TECHNICAL SPECIFICATIONS:

Ordering Cat. Nos.:	223-7788	223-7789	223-7790
Supply Characteristics:			
Power Voltage Type	Self powered supply		Auxiliary powered supply
Power Supply Voltage Range	145 - 500 VAC (Line Voltage) (L1,L2 & L3)		85 - 300 VAC/DC (P - N) A1- A2
Power Supply Frequency	45 - 65 Hz		
Power Consumption	<6VA		
Measurement Characteristics:			
Monitoring Signal	R, Y, B & N (3P3W and 3P4W Menu configurable)		
Measuring Voltage Range	Phase voltage : 90 to 288 VAC		Phase voltage : 50 to 288 VAC
	Line voltage : 155 to 500 VAC		Line voltage : 85 to 500 VAC
Measuring Frequency Range	45 - 65 Hz		
Relay Output Characteristics:			
Contact Arrangement	1 C/O Relay 1: 15(Pole),16(NC),18(NO)		1 C/O + 1 C/O Relay 1: 15(Pole),16(NC),18(NO) & Relay 2: 25(Pole),26(NC),28(NO)
Contact Rating	5A (Resistive) @ 240 VAC / 30 VDC		
Mechanical Life Expectancy	1×10^7 Operations		
Electrical Life Expectancy	1×10^5 Operations		
Contact Material	AgSnO2		

Utilization category			
AC-15	(V)	120/240 V	
	(A)	3/1.5 A	
DC-13	(V)	24/125/250 V	
	(A)	2/0.22/0.1 A	

Display Indication:	
Display Type	LCD
Backlight	Green LED Backlight
Viewing Angle	6 O'Clock
Keys:	
Escape (↰)	Escape key.
Up (▲)	To scroll setting parameters upword.
Down (▼)	To scroll setting parameters downword.
Enter (↲)	Enter key.

Feature Characteristics:		
Selection of Measuring circuit	Phase to Phase voltage (3P-3W) Phase to Neutral voltage (3P-4W) (Default)	
Reference Voltage		
Selection of reference Voltage	Configurable (Enable/Disable) Default : Disable	
Reference voltage selection band	Phase voltage : 110 to 270 VAC (Default 240V)	
	Line voltage : 190 to 470 VAC (Default 415V)	
Measuring Range		
Under Voltage	Phase voltage : 90 to 288 VAC (Default 192V)	50 to 288 VAC (Default 192V)
	Line voltage : 155 to 500 VAC (Default 332V)	85 to 500 VAC (Default 332V)
	Note: Maximum threshold of under voltage = OV threshold – hysteresis – 5V	
Under Voltage (When Reference Enabled)	Lower Limit : 55% of Ref. voltage or 'X' whichever is max. Here X is 60V-3P4W,100V-3P3W	
	Upper Limit : < Reference voltage - 3V - Hysteresis	
	Default : When ref is made en/dis UV, OV and hysteresis will set to factory default values. When ref. vtg is changed, if UV thresholds are out of band then UV will set to 80% of ref. vtg.	
Over Voltage	Phase voltage : 90 to 288 VAC (Default 264V)	50 to 288 VAC (Default 264V)
	Line voltage : 155 to 500 VAC (Default 456V)	85 to 500 VAC (Default 456V)
	Note: Minimum threshold of over voltage = UV threshold + hysteresis + 5V	
Over Voltage (When Reference Enabled)	Lower Limit : Reference voltage + 3V + Hysteresis	
	Upper Limit : 125% of reference or 'X' whichever is min. Here X is 288V-3P4W,500V-3P3W	
	Default : When ref. is made en/dis UV, OV and hysteresis will set to factory default values. When ref. vtg is changed, if OV thresholds are out of band then OV will set to 110% of ref. vtg.	
Low Cut Off	Phase voltage : 85 VAC	45 VAC
	Line voltage : 150 VAC	80 VAC
Low Cut Off (When Ref. Enable)	40 % of reference voltage	
High Cut Off	Phase voltage: 310 VAC	325 VAC
	Line voltage : 535 VAC	555 VAC
High Cut Off (When Ref. Enable)	140% of ref. voltage or "X" = 3P4W:310/325V and 3P3W:535/555V high cutoff as per cat id.	
Under Frequency	45 to 65 Hz (Default 48Hz)	
Over Frequency	45 to 65 Hz (Default 52Hz)	
	Note: Due to locking between threshold & hysteresis, minimum 2Hz difference will be there between UF threshold and OF threshold. Difference band between UF threshold & OF threshold will increase if hysteresis is increased.	
Asymmetry*	Voltage : 5 to 99 VAC (Default 60V)	
	Percentage : 2 to 50% (Default 10%)	
Hysteresis		
UV, OV, LC & HC Hysteresis	3 to (20VAC or (OV-UV-5V) Whichever is minimum) (Default 7V)	
Under Voltage Hysteresis (When Reference Enabled)	Lower Limit : 3 V	
	Upper Limit : (Ref. vtg - UV - 3V OR OV - Ref.vtg -3V OR 20V whichever is minimum)	
	Default : 7V	
Over Voltage Hysteresis (When Reference Enabled)	Lower Limit : 3 V	
	Upper Limit : (Ref. vtg - UV - 3V OR OV - Ref.vtg -3V OR 20V whichever is minimum)	
	Default : 7V	
Frequency Hysteresis	0.5 to 2 Hz (Default 1Hz)	
Hysteresis for Asymmetry	Voltage : 3 to 99 VAC (Default 7V)	
	Percentage : 2 to 15% (Default 2%)	
Other Monitoring Functions		
Phase Loss	Configurable(Enable/Disable) (Default : Enable)	
Phase Reverse	Configurable(Enable/Disable) (Default : Enable)	
Neutral Loss	Configurable(Enable/Disable) (Default : Enable) (Applicable only in 3P4W configuration)	
Setting Resolution	Voltage : 1V Frequency Threshold : 1Hz Frequency Hysteresis: 0.1Hz Time : 0.1 sec (For 0.1 to 99.9sec timing range) 1 sec (For 100 to 999sec timing range)(Power ON delay resolution is 1 sec.)	
Measuring Accuracy	Voltage : +/- 5V Frequency : +/- 0.3Hz Time : +/- (2% of setting +100msec) for UV,OV & Asymmetry +/-(2% of setting +500msec) for UF & OF	
Mode*	Configurable: Auto (Non Latch)/Manual (Latch) (Default: Auto)	

