We touch your electricity everyday!

CSEZEN-T

Advance Transformer Protection & Monitoring IED

ZEN E-Series

Catalogue

C&S electric

PMD Division

CONTENTS

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
- 7 Current Analog Input (6 Current Analog Input for CSEZEN-T140)
- 1 Voltage Analog Input (available only with CSEZEN-T200)
- Max.16 Digital Inputs
- Max. 16 Digital Outputs
- 10 LEDs at Pickup & Trip on fault
- LAN-RJ45/RS-485/USB ports for Communication
- 20x4 Bright Alpha numeric LCD
- 12 Push button on the front for HMI
- USB with Laptop / Pen-drive OTG interface
- Programmable Scheme Logic (PSL)

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) on either Primary or Secondary (HMI selection)
- High Impedance Restricted Earth Protection (64G) on either Primary or Secondary (HMI selection)
- Earth Fault (51G) and Instantaneous Over-current Protection (50G) (either HV or LV side)
- Current Unbalance (46) (HV & LV side)
- Over excitation (24 V/Hz)
- Four Setting Groups
- Fault Recorder
- Event Recorder
- Oscilloscope Data Recording
- Multi protocol communication MODBUS-RTU, IEC-103, 101, 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)

6.0 Functional Diagram for T-140 model

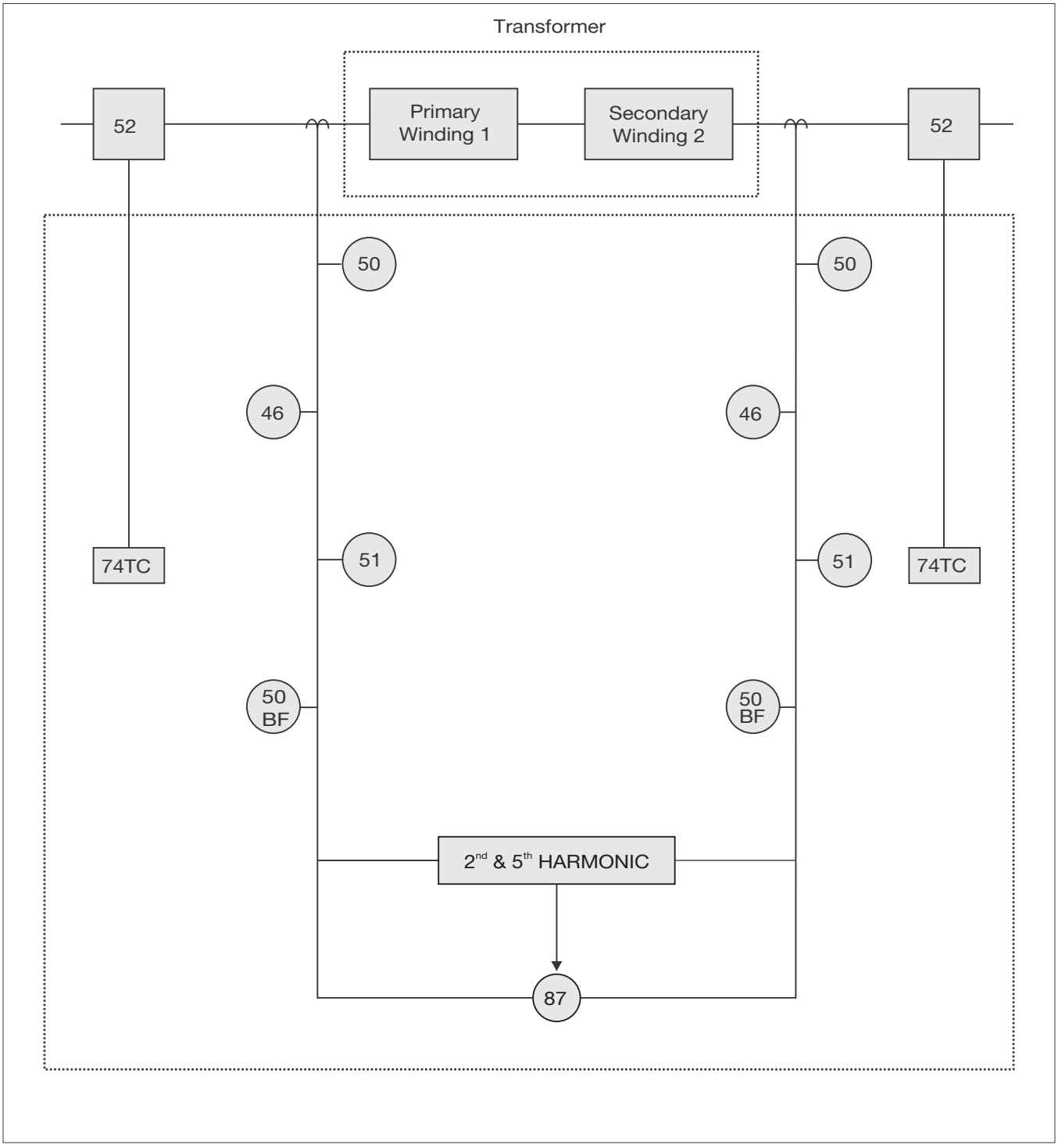
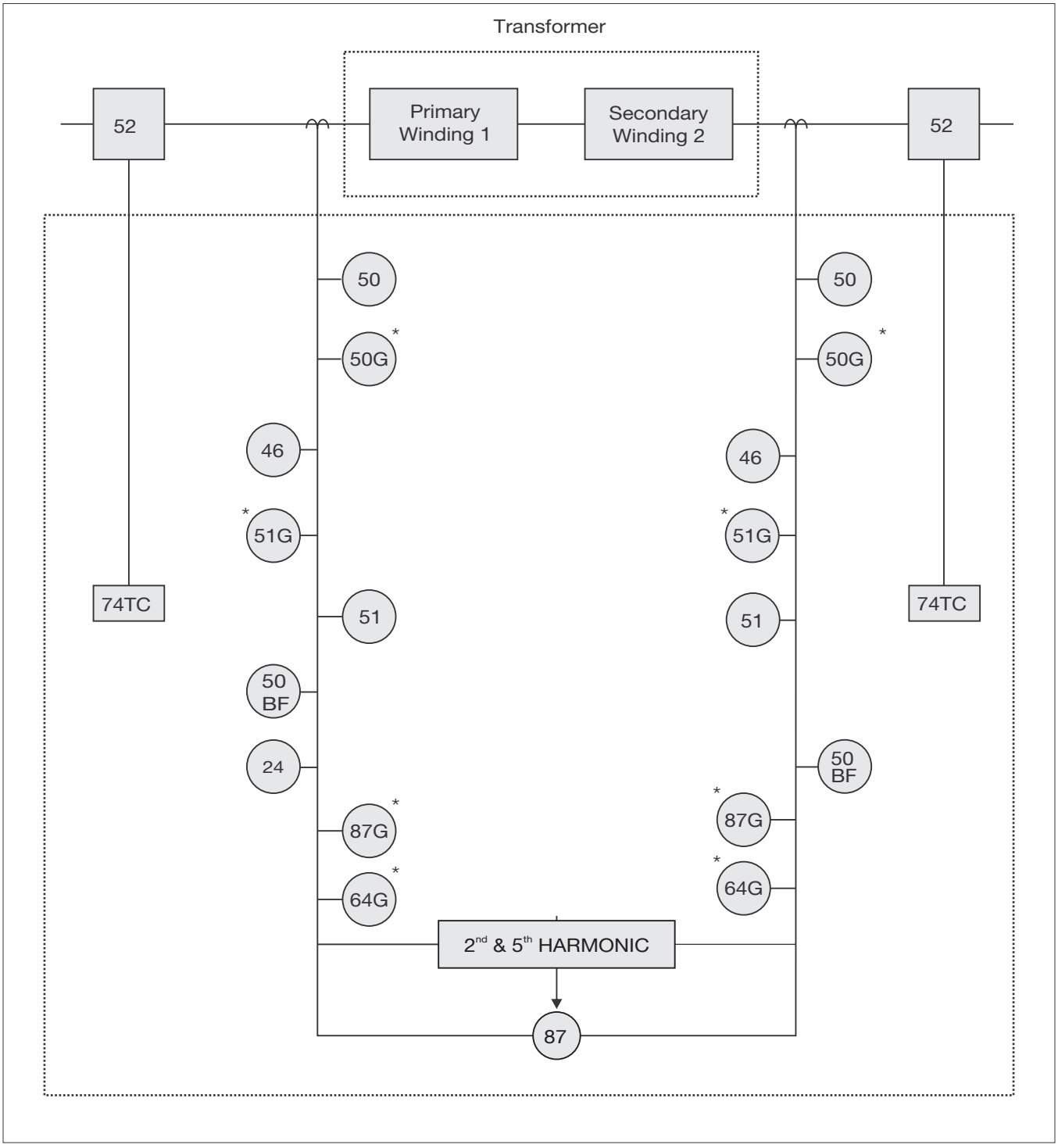


