We touch your electricity everyday!

CSEPRO-F 220

Intelligent measuring & protection device

CSEPRO
CSEPRO
CSEPRO
CSEPRO
Series

Catalogue

C&S electric

Advance Feeder Protection & Monitoring Solution

CONTENTS

1.0 Introduction

CSEPRO series offers a multi functional comprehensive smart protection solution for Feeder, Generator, Motor & Transformer segment.

CSEPRO family of protective relays are advance numerical relays that provide multi protection and monitoring with reliable and fast protection solutions in a single unit.

In this family of CSEPRO series, the CSEPROFxxx is an advanced feeder protection solution which has fast, sensitive and secure protection for feeder faults.

CSEPROFxxx also provides an automation solution of power control. It complies with IEC 60870-5-103, IEC 61850, Modbus protocol for high integration of protection & control.

CSEPROFxxx offers following model based features to cover requirements of the wide range of users.

- 1A & 5A Programmable Rated Current
- Draw out enclosure have modular design with CT shorting
- Modular design with self CT shorting
- Measurement, Protection & Metering
- SCADA Communication (Local & Remote)
- Disturbance Record
- DI/DO Matrix Programmability
- Intelligent key for DI status & DO status, details of fault pickup & status of last fault occurred
- Last 10 fault record (non-volatile memory) with time stamp
- Last 100 event record (non-volatile memory) with time stamp
- CSEPRO-F relays are equipped with self supervision function

2.0 Application

The CSEPRO-F relay has been designed for controlling, protecting and monitoring industrial, utility distribution networks and substations. They can also be used as part of a protection scheme for feeders, transformers and generators.

CSEPROF Model

CSEPROF is available in following models: -

CSEPROF120	:	Voltage Protection
CSEPROF220	:	Non Directional Sensitive Current Protection
CSEPROF240	:	Non Directional Current Protection
CSEPROF300	:	Current + Voltage Protection
CSEPROF350	:	Directional Current + Voltage Protection
CSEPROF400	:	Voltage + Frequency Protection
CSEPROF500	:	Current + Voltage + Frequency Protection

3.0 Hardware

- Digital Signal Processor based numeric design
- Measures true RMS with DFT filter
- 1A & 5A common current terminal & programmable
- 4 Current Analog Input
- Max. 6 Digital Inputs
- Max. 6 Digital Outputs
- 8 LED's at Pkup & Trip on fault + 3 LED's with special function of 3 control keys
- LAN-RJ45/RS-485/USB ports for Communication
- 16x4 Alpha numeric LCD
- 8 Push button on the front for MMI

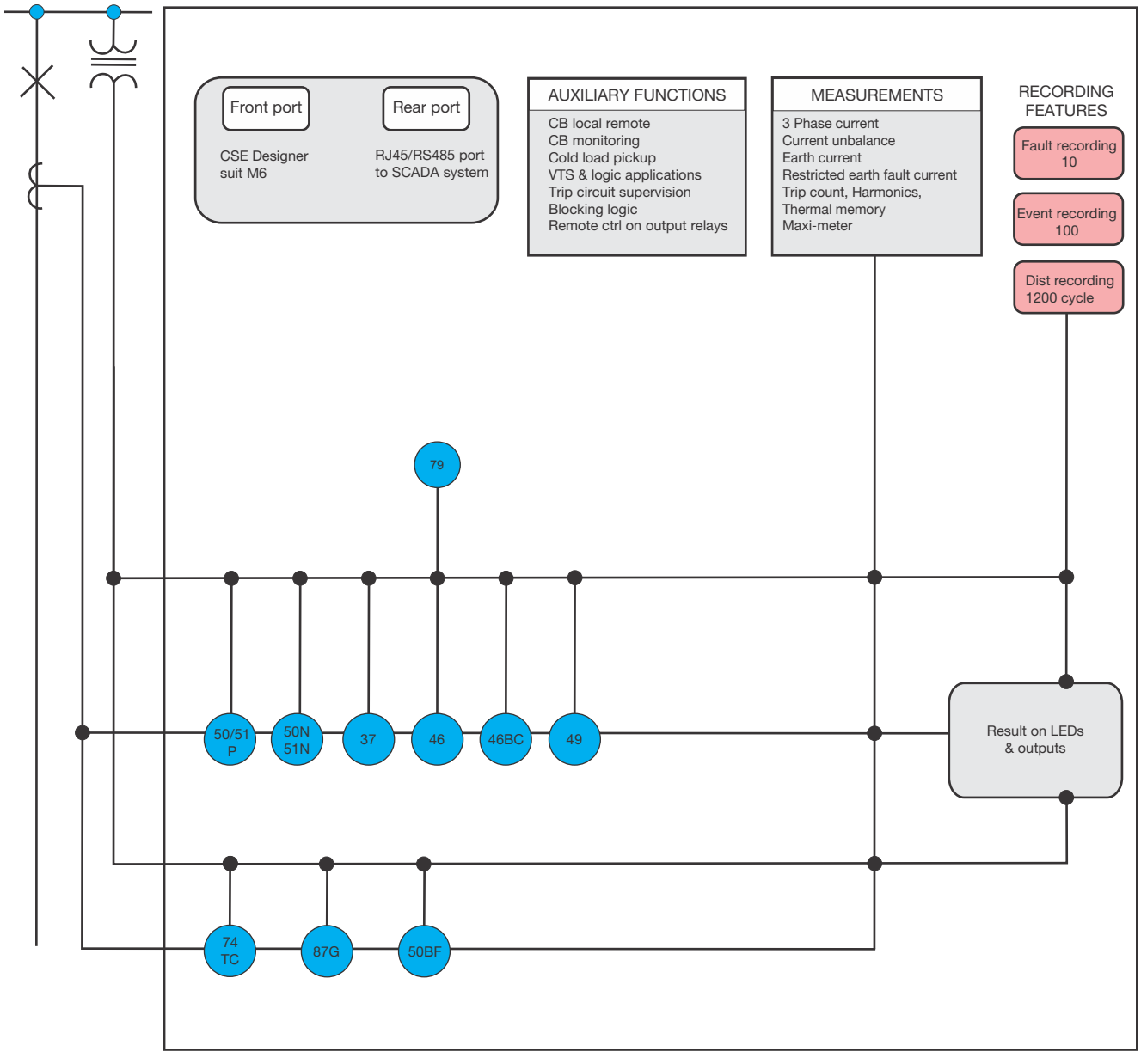
4.0 Protection Features

- Three Phase Time Over Current Protection (50/51)
- Three Phase Instantaneous Protection (50)
- Ground Time Over Current (51N)
- Ground Instantaneous Over Current (50N)
- Current Unbalance (46)
- Broken Conductor Detection (46BC)
- Auto Recloser (79)
- Cold Load Pickup
- Thermal Overload (49)
- Trip Circuit Supervision Function (74TC)
- Under Current (37P)
- Restricted Earth (87G)

5.0 Supervision Functions

- Lock out Relay
- Open-Close Breaker Command
- Trip Circuit Supervision (74TC)
- CBFP (50 BF)

6.0 Functional Diagram



(Figure-2) CSEPROF Functional Diagram

7.0 Protection Functions

1) Restricted Earth Protection (87G)

REF is based on comparing the vector sum of the phase currents to neutral point current. If the difference (Iref) is greater than the calculated value then tripping occurs. Refer table–10 for restricted earth fault protection settings.

$$\text{Restricted Earth Fault Current} = \frac{\text{Phase CT Ratio}}{\text{Earth CT Ratio}} \times I[\vec{L1}] + I[\vec{L2}] + I[\vec{L3}] - \frac{Ie}{ECTCorr}$$

Where ECTCorr = Earth CT correction factor

2) Three Phase Over-current (50/51)

The independent three stages are available for phase fault protection. For I> the user may independently select definite time delay or inverse time delay with different type of curves. The second & third Hi-Set stage can be configured with definite time only. For three phase over current protections settings refer table 5.

3) Neutral Over current (50N/51N)

The independent two stages (Ie> & Ie>>) are available for earth fault protection. For first stage (Ie>) the user can select definite time delay or inverse time delay with different type of curves. The second Hi-Set stage can be configured with definite time only. For neutral over current protections settings refer table 3.

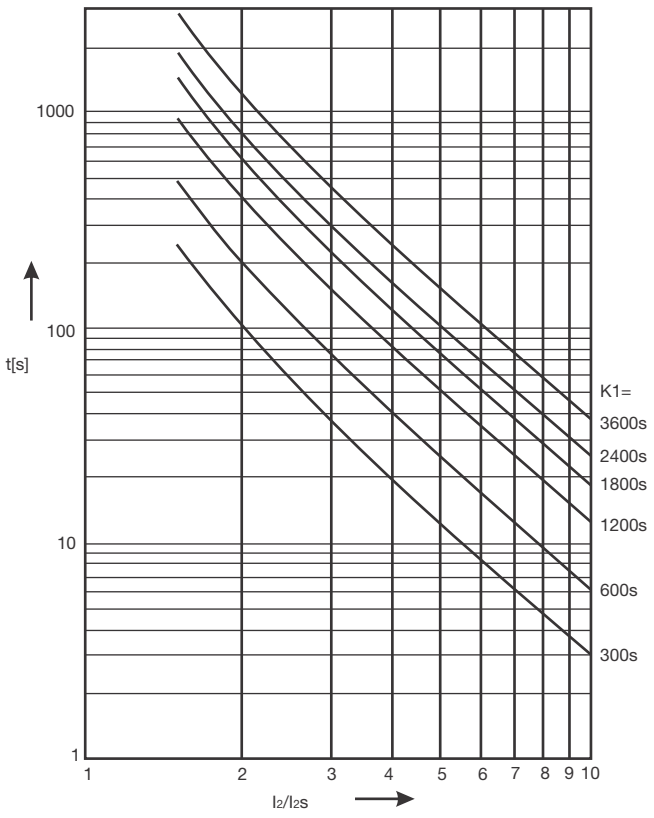
4) Negative Phase Sequence(46)

This function protects against current unbalances resulting from anomalies in the power system or unbalanced loads. For current unbalance protections settings refer table 3.