Reset	Enter key long press for 1sec (applicable for "Manual Mode (Latch")
Password Protection	Configurable(Enable/Disable) 3 Digit Password (Default : Disable)
Fault Memory	Log of previous 5 no's of Fault
Relay Output Type	Configurable :Fail safe-Yes (De-Energise to trip) (Default : Yes) No (Energise to trip - Non fail safe) (Applicable for shunt trip coil)
Timing Function	
Power ON Delay Setting	0sec to 999sec (Default : 5sec)(750ms Hardware initialization delay) **Note: Power ON Delay is not applicable for Non fail safe mode.**
Off Delay Setting	0.1 to 999sec (Default : 5sec) Configurable for faults UV, OV, UF, OF & Asymmetry. Phase rev./3 ph interruption:<100ms, High/Low cutoff:<200ms, Neutral Loss:<500ms. Phase fail:<100ms (In non fail safe mode phase fail duration is <500ms).
On delay setting	0.5 to 999 sec (Default :5sec)

Mechanical Parameter :	
Operating Mode	Continuous Operation
Degree of Protection	IP-20 for Enclosure & Terminals, IP-40 with Front Facia for Dust cover
Housing	UL94-00
Mounting	Base/Din
Dimension (WxHxD)	36 x 90 x 66.5 mm
Weight	132 g Approx.(Unpacked)
Approval	CE & RoHS

Connection :	
Connection	Eurostyle Wire Terminal Connector
Wire size	1 x 2.5 sq. mm. (24 to 12 AWG)
Stripping Length	7-8 mm
Screw Tightening Torque	0.5 Nm 4.4 lb.in.