Figure-1

6.1 Functional Diagram for T-200 model



* Available either on HV winding or on LV winding based on HMI selection

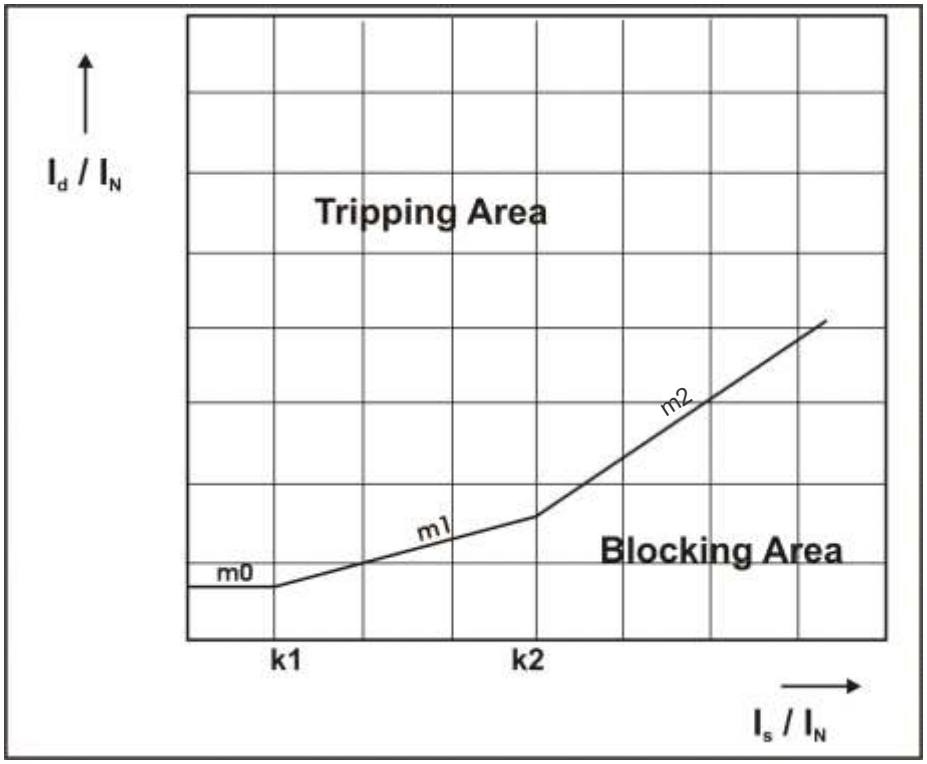
Figure-2

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-6.

The differential unit operation characteristic is as shown below (See Figure-3).



Differential protection operation characteristic

Figure-3

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-7.

3) Instantaneous Differential Protection

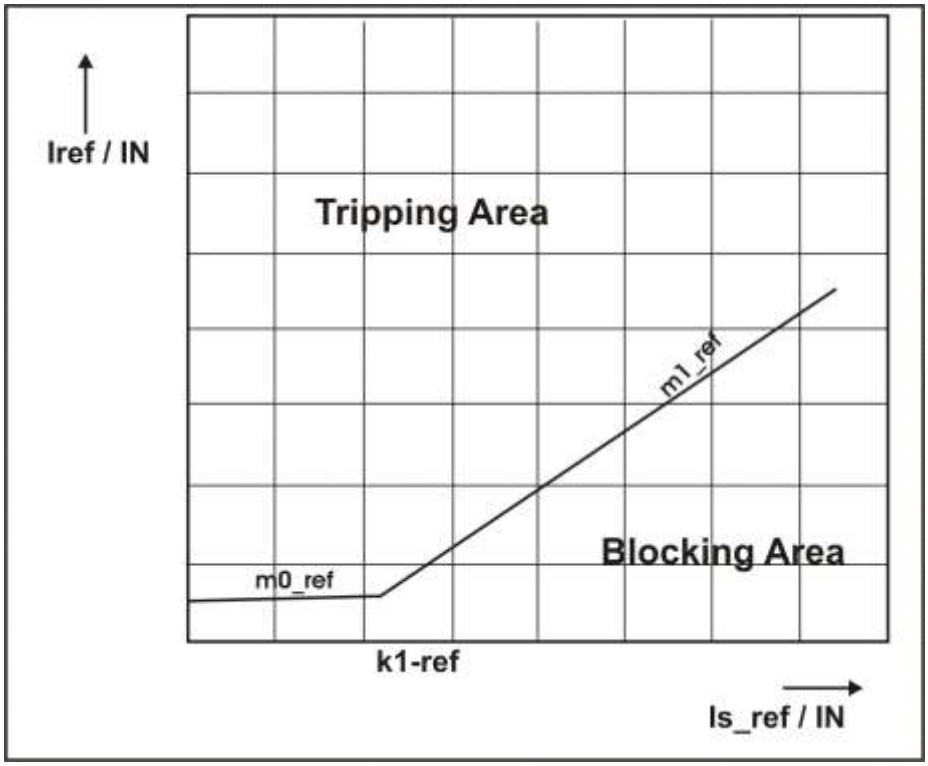
Tripping occurs when the differential current exceeds the set limit for the selected duration. For these protection Refer Table-6. Instantaneous differential protection does not have harmonic blocking.

4) Low Impedance Restricted Earth Protection (87G)*

Based on selection available in HMI for High or Low impedance REF either 87G or 64G function will be applicable and also available either to HV winding or LV winding which is selectable.

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 (Iref) is greater than the calculated value then tripping occurs. For these protection Refer Table-8.

The restricted earth unit operation characteristic is shown below (See Figure-4).



Restricted earth protection operation characteristic

Figure-4

5) High Impedance Restricted Earth Protection (64G)

Based on selection available in HMI for High or Low impedance REF either 87G or 64G function will be applicable and also available either to HV winding or LV winding which is selectable.

The restricted earth fault relay is high impedance differential scheme which balances zero sequence current flowing in the transformer neutral against zero sequence current flowing in the transformer phase windings. Any unbalance for in-zone fault will result in an increasing voltage on the CT secondary and thus will activate the REF protection.

This scheme is very sensitive and can then protect against low levels of fault current in resistance grounded systems where the earthing impedance and the fault voltage limit the fault current.

In addition, this scheme can be used in a solidly grounded system.Refer Connection Scheme for Restricted Earth on Page - 39

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-5.