Negative Phase Sequence Equation

$$t = \frac{K1}{(I_2/I_{2s})^2 - 1}$$

K1 : TMS for Inverse characteristics of NPS
t : Expected Trip Time
I_2 : Measured negative sequence value
I_{2s} : Permissible NPS value



(Figure-3)

5) Cold Load Pickup

In CSEPRO unit, this feature is provided to avoid non desired trips, when line de-energised for a period of time and re-energised later, the load exceed the protection setting without the presence of a fault.

6) Thermal Image (49)

Protect elements such as lines, transformers etc. against thermal overloads, calculating the temperature according to the present and recent load conditions of the protected device. For these setting refer table no. 16

Thermal Memory Mode

There are following three modes for thermal protection: -

M1 : On Power Reset thermal memory becomes '0'.

M2 : On Power Reset thermal memory starts from the same value as at the time of Power Off.

M3 : On Power Reset thermal memory subtracts for the time it is in off state and starts from the remaining value.

The formula for calculating the trip characteristics is as follows:

$$\text{Trip time } (t) = \tau . I_N \left[\frac{\left(\frac{I^2}{Ib^2} \right) - p^2}{\left(\frac{I^2}{Ib^2} \right) - k^2} \right] \quad \text{for } p^2 < \frac{I^2}{(Ib^2)} \cap p^2 \leqslant k^2$$

With τ = thermal time constant of the object to be protected.

I_b= Basic current

P= Initial load factor (p= 0 means cold operating component)

k= constant

for thermal characteristics user has two choices

(1) Thermal based on highest measured RMS current

$$I = \sqrt{I1^2 + I22 + I02}$$

OR

(2) Thermal based on positive & negative sequence measured.

$$I = \sqrt{I1^2 + Neg\_k \times I22}$$

where

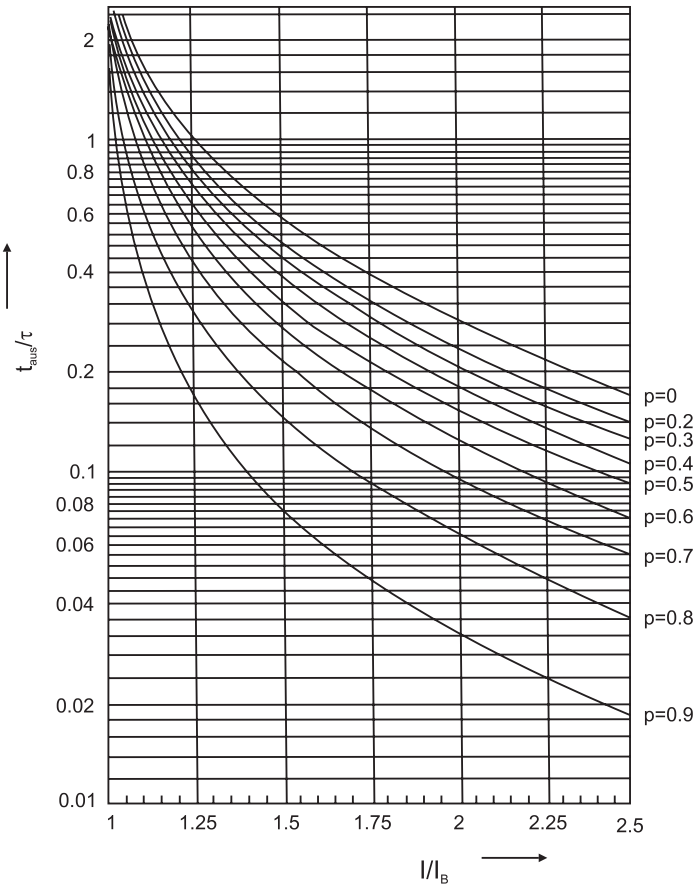
I_0 = Zero phase sequence current (ZPS)

I_1 = Positive phase sequence current (PPS)

I_2 = Negative phase sequence current (NPS)

Neg_k= is weighting factor of NPS (constant value)

Presentation of the Trip with variable initial load factor:



(Figure-4)

7) Under current (I<)
This protection covers the loss of load condition like V-belt split of shaft failure or a pump running unprimed or running dry protection, broken conveyor belt. For under current setting refer table no. 9.

If while running condition, the phase current goes below the adjusted current level for a defined time, CSEPRO-F will trip to stop the feeder.
8) Circuit Breaker Failure Protection (50BF)
The CB Failure Protection is based on supervision of phase currents and earth current after tripping events. The test criterion is whether all phase currents have dropped to less than 5% of IN within the set time (tCBFP). If one or more of the phase currents have not dropped to specified current within this time, CB failure is detected and the assigned output relay is activated. Refer table–16 for this protections settings.

9) Broken Conductor Protection (46BC)
For giving this protection the ratio of -ve phase sequence current and +ve phase sequence current is measured. The delay timer starts
When the ratio exceeds the set value and tripping is initiated as soon as set time is elapsed. Refer table–14 for this protections settings.

10) Trip Circuit Supervision (74TC)
This feature detects any anomalies in the circuit with the switch open or close. It detects trip circuit supply failure of circuit breaker, tripping mechanism failure like circuit breaker contact degeneration in wires, contacts and coils. Refer table–2 for this protections settings.

11) Auto Re-closer Strategy (79)
As 80% of faults in overhead lines are transient, the use of the auto recloser is very advantageous. Automatic auto-recloser allows a substation to operate unattended. The number of visits on site to manually reclose a circuit breaker after a fault, can then be substantially reduced. This feature gives an important advantage for substations supervised remotely.

Typically this auto reclose (AR) sequence of Instantaneous Trip(s) and Reclose Delays (Dead times) followed by Delayed Trip(s) provide the automatic optimum method of clearing all types of faults i.e. both Transient and Permanent, as quickly as possible and helps in improving the up time of the network in service.

DI Inputs:
AR Blocking - To block the auto recloser through remote DI
CB Close DI - To get the circuit breaker status
CB Ready - To get the CB ready or to give the closing command
Configurable Outputs:
79 AR Close CB
79 Lockout

AR - Blocked:
Unit changes immediately to "AR-blocked" status when an external AR Blocking DI is applied or internal EXIT is chosen for AR cycle in MMI. No Auto reclosing is possible in "AR-blocked" status.

Activating of AR:
Prior to every AR it is possible to select which kind of tripping (I> or I>>, Ie> etc.) will lead to automatic reclosing. This can be separately fixed for each protection.

Dead time (td):
Starts with the off signal of the circuit breaker. No closing command to the circuit breaker is given till expiry of the set dead time.

User programmable dead times are available for each protection trip operation.
The dead time is initiated when the trip output contact resets, the pickup is reset and the CB is open.
The CB close output relay is energized after the dead time has elapsed If CB ready input is present.
The dead time (dead time td1, dead time td2 dead time td3 dead time td4) starts when the feedback on 'CB CLOSE DI' is not available.

Reclaim time (tr):
This is the time during which after switching on or after AR a subsequent reclosing is prevented.
If the number of the set shots is reached, the relay is locked for this time after the last reclosing attempt.
If CB Ready DI is not available relay will not generate closing command.
If the circuit breaker dose not trip again, the auto reclose cycle resets to original STATE-1 at the end of the reclaim time.
successful reclosure the relays goes to the lock out state.

If the protection operates during the reclaim time of the relay:

- Either advances to the next AR cycle that is expected in next auto reclose state or
- If all the programmed recloser attempts have been accomplished, it locks out.

The reclaim time is started with the automatic closing command.

Once a CB has reclosed and remained closed for a specified time period (the reclaim time), the AR sequence is reinitialized and a successful close output issued. A single common reclaim time is used (Reclaim Timer). when an auto reclose sequence does not result in a Starting Condition for Auto recloser

1) AR should be enabled by manual setting.

2) AR blocked DI is not available

3) Respective protection AR cycle should not in exit condition.

Lock out State:

Lockout state of the breaker meansno further attempts to AR in these conditions

1) Lockout occurs when all auto reclosure attempts are over and protection operates during the final Reclaim Time.

