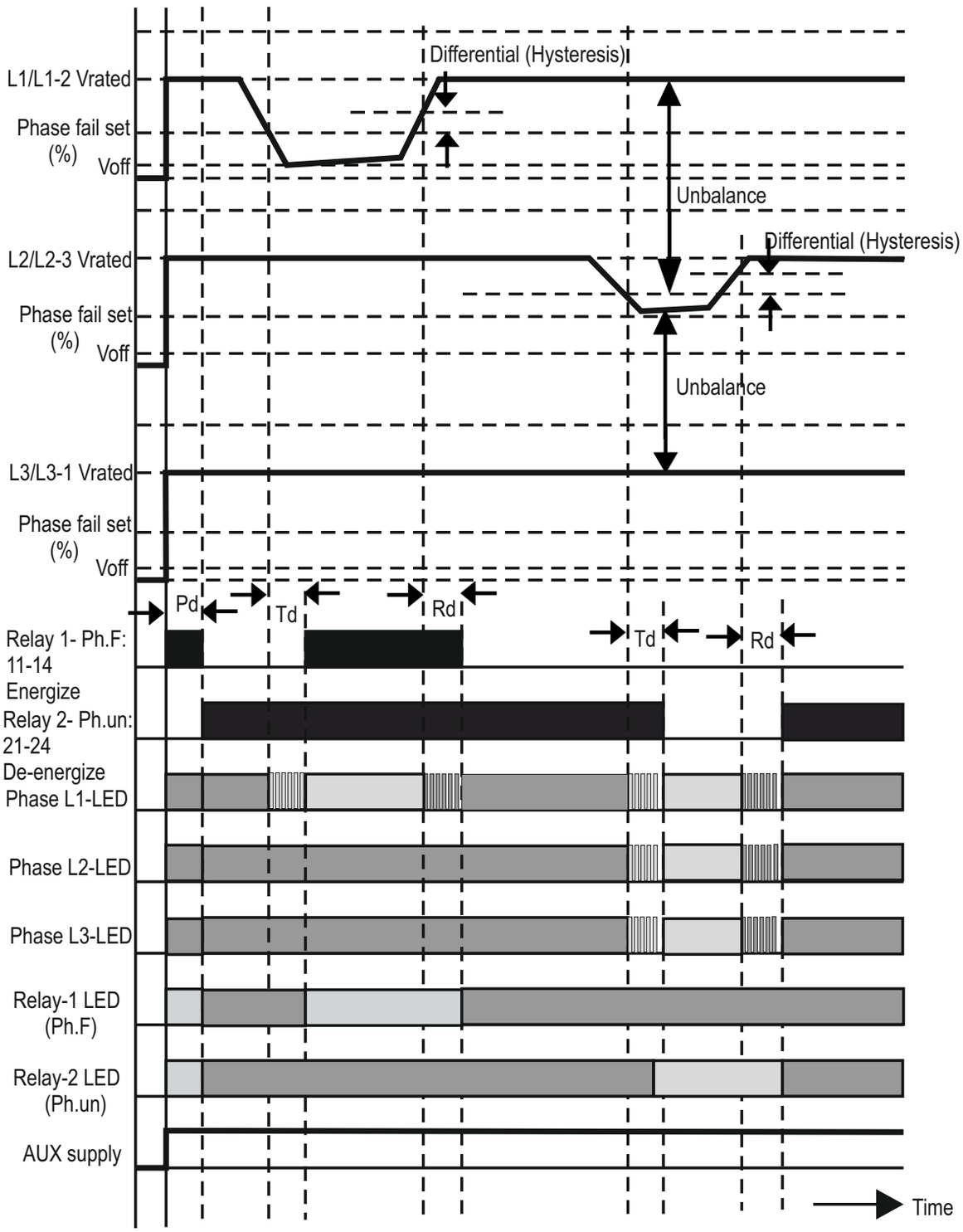
3] Rd- Reset delay

4] Both relay can be configured to energize or de-energize mode

5] Any relay can be assigned to any fault condition

**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)




**Relay States -**

Energized

De-energized

**Phase LED Indications -**

Red blinking - Trip Delay (only Phase LEDs)

Green blinking - Reset Delay (only Phase LEDs)