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. This protection is available either for HV winding or on LV winding based on HMI selection. For these protection Refer Table-5.

Inverse Characteristics Formula

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

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

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

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

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

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

8) Over Excitation Protection (24) *

The over excitation unit prevents transformers from working at a greater flux density than that for which they were designed. It will avoid heating's and consequent damage in the transformer due to over excitation. This unit is based on V / Hz over excitation detection method with two independent levels. For these protection setting Refer Table-11 & Variable Time Over excitation Protection Characteristics graph shown on Page 11.

The inverse time characteristics has the following formula:

$$t = \frac{TMS}{(M-1)^2}$$

Where $M = \frac{V/f}{(V/f \text{ trip setting})}$

V = Measured Voltage

F = Measured Frequency

Variable Time Over excitation Protection Characteristics

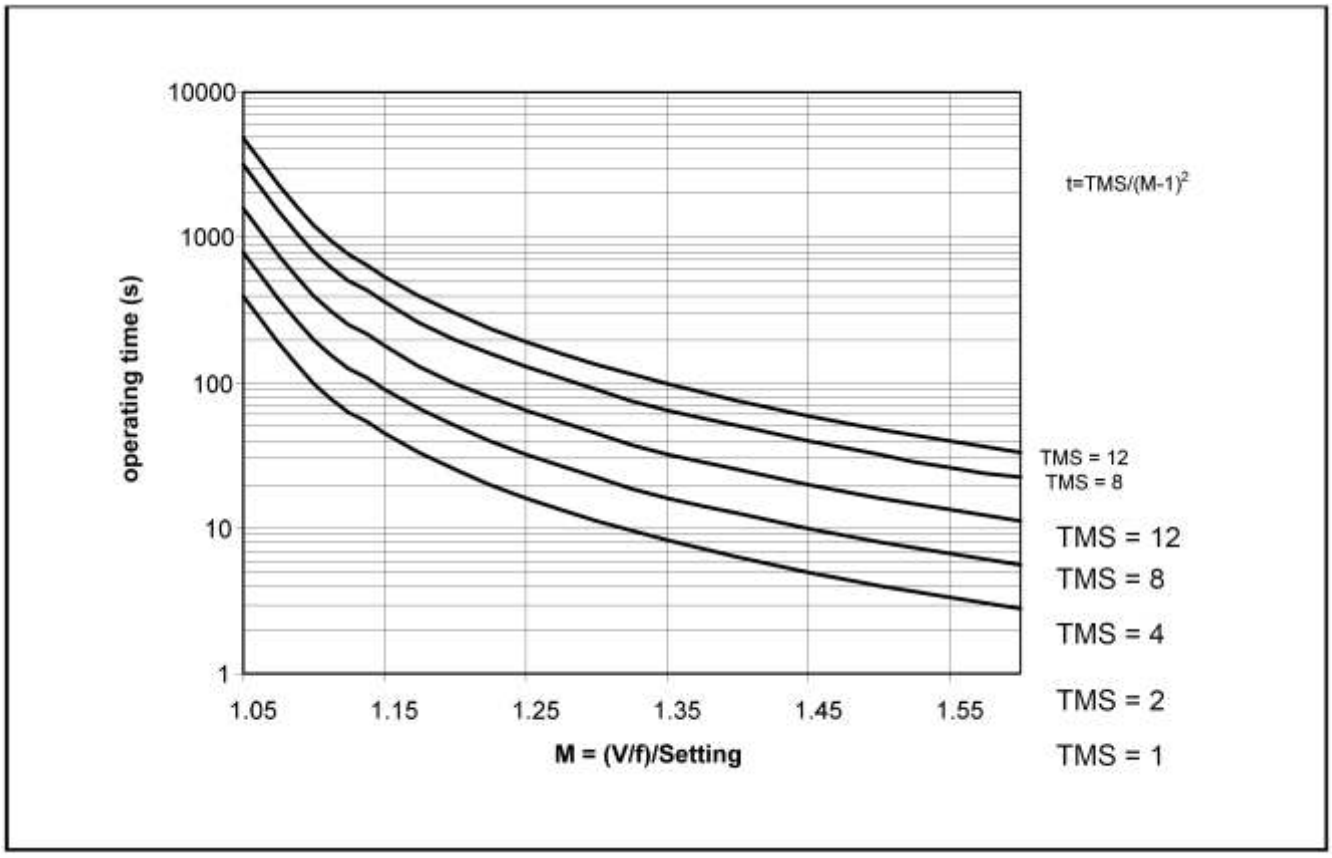


Figure-5

9) 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-4.

If I_2 is Negative phase sequence current then

$$3 \bullet |\vec{I2}| = |\vec{Ia} + a^2 \bullet \vec{Ib} + a \bullet \vec{Ic}| \quad \text{Where } a = 1\angle 120^0$$

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.