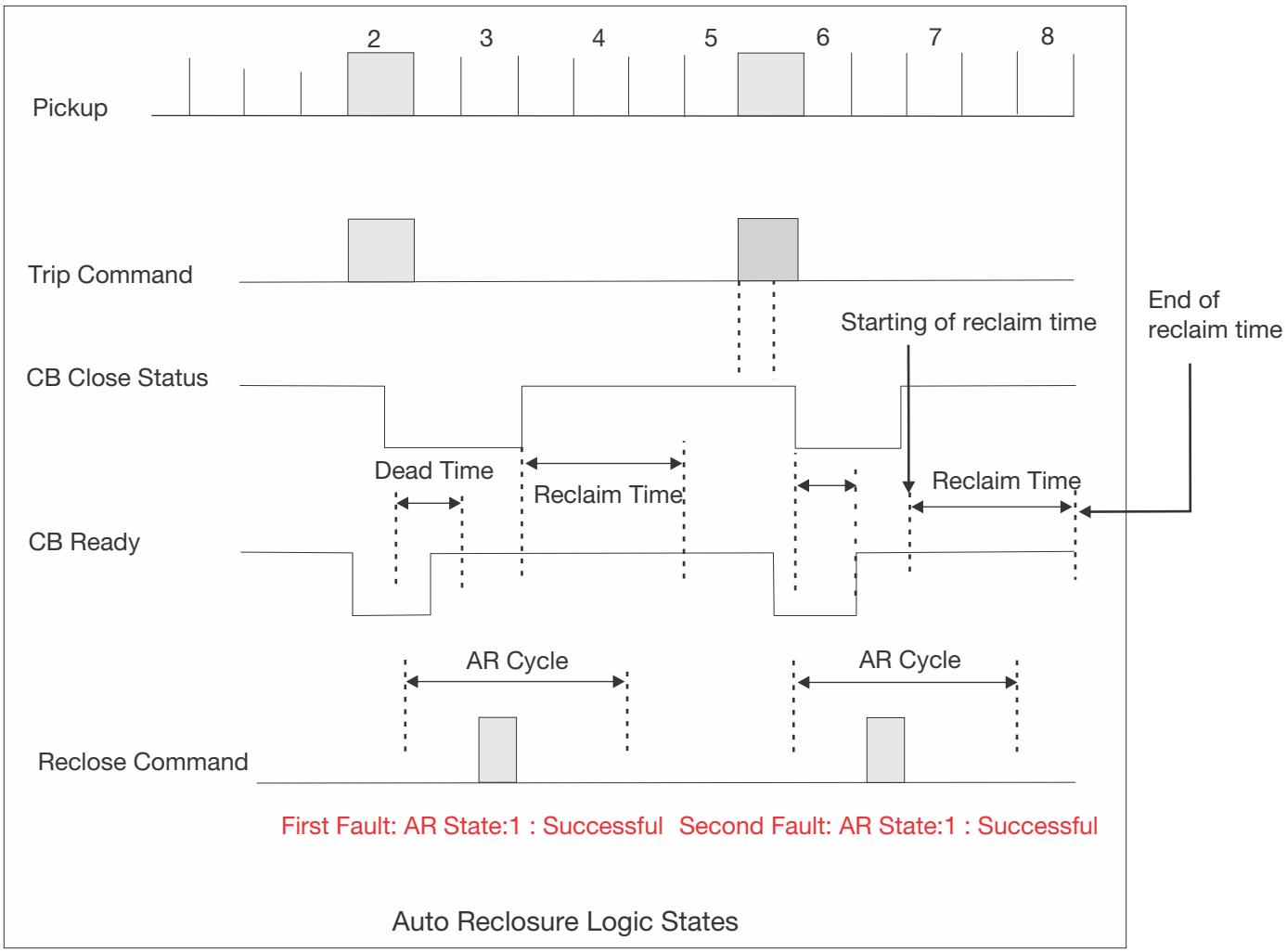
2) If CBFP failure appeared in relay (if CBFP enable).

3) At the end of the each reclaim timer if the CB is in the open position (Close DI is not present).

4) If a Close pulse of AR relay is given and the CB fails to close through close DI input or expiry of Trip Contact Sense time.

5) If a open pulse given to CB and CB fails to open in between Trip Contact Sense time.

In any of these cases, Manual reset will be required to reinitiate the AR. Refer table–15 for this protections settings.



(Figure-5)

Automation

Protection Function Locking

Each protection function can be locked via a digital input as selected and assigned in HMI.

8.0 Data Acquisition Function

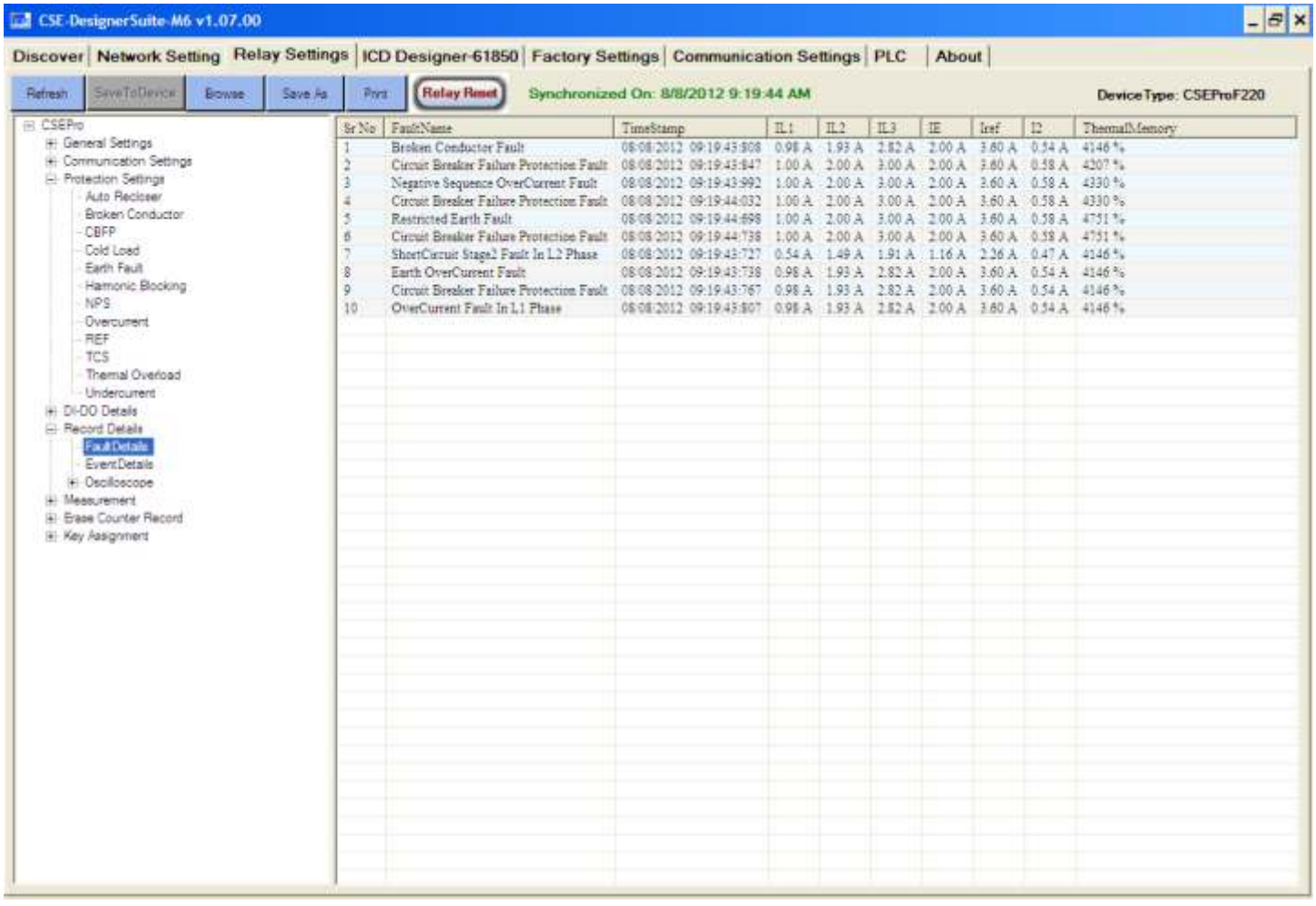
Measurement

- 3 Phase Current
- Earth current measurement
- Restricted earth current measurement
- Negative / Positive phase sequence current
- Trip counter
- Origin of last fault
- Percentage of harmonics
- Thermal memory
- Maxi meter
- AR cycles

9.0 Fault Record

CSEPRO-F records last 10 faults in its non volatile memory with its time stamp. Each record has the following information:

Fault Format					
I_{L1}	:	XX.XXA	I_2	:	XX.XXA
I_{L2}	:	XX.XXA	Them_mem	:	XXXX%
I_{L3}	:	XX.XXA	HR MIN	:	HH:MIN
Ie	:	XX.XXA	SEC Ms	:	Sec: mSec
Iref	:	XX.XXA	DATE	:	DD:MM:YR
			F-TYPE	:	Type of fault



(Figure-7) Fault Data recording on PC software

10.0 Event Record

The unit stores in non volatile memory the last 100 events with it's time stamp. When the available memory space is exhausted, the new event automatically overwrites the oldest event, which can be retrieved from a PC, with the following format:

EVENT : EVENT NUMBER

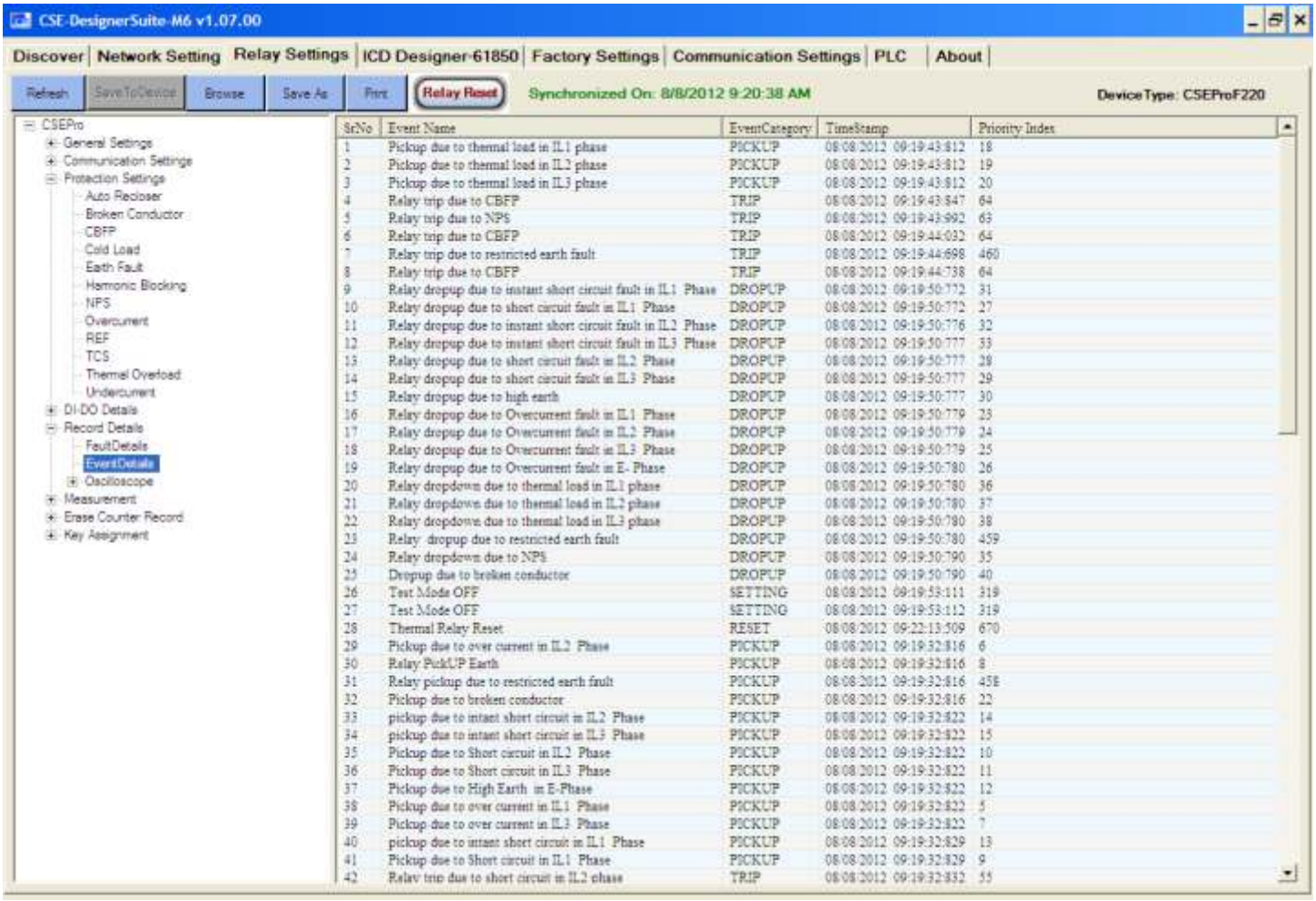
HOUR : HH.MM

SEC mSEC : SEC: mSEC

DATE : DD/MM/YY

The user can view event records via the front USB interface software

- Description of event number available in event list or in front end software.



SrNo	Event Name	EventCategory	TimeStamp	Priority Index
1	Pickup due to thermal load in IL1 phase	PICKUP	08/08/2012 09:19:43:812	18
2	Pickup due to thermal load in IL2 phase	PICKUP	08/08/2012 09:19:43:812	19
3	Pickup due to thermal load in IL3 phase	PICKUP	08/08/2012 09:19:43:812	20
4	Relay trip due to CBFP	TRIP	08/08/2012 09:19:43:847	64
5	Relay trip due to NPS	TRIP	08/08/2012 09:19:43:992	63
6	Relay trip due to CBFP	TRIP	08/08/2012 09:19:44:032	64
7	Relay trip due to restricted earth fault	TRIP	08/08/2012 09:19:44:698	460
8	Relay trip due to CBFP	TRIP	08/08/2012 09:19:44:738	64
9	Relay dropup due to instant short circuit fault in IL1 Phase	DROPUP	08/08/2012 09:19:50:772	31
10	Relay dropup due to short circuit fault in IL1 Phase	DROPUP	08/08/2012 09:19:50:772	27
11	Relay dropup due to instant short circuit fault in IL2 Phase	DROPUP	08/08/2012 09:19:50:776	32
12	Relay dropup due to instant short circuit fault in IL3 Phase	DROPUP	08/08/2012 09:19:50:777	33
13	Relay dropup due to short circuit fault in IL2 Phase	DROPUP	08/08/2012 09:19:50:777	28
14	Relay dropup due to short circuit fault in IL3 Phase	DROPUP	08/08/2012 09:19:50:777	29
15	Relay dropup due to high earth	DROPUP	08/08/2012 09:19:50:777	30
16	Relay dropup due to Overcurrent fault in IL1 Phase	DROPUP	08/08/2012 09:19:50:779	23
17	Relay dropup due to Overcurrent fault in IL2 Phase	DROPUP	08/08/2012 09:19:50:779	24
18	Relay dropup due to Overcurrent fault in IL3 Phase	DROPUP	08/08/2012 09:19:50:779	25
19	Relay dropup due to Overcurrent fault in E- Phase	DROPUP	08/08/2012 09:19:50:780	26
20	Relay dropdown due to thermal load in IL1 phase	DROPUP	08/08/2012 09:19:50:780	36
21	Relay dropdown due to thermal load in IL2 phase	DROPUP	08/08/2012 09:19:50:780	37
22	Relay dropdown due to thermal load in IL3 phase	DROPUP	08/08/2012 09:19:50:780	38
23	Relay dropup due to restricted earth fault	DROPUP	08/08/2012 09:19:50:780	459
24	Relay dropdown due to NPS	DROPUP	08/08/2012 09:19:50:790	35
25	Dropup due to broken conductor	DROPUP	08/08/2012 09:19:50:790	40
26	Test Mode OFF	SETTING	08/08/2012 09:19:53:111	319
27	Test Mode OFF	SETTING	08/08/2012 09:19:53:112	319
28	Thermal Relay Reset	RESET	08/08/2012 09:22:13:509	670
29	Pickup due to over current in IL2 Phase	PICKUP	08/08/2012 09:19:32:816	6
30	Relay PickUP Earth	PICKUP	08/08/2012 09:19:32:816	8
31	Relay pickup due to restricted earth fault	PICKUP	08/08/2012 09:19:32:816	458
32	Pickup due to broken conductor	PICKUP	08/08/2012 09:19:32:816	22
33	pickup due to intant short circuit in IL2 Phase	PICKUP	08/08/2012 09:19:32:822	14
34	pickup due to intant short circuit in IL3 Phase	PICKUP	08/08/2012 09:19:32:822	15
35	Pickup due to Short circuit in IL2 Phase	PICKUP	08/08/2012 09:19:32:822	10
36	Pickup due to Short circuit in IL3 Phase	PICKUP	08/08/2012 09:19:32:822	11
37	Pickup due to High Earth in E-Phase	PICKUP	08/08/2012 09:19:32:822	12
38	Pickup due to over current in IL1 Phase	PICKUP	08/08/2012 09:19:32:822	5
39	Pickup due to over current in IL3 Phase	PICKUP	08/08/2012 09:19:32:822	7
40	pickup due to intant short circuit in IL1 Phase	PICKUP	08/08/2012 09:19:32:829	13
41	Pickup due to Short circuit in IL1 Phase	PICKUP	08/08/2012 09:19:32:829	9
42	Relay trip due to short circuit in IL2 phase	TRIP	08/08/2012 09:19:32:832	55

(Figure-8) Event Data recording on PC Software

11.0 Disturbance Record

The CSEPRO-F relay has an oscillograph data recorder with the following characteristics:

- ❖ Oscilloscopic recording can trigger on Pickup or on trip or via DI i.e. change from pre-fault to post-fault stage. It is programmable.
- ❖ Each record comprises the samples from max. 4 analog signals (depends upon the different models) and the status of 6 digital inputs and 6 digital outputs. There will be 30 samples per cycle.
- ❖ Relay saves maximum 1200 cycles, and the number of cycles per record is programmable (for example: if 40 cycles are selected, then there will be maximum 30 records of 40 cycles each).
- ❖ The pre-fault and post-fault cycles are programmable.
- ❖ Records are in the non volatile memory.
- ❖ The records are transferred to PC using USB interface. The data is graphically displayed and can be taken on printer.
- ❖ Record 1 is always latest record. 2nd record is older than 1st..... and so on.
- ❖ Disturbance record in comtrade format as per IEC60255-24

(Figure-6) Oscilloscope recording on PC software

Output Contacts

No. of digital outputs	:	6 (DO1, DO2, DO3, DO4, DO5, DO6)
Type of outputs	:	Relay
Programmable (DO Assignment)	:	Yes
Relay reset type	:	Programmable (Auto/Manual)

Input Contacts

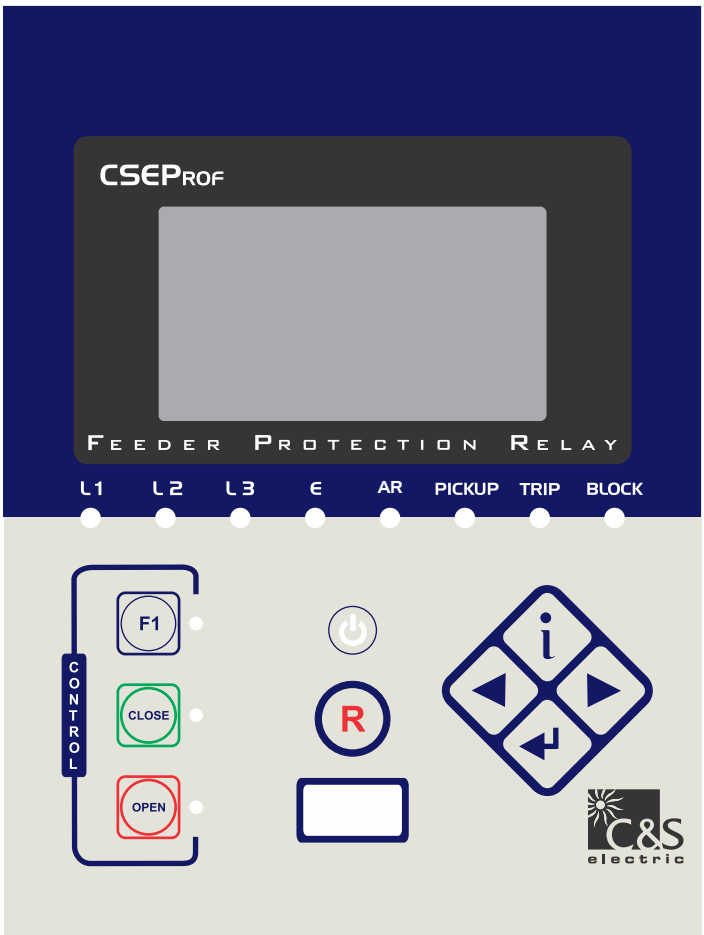
No of digital inputs	:	6 (DI1, DI2, DI3, DI4, DI5, DI6)
Type of inputs	:	AC/DC Voltage
Programmable (DI Assignment)	:	Yes

12.0 Human Machine Interface

CSEPRO-F offers a variety of front user interfaces, including:
Human-Machine Interface (HMI)
It comprises of alphanumeric display of 16x4 and 8 push buttons for setting and other operations for local access:

- ❖ Two push switches for set values of normal tripping characteristics.
- ❖ One 'RESET' push switch & One 'ENTER' push switch.
- ❖ One intelligent (I) Key.
- ❖ One push switch for the tripping of relay assigned to 'F1' Key.
- ❖ Two push switches for the tripping of relay assigned to Circuit breaker open & Circuit breaker close.
- ❖ Eight LEDs for pickup or tripping on fault's & events in any phase (See Figure-9).