Red ON - fault condition

Green ON - healthy condition

Input Absent

**Relay LED Indications**

Red ON - fault condition

Green ON - healthy condition

**Note:**

1] Pd- Power ON delay

2] Td- Trip delay

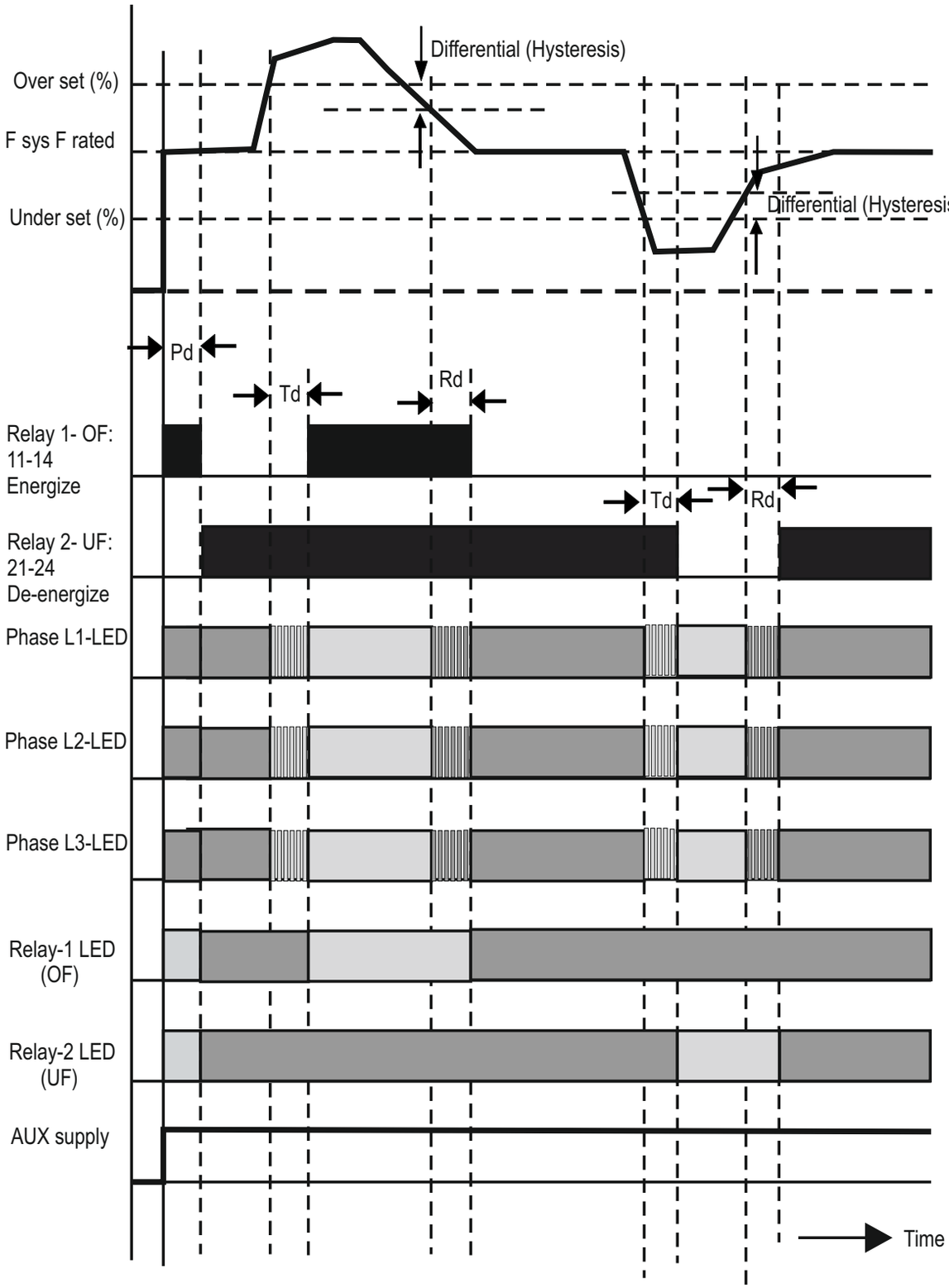
3] Rd- Reset delay

4] Both relay can be configured to energize or de-energize mode

5] Any relay can be assigned to any fault condition

**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




**Relay States -**

Energized

De-energized

**Phase LED Indications -**

Red blinking - Trip Delay (only Phase LEDs)

Green blinking - Reset Delay (only Phase LEDs)