Compliance with Standards EMI/EMC:

| Standard	IEC 60255-1	
Harmonic Current Emission	IEC 61000-3-2	CLASS A
Voltage Flicker and Fluctuations	IEC 61000-3-3	CLASS A
ESD	IEC 61000-4-2	LEVEL II
Radiated Susceptibility	IEC 61000-4-3	LEVEL III
Electrical Fast Transients	IEC 61000-4-4	LEVEL IV
Surge	IEC 61000-4-5	LEVEL IV
Conducted Susceptibility	IEC 61000-4-6	LEVEL III
Voltage Dips and Interruptions (AC)	IEC 61000-4-11	
Voltage Dips and Interruptions (DC)	IEC 61000-4-29	
Conducted Emission	CISPR 11	CLASS A
Radiated Emission	CISPR 11	CLASS A

Safety:		
Test Voltage Between I/P & O/P	IEC 60947-5-1	2KV
Test Voltage Between all Terminals & Enclosure	IEC 60947-5-1	2.5KV
Impulse Voltage Between I/P & O/P	IEC 60947-5-1	4KV
Insulation Resistance	UL508	>50KOhm
Leakage Current	UL508	<3mA
Single Fault	IEC 61010-1	
Pollution Degree	II	

Environmental:	
Operating Temperature	-10°C to + 60°C
Storage Temperature	-20°C to + 70°C
Cold Heat	IEC 60068-2-1
Dry Heat	IEC 60068-2-2
Vibration	IEC 60068-2-6 5g (10 - 50Hz)
Relative Humidity	95% RH (Without condensation)
Max. Operating Altitude	2000 meters

CONNECTION DETAILS:

223-7788, 223-7789, 223-7790 connection diagrams

PRODUCT DESCRIPTION:
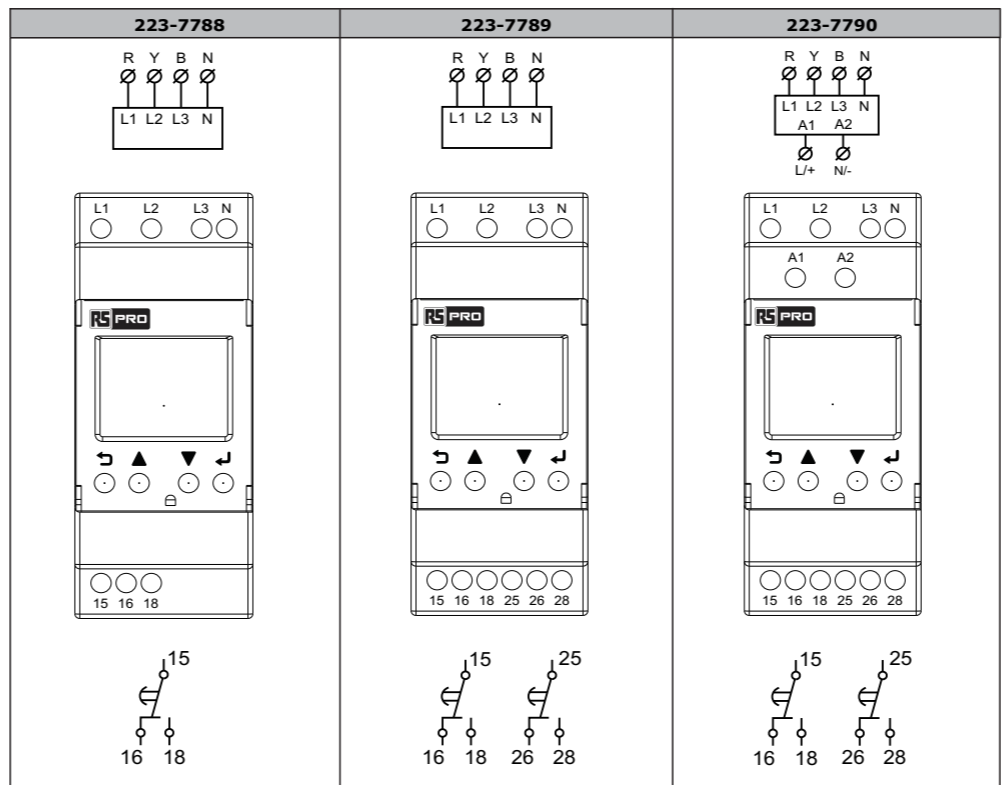
Digital supply monitoring relay monitors Over voltage, under voltage, over frequency, under frequency, phase loss, Phase asymmetry, Phase sequence & neutral fail in 3 phase system.