In order to change any setting first press enter (↵) then only (◀ / ▶) key will act as decrement/increment else these key will function as scroll in backward/forward direction.



Keys	Manual Key
	is used as intelligent key to see the details of the fault pickup / digital input / output status & last fault details.
	is used as a “ENTER” key.
	is used to manual reset (after pressing for 2 sec).
	is used to scroll in backward direction and for decrement of parameters.
	is used to scroll in forward direction and for increment of parameters.
	To perform the assigned task DO Trip, Relay reset or thermal reset.
	To open the circuit breaker.
	To close the circuit breaker.

13.0 Communication (Local & Remote)

The unit has:

- 1 Front USB port for direct connection to a PC.
- 1 Rear RS-485 communication port.
- 1 Rear terminal can be for: RJ-45 or plastic F.O.

Rear Communication (RS-485)

The protocol for the rear port is programmable. The user can choose either MODBUS or IEC 870-5-103 protocol for RS-485 communication.

Front Communication (USB)

The entire setting including protection parameter setting for both group, Fault, Event & Disturbance record are available on ‘A’ type USB (female) interface with CSE LIVELINK with saving & printing option. This unit also has Front-end Live Link simulation support for

14.0 Setting Ranges

Active Group Setting

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Active Group	ACTIVE	Group1	Group3	1	Group1
Group Toggle Step	TOGLE STEP	+1	+2	1	+1

(Table-1)

Trip Circuit Supervision

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Trip circuit supervision	TCS	0.03 Sec	2 Sec	0.01 Sec	Disable

(Table-2)

Negative Phase Sequence Protection Setting

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
NPS pickup setting	I_2	0.1xIp	1.0xIp	0.01xIp	Disbale
NPS trip characteristic	CHAR	DEFT	INVERSE	-	DEFT
Time multiple	K1	5	600	1	5
Definite time delay	td	0.1 Sec	600 Sec	0.1 Sec	0.2 Sec

(Table-3)

Earth Fault Protection

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Earth characteristic	E-CURVE	DEFT	EINV, VINV, LIINV, NINV1.3, NINV3.0, NINV0.6	-	DEFT
Earth pickup setting	Ie>	0.05xIn	2.5xIn	0.01xIn	Disable
Earth inverse timing	tie>	0.01	1.5	0.005	0.01
Earth definite timing	te>	0.03 Sec	150 Sec	0.01 Sec	0.03 Sec
Earth hi-set pickup setting	Ie>>	0.5xIn	8xIn	0.05xIn	Disable
Earth hi-set definite timing	te>>	0.02 Sec	20 Sec	0.01Sec	0.02 Sec

(Table-4)

Over Current Protection

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Phase trip characteristic	PCURVE	DEFT	EINV,VINV,LIINV,NINV1.3, NINV3.0,NINV0.6	-	DEFT
I> pickup setting	I>	0.2xIp	4xIp	0.01xIp	Disable
I> inverse timing	ti>	0.01	1.5	0.005	0.01
I> definite timing	t>	0.1 Sec	150 Sec	0.01Sec	0.1 Sec
I>> pickup setting	I>>	0.5xIp	30xIp	0.5xIp	Disable
I>> definite timing	t>>	0.02 Sec	20 Sec	0.01 Sec	0.02 Sec
I>>> pickup setting	I>>>	0.5xIp	30xIp	0.5xIp	Disable
I>>> definite timing	t>>>	0.02 Sec	20 Sec	0.01Sec	0.02 Sec

(Table-5)

(1) Refer following formula for EINV, VINV, LINV, NINV1.3, NINV3.0 characteristics:

Very Inverse $t = \frac{13.5}{(I / Is) - 1} ti$ [s]

Extremely Inverse $t = \frac{80}{(I / Is)^2 - 1} ti$ [s]

Long time Inverse $t = \frac{120}{(I / Is) - 1} ti$ [s]

Normal Inverse 3.0/1.3/0.6 $t = \frac{0.14/0.061/0.028}{(I / Is)^{0.02} - 1} ti$ [s]

Where t =Tripping time ti =Time multiplier

I =Fault current Is =Setting value of current

Circuit Breaker Failure Protection

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Circuit breaker failure protection time delay	tCBFP	0.03 Sec	2 Sec	0.01 Sec	Disable

(Table-6)

Harmonic Restrain

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Phase 2nd harmonic block	P2ndH	10%If	50%If	2	Disable
Phase 3rd harmonic block	P3rdH	10%If	50%If	2	Disable
Earth 2nd harmonic block	E2ndH	10%If	50%If	2	Disable
Earth 3rd harmonic block	E3rdH	10%If	50%If	2	Disable
Phase blocking time	tPHASE	0 Sec	20 Sec	0.1 Sec	0 Sec
Earth block time	tEARTH	0 Sec	20 Sec	0.1 Sec	0 Sec

(Table-7)

Restricted Earth Fault Protection

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
REF pickup current	Iref>	0.2xIn	30xIn	0.01xIn	Disable
REFtrip time	tref>	0 Sec	10 Sec	0.01Sec	1.0 Sec
Earth CT correction factor	ECTcorr	0.1	4.0	0.01	1.0

(Table-8)

Under Current Protection

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Under Current Pickup Setting	I<	0.2xIp	1xIp	0.01xIp	Disable
Under Current Timing	td<	1 Sec	260 Sec	0.01 Sec	1Sec
Under Current Threshold	ThrsSet	0.50xIp	1xIp	0.05xIp	Disable

(Table-9)

Cold Load Protection

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Mode of Trigger	MODE	Cold Load	DI, Inrush	1	Disable
Cold load time	tCold	0 Sec	10000 Sec	1 Sec	20 Sec
Cold load pickup time	tClp	1 Sec	3600 Sec	1 Sec	20 Sec
Inrush percentage setting	If2/If1	20%	100%	5%	20%

(Table-10)

DO Assignment

Parameters	Display
Over current protection	I>
Short circuit stage1 protection	I>>
Short circuit stage2 protection	I>>>
Earth protection	Ie>
Earth high protection	Ie>>
Under current protection	I<
Restricted earth fault protection	Iref>
Negative phase sequence protection	I2>
Thermal relay	ThrmlRly
Thermal alarm	ThrmAlrm
Trip circuit supervision	TCS
Circuit breaker failure protection	CBFP
Self supervision	SELF SUP
Broken conductor protection	BrknCond
Auto reclose	AR CLOSE
Autro reclose lockout	Arlckout
Circuit breaker open	CB open
Circuit breaker close	CB close
Remote trip-1	Rmt Trp1
Remote trip-2	Rmt Trp2
Remote trip-3	Rmt Trp3
Remote trip-4	Rmt Trp4
Remote trip-5	Rmt Trp5
Remote trip-6	Rmt Trp6

(Table-11)

DI Assignment

Parameters	Display
Circuit breaker close	CB Close
Circuit breaker open	CB Open
Remote trip-1	Rmt Trp1
Remote trip-2	Rmt Trp2
Remote trip-3	Rmt Trp3
Remote trip-4	Rmt Trp4
Remote trip-5	Rmt Trp5
Remote trip-6	Rmt Trp6
Group toggle	GRP togg
Remote reset	RMT RSET
Oscillator trigger	OSC Trig
Cold load	CLD LOAD
Over current block	I>BLK
Short circuit stage1 block	I>>BLK
Short circuit stage2 block	I>>>BLK
Earth block	E>BLK
Earth high block	E>>BLK
Under current block	UC BLK
Restricted earth fault block	REF BLK
Negative phase sequence block	NPS BLK
Thermal block	ThrmlBLK
Broken conductor block	BC BLK
Cold load pickup block	CLP BLK
Auto reclose block	AR BLK

(Table-12)

Function Reset

Parameters	Display
Over current protection	I>
Short circuit stage1 protection	I>>
Short circuit stage2 protection	I>>>
Earth protection	Ie>
Earth high protection	Ie>>
Under current protection	I<
Restricted earth fault protection	Iref>
Negative phase sequence protection	I2
Thermal relay	Thermal
Thermal alarm	ThrmAlrm
Trip circuit supervision	TCS
Broken conductor protection	BrknCond
Auto reclose	AR CLOSE
Remote trip-1	Rmt Trp1
Remote trip-2	Rmt Trp2
Remote trip-3	Rmt Trp3
Remote trip-4	Rmt Trp4
Remote trip-5	Rmt Trp5
Remote trip-6	Rmt Trp6

(Table-13)

Broken Conductor Protection

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
NPS to PPS ratio	I2/I1 Ratio	0.1	0.5	0.01	Disable
Definite time for broken conductor fault	td(BC)	0.05 Sec	20 Sec	0.01 Sec	0.10 Sec

(Table-14)

Auto Recloser Setting

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Blocking of Auto-recloser	ENABLE	NO	YES	-	NO
Set Dead Time-1	D1	0.2 Sec	300 Sec	0.01 Sec	0.2 Sec
Set Dead Time-2	D2	0.2 Sec	300 Sec	0.01 Sec	0.2 Sec
Set Dead Time-3	D3	0.2 Sec	300 Sec	0.01 Sec	0.2 Sec
Set Dead Time-4	D4	0.2 Sec	300 Sec	0.01 Sec	0.2 Sec
Set Reclaim Time	tR	0.2 Sec	300 Sec	0.01 Sec	0.2 Sec
Cycle I>	Cycle I>	2	4/Disable	1	2
Cycle I>>	Cycle I>>	2	4/Disable	1	2
Cycle I>>>	Cycle I>>>	2	4/Disable	1	2
Cycle Ie>	Cycle Ie>	2	4/Disable	1	2
Cycle Ie>>	Cycle Ie>>	2	4/Disable	1	2
Trip sense time	t_TST	0.05 Sec	2 Sec	0.01Sec	0.05 Sec