Red ON - fault condition

Green ON - healthy condition

Input Absent

**Relay LED Indications**

Red ON - fault condition

Green ON - healthy condition

**Note:**

1] Pd- Power ON delay

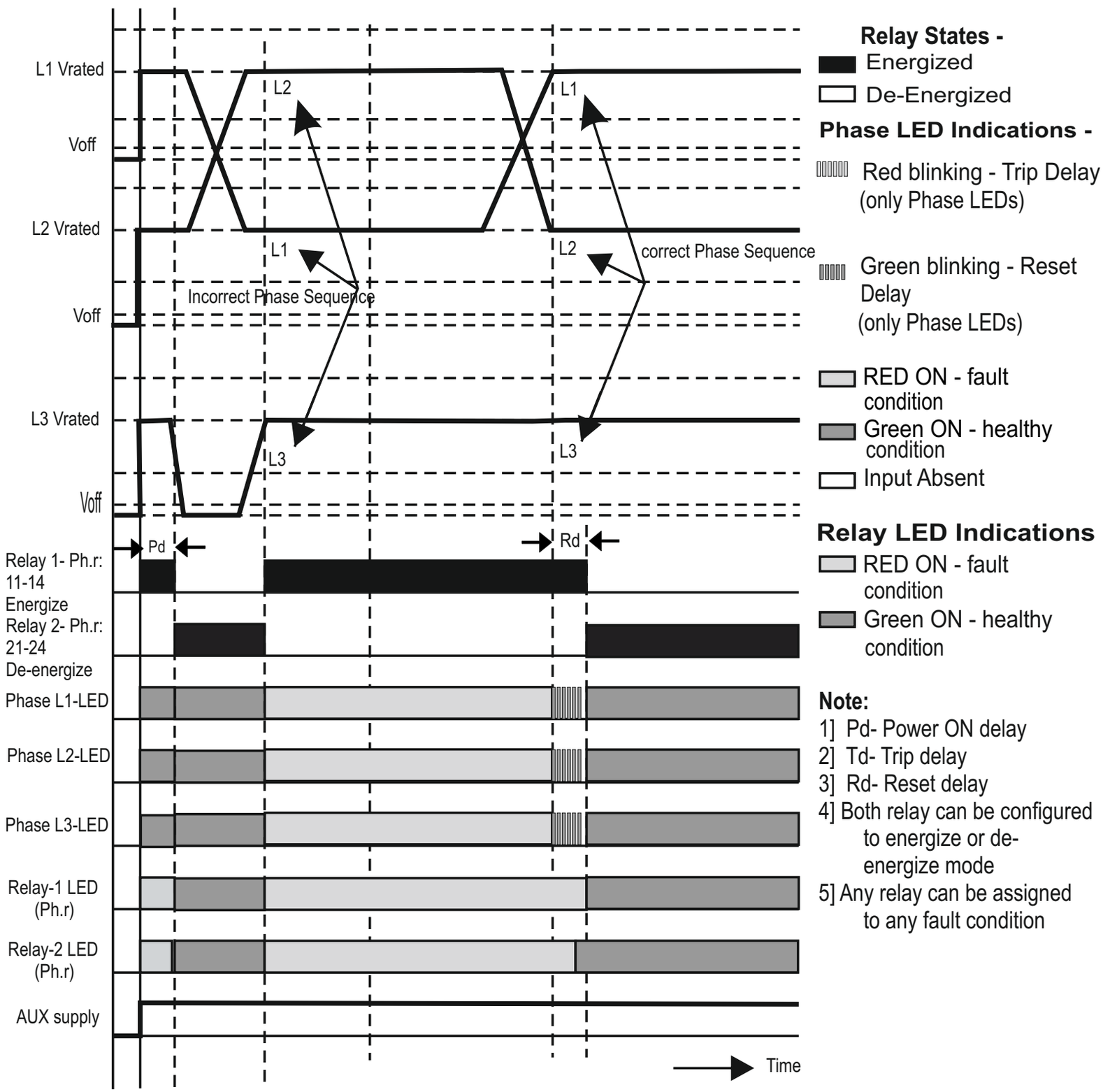
2] Td- Trip delay

3] Rd- Reset delay

4] Both relay can be configured to energize or de-energize mode

5] Any relay can be assigned to any fault condition

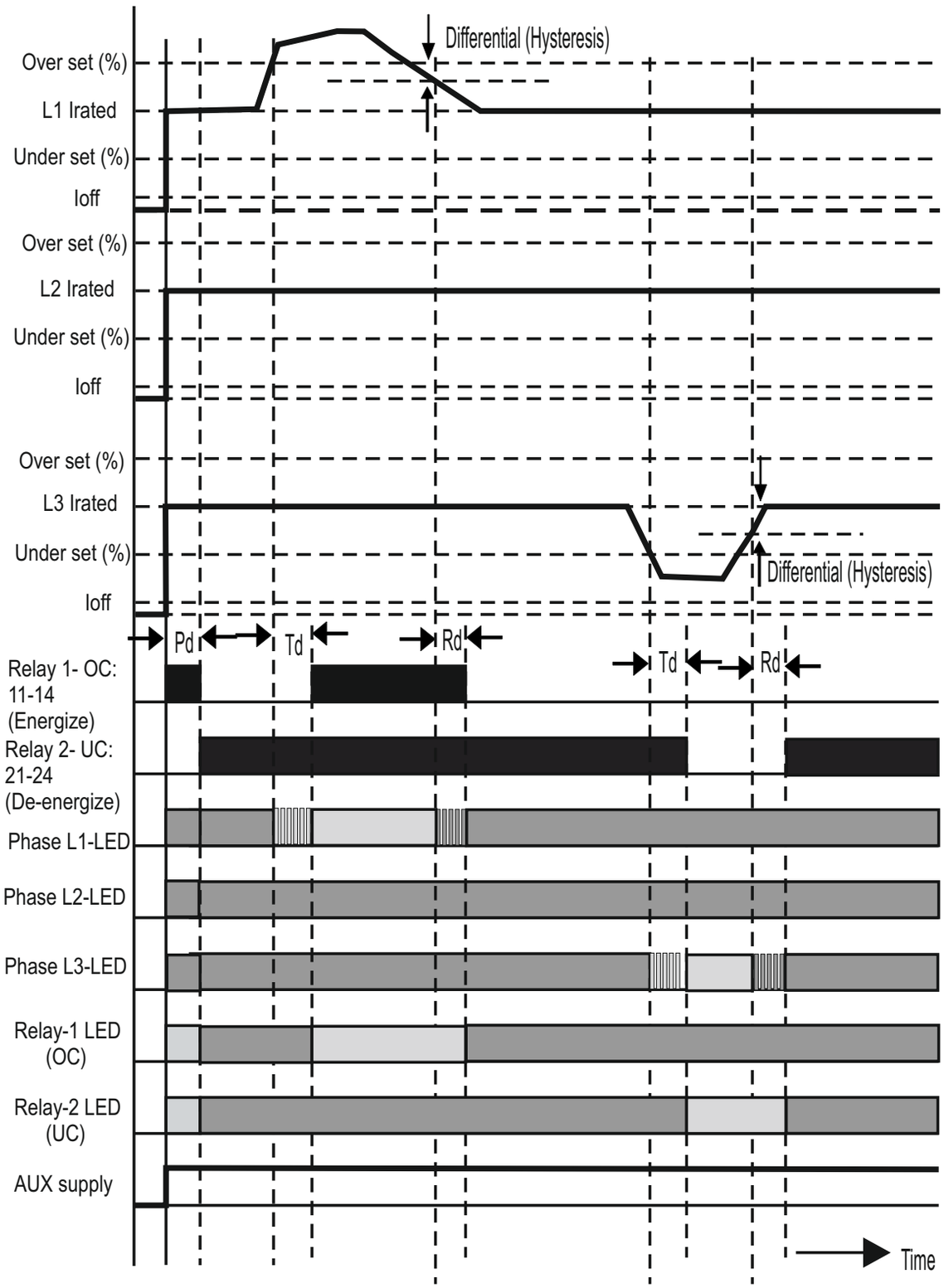
## Phase sequence (Ph.r)




**Note:**

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

## Over (OC) and Under (UC) Current




**Relay States -**

Energized

De-energized

**Phase LED Indications -**

Red blinking - Trip Delay (only Phase LEDs)

Green blinking - Reset Delay (only Phase LEDs)