FEATURES:

- Monitor under-over voltage & frequency in 3 phase systems for line/Phase voltage.
- Monitoring of phase loss, phase sequence, Phase asymmetry & neutral fail.
- Measure true RMS AC voltage.
- Self & auxiliary power devices.
- Configurable Power on delay, off delay & On delay.
- Faults can be individually Enable/Disable for individual relays.
- Configurable output contact for Energise to trip & De-energise to trip.
- Relay Latch mode can be individually Enable/Disable (Manual / Auto mode).
- Digital LCD display for real time monitoring.
- Instantaneous faults can be viewed on LCD window.
- Stores last five fault history.
- Backlit functioning is based on Fault & Relay status.
- Configurable backlit.
- Password protection.
- Sealable transparent dust cover.
- Din rail/Base mount.
- CE & RoHS compliance.

⚠ CAUTION:

- Do not touch the terminals while power is being supplied.
- Tighten terminal screws with the specified torque.
- Always follow instructions stated in product leaflet.
- Before installation, check to ensure that specifications agree with intended application.
- During installation, keep 10mm distance on both sides of product from adjacent devices.
- Suitable dampers should be provided in the event of excessive vibrations.
- Only qualified persons are authorized to install the product.
- Use slow blow fuse of 250mA rating in series with product supply.
- Device should be kept away from wet, dust & humidity environments.
- Device manufacturer will not be responsible if any incident occur due to negligence of cautions.

SUITABILITY FOR USE:

These are products with Auto reset, hence never use the products for an application involving significant risk to life without ensuring that the system as a whole has been designed to address the risks and that our products are properly rated and installed for the intended use within the entire system or equipment.

NOTE:

- The technical information provided in this document was correct at the time of publish.
- Product innovation being a continuous process, we reserve the right to alter specifications without any prior notice.

FUNCTION DESCRIPTION:

A. Voltage Asymmetry : If measured asy. exceeds asymmetry threshold then device will declare it as asymmetry fault.
Note : Due to locking between threshold & hysteresis, in case of absolute asymmetry, maximum value of hysteresis will be less than equal to -5V of asymmetry threshold while incase of % asymmetry, maximum value of hysteresis will be less than equal to -2% of asymmetry threshold.
- **Percent Asymmetry :**
Find out max line voltage , min line voltage and average line voltage .
Calculate two differences as D1 and D2 :
D1 = Max line voltage – Average line voltage &D2 = Average line voltage – Min line voltage
% Asymmetry Calculation :
if (D1 > D2) then D = D1 otherwise D = D2.
% Asymmetry = (D / Average) x 100.
- **Absolute Asymmetry :**
Find out max line voltage and min line voltage .
Absolute Asymmetry = Max line voltage – Min line voltage.

B. Neutral Fail : In run time or at power on, if neutral connection open then device detect it as Neutral fail fault.(Applicable to 3P-4W only).

C. On Delay : On delay is time duration between fault recovery and relay action. ON delay is applicable for recovery of all type of faults.
Note: If fault occur again during ON delay, then device reload ON delay.

D. Off Delay : OFF delay is time duration between fault detection and relay action.

E. Mode: Each relay mode can be configure as Auto or Manual(Latch.At this time of fault recovery ,Auto mode relay recovers automatically. However Manual mode relay require to press Reset key for recovery

F. History: History saving is done when any relay is tripped by any fault. Eg. If multiple faults are present while tripping then history will be logged for only one fault for which the relay has tripped first. In history saving total last five faults are logged in the data flash memory including Relay 1 & 2. If multiple faults occurs on same instant then it will log only one fault due to which it was tripped.

KEY FUNCTIONS:

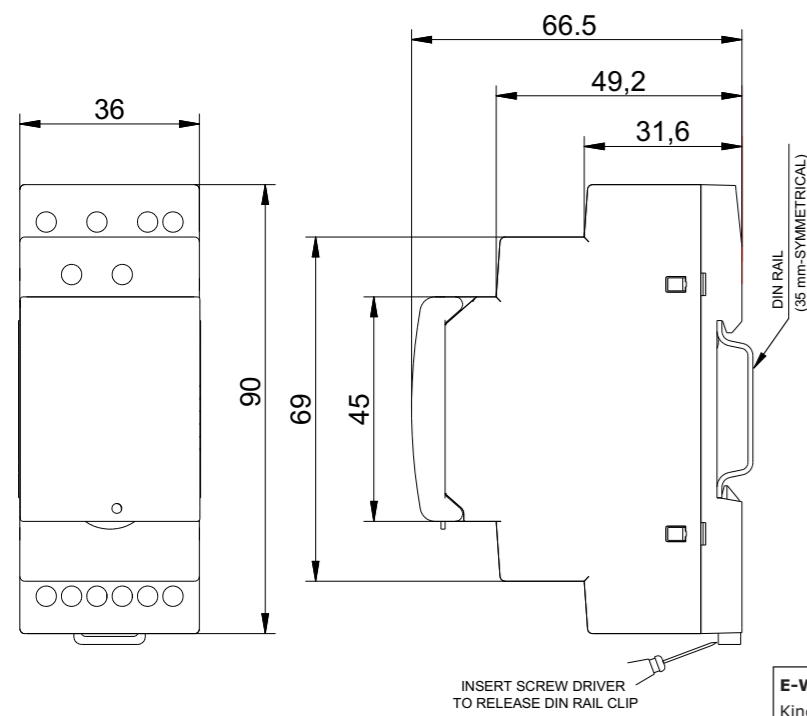|		
1	ESCAPE(⟲)	• To enter in setup menu(Long press > 1Sec) • To return to main screen or previous menu while in edit or view mode • To abort changed value or parameter
2	UP(▲)	• To scroll parameters upward • To change/increment parameter value in edit mode • To enter into Run mode menu and view instantaneous measurement values frequency, Asymmetry & voltages (Key press < 500ms)
3	DOWN(▼)	• To scroll parameters downward • To change/decrement parameter value in edit mode • To enter into History menu mode & view fault log history(Key press < 500ms).
4	ENTER(↵)	• To select and save parameter value in edit mode • To reset the product from latch mode (Long press > 1Sec)
5	ESCAPE(⟲) + ENTER(↵)	• Combine key press to view read only setup menu (Long press > 1Sec).

LCD DISPLAY CONTENT & SYMBOLS:

- Fault window and menu feature parameter
- Delay timer status
- Time in second — VS
- Percentage Asymmetry — Hz %
- Frequency in Hz — V
- Voltage — V
- Instantaneous Voltage or other setable parameter
- Line or Phase voltage
- Relay Status

DIMENSION DETAILS:

66.5, 49,2, 31,6, 36, 90, 69, 45

DIN RAIL (35 mm-SYMMETRICAL)

INSERT SCREW DRIVER TO RELEASE DIN RAIL CLIP
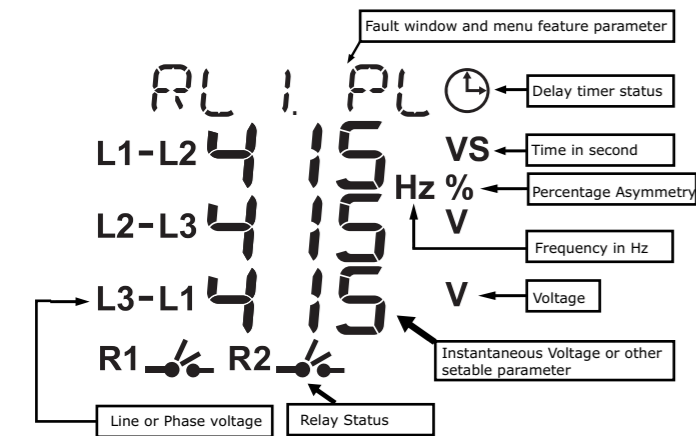
RELAY CONTACT STATUS:

Relay Mode	Device Healthy Condition	Device Faulty Condition
Fail Safe	15 & 25 (Pole) — 18 & 28 (NO)	15 & 25 (Pole) — 18 & 28 (NO)
Non Fail Safe	15 & 25 (Pole) — 18 & 28 (NO)	15 & 25 (Pole) — 18 & 28 (NO)

EDIT MENU STRUCTURE:

Press & hold ESC key(⟲) for > 1sec. to enter in programming mode.

