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CSEZEN-T 240

Advance Transformer Protection & Monitoring IED



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ZEN **E**-Series

Catalogue



PMD Division

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1.0 Introduction

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

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

In this family of CSEZEN series, the CSEZEN-T is an advanced Transformer protection relay designed for controlling, protecting and monitoring industrial installations, public distribution networks and substations.

CSEZEN-T 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.

CSEZEN-T offers following features in a compact & smart flush mounting enclosure.

- ❖ Programmable Rated Current 1A & 5A for HV & LV winding
- ❖ Measurement, Protection & Metering
- ❖ Draw-out enclosure have modular design with CT shorting
- ❖ Communication (Local & Remote)
- ❖ DI/DO/LED Matrix Programmability
- ❖ Intelligent key for DI & DO status, details of fault pickup & status of last fault occurred
- ❖ Last 20 fault record (non-volatile memory) with time stamp
- ❖ Last 500 event record (non-volatile memory) with time stamp
- ❖ Disturbance Recording
- ❖ CSEZEN-T relays are equipped with self supervision function

2.0 Application

CSEZEN-T relay will cover wide range of protection functions required for Transformer segment. It can be used as part of protection scheme for transformers and generator transformers. CSEZEN-T relays can also provide back-up protection for HV and EHV transmission systems.

3.0 Hardware

- ❖ Digital Signal Processor based numeric design
- ❖ Measures true RMS with DFT filter
- ❖ 1A & 5A site selectable
- ❖ CT Terminal with self shorting
- ❖ 8 Current Analog Input
- ❖ Max.12 Digital Inputs
- ❖ Max. 12 Digital Outputs
- ❖ 10 LEDs at Pickup & Trip on fault
- ❖ LAN-RJ45/RS-485/USB ports for Communication
- ❖ 20x4 Bright Alpha numeric LCD
- ❖ 11 Push button on the front for HMI
- ❖ USB with Laptop / Pen-drive OTG interface

4.0 Relay Features

- ❖ DO Programmable Matrix
- ❖ DI Programmable Matrix
- ❖ Breaker Control (open/closed) using front keys
- ❖ Function Key programmable for various functions
- ❖ Time Synchronization via SNTP
- ❖ Three Phase Differential Percentage Protection (87) with Harmonic Blocking
- ❖ Three Phase Instantaneous Differential Protection (87)
- ❖ Three Phase Time and Instantaneous Over-current Protection (50/51) (HV & LV side)
- ❖ Low Impedance Restricted Earth Protection (87G) (HV & LV side)
- ❖ Earth Fault (51G) and Instantaneous Over-current Protection (50G) (HV & LV side)
- ❖ Current Unbalance (46) (HV & LV side)
- ❖ Four Setting Groups
- ❖ Fault Recorder
- ❖ Event Recorder
- ❖ Oscilloscope Data Recording
- ❖ Multi protocol communication Modbus RTU, IEC-103, IEC-61850

5.0 Supervision Functions

- ❖ Output Relay Latching (86)
- ❖ Open-Close Breaker Command
- ❖ Circuit Breaker Failure (50BF) (HV & LV side)
- ❖ Trip Circuit Supervision (74TC) (HV & LV side)

6. Functional Diagram

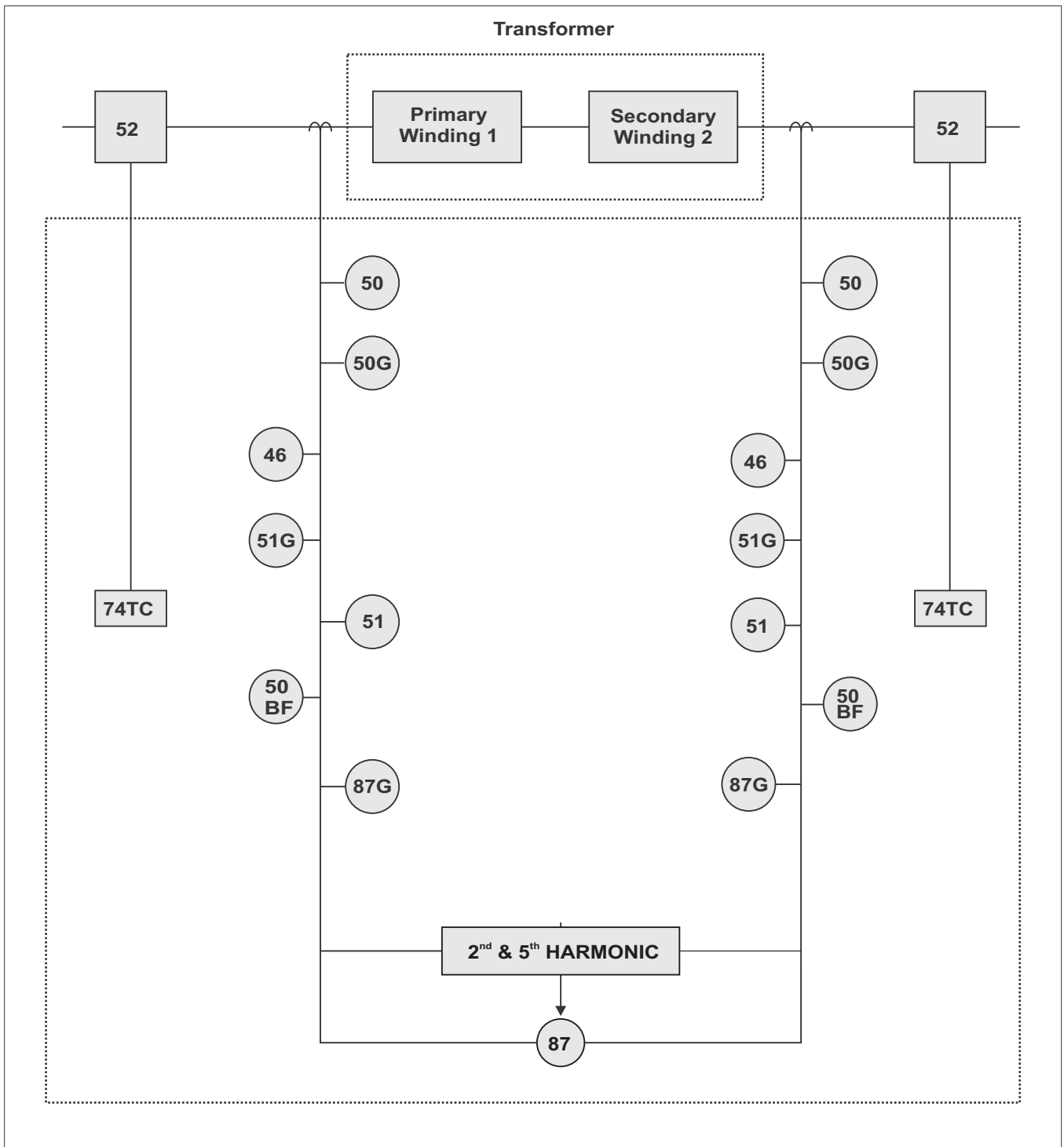


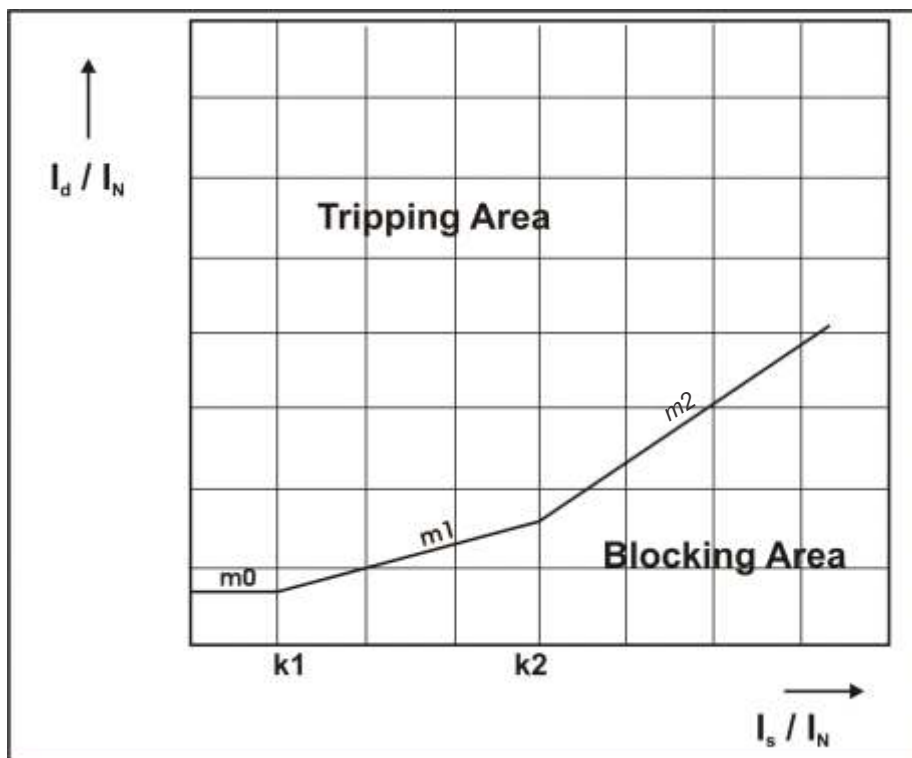
Figure-1

7.0 Protection Functions

1) Percent Differential Protection (87)

CSEZEN-T unit has dual slope characteristic for differential protection with programmable percentage slope settings, adjustable slope breakpoints, and adjustable additional time delay. This unit provides programmable CT ratio correction factor for primary and secondary side of transformer and CT connection configurations through programmable vector groups. For these protection Refer Table.

The differential unit operation characteristic is as shown below (See Figure-2).



Differential protection operation characteristic

Figure-2

2) Harmonic Blocking

Harmonic component of the differential current (2nd & 5th for each phase, whereas 2nd & 3rd for earth) is calculated & extracted using Digital Fourier transforms. The magnitude of these current is used to discriminate between faults and Harmonic conditions that will restrain differential function during Harmonic caused by energisation and over excitation.

If blocking on harmonic setting is enabled then the relay blocks all the tripping operations when if 2nd/5th harmonic for phase & 2nd & 3rd for earth are higher than the set values. For these protection Refer Table.

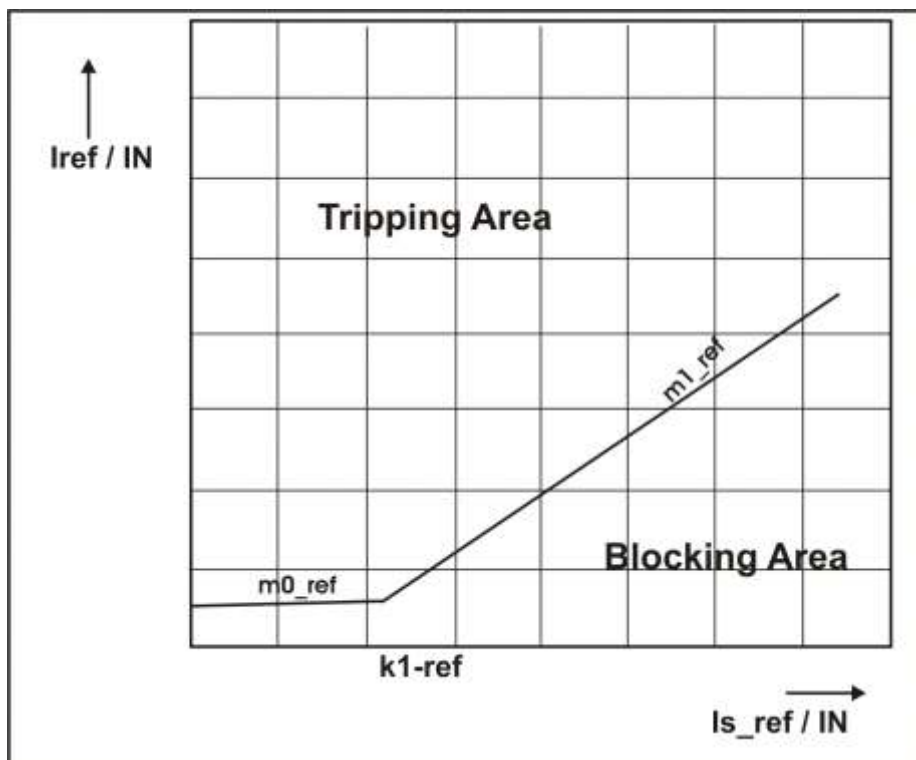
3) Instantaneous Differential Protection

Tripping occurs when the differential current exceeds the set limit for the selected duration. For these protection Refer Table. Instantaneous differential protection does not have harmonic blocking.