Red ON - fault condition

Green ON - healthy condition

Input Absent

**Relay LED Indications**

Red ON - fault condition

Green ON - healthy condition

**Note:**

1] Pd- Power ON delay

2] Td- Trip delay

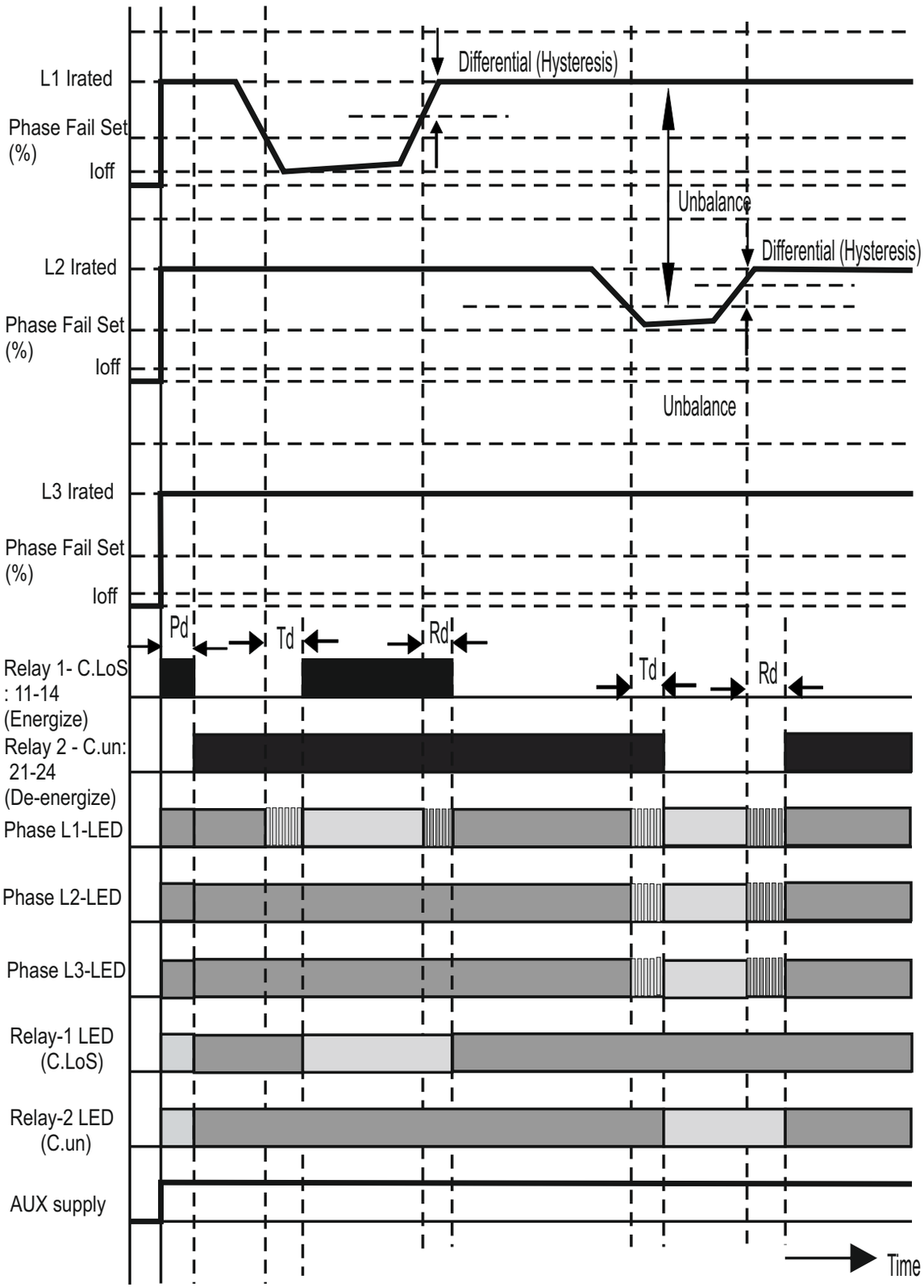
3] Rd- Reset delay

4] Both relay can be configured to energize or de-energize mode

5] Any relay can be assigned to any fault condition

**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)




**Relay States -**

Energized

De-energized

**Phase LED Indications -**

Red blinking - Trip Delay (only Phase LEDs)

Green blinking - Reset Delay (only Phase LEDs)

Red ON - fault condition

Green ON - healthy condition

Input Absent

**Relay LED Indications**

Red ON - fault condition

Green ON - healthy condition

**Note:**

1] Pd- Power ON delay

2] Td- Trip delay

3] Rd- Reset delay

4] Both relay can be configured to energize or de-energize mode

5] Any relay can be assigned to any fault condition

**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 RISH Voltage / Current protection relay according to individual user requirement.

### 4.1.1 Password Protection


**Fig No: - 1**

To access the Set-Up menu press and hold " ENTER " key for 3 Seconds, the screen is shown in fig 1.
On pressing "ENTER" key, meter will ask for password shown in fig 2.

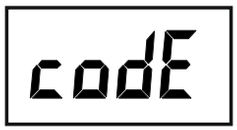



**Fig No: - 2**

Then meter will enter into edit mode as shown in fig 3 (*Denotes decimal Point is flashing).
Press "ENTER" key, by default password is set to "0000" as shown in fig 4.

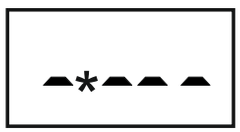



**Fig No: - 3**


**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 3 (*Denotes decimal Point is flashing).

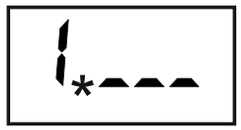



**Fig No: - 5**

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.


**Fig No: - 6**

Press " ENTER " key to confirm digit 2.
Press "▲ " key to increment third digit to " 3 " as shown in fig 7. Press " ENTER " key to confirm digit " 3 ".


**Fig No: - 7**

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


**Fig No: - 8**

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: - 9**

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

**SET UP menu**

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


**Fig No: - 10**

"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**

"rESt" (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.

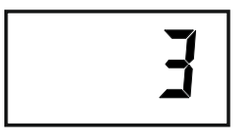



**Fig No: - 18**

**Setting New system Type: -**


**Fig No: - 19**

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

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)

**Voltage Protection Relay: -**

### 4.1.2.2 Potential Transformer (PT) Primary V-Line to Line


**Fig No: -20**

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 $KV_{L-L}$ to 1200 $KV_{L-L}$.


**Fig No: -21**

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


**Fig No: -22**

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


**Fig No: -23**


Fig No: -24


Fig No: -25


Fig No: -26


Fig No: -27


Fig No: -28


Fig No: -29


Fig No: -30

**Setting New Potential transformer's Primary Value.**

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

**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.

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.

Press "ENTER" key to advance to next digit as shown in fig No 24.

(*Denotes decimal Point is flashing).

Press "▼" key to decrement digit to "2" as shown in fig 25.

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.

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 $V_{L-L}$ to 600 $V_{L-L}$.


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**

This Screen “ Ct-S ” (Current transformer Secondary) allows user to set Current transformer’s Secondary value in A.

The CT secondary can be set from 1A to 5A.

After “Ct-S” as shown in fig 34, meter will show previously stored CT Secondary value.

**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.

**Factory Resetting :-**

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

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

**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**.

#### 4.1.3.2 YES / NO


**Fig No: -39**

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


**Fig No: - 40**


**Fig No: -41**

**Parameters Enable mode :-**

To enabled parameters follow the steps: -

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

**Example: -**

Press "▲" key to get "YES" on screen as shown in fig 40.