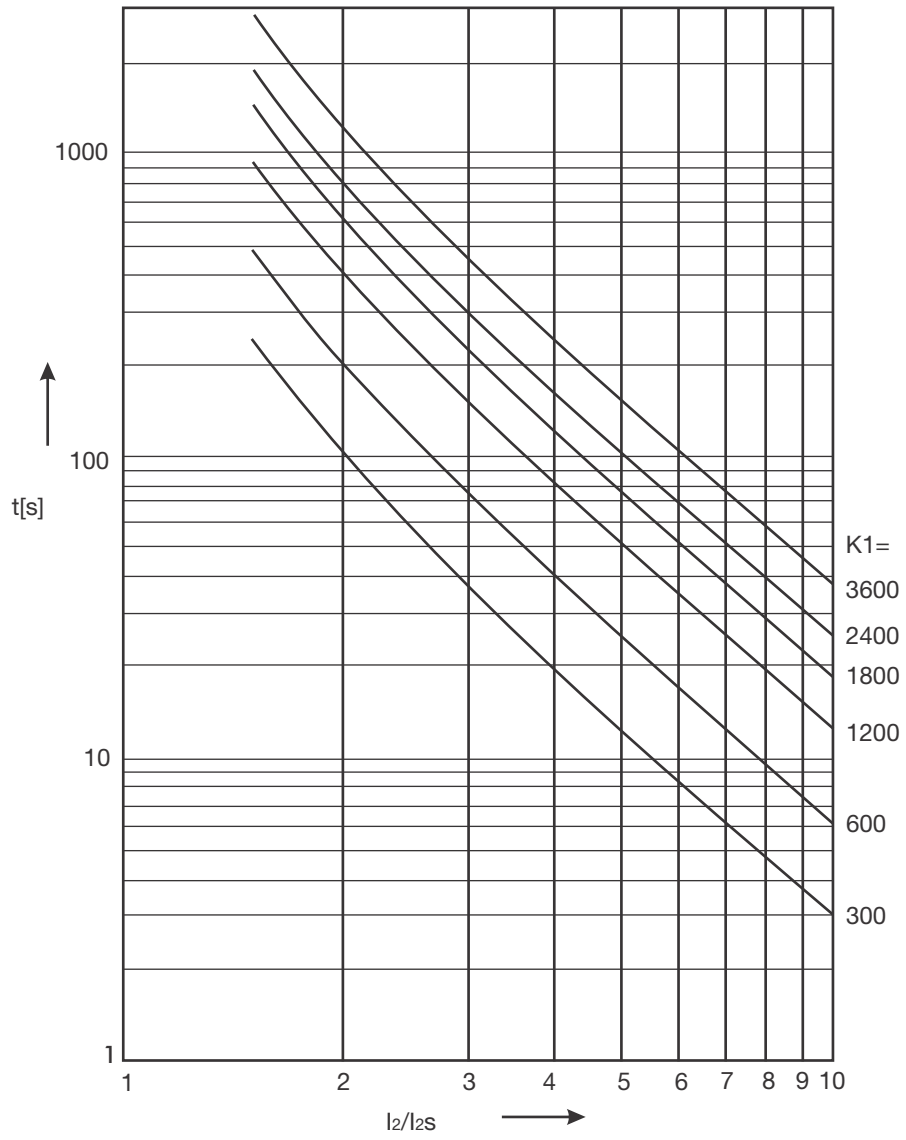


Figure-6

Negative Phase Sequence Inverse Time Characteristics

10) 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-9.

11) 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-2.

12) 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.

13) 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.

14) 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.

15) 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.

16) Selective Relay Scheme Logic

CSEZEN-T relays include selective logic scheme for various protection functions.

17) 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).