4) Low Impedance Restricted Earth Protection (87G)

This function is applicable when a transformer winding is earthed. REF is based on comparing the vector sum of the phase currents of the transformer winding to neutral point current. If the difference (I_{ref}) is greater than the calculated value then tripping occurs.

The restricted earth unit operation characteristic is shown below.



Restricted earth protection operation characteristic

Figure-3

6) Phase Over-current (50/51)

This protection gives backup protection for transformer external faults. If the external faults are not cleared by the primary protections, this over-current unit will actuate, otherwise the transformer will be seriously damaged due to overloads. Each winding has overload as well as short-circuit protection. For these protection Refer Table.

7) Ground Over-current (50G/51G)

This is an over-current function used on the current measured at the grounding of a power transformer in order to detect faults to earth. Each winding features has Earth low and Earth hi-set protections. Refer Table for these protection settings. For these protection Refer Table.

Inverse Characteristics Formula

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

$$\text{Very Inverse} \quad t = \frac{13.5}{(I / I_s) - 1} \quad t_i \text{ [s]}$$

$$\text{Extremely Inverse} \quad t = \frac{80}{(I / I_s)^2 - 1} \quad t_i \text{ [s]}$$

$$\text{Long time Inverse} \quad t = \frac{120}{(I / I_s) - 1} \quad t_i \text{ [s]}$$

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

Where t = Tripping time t_i = Time multiplier
 I = Fault current I_s = Setting value of current

8) Negative Phase Sequence (46)

This function protects against current unbalances resulting from anomalies in the power System or unbalanced loads. Negative phase sequence over current element give greater sensitivity to resistive phase to phase faults, where phase over-current element may not operate. Each winding has negative phase sequence over current protections. For these protection setting Refer Table.

If I_2 is Negative phase sequence current then

$$3 \cdot |I_2| = |I_a + a^2 \cdot I_b + a \cdot I_c| \quad \text{Where } a = 1 \angle 120^\circ$$

The Trip can be time delayed by a curve selectable by settings.

Refer following formula for the inverse characteristics of Negative Phase Sequence protection: -

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

Refer Table-3 for Negative Phase Sequence over current setting.

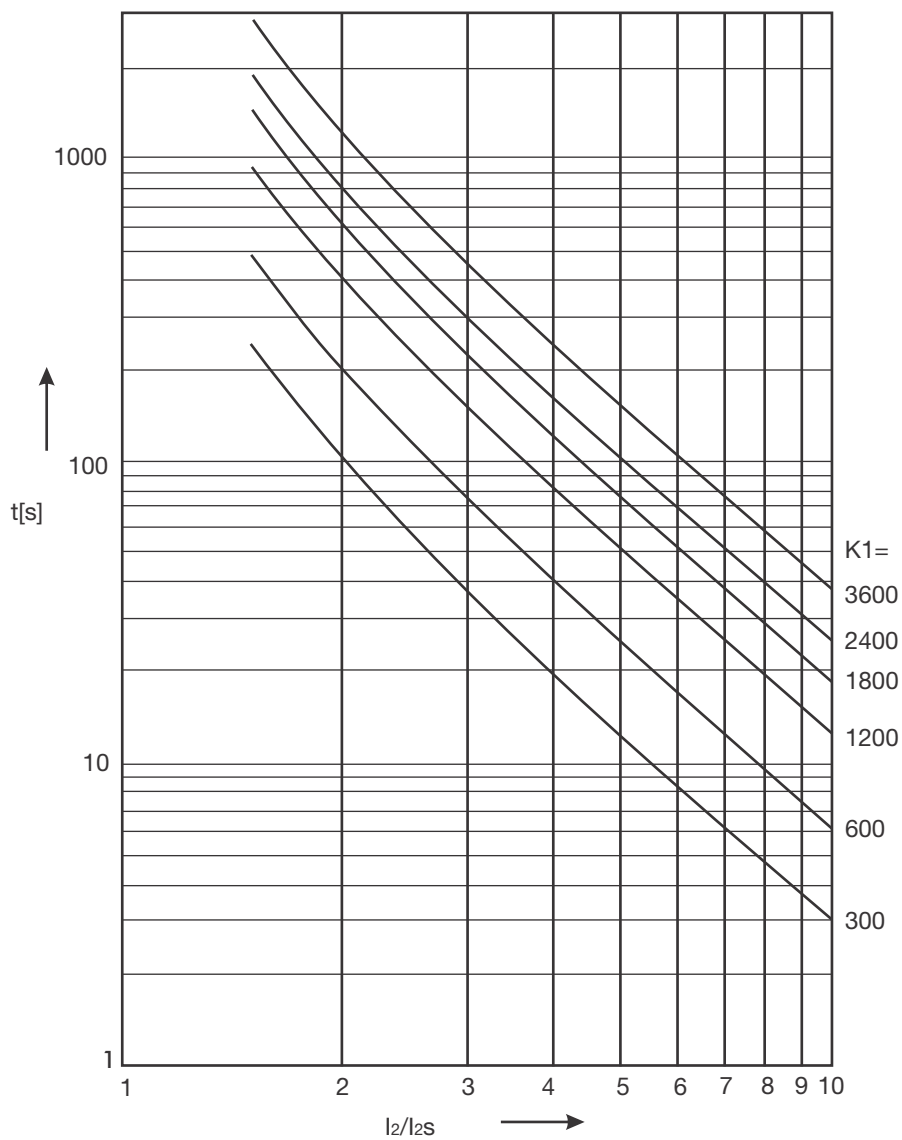


Figure-4

Negative Phase Sequence Inverse Time Characteristics

9) 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 set value of rated current 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. For these protection setting Refer Table.

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. For these protection setting Refer Table.

11) Output Relay Latching (86)

Any digital output can be latched. Reset of the latched output is possible by logic input front panel operator interface or by remote communication or through RESET key.

12) Blocking Logic

CSEZEN relay includes logic inputs, which can be configured to block the selected protection functions. Each protection functions can be locked via a digital input as selected and assigned.

13) Test of Output Relay's

Select the 'TRIP TEST' menu from HMI, then by using backward/forward key it will start operating the output relay's & LED's one by one unless the enter key is pressed again.

14) Local / Remote CB Control

In CSEZEN-T circuit breaker control can be done locally using front key's whereas same can be controlled remotely using configurable DI's as well as communication mode.

15) Setting Group

CSEZEN-T relays have four protection related setting groups. Changes between the groups are executed via the front interface, a dedicated logic input or through the communication port.

To avoid any undesirable tripping, the setting group change is only executed when none of the protection functions are running (deactivated or inhibited).

Time Synchronization

Inside CSEZen there is an internal time clock. Relay supports SNTP Protocol (ordering based). SNTP (Simple network Time Protocol) have mechanisms within the protocol to synchronize the clock and keep it accurate to certain accuracy. The protocol itself has the ability to send commands and re-synchronize the clock so that each attached IED using its synchronization capability on the network is accurate within resolution.. The relay makes the synchronization automatically using SNTP protocol. The internal clock of the relay is synchronized to the UTC time of the NTP server.

8.0 Data Acquisition Functions

Measurement

- ❖ L1, L2, L3 Phase measurement in HV winding
- ❖ L1, L2, L3 Phase measurement in LV winding
- ❖ L1, L2, L3 Differential current measurements
- ❖ L1, L2, L3 Restraining current measurements
- ❖ Negative Phase sequence in HV & LV side
- ❖ Earth current
- ❖ Restricted Earth current
- ❖ Trip counter (Increments whenever any DO trip due to some fault)
- ❖ Origin of last fault

9. Fault Record

CSEZEN-T records last 20 faults in its non volatile memory with its time stamp. Each record has the following information:

IL1[P]	:	xx.xxA	Iref	:	xx.xxA
IL2[P]	:	xx.xxA	I2[P]	:	xx.xxA
IL3[P]	:	xx.xxA	I2[S]	:	xx.xxA
IL1[S]	:	xx.xxA	L1[2H]	:	xx.xxA
IL2[S]	:	xx.xxA	L2[2H]	:	xx.xxA
IL3[S]	:	xx.xxA	L3[2H]	:	xx.xxA
IL1[D]	:	xx.xxA	L1[5H]	:	xx.xxA
IL2[D]	:	xx.xxA	L2[5H]	:	xx.xxA
IL3[D]	:	xx.xxA	L3[5H]	:	xx.xxA
L1[RES]	:	xx.xxA	HR MIN	:	HH:MIN
L2[RES]	:	xx.xxA	SEC Ms	:	Sec: mSec
L3[RES]	:	xx.xxA	DATE	:	DD:MM:YR
Ie	:	xx.xxA	F-TYPE	:	Type of fault

Sl. No.	Fault Name	TimeStamp	I2[P]	I2[S]	I2[H]	I2[L]	I2[N]	I2[0]	I2[1]	I2[2]	I2[3]	I2[4]	I2[5]	I2[6]	I2[7]	I2[8]	I2[9]	I2[10]	I2[11]	I2[12]
1	Over Load Fault in E Phase	02/01/2011 11:02:43.022	1.08 A	2.26 A	1.30 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
2	Over Load Fault in L1 Primary Phase	02/01/2011 11:02:43.099	1.08 A	2.00 A	1.30 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
3	Over Load Fault in L2 Primary Phase	02/01/2011 11:02:43.179	1.08 A	2.00 A	1.30 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
4	Over Load Fault in L1 Primary Phase	02/01/2011 11:02:43.259	1.08 A	2.00 A	1.30 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
5	Main Circuit Break in L2 Primary Phase	02/01/2011 11:02:43.339	0.47 A	0.38 A	1.51 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
6	Over Load Fault in E Phase	02/01/2011 11:02:43.419	1.08 A	2.00 A	1.30 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
7	Over Load Fault in L1 Primary Phase	02/01/2011 11:02:43.499	1.08 A	2.00 A	1.30 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
8	Main Circuit Break in L2 Primary Phase	02/01/2011 11:02:43.579	0.47 A	0.38 A	1.51 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A
9	Main Circuit Break in L2 Primary Phase	02/01/2011 11:02:43.659	0.47 A	0.38 A	1.51 A	0.98 A	0.99 A	0.99 A	0.97 A	1.00 A	1.21 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A	1.10 A

Fault Data recording on PC software

Figure-5

10.0 Event Record

The unit stores in non volatile memory the last 500 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.

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

The screenshot shows the 'CSE Designer Suite M12' software interface. The main window displays a list of 31 events recorded on 18/10/2013. The events are categorized into PICKUP and DROPLUP. The right-hand side of the interface features an 'EVENT RECORDER' panel with a table of event details and a legend for event categories.