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% |
| UV (Under Voltage) | 99% | 70% |
| OF (Over Frequency) | 110% | 101% |
| 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% |
| UC (Under Voltage) | 99% | 10% |
| C.LoS (Current Loss) | 99% | 5% |
| 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 |
| UV (Under Voltage) | 30 Sec | 0 Sec |
| OF (Over Frequency) | 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 |
| UC (Under Voltage) | 30 Sec | 0 Sec |
| C.LoS (Current Loss) | 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% |
| UV (Under Voltage) | 15% | 1% |
| OF (Over Frequency) | 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% |
| UC (Under Voltage) | 15% | 1% |
| C.LoS (Current Loss) | 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 $V_{L-L.}$
Trip point = 105% (105 $V_{L-L}$)
Hysteresis = 2% (2 $V_{L-L.}$)
Relay Reset =Trip point - Hysteresis
= 105 - 2
= 103 $V_{L-L.}$

**Example: -**
For “Ph.un” (Phase Unbalance)
PT Secondary = 100 $V_{L-L.}$
Trip point = 10% (10 $V_{L-L}$)
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

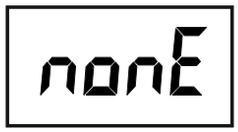



**Fig No: - 42**


**Fig No: - 43**


**Fig No: -44**

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).

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

**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.

#### 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

**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.

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

Where,
T = Time in Sec (Operating time of relay).
I = Input Current.
Is = Secondary Current.
TMS = Time multiplier setting.
C = Constant for relay characteristics.
α = Constant representing inverse time type (α > 0)


Fig No: - 47

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

To enable IDMT follow the steps: -


Fig No: -48

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

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:-**


**Fig No: -52**

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

**Example: -**

For Selecting extremely inverse curve, follow the steps: -


**Fig No: -53**

Press "▲" key to get "E.inV" (Extremely inverse curve) as shown in fig 52.

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 α, 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.

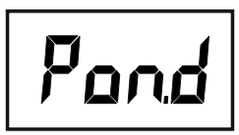



**Fig No: - 55**

Pressing "▲" 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.

**Fig No: - 58**

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

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)

### 4.1.4.4 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.**

### 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.

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


**Fig No: - 63**

**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


**Fig No: - 67**

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: -

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


**Fig No: - 68**


**Fig No: - 69**


**Fig No: -70**


**Fig No: -71**


**Fig No: - 72**


**Fig No: - 73**


**Fig No: -74**

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.

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

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

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

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.

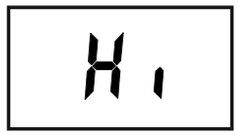



**Fig No: - 79**


**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


**Fig No: - 82**

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

## 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.


**Fig No: - 84**

This function will show Last 15 faults

**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.


**Fig No: - 85**

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).

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

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

**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.**

### 4.2.2 Quit


**Fig No: - 86**

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 **Current Protection relay**, meter will show "-OL-" (Over Load) as shown in fig 87.

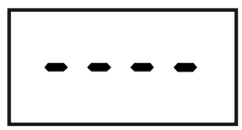



**Fig No: -88**

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

# 6. DEFAULT SETTINGS / ON Factory RESET

**TABLE 9 (A): Current Protection Relay**

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

**TABLE 9 (B): Voltage Protection Relay**

| Parameters | Default values |
|---|---|
| System Type | 3 |
| PT primary / Secondary | 415 |
| System Nominal Voltage | 600 |
| System Frequency | 50 |
| Phase Sequence | 1-2-3 |
| Over Voltage Trip point | 110 |
| Under Voltage Trip point | 80 |
| Over Frequency Trip point | 105 |
| Under Frequency Trip point | 95 |
| Phase Failure Trip point | 20 |
| Hysteresis | 1 |
| Phase unbalance Trip point | 20 |
| Trip Delay | 1 |
| Power ON Delay | 1 |
| Reset Delay | 1 |
| Fault activation | 0 |
| Relay assignment | 1 |

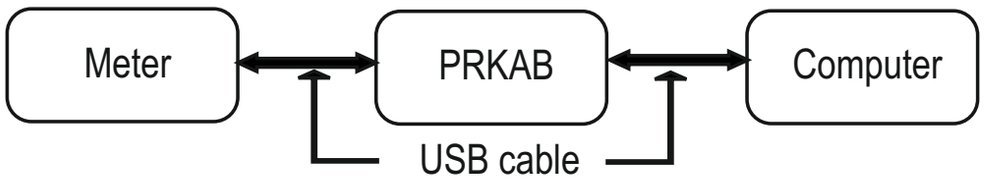
**Note :-**

**1.** User can not disable Phase failure parameter.

**2.** 0: Disabled
1: Enabled

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

**Communication Baud Rate is fixed 19200 bps.**

**Function code :**

| | | |
|---|---|---|
| 03 | Read Holding Registers | Read content of read / write location ( 4X ) |
| 04 | Read input Registers | Read content of read only location ( 3X ) |
| 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 | Data Register1 Low Byte | Data Register2 High Byte | Data Register2 Low Byte | CRC Low | CRC High |