8.0 Data Acquisition Function

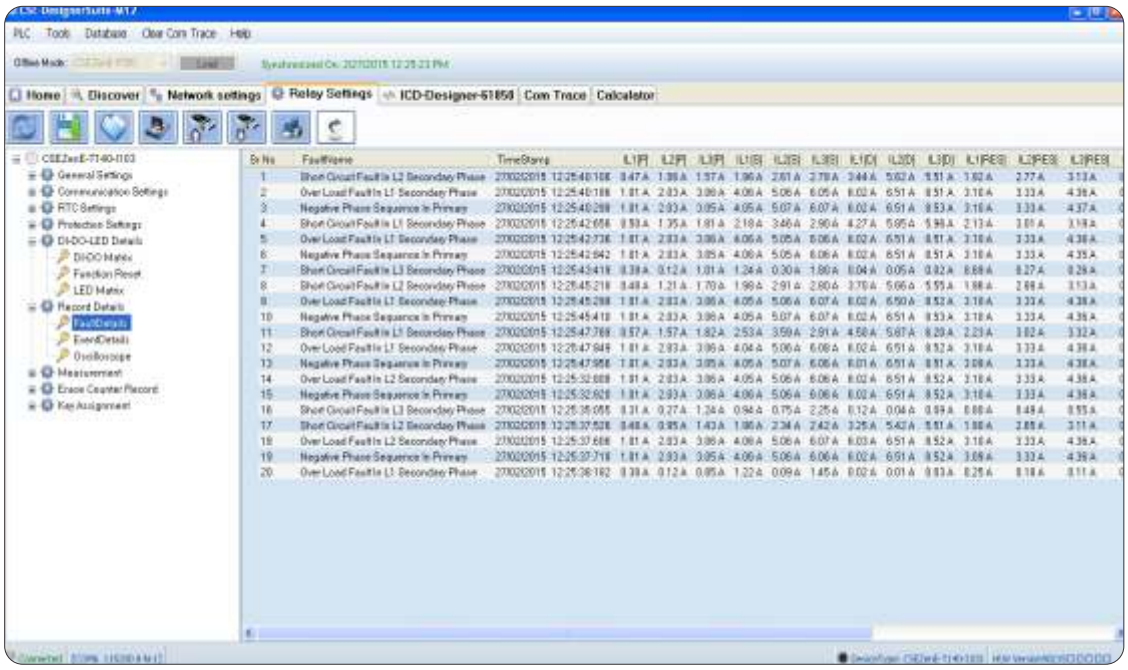
Measurement

- 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*
- Phase Voltage *
- Frequency *
- Trip counter (Increments whenever any DO trip due to some fault)
- Origin of last fault

9.0 Fault Record for T-140 model

CSEZEN-T140 records last 20 faults in its non volatile memory with its time stamp. Each record has the following information:

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



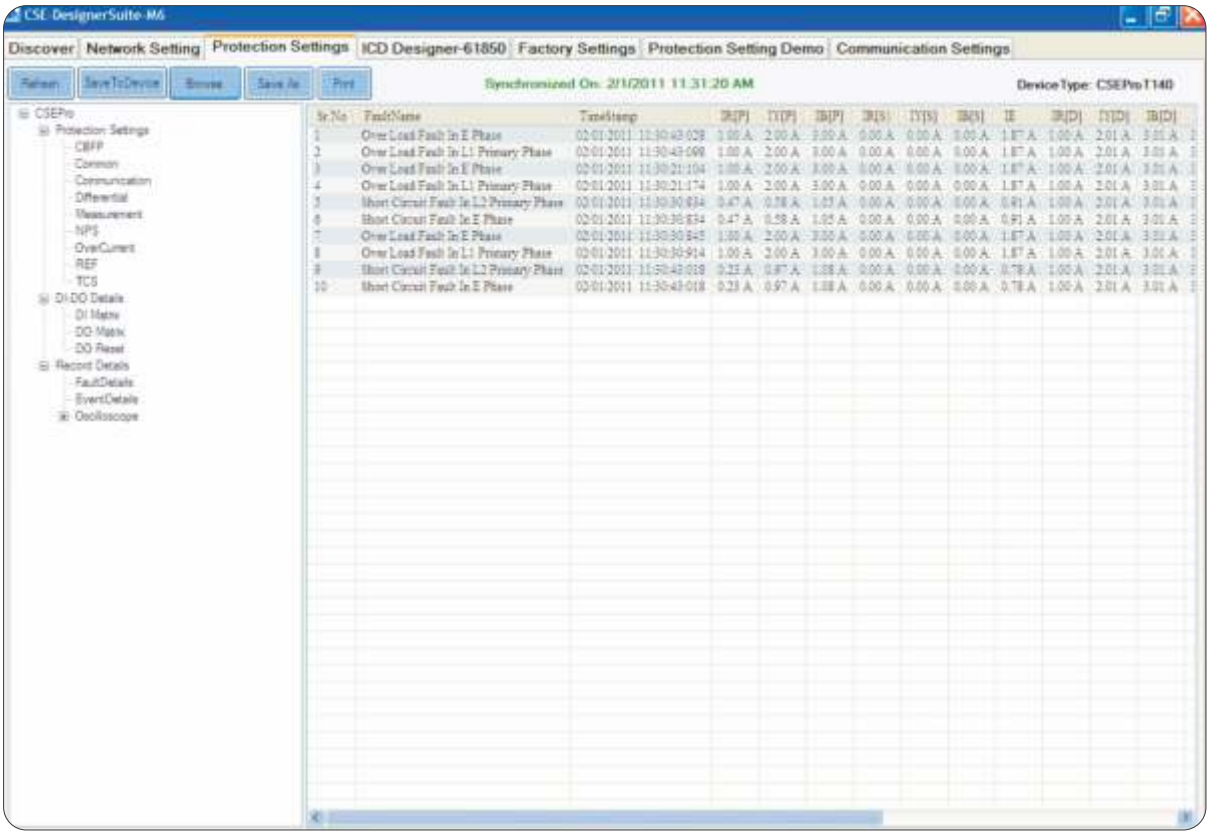
Fault Data recording on PC software

Figure-7

9.1 Fault Record for T-200 model

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



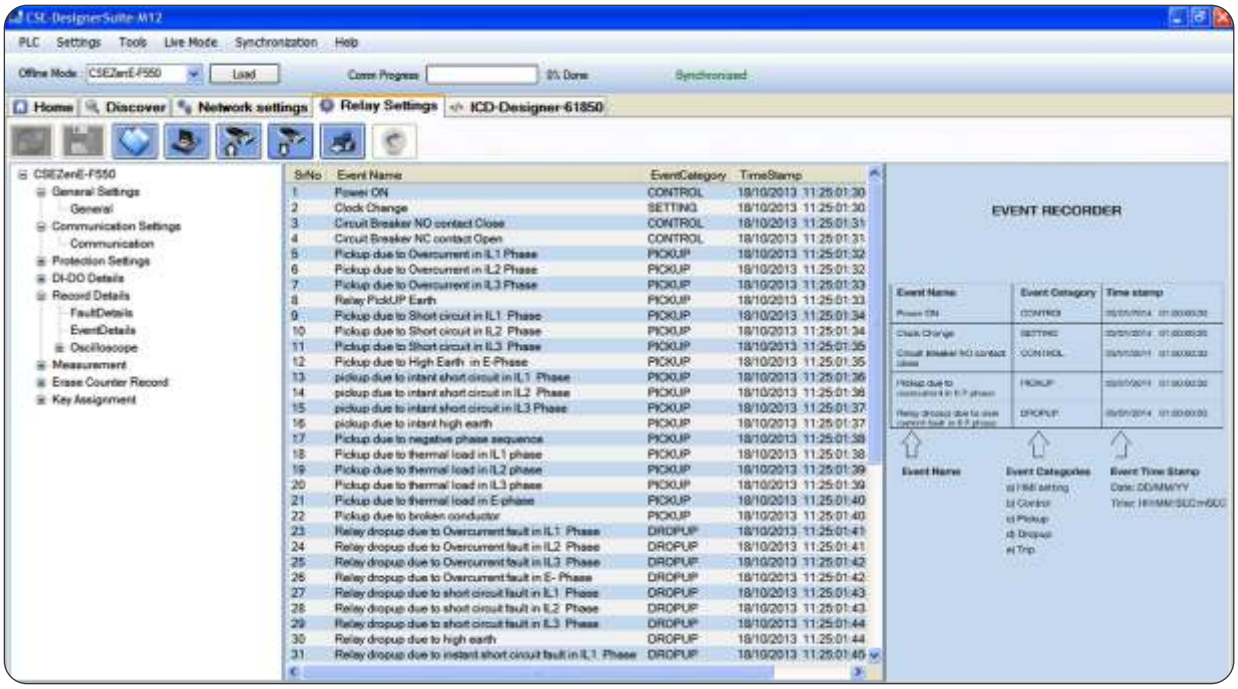
Fault Data recording on PC software

Figure-8

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.



Event Data recording on PC Software

Figure-9

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 16 digital inputs and maximum 16 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-10

Output Contacts

Max. No. of digital outputs	:	16 (DO1, DO2 .....DO16)
Type of outputs	:	Relay
Programmable (DO Assignment)	:	Yes (Max.15 DO are programmable & 1 is fixed for self supervision function