S.No	Event Name	Event Category	Time Stamp
1	Power ON	CONTROL	18/10/2013 11:25:01:30
2	Clock Change	SETTING	18/10/2013 11:25:01:30
3	Circuit Breaker NO contact Close	CONTROL	18/10/2013 11:25:01:31
4	Circuit Breaker NC contact Open	CONTROL	18/10/2013 11:25:01:31
5	Pickup due to Overcurrent in IL1 Phase	PICKUP	18/10/2013 11:25:01:32
6	Pickup due to Overcurrent in IL2 Phase	PICKUP	18/10/2013 11:25:01:32
7	Pickup due to Overcurrent in IL3 Phase	PICKUP	18/10/2013 11:25:01:32
8	Relay Pickup Earth	PICKUP	18/10/2013 11:25:01:33
9	Pickup due to Short circuit in IL1 Phase	PICKUP	18/10/2013 11:25:01:34
10	Pickup due to Short circuit in IL2 Phase	PICKUP	18/10/2013 11:25:01:34
11	Pickup due to Short circuit in IL3 Phase	PICKUP	18/10/2013 11:25:01:35
12	Pickup due to High Earth in E-Phase	PICKUP	18/10/2013 11:25:01:35
13	pickup due to instant short circuit in IL1 Phase	PICKUP	18/10/2013 11:25:01:36
14	pickup due to instant short circuit in IL2 Phase	PICKUP	18/10/2013 11:25:01:36
15	pickup due to instant short circuit in IL3 Phase	PICKUP	18/10/2013 11:25:01:37
16	pickup due to instant high earth	PICKUP	18/10/2013 11:25:01:37
17	Pickup due to negative phase sequence	PICKUP	18/10/2013 11:25:01:38
18	Pickup due to thermal load in IL1 phase	PICKUP	18/10/2013 11:25:01:38
19	Pickup due to thermal load in IL2 phase	PICKUP	18/10/2013 11:25:01:39
20	Pickup due to thermal load in IL3 phase	PICKUP	18/10/2013 11:25:01:39
21	Pickup due to broken conductor	PICKUP	18/10/2013 11:25:01:40
22	Relay dropout due to Overcurrent fault in IL1 Phase	DROPLUP	18/10/2013 11:25:01:41
23	Relay dropout due to Overcurrent fault in IL2 Phase	DROPLUP	18/10/2013 11:25:01:41
24	Relay dropout due to Overcurrent fault in IL3 Phase	DROPLUP	18/10/2013 11:25:01:42
25	Relay dropout due to Overcurrent fault in E- Phase	DROPLUP	18/10/2013 11:25:01:42
26	Relay dropout due to short circuit fault in IL1 Phase	DROPLUP	18/10/2013 11:25:01:43
27	Relay dropout due to short circuit fault in IL2 Phase	DROPLUP	18/10/2013 11:25:01:43
28	Relay dropout due to short circuit fault in IL3 Phase	DROPLUP	18/10/2013 11:25:01:44
29	Relay dropout due to high earth	DROPLUP	18/10/2013 11:25:01:44
30	Relay dropout due to instant short circuit fault in IL1 Phase	DROPLUP	18/10/2013 11:25:01:45
31			

The 'EVENT RECORDER' panel on the right shows a table with columns for Event Name, Event Category, and Time stamp. Below the table is a legend for Event Categories: #1 Fault setting, #2 Control, #3 Pickup, #4 Dropout, #5 Trip.

Event Data recording on PC Software

Figure-6

11.0 Disturbance Record

The CSEZEN-T 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. 8 analog signals (depends upon the different models) and the status of maximum 12 digital inputs and maximum 12 digital outputs. There will be 30 samples per cycle.
- ❖ Relay saves maximum 1200 cycles, and the number of cycles per record is programmable which limits the maximum no. of records possible to store in the relay (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 can be fetch in comtrade format as per IEC60255-24.



Oscilloscope recording on PC software

Figure-7

Output Contacts

- Max. No. of digital outputs : 12 (DO1, DO2DO12)
- Type of outputs : Relay
- Programmable (DO Assignment) : Yes (Max.11 DO are programmable & 1 is fixed for self supervision function)
- Relay reset type : Programmable (Auto/Manual)

Input Contacts

- Max. No of digital inputs : 12 (DI1, DI2..... DI 12)
- Type of inputs : AC/DC Voltage
- Programmable (DI Assignment) : Yes

12.0 Communication (Local & Remote)

The unit has:

- ❖ 1 Front USB port for direct connection to a PC.
- ❖ 1 Rear RS-485 communication port.
- ❖ 2 Rear terminal Dual Type for RJ-45 communication port.

Dual Rear Communication

The communication protocol for the rear port is available in IEC 61850 on RJ-45 and IEC 870-5-103 protocol on RS-485 communication.

Front Communication (USB)

The entire setting including protection parameter setting for both group, Fault, Event & Disturbance record are available on 'Mini-B to A' type USB (female) interface with CSE LIVELINK with saving & printing option. This unit also has Front-end Live Link simulation support for testing of relay even without any three phase injection source.

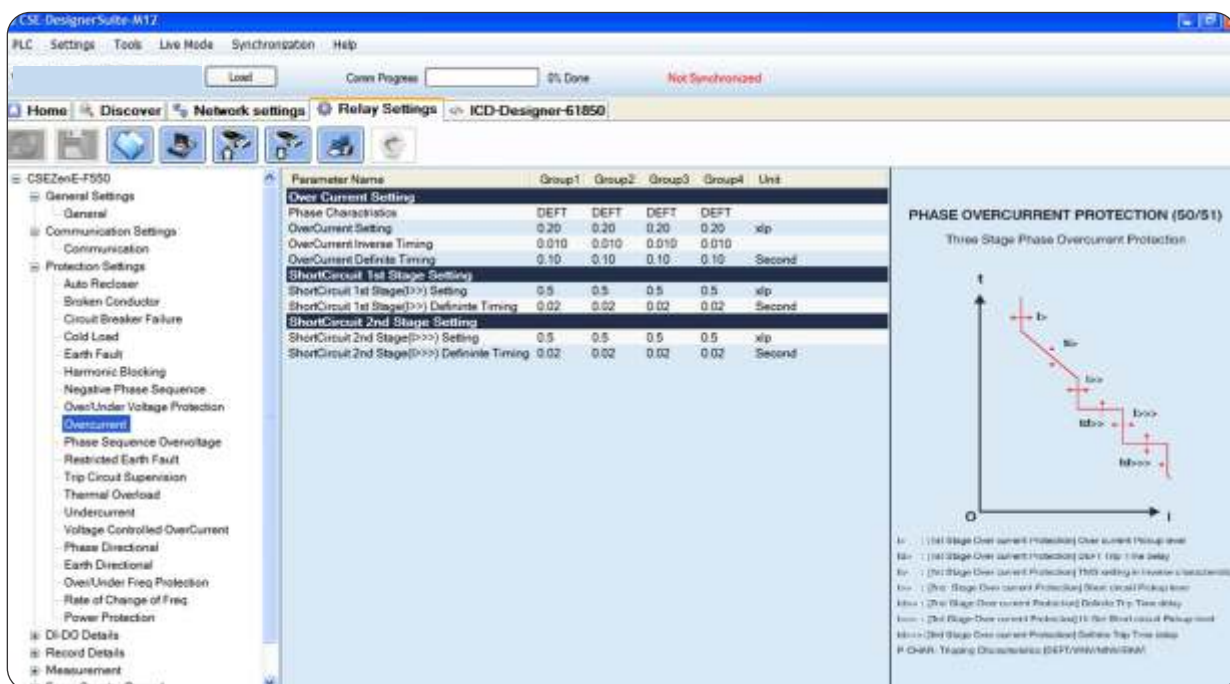


Figure-8

13.0 Human Machine Interface

CSEZEN-T offers a variety of front user interfaces, including:

Human-Machine Interface (HMI)

It comprises of 20x4 Alpha numeric display and 11 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.
- ❖ Ten LEDs for pickup or tripping on fault's & events in any phase.

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.

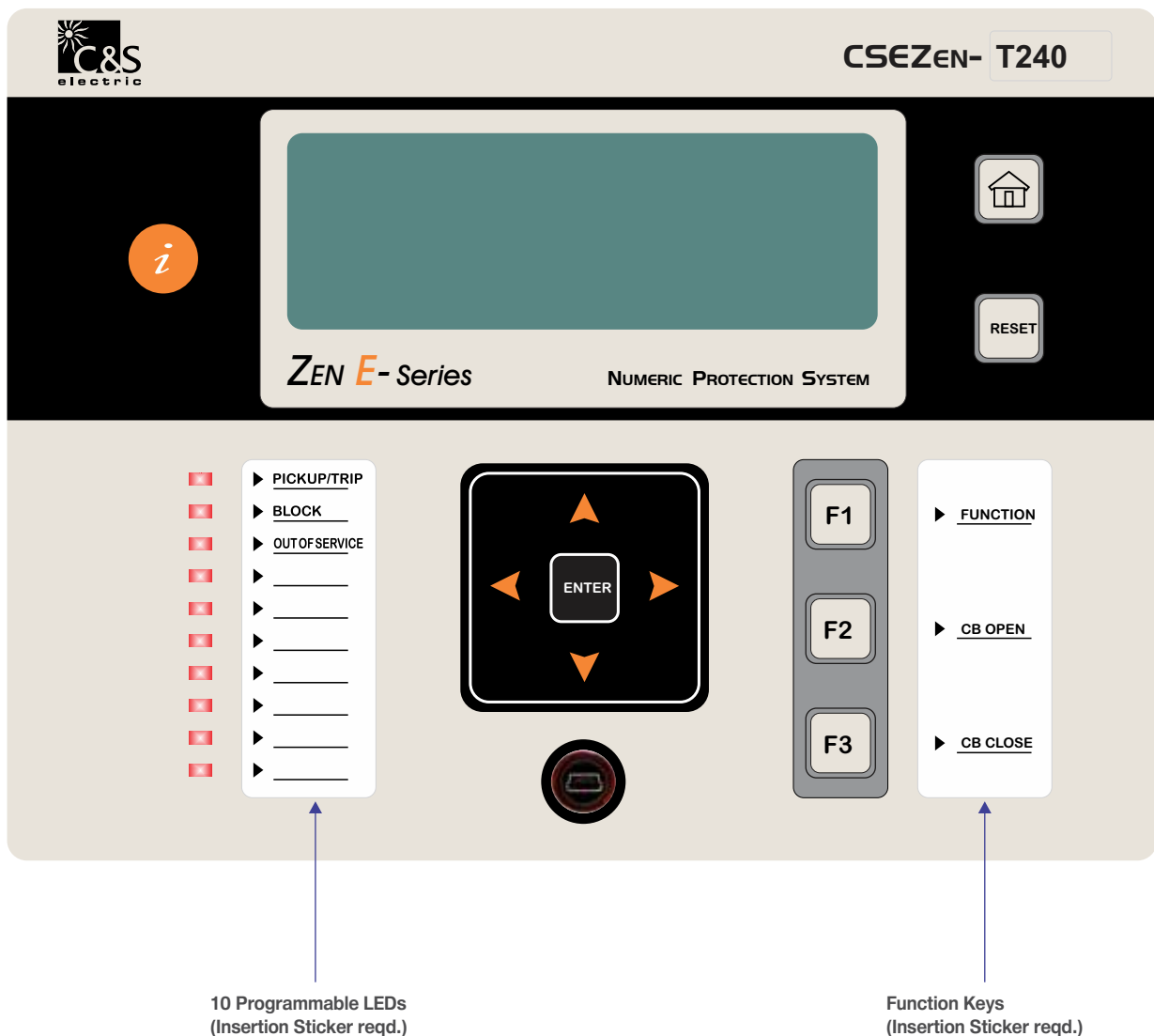













Figure-9

Key Description

Keys	Manual Key
	is used as intelligent key to see the details of the fault pickup / digital input / output status & last fault details / LED Status.
	is used as a “HOME” key.
	is used as a “RESET” key.
	is used as a “ENTER” key.
	is used to scroll in upward direction for parameters.
	is used to scroll in downward direction for parameters.
	is used to scroll in backward direction and for decrement of parameters.
	is used to scroll in forward direction and for increment of parameters.
	is used as a “FUNCTION” key.
	is used as a “CB Open” key.
	is used as a “CB Close” key.

LED Description

In CSEZEN Relay Ten LEDs are given for pickup or tripping on faults & events in any phase. 3 LEDs are fix

- | | | |
|----|----------------|--|
| 1) | PICKUP/TRIP | Relay is in Pickup / Trip mode |
| 2) | BLOCK | Some protection function is blocked |
| 3) | OUT OF SERVICE | Relay is in out of service mode (Protection on hold) |

All 10 LED's are programmable via front end software CSE Designer Suite - M12, available on front fascia. For these 10 LED's protection function naming sticker is needed to be inserted.

USB Description

CSE Designer Suite - M12

USB port is available as HOST & OTG. PC/Laptop can be interfaced via USB port for connecting with CSE Designer Suite-M12 Front End Software. USB Pen drive can also be connected on this port via OTG cable for downloading / uploading the setting / record details.