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 | ✓ | ✓ | ✗ |
| 30063 | 32 | L3 | 00 | 3E | ✓ | ✓ | ✗ |
| 30065 | 33 | Fault 4 | 00 | 40 | ✓ | ✓ | ✓ |
| 30067 | 34 | L1 | 00 | 42 | ✓ | ✓ | ✓ |
| 30069 | 35 | L2 | 00 | 44 | ✓ | ✓ | ✗ |
| 30071 | 36 | L3 | 00 | 46 | ✓ | ✓ | ✗ |
| 30073 | 37 | Fault 5 | 00 | 48 | ✓ | ✓ | ✓ |
| 30075 | 38 | L1 | 00 | 4A | ✓ | ✓ | ✓ |
| 30077 | 39 | L2 | 00 | 4C | ✓ | ✓ | ✗ |
| 30079 | 40 | L3 | 00 | 4E | ✓ | ✓ | ✗ |
| 30081 | 41 | Fault 6 | 00 | 50 | ✓ | ✓ | ✓ |
| 30083 | 42 | L1 | 00 | 52 | ✓ | ✓ | ✓ |
| 30085 | 43 | L2 | 00 | 54 | ✓ | ✓ | ✗ |
| 30087 | 44 | L3 | 00 | 56 | ✓ | ✓ | ✗ |
| 30089 | 45 | Fault 7 | 00 | 58 | ✓ | ✓ | ✓ |
| 30091 | 46 | L1 | 00 | 5A | ✓ | ✓ | ✓ |
| 30093 | 47 | L2 | 00 | 5C | ✓ | ✓ | ✗ |
| 30095 | 48 | L3 | 00 | 5E | ✓ | ✓ | ✗ |
| 30097 | 49 | Fault 8 | 00 | 60 | ✓ | ✓ | ✓ |
| 30099 | 50 | L1 | 00 | 62 | ✓ | ✓ | ✓ |
| 30101 | 51 | L2 | 00 | 64 | ✓ | ✓ | ✗ |
| 30103 | 52 | L3 | 00 | 66 | ✓ | ✓ | ✗ |
| 30105 | 53 | Fault 9 | 00 | 68 | ✓ | ✓ | ✓ |
| 30107 | 54 | L1 | 00 | 6A | ✓ | ✓ | ✓ |
| 30109 | 55 | L2 | 00 | 6C | ✓ | ✓ | ✗ |
| 30111 | 56 | L3 | 00 | 6E | ✓ | ✓ | ✗ |

**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 | ✓ | ✓ | ✗ |
| 30119 | 60 | L3 | 00 | 76 | ✓ | ✓ | ✗ |
| 30121 | 61 | Fault 11 | 00 | 78 | ✓ | ✓ | ✓ |
| 30123 | 62 | L1 | 00 | 7A | ✓ | ✓ | ✓ |
| 30125 | 63 | L2 | 00 | 7C | ✓ | ✓ | ✗ |
| 30127 | 64 | L3 | 00 | 7E | ✓ | ✓ | ✗ |
| 30129 | 65 | Fault 12 | 00 | 80 | ✓ | ✓ | ✓ |
| 30131 | 66 | L1 | 00 | 82 | ✓ | ✓ | ✓ |
| 30133 | 67 | L2 | 00 | 84 | ✓ | ✓ | ✗ |
| 30135 | 68 | L3 | 00 | 86 | ✓ | ✓ | ✗ |
| 30137 | 69 | Fault 13 | 00 | 88 | ✓ | ✓ | ✓ |
| 30139 | 70 | L1 | 00 | 8A | ✓ | ✓ | ✓ |
| 30141 | 71 | L2 | 00 | 8C | ✓ | ✓ | ✗ |
| 30143 | 72 | L3 | 00 | 8E | ✓ | ✓ | ✗ |
| 30145 | 73 | Fault 14 | 00 | 90 | ✓ | ✓ | ✓ |
| 30147 | 74 | L1 | 00 | 92 | ✓ | ✓ | ✓ |
| 30149 | 75 | L2 | 00 | 94 | ✓ | ✓ | ✗ |
| 30151 | 76 | L3 | 00 | 96 | ✓ | ✓ | ✗ |
| 30153 | 77 | Fault 15 | 00 | 98 | ✓ | ✓ | ✓ |
| 30155 | 78 | L1 | 00 | 9A | ✓ | ✓ | ✓ |
| 30157 | 79 | L2 | 00 | 9C | ✓ | ✓ | ✗ |
| 30159 | 80 | L3 | 00 | 9E | ✓ | ✓ | ✗ |

**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-1High Byte | 40 (Hex) |
| Data Register-1 Low Byte | 00(Hex) |
| Data Register-2 High 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 | R/Wp | ✓ | ✗ |
| 40015 | 5 | Reset parameters (0) | 00 | E | 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/W | ✓ | ✓ |
| 40053 | 18 | Enable / Disable (0) | 00 | 34 | R/Wp | ✓ | ✓ |
| 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.<br>Write one of the following value to this address.<br>**1**: 1 Phase 2 Wire<br>**2**: 3 Phase 3 Wire<br>**3**: 3 Phase 4 Wire**.**<br>Writing any other value will return error . |
| 40013 | System frequency | This address is used to set System Frequency in voltage protection relay.<br>Writing any other value will return error. Write one of the following to this address.<br>**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.<br>**0:** None **1:** ALL **2:** Max voltage, Max frequency (**Voltage Protection Relay**)<br>Max current, Max frequency (**Current Protection Relay**)<br>**3:** Min voltage, Min frequency (**Voltage Protection Relay**)<br>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.<br>Write one of the following to this address.<br>**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.<br>**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.<br>**0:** Energize<br>**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.<br>**0:** Energize<br>**1:** De-energize |