Main Menu → Password Enable → Enter Password "EN PSW"

Password Disable

Copy Relay 1 configuration "YES/NO" → "YES" → All Setting same as Relay 1

Supply Configuration "SPL.CFG" — Reference Voltage "REF.VTG" — Relay 1 Configuration "RL1 CFG" — Relay 2 Configuration "RL2 CFG" — Asymmetry Type "AS TYP" — Neutral Open Selection "N OPEN" — Hysteresis Setting "HYST"

Supply Configuration branch:
"3P4W" → To change config. → 3P4W blink on display Press up key(▲) "3P3W" → Press twice ESC key to save "SAVED" → Main Screen

Reference Voltage branch:
Reference Voltage status disable "diS" → Reference Voltage Status Enable "En" → Default Reference Voltage "240V" → Set ref. voltage using up/down & enter key → Press twice ESC key to save "SAVED" → Main Screen

Relay 1 Configuration branch (column 1):
Under Voltage Setting "U VTG" → Under Voltage Enable/Disable "STATUS" → Under Voltage Trip Threshold "THRLD" → Over Voltage Setting "O VTG" → Over Voltage Enable/Disable "STATUS" → Over Voltage Trip Threshold "THRLD" → Under Frequency Setting "U FREQ" → Under Frequency Enable/Disable "STATUS" → Under Frequency Trip Threshold "THRLD"

Relay 1 Configuration branch (column 2):
Over Frequency Setting "U FREQ" → Over Frequency Enable/Disable "STATUS" → Over Frequency Trip Threshold "THRLD" → Asymmetry Setting "ASY" → Asymmetry Setting "STATUS" → Asymmetry Trip Threshold "THRLD" → Phase Fail Setting "PHLOSS" → Phase Fail Enable/Disable "STATUS" → Phase Reverse Setting "PHREV" → Phase Reverse Enable/Disable "STATUS"

Relay 1 Configuration branch (column 3):
OFF Delay Setting "OFFDLY" → OFF Delay Threshold Setting "SETDLY" → ON Delay Setting "ONDLY" → ON Delay Threshold Setting "SETDLY" → Relay Mode Setting "RLY MD" → Fail Safe Non Fail Safe "F SAFE" → Latch Mode Setting "LCH MD" → Latch Mode YES/NO "NO" → Press thrice ESC key to save "SAVED" → Main Screen

Relay 2 Configuration branch (column 1):
Relay 2 Setting "RL2 SET" → Under Voltage Setting "U VTG" → Under Voltage Enable/Disable "STATUS" → Under Voltage Trip Threshold "THRLD" → Over Voltage Setting "O VTG" → Over Voltage Enable/Disable "STATUS" → Over Voltage Trip Threshold "THRLD" → Under Frequency Setting "U FREQ" → Under Frequency Enable/Disable "STATUS" → Under Frequency Trip Threshold "THRLD"

Relay 2 Configuration branch (column 2):
Over Frequency Setting "U FREQ" → Over Frequency Enable/Disable "STATUS" → Over Frequency Trip Threshold "THRLD" → Asymmetry Setting "ASY" → Asymmetry Setting "STATUS" → Asymmetry Trip Threshold "THRLD" → Phase Fail Setting "PHLOSS" → Phase Fail Enable/Disable "STATUS" → Phase Reverse Setting "PHREV" → Phase Reverse Enable/Disable "STATUS"

Relay 2 Configuration branch (column 3):
OFF Delay Setting "OFFDLY" → OFF Delay Threshold Setting "SETDLY" → ON Delay Setting "ONDLY" → ON Delay Threshold Setting "SETDLY" → Relay Mode Setting "RLY MD" → Fail Safe Non Fail Safe "F SAFE" → Latch Mode Setting "LCH MD" → Latch Mode YES/NO "NO" → Press thrice ESC key to save "SAVED" → Main Screen

Asymmetry Type branch:
Select Absolute/Percentage "PEr/AbS" → Press twice ESC key to save "SAVED" → Main Screen

Neutral Open Selection branch:
Enable/Disable "STATUS" → Select Status Press twice ESC key to save "SAVED" → Main Screen

Hysteresis Setting branch:
Voltage Hysteresis Threshold setting "VHYST" → Asymmetry Hysteresis Threshold setting "ASHYST" → Frequency Hysteresis Threshold setting "FRHYST" → Select Hysteresis. Press twice ESC key to save "SAVED" → Main Screen