14.0 Setting Ranges

Active Group Setting

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Active Group	ACTIVE GROUP	GROUP1	GROUP4	-----	GROUP1
Group Toggle Step	TOGGLE STEP	+1	+3	1	+1

(Table-1)

Trip Circuit Supervision Setting (74TC)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
TCS Function [HV]	TCS FUN[HV]	Disable	Enable	-----	Disable
TCS Timing [HV]	TCS td[HV]	0.03sec	2sec	0.01sec	0.03sec
TCS Function [LV]	TCS FUN[LV]	Disable	Enable	-----	Disable
TCS Timing [LV]	TCS td[LV]	0.03sec	2sec	0.01sec	0.03sec

(Table-2)

Earth Fault Protection Setting (51G)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Earth Overcurrent Protection	Ie> FUNC	Disable	Enable	-----	Disable
Earth Overcurrent Setting	Ie>Pkup	0.05xIn	2.5xIn	0.01xIn	0.05xIn
Earth Characteristics	Curve	DEFT	EINV,VINV,LIINV, NINV1.3,NINV3.0	-----	DEFT
Earth Overcurrent inverse timing	Ie>ti	0.01	1.5	0.005	0.01
Earth Overcurrent Definite timing	Ie>td	0.03sec	150sec	0.01sec	0.1sec
Earth HiSet Protection	Ie>>FUNC	Disable	Enable	-----	Disable
Earth HiSet Current Setting	Ie>>Pkup	0.5xIn	15xIn	0.05xIn	0.5xIn
Earth HiSet definite timing	Ie>>td	0.02sec	20sec	0.01sec	0.1sec

(Table-3)

Negative Phase Sequence (46)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Neg.phase Seq. protection Setting					
I2>Function[HV]	I2>FUNC[HV]	Disable	Enable	-----	Disable
NPS characteristic [HV]	I2>Char[HV]	DEFT	NPS_INV	-----	DEFT
NPS pickup [HV]	I2>Pkup[HV]	0.10xIp	1.00xIp	0.01xIp	0.26xIp
K1 constant [HV]	K1 Multp[HV]	5	600	1	5
NPS definite time [HV]	I2>td[HV]	0.1sec	600sec	0.1sec	0.5sec
I2>Function[LV]	I2>FUNC[LV]	Disable	Enable	-----	Disable
NPS characteristic [LV]	I2>Char[LV]	DEFT	NPS_INV	-----	DEFT
NPS pickup [LV]	I2>Pkup[LV]	0.10xIp	1.00xIp	0.01xIp	0.26xIp
K1 constant [LV]	K1 Multp[LV]	5	600	1	5
NPS definite time [LV]	I2>td[LV]	0.1sec	600sec	0.1sec	0.5sec

(Table-4)

Phase Over current Protection Setting (50/51)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
I> Function [HV]	I> FUNC[HV]	Disable	Enable	-----	Disable
Phase Characteristics [HV]	Curve[HV]	DEFT	EINV,VINV,LIINV, NINV1.3,NINV3.0	-----	DEFT
I> Setting [HV]	I>Pkup[HV]	0.2xIn	5xIn	0.01xIn	1xIn
I> inverse timing [HV]	I>ti[HV]	0.01	1.5	0.005	0.01
I> Definite timing [HV]	I>td[HV]	0.1sec	150sec	0.01sec	0.1sec
I>> Function [HV]	I>>FUNC[HV]	Disable	Enable	-----	Disable
I>> Current Setting [HV]	I>>Pkup[HV]	0.5xIn	30xIn	0.5xIn	1.5xIn
I>> definite timing [HV]	I>>td[HV]	0.02sec	20sec	0.01sec	0.02sec
I> Function [LV]	I> FUNC[LV]	Disable	Enable	-----	Disable
Phase Characteristics [LV]	Curve[LV]	DEFT	EINV,VINV,LIINV, NINV1.3,NINV3.0	-----	DEFT
I> Setting [LV]	I>Pkup[LV]	0.2xIn	5xIn	0.01xIn	1xIn
I> inverse timing [LV]	I>ti[LV]	0.01	1.5	0.005	0.01
I> Definite timing [LV]	I>td[LV]	0.1sec	150sec	0.01sec	0.1sec
I>> Function [LV]	I>>FUNC[LV]	Disable	Enable	-----	Disable
I>> Current Setting [LV]	I>>Pkup[LV]	0.5xIn	30xIn	0.5xIn	1.5xIn
I>> definite timing [LV]	I>>td[LV]	0.02sec	20sec	0.01sec	0.02sec

(Table-5)

Differential Protection Setting (87)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Differential Function	DIFF FUNC	Disable	Enable	-----	Enable
Start point of 2nd slope (k2)	k2	1.00PU	10.00PU	0.02PU	2.00PU
Start point of 1st slope (k1)	k1	0.04PU	2.00PU	0.01PU	1.00PU
Min. Pickup Current (Imin)	m0	0.04PU	1.00PU	0.01PU	0.20PU
1st Slope (m1)	m1	10%	100%	1%	20%
2nd Slope (m2)	m2	10%	100%	1%	50%
Vector Group	Vectr Grp	Yd1	Yd3/Yd5/Yd7/ Yd9/Yd11 /Dy1/Dy3/Dy5 /Dy7/Dy9/Dy11 /Yd6/YY0/DD0 /YY2/DD2/YY4 /DD4/YY6/DD6 /YY8/DD8/ /YY10/DD10/ DZ10/Yd0	-----	YY0
Primary CT correction facdtor	PriCT corctn	0.2	4	0.001	1
secondary CT correction facdtor	SecCT corctn	0.2	4	0.001	1
Added Delay	td> [add]	0sec	60sec	0.01sec	0.02sec
Differential Hiset Function	DIFF-HI	Disable	Enable	-----	Enable
Hiset setting	HiSetPkup	1xIn	25xIn	0.5xIn	5xIn
Added Delay	td>>	0sec	60sec	0.01sec	0sec

Note: (3) (Always ensure that $m_0 < k_1$ and $k_1 < k_2$). (Table-6)

Harmonic Blocking

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Harmonic Setting for Protection Blocking					
Protection blocking by 2nd Harmonic	Blk by 2ndH	Disable	Enable	----	Enable
2nd Harmonic limit	Phase 2ndH	10%If	80%If	5%If	20%If
Protection blocking by 5th Harmonic	Blk by 5thH	Disable	Enable	----	Enable
5th Harmonic limit	Phase 5thH	10%If	80%If	5%If	20%If
Protection blocking by 3rd Harmonic	Blk by 3rdH	Disable	Enable	----	Enable
3rd Harmonic limit	Earth 3rdH	10%If	80%If	5%If	20%If
Blocking by 3-phase/1-phase	3/1 PHASE	1-phase	3-phase	----	3-phase
Differential protection Blocking	DIFF BLOCK	Disable	Enable	----	Enable
Overload protection Blocking	OC BLOCK	Disable	Enable	----	Disable
Short circuit protection Blocking	SC BLOCK	Disable	Enable	----	Disable
Neg. phase Seq. protection Blocking	NPS BLOCK	Disable	Enable	----	Disable
Earth Over-current protection Blocking	EL BLOCK	Disable	Enable	----	Disable
Earth Hi-set protection Blocking	EH BLOCK	Disable	Enable	----	Disable
Restricted Earth protection Blocking	REF BLOCK	Disable	Enable	----	Disable

(Table-7)

Restricted Earth Protection (87G)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
REF Protection	REF FUNC	Disable	Enable	-----	Disable
Start point of slope(k1_REF)	k1_REF	0.04PU	3PU	0.02PU	1PU
Min. REF Pickup (m0_REF)	m0_REF	0.04PU	1PU	0.02PU	0.2PU
REF First Slope(m1REF)	m1REF	10%	100%	1%	30%
Added Delay	td>	0sec	60sec	0.01sec	0.02sec
Earth CT correction factor	E CT corctn	0.1	4	0.01	1

Note: (4) (4) Refer Figure for settable parameters of restricted earth fault (REF) trip characteristic
Always ensure that $m1REF < k1_REF$

(Table-8)

Circuit Breaker Failure Protection Setting (50BF)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
CBFP Function [HV]	CBFP [HV]	Disable	Enable	-----	Disable
Pickup for CBFP [HV]	PKUP_[HV]	0.05xIn	2xIn	0.01xIn	0.10xIn
Time for CBFP [HV]	CBFP td[HV]	0.03sec	2sec	0.01sec	0.03sec
CBFP Function [LV]	CBFP [LV]	Disable	Enable	-----	Disable
Pickup for CBFP [LV]	PKUP_[LV]	0.05xIn	2xIn	0.01xIn	0.10xIn
Time for CBFP [LV]	CBFP td[LV]	0.03sec	2sec	0.01sec	0.03sec

(Table-9)

Erase Counter Record Setting

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Trip Count	Trip Counter	NO	YES	-----	NO
Erase Events	Events Erase	NO	YES	-----	NO
Erase Faults	Faults Erase	NO	YES	-----	NO
Oscillator Record Erase	Osc. Record Erase	NO	YES	-----	NO

(Table-10)

DO Assignment Setting

S.No.	Parameters	S.No.	Parameters
1	HV Winding Over-current Pickup	27	LV Winding Negative Phase Sequence Pickup
2	HV Winding Over-current Trip	28	LV Winding Negative Phase Sequence Trip
3	LV Winding Over-current Pickup	29	HV Winding Trip Circuit Supervision
4	LV Winding Over-current Trip	30	LV Winding Trip Circuit Supervision
5	HV Winding Short-circuit Pickup	31	HV Winding Circuit Breaker Fault Protection
6	HV Winding Short-circuit Trip	32	LV Winding Circuit Breaker Fault Protection
7	LV Winding Short-circuit Pickup	33	HV winding Circuit Breaker Open
8	LV Winding Short-circuit Trip	34	HV winding Circuit Breaker Close
9	HV Winding Earth Over-current Pickup	35	LV winding Circuit Breaker Open
10	HV Winding Earth Over-current Trip	36	LV winding Circuit Breaker Close
11	LV Winding Earth Over-current Pickup	37	Remote Trip1
12	LV Winding Earth Over-current Trip	38	Remote Trip2
13	HV Winding Earth Hi-set Pickup	39	Remote Trip3
14	HV Winding Earth Hi-set Trip	40	Remote Trip4
15	LV Winding Earth Hi-set Pickup	41	Remote Trip5
16	LV Winding Earth Hi-set Trip	42	Remote Trip6
17	Percentage Differential Pickup	43	Backup Relay Trip
18	Percentage Differential Trip	44	BUCHHOLTZ Alarm
19	Differential Hiset Pickup	45	BUCHHOLTZ Trip
20	Differential Hiset Trip	46	OLTC Alarm
21	HV Winding Restricted Earth Pickup	47	OLTC Trip
22	HV Winding Restricted Earth Trip	48	WTI Alarm
23	LV Winding Restricted Earth Pickup	49	WTI Trip
24	LV Winding Restricted Earth Trip	50	OTI Alarm
25	HV Winding Negative Phase Sequence Pickup	51	OTI Trip
26	HV Winding Negative Phase Sequence Trip	52	PRV Alarm
		53	PRV Trip

(Table-11)

DI Assignment Setting

S.No.	Parameters
1	CB Close Status HV Winding
2	CB Open Status HV Winding
3	CB Close Status LV Winding
4	CB Open Status LV Winding
5	Remote Trip1
6	Remote Trip2
7	Remote Trip3
8	Remote Trip4
9	Remote Trip5
10	Remote Trip6
11	Group Toggling
12	Remote Reset
13	Oscilloscope Record Triggering
14	HV Winding OverCurrent Blocking
15	LV Winding OverCurrent Blocking
16	HV Winding ShortCircuit Blocking
17	LV Winding ShortCircuit Blocking
18	HV Winding Earth Overcurrent Blocking
19	LV Winding Earth Overcurrent Blocking
20	HV Winding Earth Hiset Blocking
21	LV Winding Earth Hiset Blocking
22	Differential Blocking
23	Differential Hiset Blocking
24	HV Winding Restricted Earth Blocking
25	LV Winding Restricted Earth Blocking
26	HV Winding NPS Current Blocking
27	LV Winding NPS Current Blocking
28	Backup Relay Trip
29	BUCHHOLTZ Alarm
30	BUCHHOLTZ Trip
31	OLTC Alarm
32	OLTC Trip
33	WTI Alarm
34	WTI Trip
35	OTI Alarm
36	OTI Trip
37	PRV Alarm
38	PRV Trip

(Table-12)