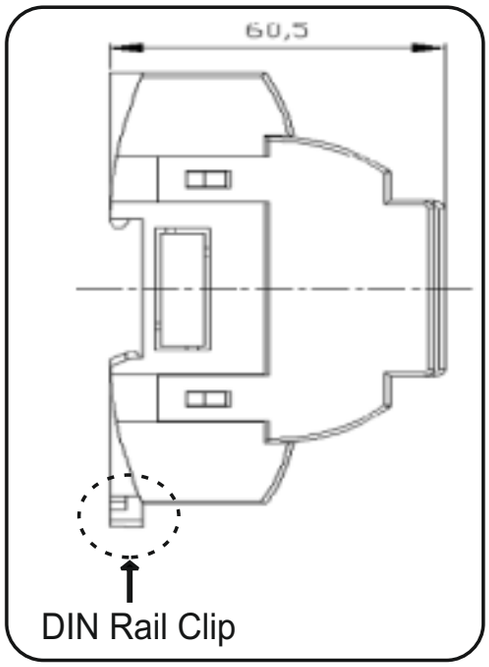
| | | |
|---|---|---|
| 40029 | Reset delay | This address allows the user to set reset delay in between 0.2 Sec to 30 Sec. |
| 40031 | Power on delay | This address allows the user to set Power ON delay in between 0.5 Sec to 30 Sec. |
| 40033 | PT Primary | This address allows the user to set PT Primary value (in terms of $V_{L-L}$).<br>The settable range is 0.100 KVL-L to 1200 $KV_{L-L}$ for all system types. |
| 40035 | CT Primary | This address allows the user to set CT Primary value.<br>The settable range is 1A to 999 KA for all system types. |
| 40041 | Register order / Word order | Word Order controls the order in which RISH 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.<br>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 $V_{L-L}$).<br>The settable range is 100 $V_{L-L}$ to 600$V_{L-L}$ 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.**<br>Writing any other value will return error. Write one of the following to this address.<br>**0:** Over voltage **1:** Under voltage **2:** Over Frequency **3:** Under frequency<br>**4:** Phase Failure **5:** Phase Unbalance **6:** Phase sequence<br>This address allows the user to select one out of 4 different parameters for editing in **Current protection relay.**<br>Writing any other value will return error. Write one of the following to this address.<br>**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.<br>**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.<br>Refer section **4.1.3.4** for Trip Delay setting of parameters. |
| 40059 | Hysteresis | 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.<br>**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.<br>**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.<br>**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.<br>**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.<br>**0:** Relay De-energize **1:** Relay Energize |
| 40071 | Password | This address is used to set & reset the password.<br>Valid Range of Password can be set is 0000 - 9999 .<br>1) If password lock is present & if this location is read it will return **zero**.<br>2) If Password lock is absent & if this location is read it will return **One**.<br>3) If password lock is present & to disable this lock first send valid password to this location then write “0000” to this location<br>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.<br>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.<br>Writing any other value will return error. Write one of the following to this address.<br>**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.<br>**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.<br>**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.<br>Writing any other value will return error. Write one of the following to this address.<br>Writing any other value will return an error. **0:** Disable **1:** Enable<br>**Note: -** if any one ANDing parameter is disabled then ANDing function will get disabled |
| 40089 | ANDing para1 | **Voltage Protection Relay**: -<br>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.<br>**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)<br>**Current Protection Relay: -**<br>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.<br>**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**: -<br>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.<br>**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)<br>**Current Protection Relay: -**<br>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.<br>**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.<br>Write one of the following to this address.<br>**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 $55^{0}$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.

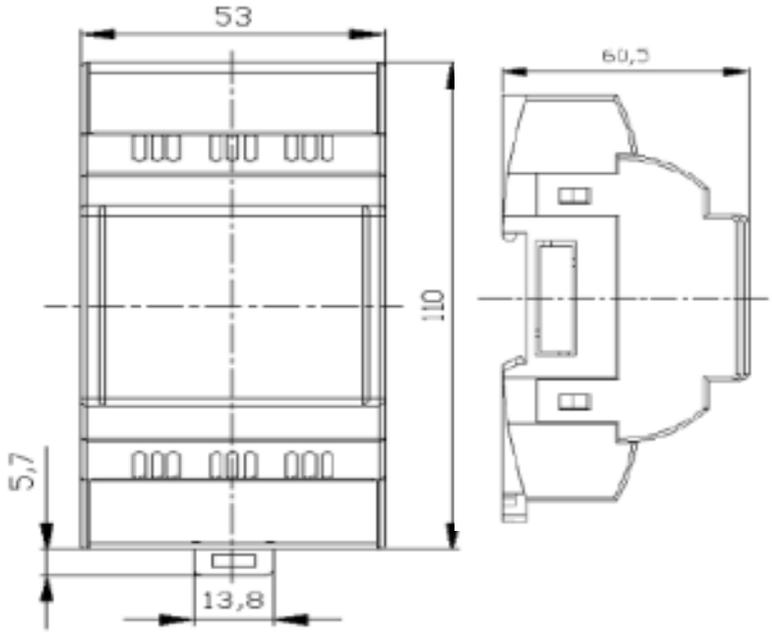
1. Screened output and low signal input leads or have provision for fitting RF suppression components, such as ferrite absorbers, line filters etc., in the event that RF fields cause problems.

Note: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.