Relay reset type	:	Programmable (Auto/Manual)

Input Contacts

Max. No of digital inputs	:	16 (DI1, DI2..... DI 16)
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.
- ❖ 1 Rear terminal can be for: RJ-45 or plastic F.O.

Rear Communication (RS-485)

The communication protocol for the rear port is based on ordering information. 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 '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.

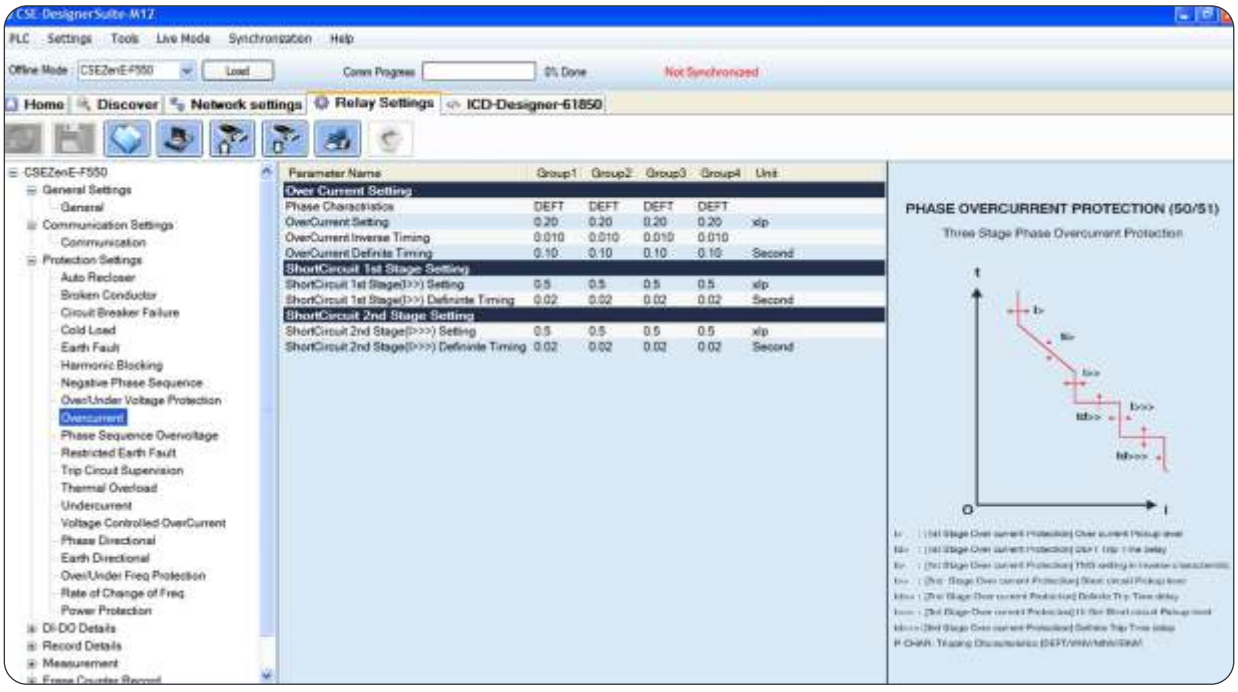


Figure-11

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 12 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 function 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.