Function Reset Setting

S.No.	Parameters
1	HV Winding OverCurrent Pickup
2	HV Winding OverCurrent Trip
3	LV Winding OverCurrent Pickup
4	LV Winding OverCurrent Trip
5	HV Winding ShortCircuit Pickup
6	HV Winding ShortCircuit Trip
7	LV Winding ShortCircuit Pickup
8	LV Winding ShortCircuit Trip
9	HV Winding Earth Overcurrent Pickup
10	HV Winding Earth Overcurrent Trip
11	LV Winding Earth Overcurrent Pickup
12	LV Winding Earth Overcurrent Trip
13	HV Winding Earth Hiset Pickup
14	HV Winding Earth Hiset Trip
15	LV Winding Earth Hiset Pickup
16	LV Winding Earth Hiset Trip
17	Percentage Differential Pickup
18	Percentage Differential Trip
19	Differential Hiset Pickup
20	Differential Hiset Trip
21	HV Winding Restricted Earth Pickup
22	HV Winding Restricted Earth Trip
23	LV Winding Restricted Earth Pickup
24	LV Winding Restricted Earth Trip
25	HV Winding Negative Phase Sequence Pickup
26	HV Winding Negative Phase Sequence Trip
27	LV Winding Negative Phase Sequence Pickup
28	LV Winding Negative Phase Sequence Trip
29	HV Winding Trip Circuit Supervision
30	LV Winding Trip Circuit Supervision
31	HV Winding Circuit Breaker Fault Protection
32	LV Winding Circuit Breaker Fault Protection
33	Remote Trip1
34	Remote Trip2
35	Remote Trip3
36	Remote Trip4
37	Remote Trip5
38	Remote Trip6
39	Backup Relay Trip
40	BUCHHOLTZ Alarm
41	BUCHHOLTZ Trip
42	OLTC Alarm
43	OLTC Trip
44	WTI Alarm
45	WTI Trip
46	OTI Alarm
47	OTI Trip
48	PRV Alarm
49	PRV Trip

(Table-13)

LED Assignment Setting

S.No.	Parameters	S.No.	Parameters
1	HV Winding Over Current Pickup	28	LV Winding Negative Phase Sequence Trip
2	HV Winding Over Current Trip	29	HV Winding Trip Circuit Supervision
3	LV Winding Over Current Pickup	30	LV Winding Trip Circuit Supervision
4	LV Winding Over Current Trip	31	HV Winding Circuit Breaker Fault Protection
5	HV Winding Short Circuit Pickup	32	LV Winding Circuit Breaker Fault Protection
6	HV Winding Short Circuit Trip	33	HV winding Circuit Breaker Open
7	LV Winding Short Circuit Pickup	34	HV winding Circuit Breaker Close
8	LV Winding Short Circuit Trip	35	LV winding Circuit Breaker Open
9	HV Winding Earth Over current Pickup	36	LV winding Circuit Breaker Close
10	HV Winding Earth Over current Trip	37	Remote Trip1
11	LV Winding Earth Over current Pickup	38	Remote Trip2
12	LV Winding Earth Over current Trip	39	Remote Trip3
13	HV Winding Earth Hi set Pickup	40	Remote Trip4
14	HV Winding Earth Hi set Trip	41	Remote Trip5
15	LV Winding Earth Hi set Pickup	42	Remote Trip6
16	LV Winding Earth Hi set Trip	43	Backup Relay Trip
17	Percentage Differential Pickup	44	BUCHHOLTZ Alarm
18	Percentage Differential Trip	45	BUCHHOLTZ Trip
19	Differential Hi set Pickup	46	OLTC Alarm
20	Differential Hi set Trip	47	OLTC Trip
21	HV Winding Restricted Earth Pickup	48	WTI Alarm
22	HV Winding Restricted Earth Trip	49	WTI Trip
23	LV Winding Restricted Earth Pickup	50	OTI Alarm
24	LV Winding Restricted Earth Trip	51	OTI Trip
25	HV Winding Negative Phase Sequence Pickup	52	PRV Alarm
26	HV Winding Negative Phase Sequence Trip	53	PRV Trip
27	LV Winding Negative Phase Sequence Pickup	54	Battery Low

Oscilloscope (Disturbance) Record

(Table-14)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Oscilloscope recording selection	OSC. RECORD	NO	YES	-	NO
Pre-fault cycle	PRE CYCLE	002C	298C	1C	002C
Post-fault cycle	POST CYCLE	002C	298C	1C	002C
Triggering mode	TRIGGER MODE	PK-UP	PK-UP/TRIP/DI/ Anyone	-	PK-UP

Date & Time Setting

(Table-15)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Date	DATE	1	31	1	---
Month	MONTH	Jan	Dec	1	---
Year	YEAR(2000 Y)	00	99	1	---
Day	DAY	SUN	SAT	1	---
Hour	HOUR	0	23	1	---
Minute	MIN	0	59	1	---
Second	SEC	0	59	1	---

(Table-16)

Common Setting

Parameters	Min Value	Max Value	Step Size
HV Winding Rated current	1A	5A	----
LV Winding Rated current	1A	5A	----
Earth Rated current	1A	5A	----
HV Winding CT Ratio	1	10000	1
LV Winding CT Ratio	1	10000	1
Earth CT Ratio	1	10000	1
Nominal frequency	50Hz	60Hz	----
Fault message status	Disable	Enable	----

Communication

(Table-17)

USB Communication	
Protocol	CSE Proprietary Protocol: available with front software
Baud rate	115200 bps
Cable required for Interface	USB cable type (Mini-B to A)

(Table-18)

RS-485 Communication	Default Setting
Baud rate selection (programmable)	9600/19200/38400/57600 bps
Parity selection (programmable)	EVEN / ODD / NONE
Stop bit	1 Bit
Data bit	8 Bit data
Remote address (programmable)	247/254
Cable required for Interface	Two wire twisted shielded cable

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

(Table-19)

15.0 Technical Data

Measuring Input

Rated Data	Rated current I_n : 1A or 5A Rated frequency F_n : 50 Hz/60Hz
Drop out to Pickup Ratio	>96%
Reset Time	30mSec
AC Current: VA Burden	At $I_n=1A$ <0.1 VA At $I_n=5A$ <0.2 VA
AC Voltage: VA Burden	At $V_n=110V$ <0.06 VA
Thermal withstand capability in current circuit	Dynamic current withstand for 1 Sec : $100 \times I_n$ for 10 Sec : $30 \times I_n$ continuously : $4 \times I_n$

(Table-20)

Trip Time Accuracy for Voltage Protections

Parameters	Accuracy
Trip time accuracy for voltage protections	Inaccuracy in Trip Timing in reference to $\pm 2\%$ error in measured voltage OR $\pm 30mSec$

(Table-21)

Trip Time Accuracy for Current Protections

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

(Table-21)

Measurement Accuracy

Parameters	Range	Frequency Range	Accuracy
Current in Ampere	1.0-30xIn	50-60Hz	Less than $\pm 2\%$
Voltage	5-150%Un	50-60Hz	Less than $\pm 2\%$
Frequency	$F_n \pm 10\text{ Hz}$	40-70 Hz	Less than $\pm 0.01\text{ Hz}$

(Table-23)

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(cos ϕ =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	10000 operation minimum
Unloaded contact	30000 operation minimum

(Table-24)

Auxiliary Supply

Rated auxiliary voltage UH	For 'L' Model	18V-150V DC
	For 'H' Model	80V-280V AC / 90V-300V DC
Rated supply for digital input	Normal Voltage UN	80V-260V AC (Active)
	For 'H' Model	48V-300V DC (Active)
		<30V DC (Inactive)
		<50V AC (Inactive)
	Normal Voltage UN	24V - 60V DC (Active)
	For 'L' Model	<18V DC (Inactive)
Power consumption	Quiescent approx. 3W	Operating approx. <7W

(Table-25)

Common Data

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

(Table-26)

16.0 Standards

Type Test

F1	Functional Tests	Internal Design	Performance in line with Specification & Standards
		Specifications & IEC 60255-6 IEC 60255-3	Pickup/Drop down/ Power consumption in Current/Voltage/Aux Supply/ Trip timing accuracy: OC/ Differential/ Negative Phase Sequence / Over excitation / Earth / Restricted Earth Fault

Climatic Test

C1	Temperature Dry Cold (Relay operational)	IEC 60068-2-1	-20 deg C, 96 hours
C2	Temperature Dry Cold Transportation & Storage	IEC 60068-2-1	-25 deg C, 96 hours
C3	Temperature Dry Heat (Relay operational)	IEC 60068-2-2	55 deg C, 96 hours
C4	Temperature Dry Heat Transportation & Storage	IEC60068-2-2	70 deg C, 96 hours
C5	Damp Heat Test (Relay operational)	IEC 60068-2-3	95% @ +55 / +25 deg C, 6 cycle (12hr + 12hr each)

Enclosure

C6	Enclosure	IEC 529	Front IP54 (Dust 5x + Water x4)
----	-----------	---------	---------------------------------

Mechanical Test

Relay Operational

M1	Vibration response / Endurance test	IEC 60255-21-1	Class I Vibration response (Relay operational) 10Hz~150 Hz - peak displacement 0.035 mm below 58/60 Hz, 0.5 g above, 1 sweep cycle in each axis Vibration endurance (Relay de-energised) 10 Hz~150 Hz 1g, 20 sweep cycles in each axis
M2	Shock response / Withstand test	IEC 60255-21-1	Class I Shock response (Relay operational) 5g 11mS 3 pulse in each axis Shock withstand (Relay de-energised) 15g 11mS 3 pulses in each axis
M3	Bump	IEC 60255-21-1	Bump (Relay de-energised) 10g 16mS 1000 pulses in each axis
M4	Seismic	IEC 60255-21-3	Class I Method A single axis sine sweep 1 Hz~35 Hz~below 8/9 Hz 3.5 mm peak displacement horizontal axis, 1.5 mm vertical axis above 8/9 Hz 1g horizontal, 0.5 g vertical 1 sweep cycle in each axis

Electrical Test

E1	Insulation Resistance >100MΩ	IEC 60255-5	500V DC, 5 sec between all terminals & case earth, between terminals of independent circuits including contact circuits and across open contacts
E2	DC & AC Supply Voltage (Relay operational)		IEC 60255-6 Voltage range, upper & lower limit continuous withstand, ramp up & down over 1 minute
E3	Voltage Dips, Short Interruptions & Voltage variations immunity (Relay operational)	IEC 1000-4-11	IEC 60255-113 Dips & 3 Interruptions at 10 sec intervals of duration between 10mS and 500mS at zero crossings & at other points on wave Variation: 100% to 40% over 2s, hold for 1s, return to 100% over 2s
E4	Ripple in DC supply (Relay operational)	IEC 60255-11	12% AC ripple
E5	Dielectric Test (Relay de-energised) No breakdown or flash over Test voltage 45-65 Hz sinusoidal or with DC voltage at 1.4x the stated AC values	IEC 60255-5	2.0 KV @ 1min All circuit to Earth / Between IP & OP
E6	High Voltage Impulse (Relay de-energised)	IEC 60255-5	5 kV peak 1.2/50uS, 0.5 J-3 positive, 3 negative between all terminals to case earth between independent circuits
E7	VT Input Thermal Withstand		1.5xVn, continuous
E8	CT Input Thermal Withstand		250xIn half wave 100xIn for 1 second 30xIn for 10 second 4xIn continuously
E9	Contact performance & endurance tests	IEC 60255-14,15 IEC 60255-23	

Electro-magnetic Compatibility

R1	Electrical fast Transient/Burst (Relay operational)	IEC 60255-22-4 IEC 60100-4-4	Class IV- ± 4.0 kV All Circuits. Pulse 5/50msec/ Duration 15msec/ Period: 300msec/ Pulse Freq: 5KHz / 2KV at I/O
R2	HF Disturbance Test (Oscillatory Waves) 1 MHz Burst (Relay operational)	IEC 60255-22-1	Class III Longitudinal 2.5 kV peak, 2sec between independent circuits & case earth
R3	Electrostatic Discharge (Relay operational)	IEC 60255-22-2 IEC 61000-4-2	Class III 8kV air discharge, 6KV contact No of Discharge : 10 both polarities at 1 sec intervals
R4	Conducted Disturbance RF fields (Relay operational)	IEC 61000-4-6 IEC 60255-22-6	0.15 to 80 MHz (Level-3) Severity Level 10V RMS + sweeps 0.05-0.15 MHz & 80-100 MHz
R5	Radiated RF E-M field immunity test (Relay operational)	IEC 60255-22-3 IEC 61000-4-3	Class III Test method A + sweep 80-1000 MHZ or IEC 1000-4-3 80-1000 MHZ severity 10 V/m 80% modulated 1 kHz
R6	Surge Immunity capacitively coupled (Relay operational)	IEC 61000-4-5 Class 5 Test level 4 IEC 60255-22-5: 2008 Latest: IEC 60255-26:2013	Short circuit combination wave generator 1.2 uS/50 uS open circuit repetition rate 1 per minute Power supply, CT & VT circuits – 4kV common mode 2 Ohm source 2kV differential mode 12 Ohm source
R7	Power Frequency Magnetic Field (Relay operational)	IEC61000-4-8	100 A/m for 1 minute in each of 3 axes
R8	Conducted & Radiated RF Interference Emission (Relay operational)	EN 55011 IEC 60255-25	CISPR11/Class A
R9	Power Frequency, conducted common mode	IEC 1000-4-16 IEC 60255-22-7	D.C. to 150 kHz Test Level 4 300V at 16 2/3 Hz and 50 Hz