Lower branch:
Power ON Delay Selection "POn.DLY" — Backlit ON/OFF option "BAKLIT" — Reset Parameter option "RESET" — Password Protection "PSSWD"

Power ON Delay Selection "POn.DLY" → Set Power ON Delay "SETDLY" → Press twice ESC key to save "SAVED" → Main Screen

Backlit ON/OFF option "BAKLIT" → Continuous ON YES/NO "CONT.ON" → Press twice ESC key to save "SAVED" → Main Screen

Reset Parameter option "RESET" → RESET "non" → Press UP key select Factory(FCt)/ History(hSt)Reset → Press Enter key to save or Press twice ESC key to save "SAVED" → Main Screen

Password Protection "PSSWD" → Password Status Enable(En)/Disable(diS) → diS / En → Set password "SETPSW" → Press twice ESC key to save "SAVED" → Main Screen

DISPLAY OF FAULTS:

Display	Meaning
"FLT.INT"	Voltage Interruption
"FLT.NF"	Neutral Open
"FLT.LC"	Low Cut off
"FLT.HC"	High Cut off
"RLx.PL"	Phase Loss
"RLx.PR"	Phase Reverse
"RLx.ASY"	Voltage Asymmetry
"RLx.OF"	Over Frequency
"RLx.UF"	Under Frequency
"RLx.OV"	Over Voltage
"RLx.UV"	Under Voltage
Note: RLx indicate RL1 & RL2	

TIMING DIAGRAM: VOLTAGE MONITORING

Initialize Time Pon, Over Voltage, Toff, Ton, Δt < Toff, Under Voltage

Over Voltage, Hys, Voltage, Hys, Under Voltage

Supply Voltage

Relay Status — Fail Safe De-energise to trip — 18 & 28 / 16 & 26

Relay Status — Non Fail Safe Energise to trip — 18 & 28 / 16 & 26

Pon - Power ON delay   Ton - ON Delay   Toff - OFF delay
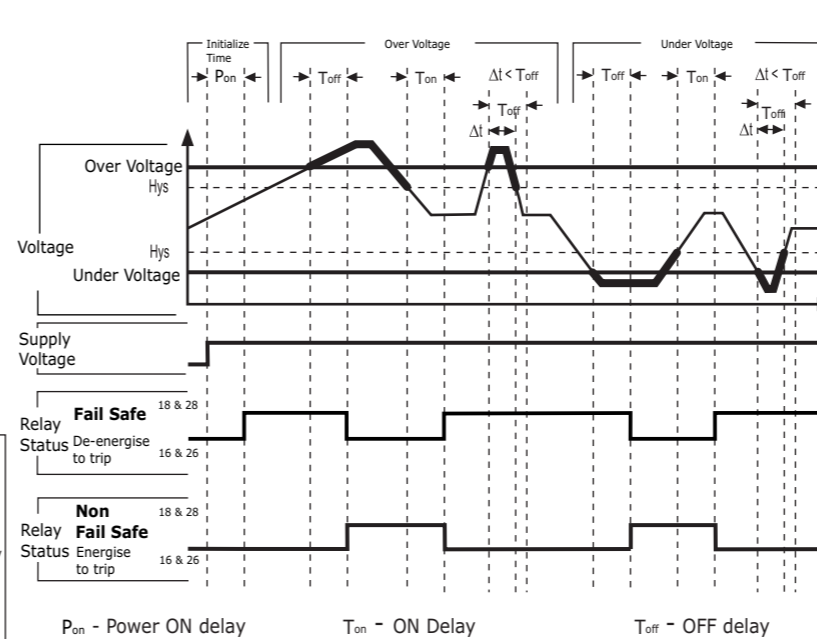
TIMING DIAGRAM: PHASE LOSS, PHASE SEQUENCE, ASYMMETRY

Asymmetry — Asy % — L1 L2 L3 — Pon, Toff, Ton, Δt < Toff, Δt

Phase Fail — L1 L2 L3

Phase Reverse — Lx L2 L3

Supply Voltage

Relay Status — Fail Safe De-energise to trip — 18 & 28 / 16 & 26

Relay Status — Non Fail Safe Energise to trip — 18 & 28 / 16 & 26

Pon -Power ON delay   Ton - ON Delay   Toff -OFF Delay

MLL055-03