(Table-15)

Thermal Over-load setting

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Thermal memory mode	TMemMod	M1	M3	1.0	M1
Permissible basic current	Ib	0.2xIp	4xIp	0.02xIp	Disable
Constant	K	0.5	2	0.01	1
Heating time constant	Th	0.5 Min	180 Min	0.10 min	0.5 Min
Cooling constant	Tc	1xTh	8xTh	0.01xTh	1xTh
Thermal alarm	Alarm_R	20%	99%	1%	20%
NPS weighting factor	I2_Wgt	0.05	2.5	0.05	2.5
Thermal reset	TH_RST	0%	99%	1%	70%
Thermal trip characteristics	ThChar	th1	th2	1	th1

(Table-16)

Erase Counter Record

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Trip Count	Trip-Cntr	NO	YES	1	NO
Thermal Memory Reset	ThrmMemRset	NO	YES	1	NO
Erase Maxi-meter	MaxMetrRset	NO	YES	1	NO
Erase Events	EventsErase	NO	YES	1	NO
Erase Faults	FaultErase	NO	YES	1	NO
Oscillator Record Erase	OscRcrdEras	NO	YES	1	NO
Energy Counter Erase	EnrgCntrRst	NO	YES	1	NO

(Table-17)

Common Setting

These are the setting's common for all the protections:

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Rated phase current	Ip	1.00 Amp	5.00 Amp	-----	1.0 Amp
Rated earth current	In	1.00 Amp	5.00 Amp	-----	1.0 Amp
Phase CT ratio	Ph CTRatio	1	9999	1	1
Earth CT ratio	E CT Ratio	1	9999	1	1
Nominal frequency	FREQ(Fn)	50 Hz	60 Hz	-----	50 Hz
Fault Message Status	[F]Stats	DISABLE	ENABLE	-----	ENABLE

(Table-18)

Oscilloscope (Disturbance) Record Setting

These are the settings for Oscilloscope

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Oscilloscope recording selection	RECORD	NO	YES	-----	NO
Pre-fault cycle	PRE CYCLE	2 cycles	298 cycles	-----	2 Cycle
Post-fault cycle	POST CYCLE	2 cycles	298 cycles	-----	2 Cycle
Triggering mode	TRIG. MODE	PK-UP	PK-UP/TRIP/DI/ Anyone	-----	PK-UP

(Table-19)

Communication

RS-485 Communication		Default Setting
Baud rate selection (programmable)	9600 / 19200 / 38400 bps	19200 bps
Parity selection (programmable)	Even / Odd / None	None
Stop bit	1 Bit	1 Bit
Data bit	8 Bit data	8 Bit data
Remote address (programmable)	247/254	1
Cable required for Interface	Two wire twisted shielded cable	------

(Table-20)

* For MODBUS : Remote Address Setting Range is 1 - 247
& For IEC 103 : Remote Address Setting Range is 1 - 254

USB Communication	
Protocol	CSE Proprietary Protocol: available with front software
Baud rate	19200 bps
Cable required for Interface	USB cable type (A to A)

(Table-21)

15.0 Technical Data

Measuring Input

Rated data	Rated current Ip : 1A & 5A Rated frequency Fn : 50Hz / 60Hz
Thermal withstand capability in current circuit	At Ip : 1A Continuous=5xIp for 10 Sec=30xIp for 1 Sec=100xIp At Ip : 5A Continuous=3xIp for 10 Sec=10xIp for 1 Sec=20xIp
Nominal burden	For phase=<0.2VA For earth=<0.2VA

(Table-22)

Trip Time Accuracy for Current Protections

Parameters	Accuracy
Trip time accuracy for protections except NPS & REF	+30mSec OR +5% (whichever is higher)
Trip time accuracy for NPS	+60mSec OR +7.5% (whichever is higher)
Trip time accuracy for REF	Corresponding to error generated by inaccuracies in each phase +30mSec OR +5% (whichever is higher)

(Table-23)

Measurement Accuracy

Parameters	Range	Frequency Range	Accuracy
Current in Ampere	1.0-30xIn	50-60Hz	Less than+2%

(Table-24)

Trip Contact Rating

Contact rating	
Contact relay	Dry contact Ag Ni
Make current	Max. 30A & carry for 3S
Carry capacity	8A continuous
Rated voltage	250V AC / 30V DC
Breaking characteristics	
Breaking capacity AC	1500VA resistive 1500VA inductive (PF=0.5) 220V AC, 5A(cosØ=0.6)
Breaking capacity DC	135V DC, 0.3A (L/R=30ms) 250V DC, 50W resistive or 25W inductive (L/R=40ms)
Operation time	<10ms
Durability	
Loaded contact	10,000 operation minimum
Unloaded contact	30,000 operation minimum

(Table-25)

Auxiliary Supply

Rated auxiliary voltage UH	For 'L' Model	18V-60V DC
	For 'H' Model	85V-280V AC / 110V-300V DC
Rated supply for digital input	Normal Voltage UN For 'H' Model	80V-260V AC (Active)
		48V-300V DC (Active)
		<30V DC (Inactive)
		<50V AC (Inactive)
	Normal Voltage UN For 'L' Model	24V - 60V DC (Active)
		<18V DC (Inactive)
Power consumption	Quiescent approx. 3W	Operating approx. <7W

(Table-26)

Common Data

Dropout ratio	> 96%
Relay reset time	30 ms
Minimum operating time	30 ms
Transient overreach at instantaneous operation	≤5 %

(Table-27)

Date & Time Setting

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Hour	HOUR	0	23	1	---
Minute	MIN	0	59	1	---
Second	SEC	0	59	1	---
Date	DATE	1	31	1	---
Day	DAY	SUN	SAT	1	---
Month	MONTH	1	12	1	---
Year	YEAR	0	99	1	---

(Table-28)

16.0 Standards

Design Standards

IEC 60255-22-[1-6]
IEC 60255-5

16.1 HIGH VOLTAGE TESTS:

High Frequency Interference Test

IEC 60255-22-1	:		
Class 3	:	Auxiliary Supply	2.5 kV/2 s
	:	Circuit to Earth	2.5 kV/2 s
Dielectric Voltage Test			
IEC 60255-5/EN 50178	:	i) All Input / Output circuits to Earth	2.5 kV (eff)/50Hz, 1 min.
		ii) Between Input & Output Circuits	
Impulse Voltage Test			
IEC 60255-5	:	i) All Input/ Output circuits to Earth	5kV / 0.5J, 1.2/50 µs
		ii) Between Input & Output Circuits	

16.2 EMC IMMUNITY TESTS

Fast Transient Disturbance Immunity Test (Burst)

IEC 60255-22-4	:	Power supply, mains inputs	+4 kV, 2.5 kHz
IEC 61000-4-4			
Class 4	:	Other in and outputs	+2 kV, 5 kHz

Surge Immunity Test

IEC 61000-4-5	:	Within one circuit	2 kV, Differential Mode, Level 4
Class 4			
	:	Circuit to Earth	4 kV, Common Mode, Level 4

Electrical Discharge Immunity Test

IEC 60255-22-2	:	Air discharge	8 kV
IEC 61000-4-2			
Class 3	:	Contact Discharge	6 kV

Radiated Immunity Test

EN 61000-4-3 / IEC60255-22-3 : Level 3, 10V/m 80MHz to 1GHz @ 1kHz 80% AM

Conducted Immunity Test

EN 61000-4-6 / IEC60255-22-6 : Level 3, 10V rms @ 1kHz 80% AM, 150KHz to 80Mhz

Power Frequency Magnetic Field Immunity Test

IEC61000-4-8 : Level 5, 100A/m applied continuously, 1000A/m for 3s.

EMC Emission Tests

Radio Interference Suppression Test

IEC-60255-25/EN55011/CISPR11 Limit value class A

0.15 - 0.5MHz, 79dBµV (quasi peak) 66dBµV (average)
0.5 - 30MHz, 73dBµV (quasi peak) 60dBµV (average)

Radio Interference Radiation Test

IEC 60255-25 / EN55011 / CISPR11 Limit value class A

30 - 230 MHZ, 40 dB V/m at 10m measurement distance

230 - 1 GHz, 47 dB V/m at 10m measurement distance

16.3 ENVIRONMENTAL TESTS

Temperature

IEC 60068-2-1	:	Storage : –25°C to + 85°C	
IEC 60068-2-2	:	Operation : –25°C to + 70°C	

Test Bd: Dry Heat

IEC 60068-2-2	:	Temperature	55°C
	:	Relative humidity	<50%
	:	Test duration	72 h

Test Bd: Dry Heat

IEC 60068-2-2	:	Temperature	70°C
	:	Relative humidity	<50%
	:	Test duration	2h
		(The clearness of the display is constricted)	

Test Db: Damp Heat (Cyclic)

IEC 60068-2-30	:	Temperature	55°C
	:	Relative humidity	95%
	:	Cyclic duration (12 + 12 Hours)	2

16.4 MECHANICAL TESTS

Test: Vibration Response Test

IEC 60068-2-6	:	(10Hz – 59 Hz)	0.035 mm
IEC 60255-21-1		displacement	
Class 1	:	(59Hz-150Hz)	0.5 gn
		Acceleration	
	:	No. of cycles in each axis	1

Test: Vibration Endurance Test

IEC 60068-2-6	:	(10Hz-150Hz)	1.0 gn
IEC 60255-21-1		Acceleration	
Class 1	:	No. of cycles in each axis	20