17.0 Recommended Terminal Lugs Specifications

Term Blocks	Type/Cable Specifications
Current Inputs	Ring Type lug / 2.5mm ² or 4 mm ² control cable
Auxiliary Supply	Pin Type lug / 1.5 mm ² / 2.5 mm ² control cable
Rear Comm. Port	Pin Type lug / 1.5 mm ² / 2.5 mm ² control cable
Front Comm. Port	USB, Type mini - B to A
Binary Input	Pin Type lug / 1.5mm ² / 2.5mm ² control cable
Binary Output	Pin Type lug / 4.0mm ² control cable
Earth Connections	Ring Type / 2.5mm ² or 4 mm ² contact cable



**USB Cable required for Front communication
(Mini-Type B to A)**



OTG Cable required for Pen Drive Interface



18.0 Connection Diagram

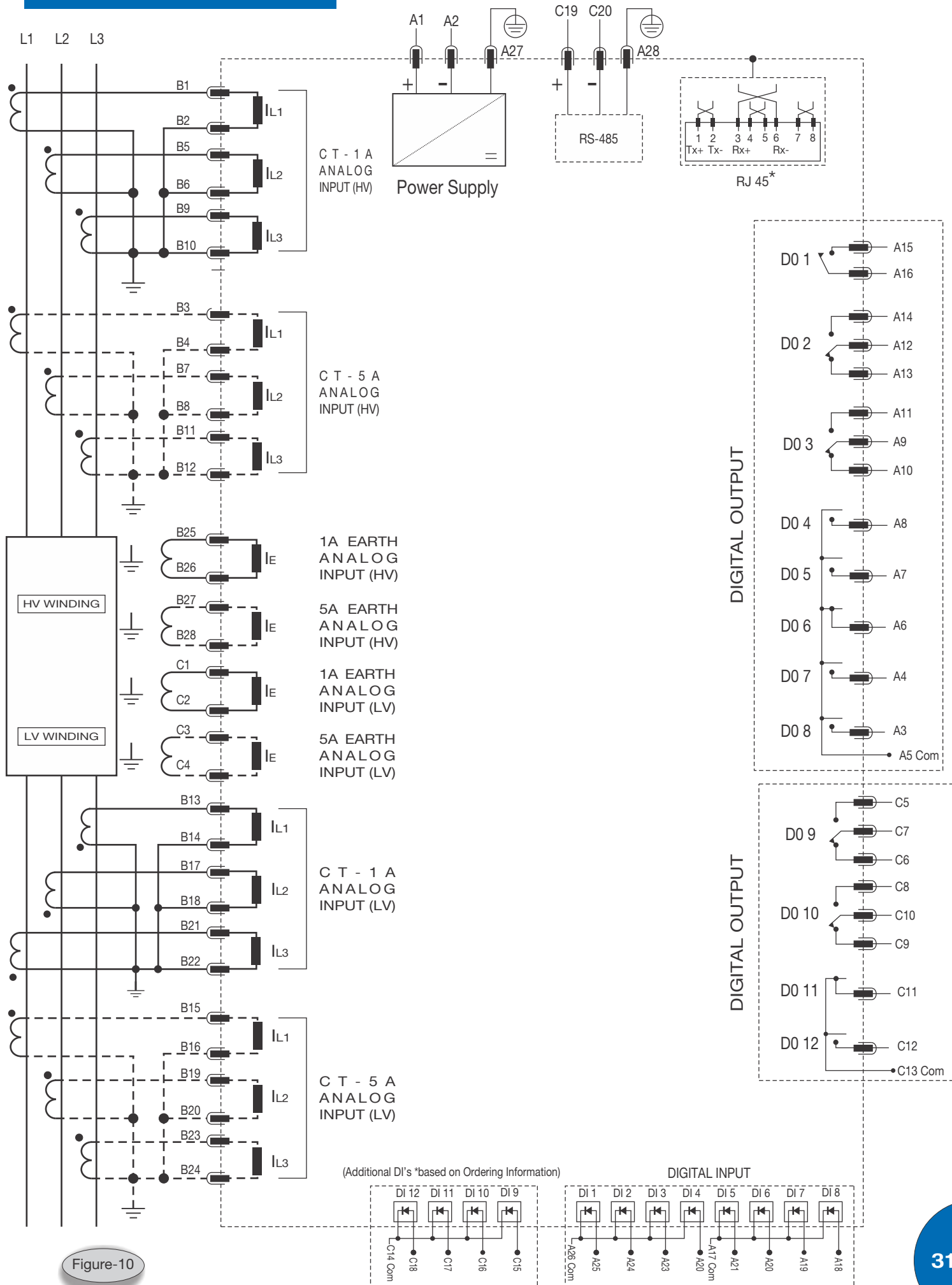


Figure-10

19.0 Terminal Description

Terminal No.	Terminal Description	Contact Details
A1	: Auxiliary Supply (+)	
A2	: Auxiliary Supply (-)	
A27	: Earth	
A3-A5	: Digital Output-8 (DO-8)	: (NO-COMMON)
A4-A5	: Digital Output-7 (DO-7)	: (NO-COMMON)
A6-A5	: Digital Output-6 (DO-6)	: (NC-COMMON)
A7-A5	: Digital Output-5 (DO-5)	: (NO-COMMON)
A8-A5	: Digital Output-4 (DO-4)	: (NO-COMMON)
A11-A9-A10	: Digital Output-3 (DO-3)	: (NO-COMMON-NC)
A14-A12-A13	: Digital Output-2 (DO-2)	: (NO-COMMON-NC)
A15-A16	: Digital Output-1 (DO-1)	: (NO-COMMON)
A18-A17	: Digital Input-8 (DI-8)	
A19-A17	: Digital Input-7 (DI-7)	
A20-A17	: Digital Input-6 (DI-6)	
A21-A17	: Digital Input-5 (DI-5)	
A22-A26	: Digital Input-4 (DI-4)	
A23-A26	: Digital Input-3 (DI-3)	
A24-A26	: Digital Input-2 (DI-2)	
A25-A26	: Digital Input-1 (DI-1)	
B1-B2	: CT Terminal for Phase current (1A) input (HV Winding) in L1 Phase	
B3-B4	: CT Terminal for Phase current (5A) input (HV Winding) in L1 Phase	
B5-B6	: CT Terminal for Phase current (1A) input (HV Winding) in L2 Phase	
B7-B8	: CT Terminal for Phase current (5A) input (HV Winding) in L2 Phase	
B9-B10	: CT Terminal for Phase current (1A) input (HV Winding) in L3 Phase	
B11-B12	: CT Terminal for Phase current (5A) input (HV Winding) in L3 Phase	
B13-B14	: CT Terminal for Phase current (1A) input (LV Winding) in L1 Phase	
B15-B16	: CT Terminal for Phase current (5A) input (LV Winding) in L1 Phase	
B17-B18	: CT Terminal for Phase current (1A) input (LV Winding) in L2 Phase	
B19-B20	: CT Terminal for Phase current (5A) input (LV Winding) in L2 Phase	
B21-B22	: CT Terminal for Phase current (1A) input (LV Winding) in L3 Phase	
B23-B24	: CT Terminal for Phase current (5A) input (LV Winding) in L3 Phase	
B25-B26	: Earth Analog Input (1A) - HV	
B27-B28	: Earth Analog Input (5A) - HV	
C1-C2	: Earth Analog Input (1A) - LV	
C3-C4	: Earth Analog Input (5A) - LV	
C5-C7-C6	: Digital Output-9 (DO-9)	: (NO-COMMON-NC)
C8-C10-C9	: Digital Output-10 (DO-10)	: (NO-COMMON-NC)
C11-C13	: Digital Output-11 (DO-11)	: (NO-COMMON)
C12-C13	: Digital Output-12 (DO-12)	: (NC-COMMON)
C15-C14	: Digital Input-9 (DI-9)	
C16-C14	: Digital Input-10 (DI-10)	
C17-C14	: Digital Input-11 (DI-11)	
C18-C14	: Digital Input-12 (DI-12)	
C19	: RS-485 MODBUS (+)	
C20	: RS-485 MODBUS (-)	
A28	: Communication Ground	