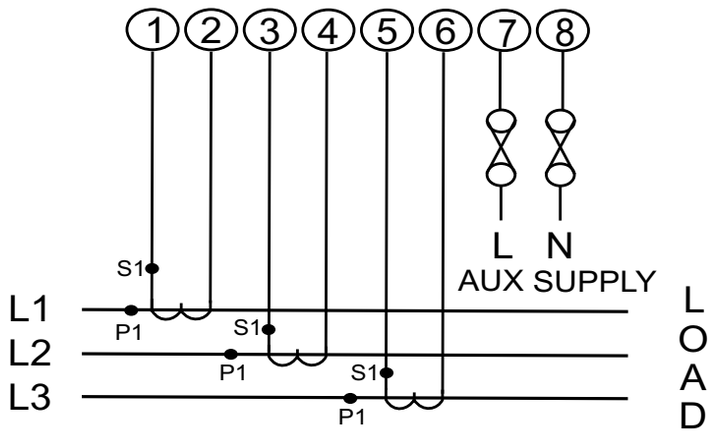
### 8.6 Earth/Ground Connections

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

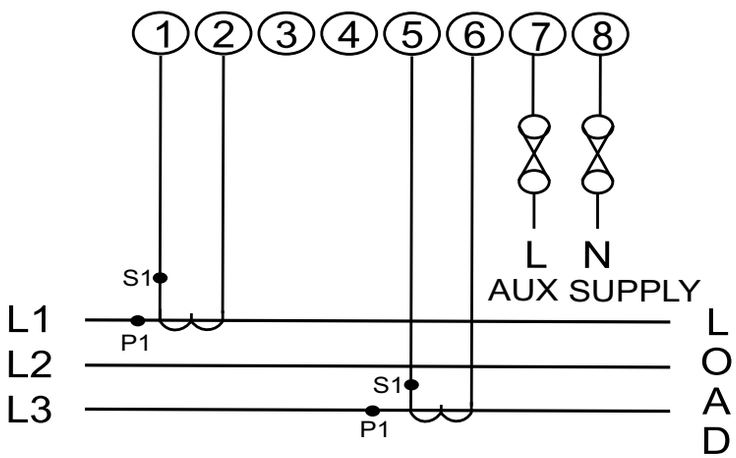
## 9. CONNECTION DIAGRAMS

### Current Protection Relay

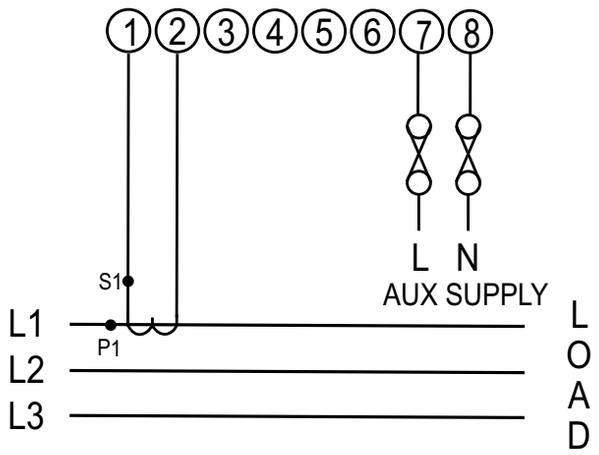
For 3 Phase 4 Wire Unbalanced Load

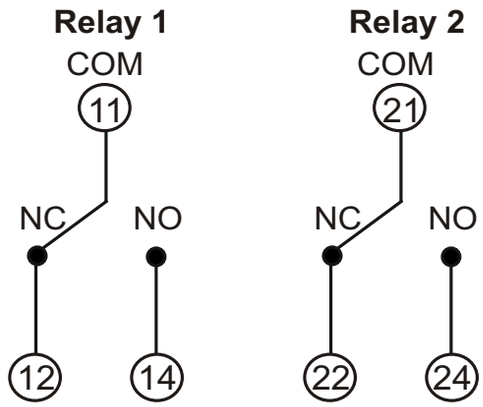



For 3 Phase 3 Wire Unbalanced Load



For 1 Phase 2 Wire Load

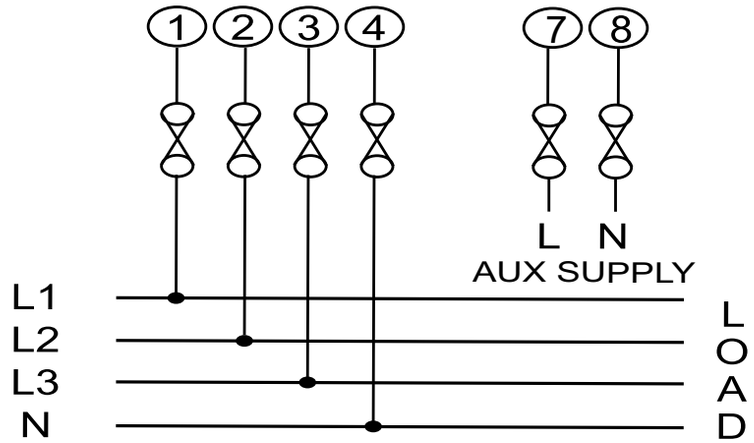


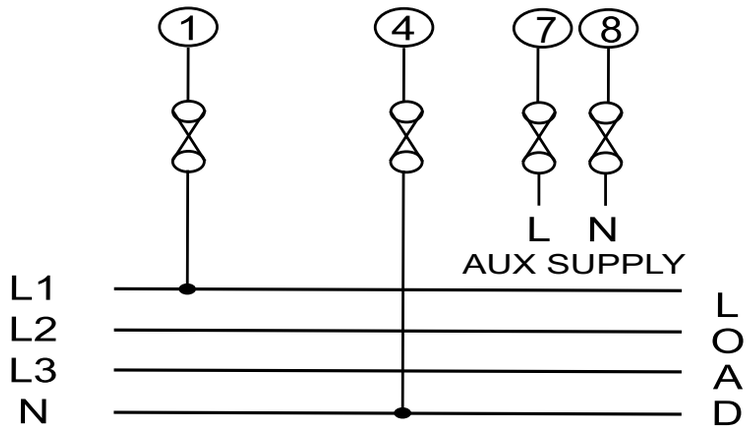

**Note-** Relay Contacts are shown in power off condition

## Voltage Protection Relay

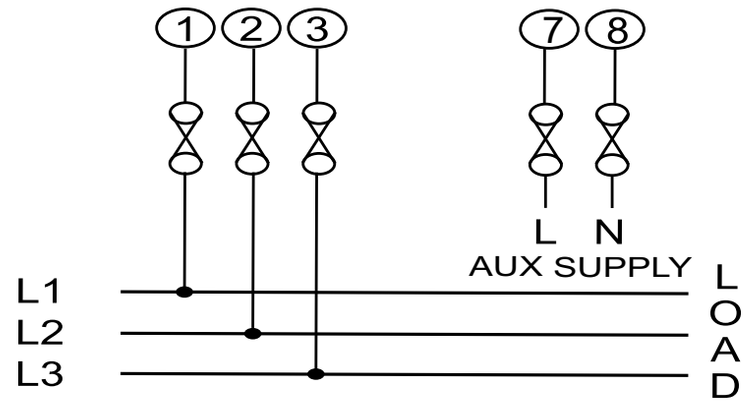
For 3 Phase 4 Wire Unbalanced Load

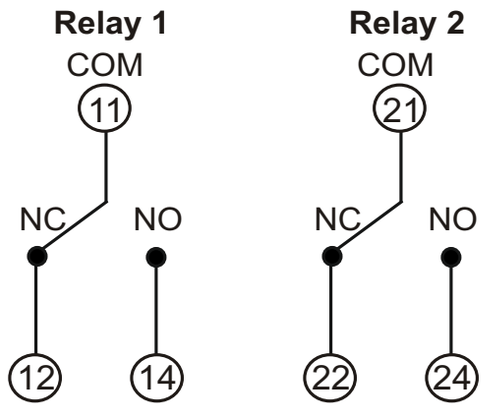



For 1 Phase 2 Wire Load




For 3 Phase 3 Wire Unbalanced Load




**Note-** Relay Contacts are shown in power off condition

# 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<br>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 |
| Pollution degree: | 2 |
| Installation category: | 300V CAT III / 600V CAT II |
| 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<br>NC- 1x10^4 OPS for 1CO / 1CO+1CO relay<br>1x10^5 OPS for 2CO relay |

| **Mechanical Attributes :** | |
|---|---|
| Weight | 300g Approx. |

# 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 responcibility to determine the suitability of installation method in the user's field condition, 'manufacturer' only obligations are responcibility 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.