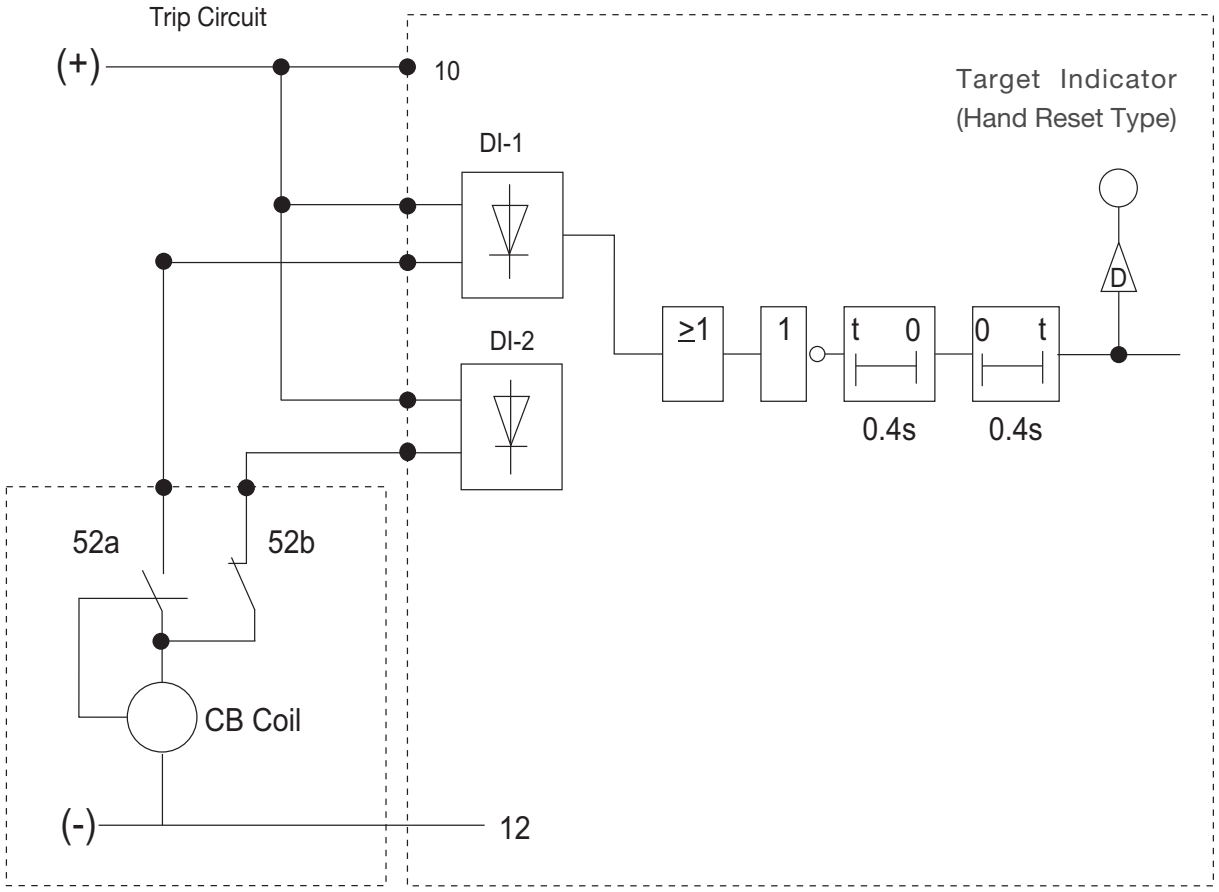
Test: Shock Tests

IEC 60068-2-27	:	Shock response test	5 gn, 11 ms, 3 impulses in each direction
IEC 60255-21-2			
Class 1	:	Shock resistance test	15 gn, 11 ms, 3 impulses in each direction

Test: Shock Endurance Test

IEC 60068-2-29	:	Shock endurance test	10 gn, 16 ms, 1000 impulses in each direction
IEC 60255-21-2			
Class 1			

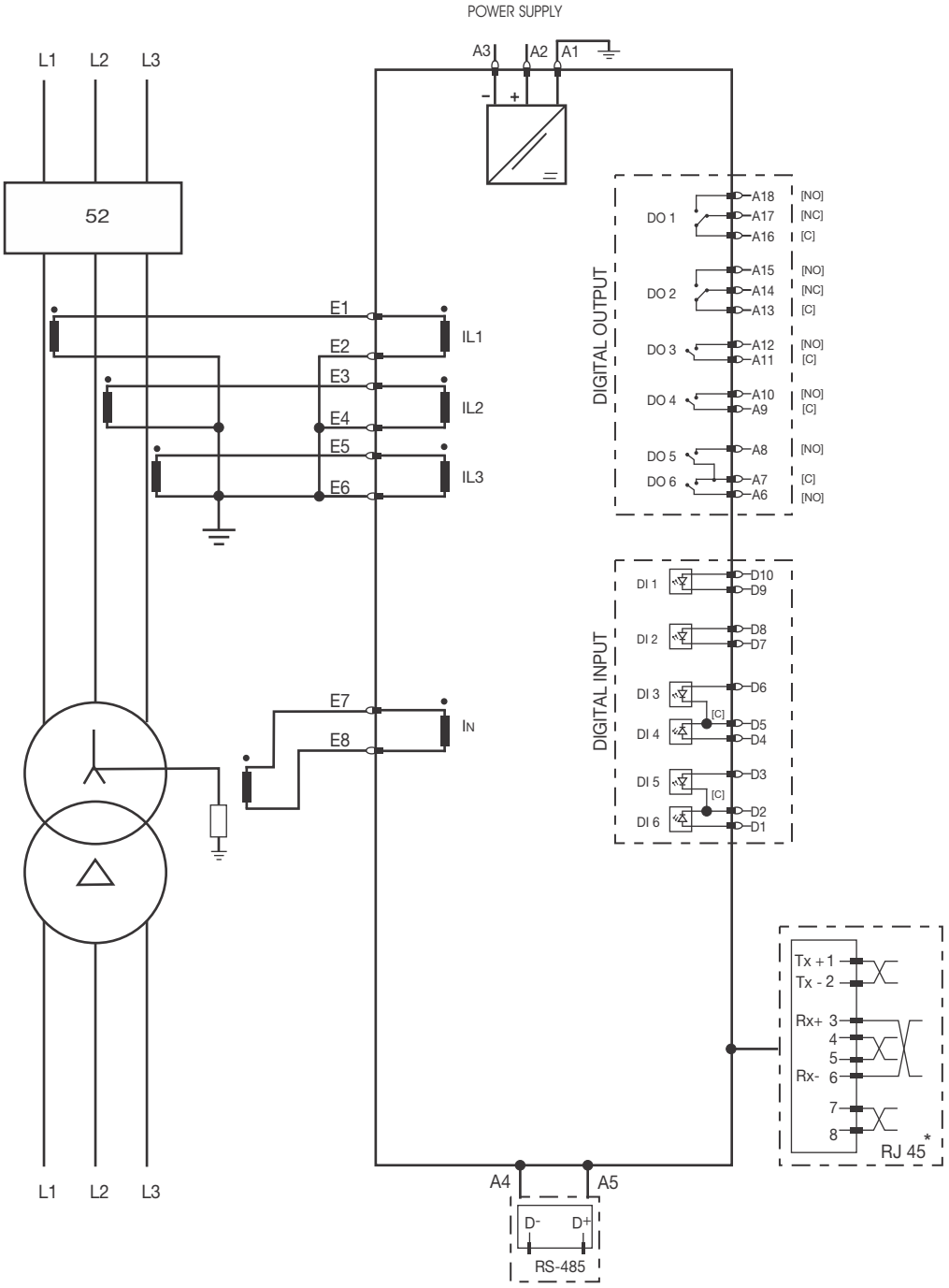
17.0 Trip Circuit Supervision Diagram



(Figure-7) (Trip Circuit Supervision Function)

18.0 Connection Diagram

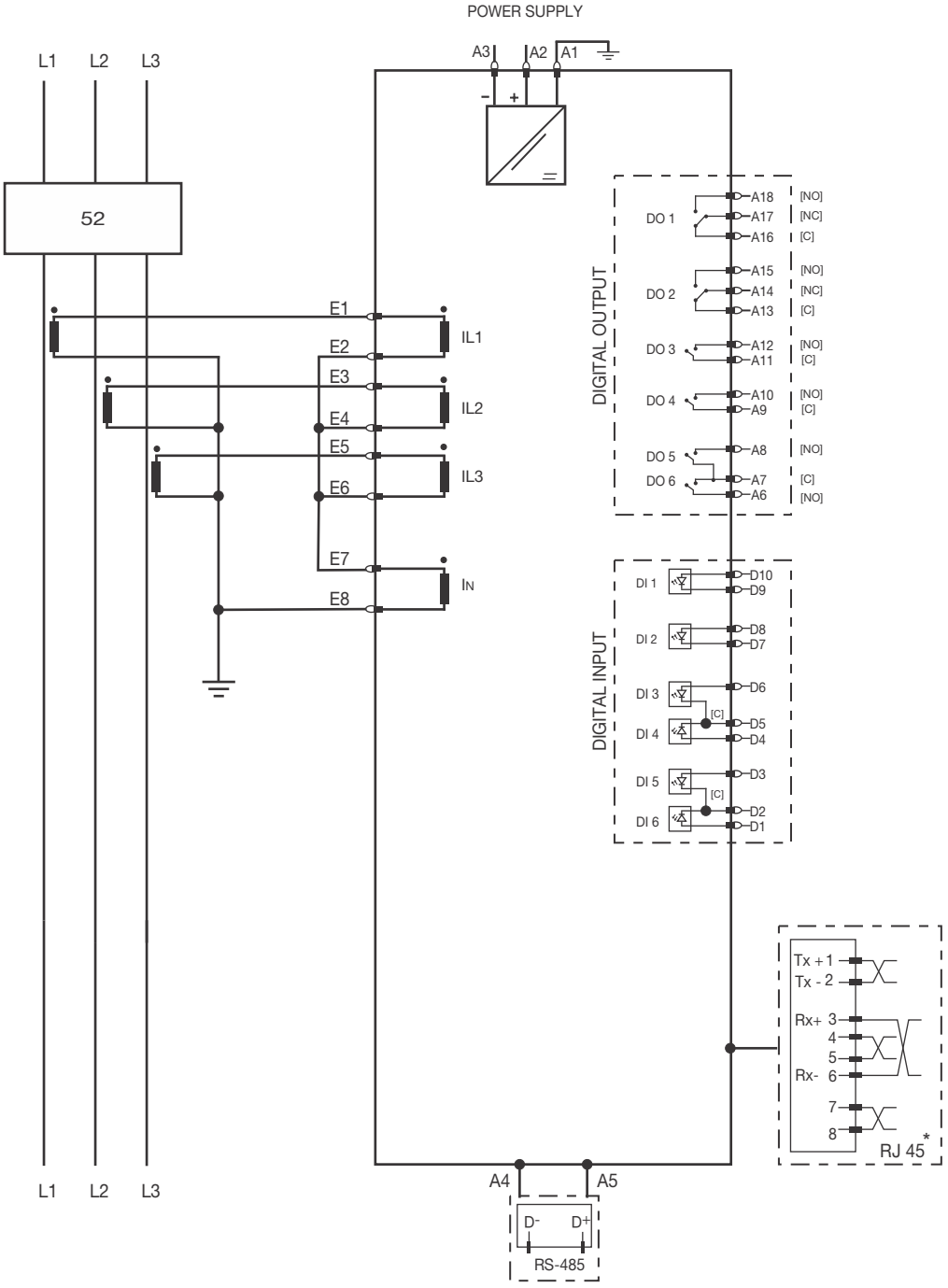
3 Phase Over current & Restricted Earth Protection