CT Schemes Holmgreen Residual CT's Connection for 1A

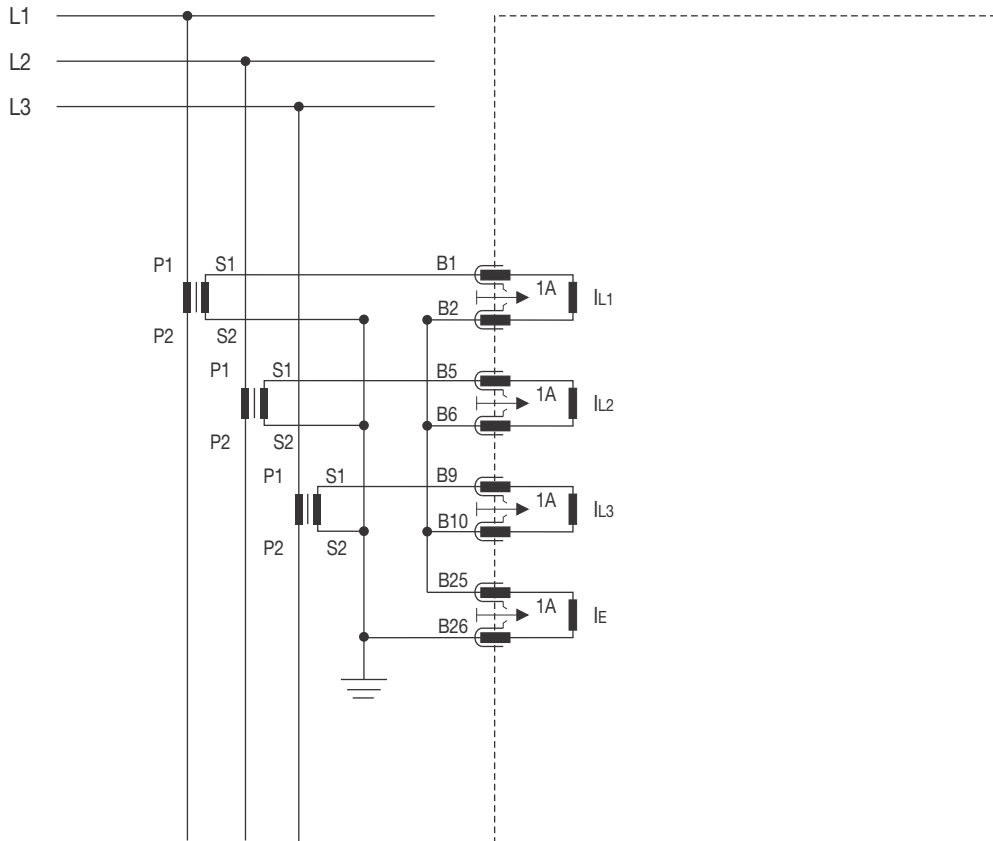


Figure-11

21.0 CT Connection Diagram

CT Schemes Holmgreen Residual CT's Connection for 5A

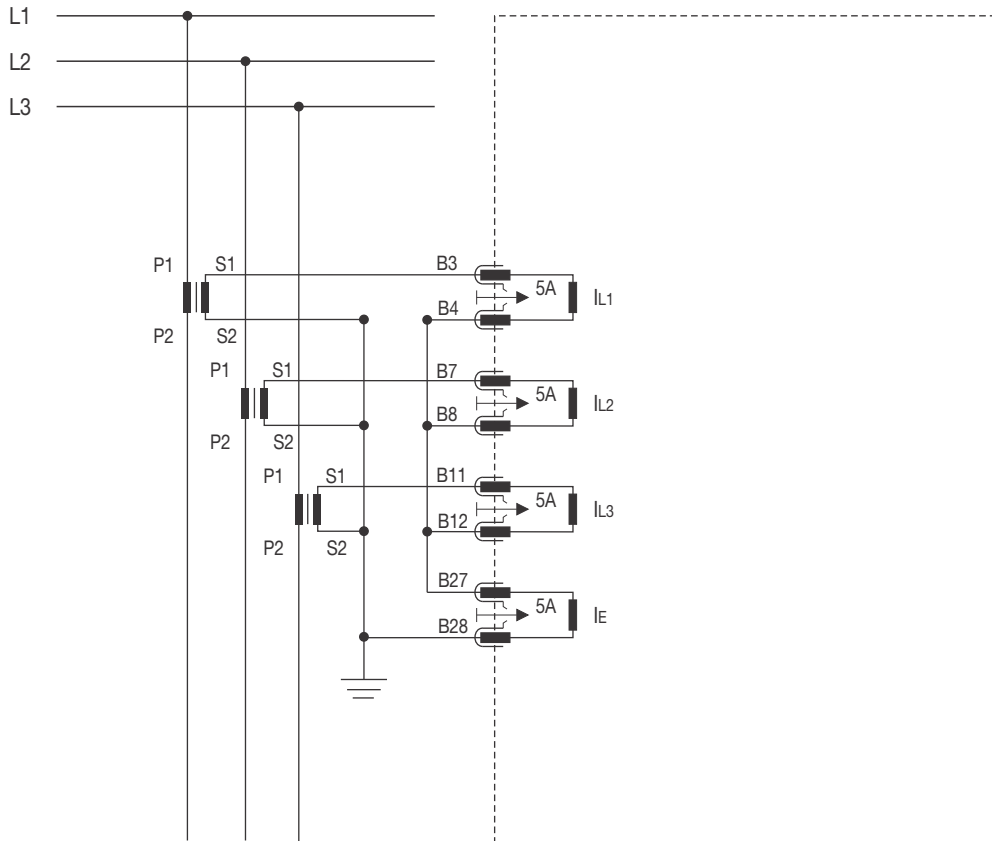
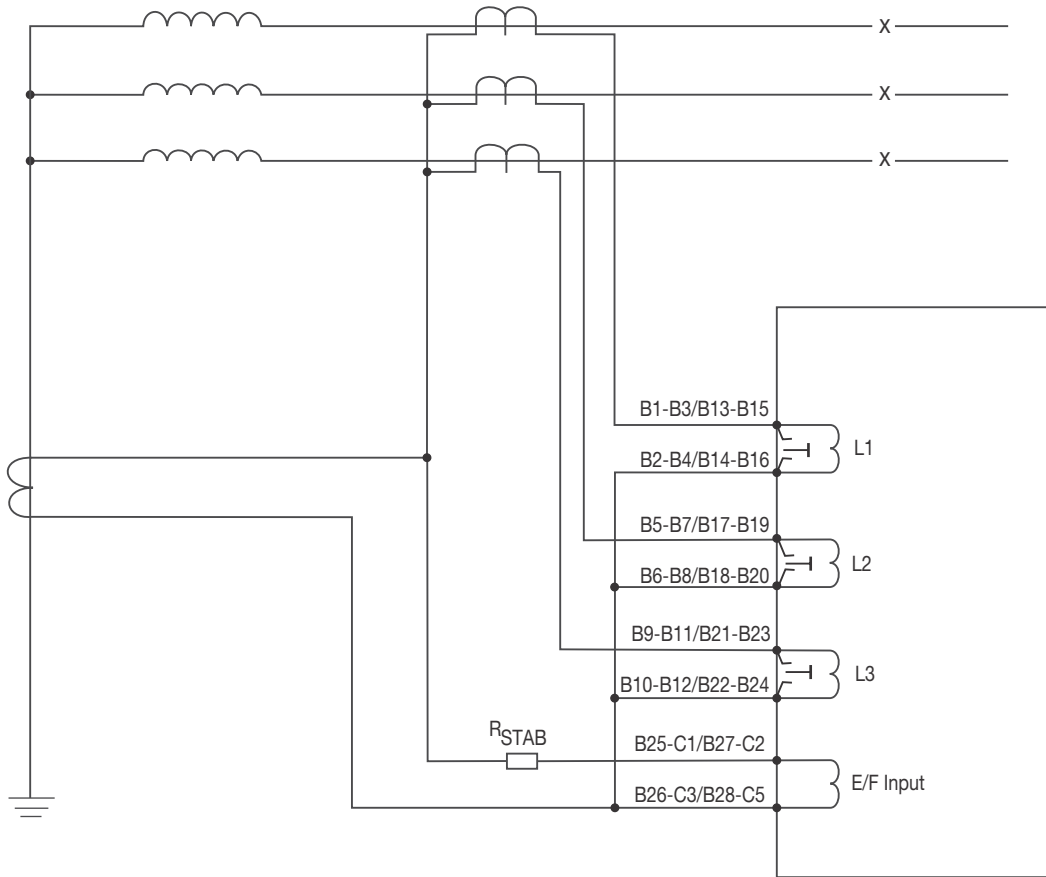


Figure-12

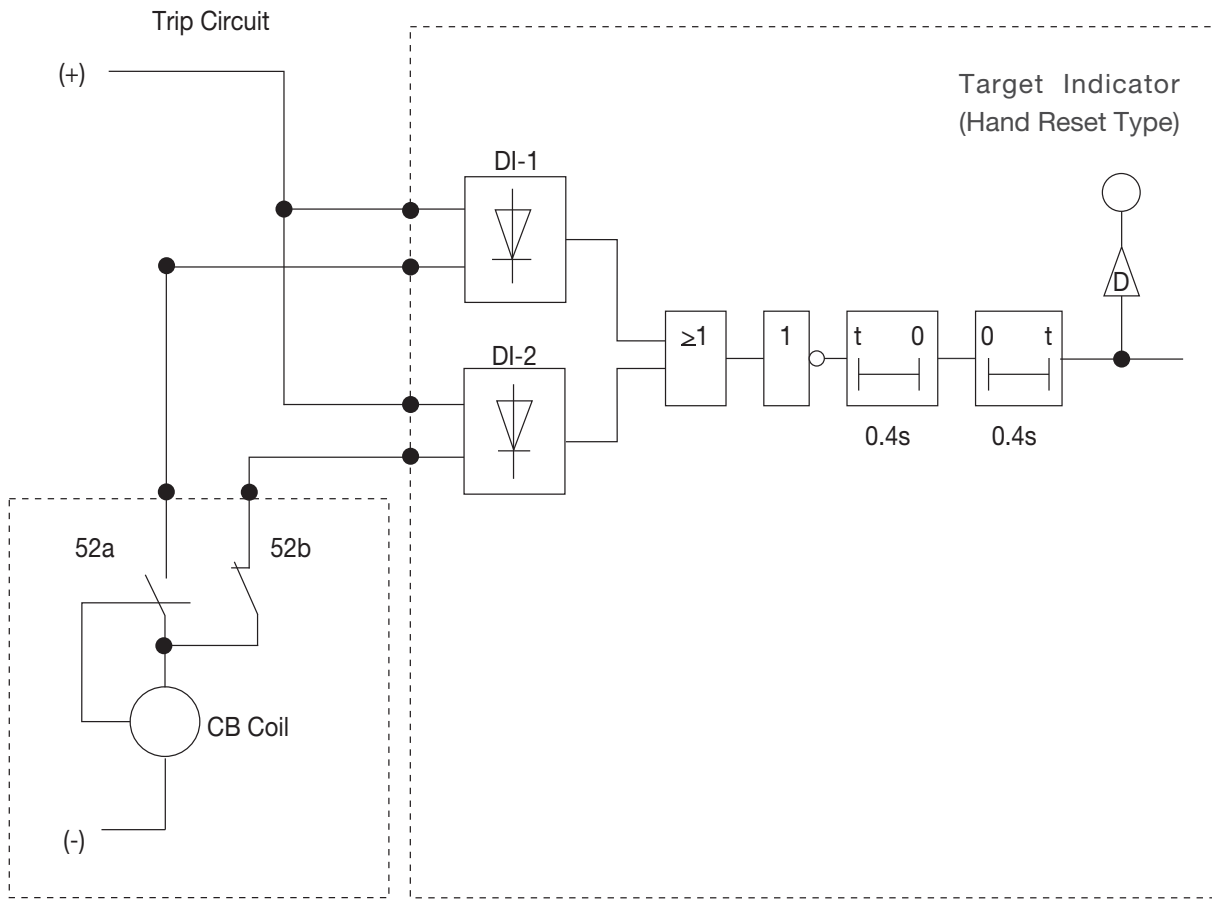
22.0 Connection Scheme for Restricted Earth



CT Connection Diagram for High Impedance REF Application

Figure-13

23.0 Trip Circuit Supervision Diagram



(Trip Circuit Supervision Function)

Figure-14

24.0 Model Selection Table

CSEZEN-T	ANSI	T240
CT Inputs		8
VT Inputs		-
Opto Inputs (Max)		12
Output Contacts (Max)		12
Function Keys/Hot Keys		●
Programming Logic		●

Protection		
Transformer Differential	87P	✓
Three Phase over current	50P/51P	✓
Earth over current	50G/51G	✓
Negative Phase Sequence Over current	46	✓
Low Impedance Restricted Earth Fault (REF)	87G	✓
Output Relay Latching	86	✓
Circuit Breaker Failure Detection	50BF	✓
Blocking Logic		✓
Test of Output Relays (Maintenance)		✓
CB Control Local / Remote		✓
Circuit Breaker Maintenance & Trip Circuit Supervision	74TC	✓
Selective Relay Scheme Logic		✓
Over Fluxing / 5th Harmonic / 2nd Harmonic		✓
Harmonic Blocking	50H	✓

Communication		
Front (USB)		●
RS-485 Modbus		○
RS-485 IEC 60870-5-103		○
RJ-45 IEC 61850		○
SNTP-Time Synch RJ-45		○

○ Optional-Based on ordering information.

25.0 Dimensional Details

All the dim are in mm (Gen. Tol $\pm 1.0\text{mm}$)