(Figure-9)

Connection Diagram

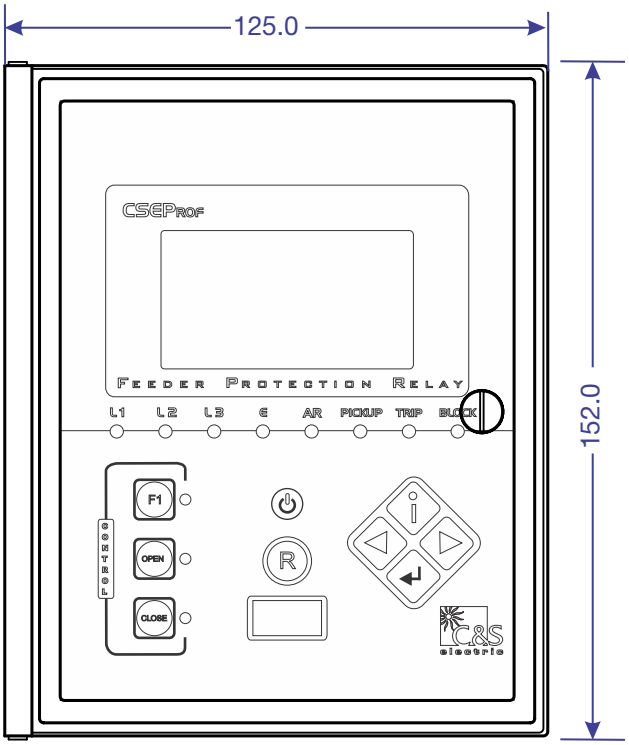
3 Phase Neutral Over current Protection



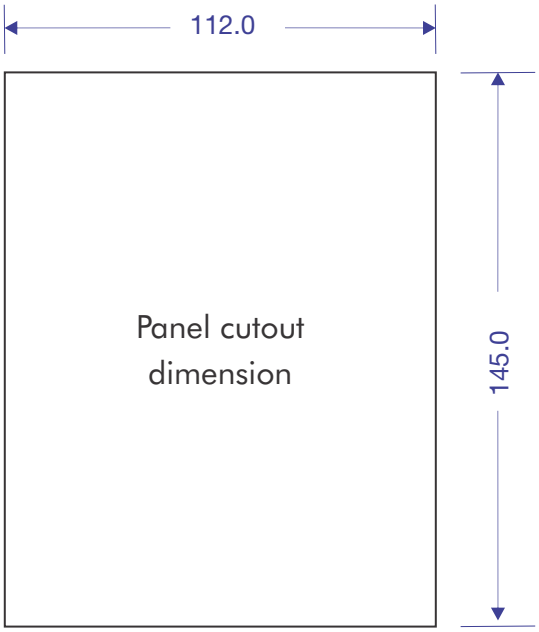
(Figure-10)

19.0 Dimension Details (All the dim. are in mm)

Front View

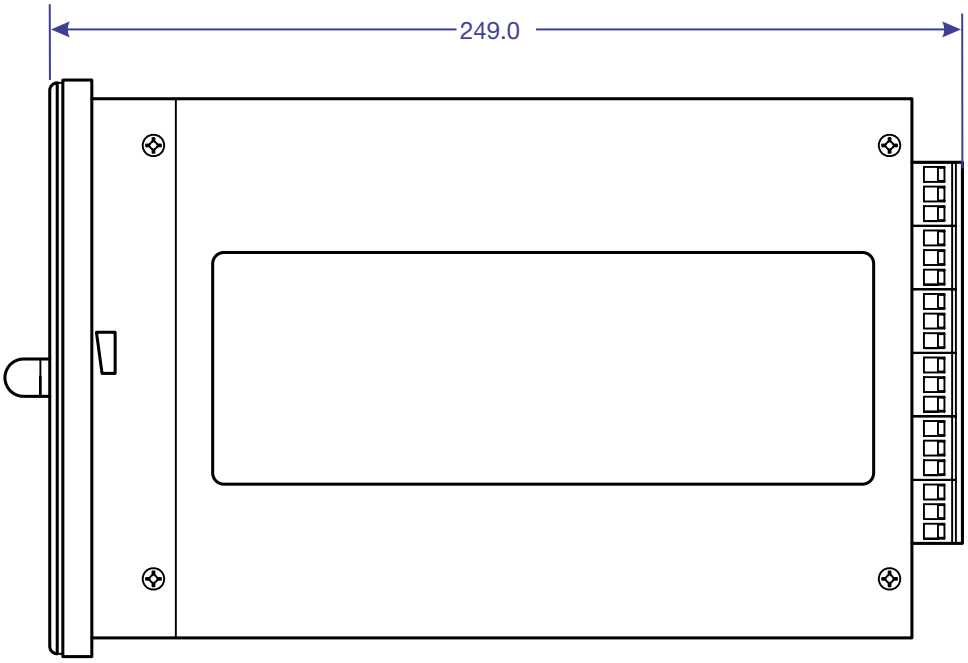


(Figure-11)



(Figure-12)

Side View



(Figure-13)

20.0 Model Selection Table

CSEPRO-F Series	ANSI	F120	F220	F300	F350	F400	F500
CT Inputs		-	4	4	4	-	4
VT Inputs		4	-	3	3	4	4
Opto Inputs (Max)		4	6	6	6	6	6
Output Contacts (Max)		4	6	6	6	6	6
Function Keys/Hot Keys		●	●	●	●	●	●
Programming Logic		-	●	●	●	●	●
Protection							
3 Phase Over-Current	50/51P	-	●	●	●	-	●
Ground Fault	50/51N	-	●	●	●	-	●
Phase Directional	67P	-	-	-	●	-	-
Ground Fault Directional	67N	-	-	-	●	-	-
Sensitive Earth Fault	50/51SN	-	-	-	-	-	-
Restricted Earth Fault	64	-	●	●	●	-	●
Voltage Controlled Over-Current	51V	-	-	●	●	-	●
Negative Sequence Over-Current	46	-	●	●	●	-	●
Thermal Over-Load	49	-	●	●	●	-	●
Under-Current	37	-	●	●	●	-	●
Over/Under Voltage	27/59	●	-	●	●	●	●
Residual Over-Voltage	59N	●	-	●	●	●	●
Negative Sequence Over-Voltage	47	●	-	●	●	●	●
Over/Under Frequency	81O/U	-	-	-	-	●	●
Rate of change of Frequency	81R	-	-	-	-	●	●
Circuit Breaker Failure	50BF	●	●	●	●	●	●
Auto Reclose	79	-	●	●	●	-	●
Broken Conductor	46BC	-	●	●	●	-	●
Cold Load Pick-up		-	●	●	●	-	●
Inrush Blocking		-	●	●	●	-	●
Trip Circuit Supervision	74TC	●	●	●	●	●	●
Communication							
Front (USB)		●	●	●	●	●	●
RS-485 Modbus		●	●	●	●	●	●
Modbus on Fiber Optics		○	○	○	○	○	○
RJ-45 Modbus TCP/IP		○	○	○	○	○	○
IEC 60870-5-103 on Fiber Optics		○	○	○	○	○	○
RJ-45 IEC 60870-5-101		○	○	○	○	○	○
RS-485 IEC 60870-5-103		○	○	○	○	○	○
RJ-45 IEC 61850		○	○	○	○	○	○
SNTP-Time Synch RJ-45		○	○	○	○	○	○
Web Server on RJ-45		○	○	○	○	○	○

○ Optional-Based on ordering information.

(Table-29)

21.0 Ordering Information

CSEPROF-220 - X - X

Rear Communication Protocol	
MODBUS on RS-485	M
IEC 60870-5-103 on RS-485	I 103
IEC 61850 on Ethernet	I 650
MODBUS on TCP/IP RJ45	MT

AUXILIARY SUPPLY	
18 - 60V DC	L
85-280V AC / 110-300V DC	H

Example : CSEPROF-220-M-L

Revision History

S.No.	Rev.No.	Details	Date
01	09	Inclusion of TCS Diagram	05.08.14

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