Front View

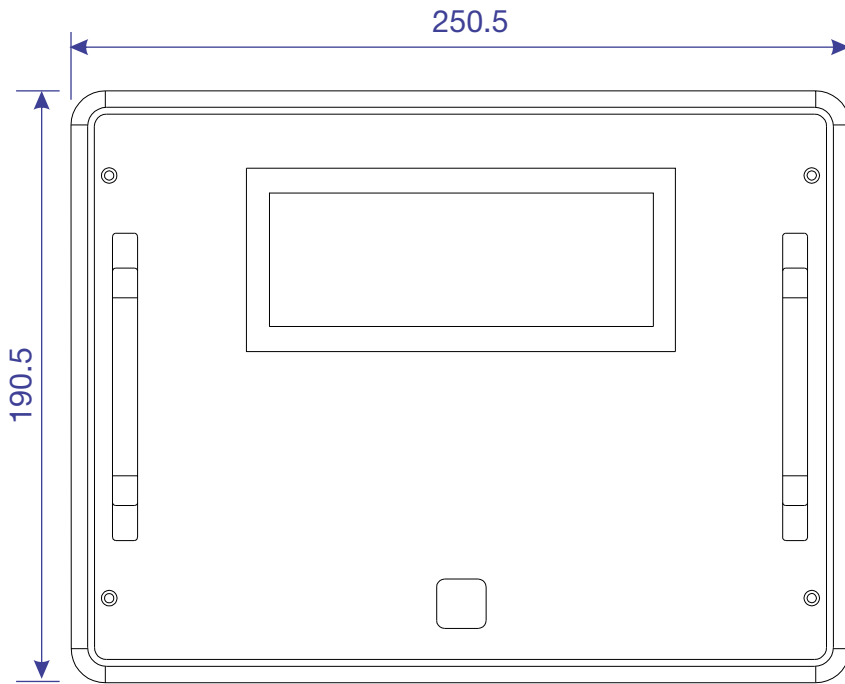


Figure-15

Top View

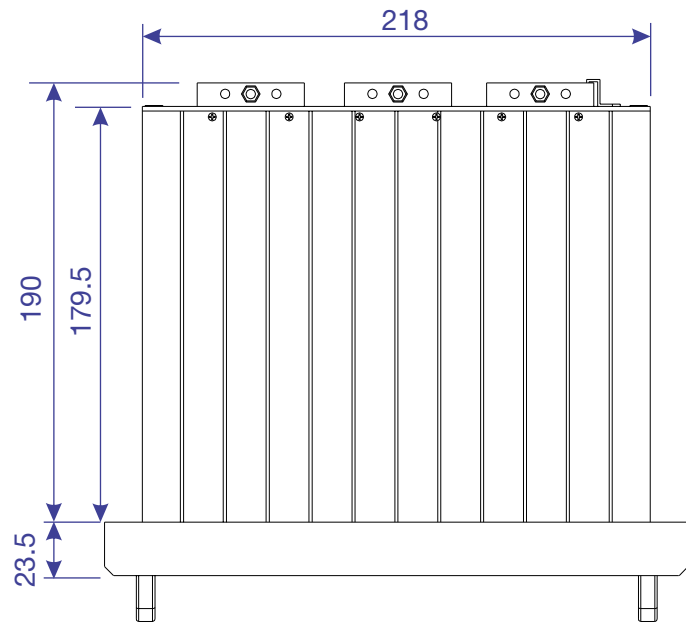


Figure-16

Side View

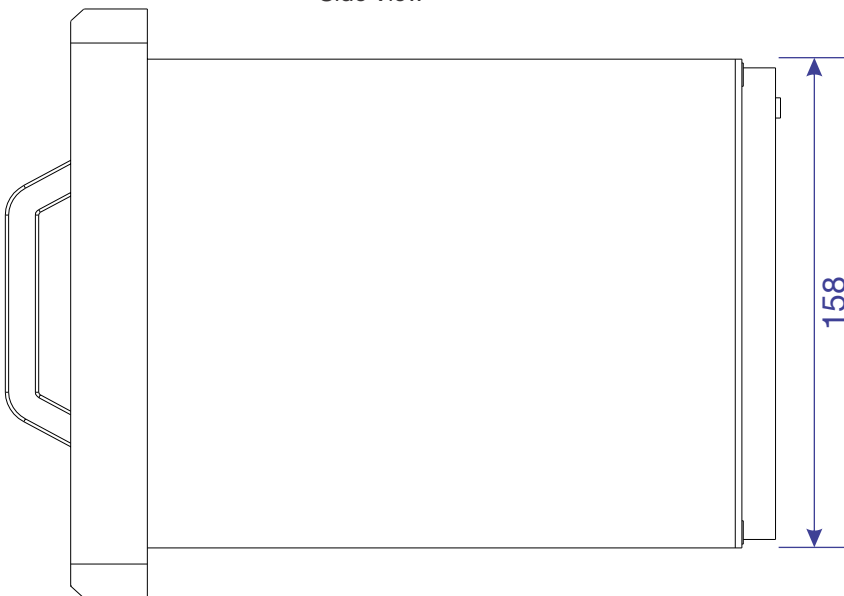


Figure-17

26.0 Panel mounting of the Relay

for Panel mounting

Screw : M4x12mm

Qty : 8 Nos.

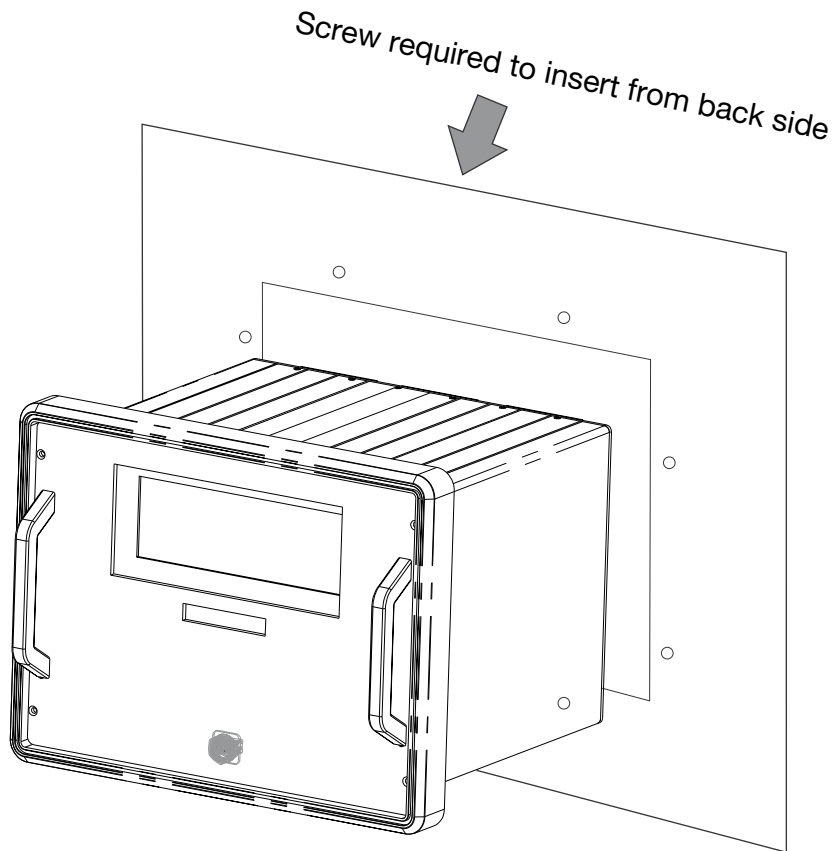


Figure-18

24.0 Panel mounting of the Relay

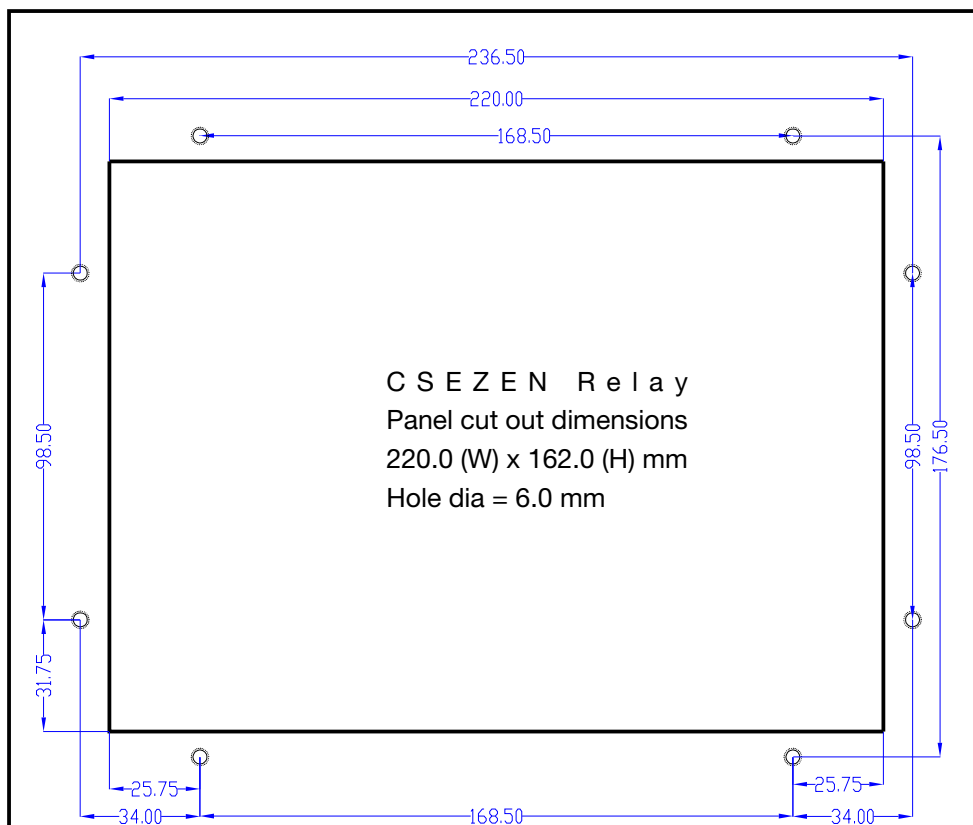


Figure-19

Different views of the Relay

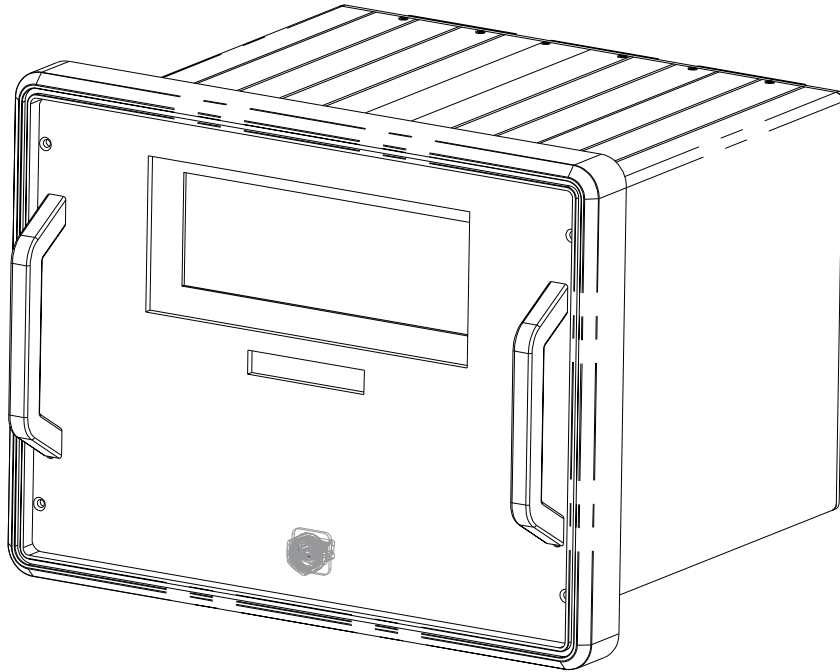


Figure-20

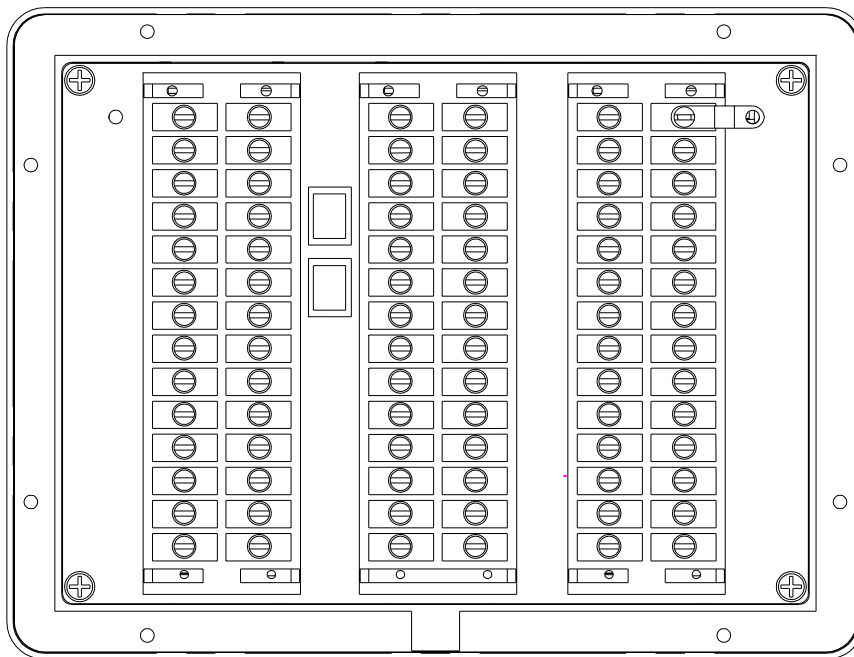


Figure-21

27.0 Ordering Information

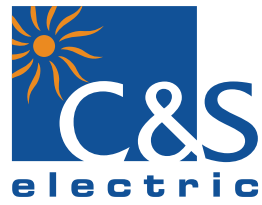
CSEZEN - **T** - **240** - **D** - **X** - **X** - **X** - **X** - **HE**

DIGITAL I O CARD	
8 DI / DO	0
12 DI / DO	1

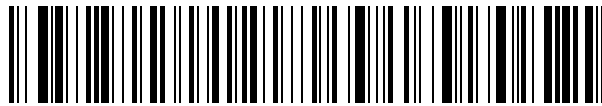
AUXILIARY SUPPLY	
18V-150V DC	L
80V-280V AC / 90V-300V DC	H

COMMUNICATION	
MODBUS on RS-485	A
IEC 60870-5-103 on RS-485	B
IEC 61850 on Ethernet	C
IEC 61850 on RJ-45 Single port	D
IEC 61850 on RJ-45 Dual port	E

TIME SYNCHRONIZATION	
None	0
SNTP on RJ-45	S



Issue Date : 02.09.16
Rev. No : 02
Rev. Date : 27.02.17



CSEZEN- E Cat a l o g u e