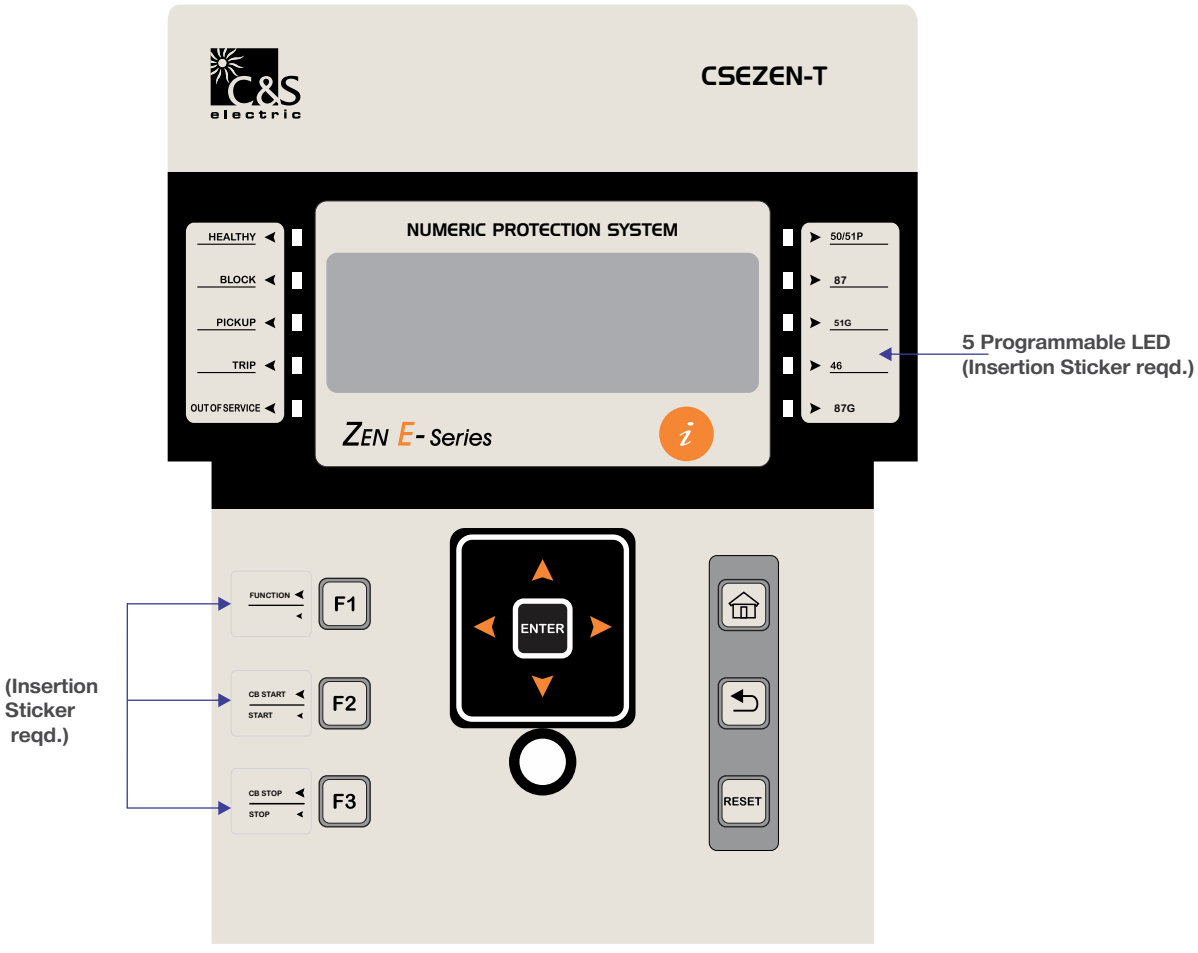


Figure-12

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.
	is used as a “HOME” key.
	is used as a “RESET” key.
	is used as a “BACK” key.
	is used as a “ENTER” key.
	is used to scroll in backward direction and for increment of parameters.
	is used to scroll in forward direction and for decrement of parameters.
	is used to scroll in backward / upward direction of parameters.
	is used to scroll in forward / downward direction of parameters.
	is used as a “FUNCTION” key.
	is used as a Circuit Breaker Open key.
	is used as a Circuit Breaker Close key.

LED Description

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

1) HEALTHY — Relay is in Healthy condition
2) BLOCK — Some protection function is blocked
3) PICKUP — Relay is in pickup mode
4) TRIP — Relay is in Trip mode
5) OUT OF SERVICE — Relay is in out of service mode (Protection on hold)

Rest 5 LED’s are programmable via front end software CSE Designer Suite-M12, which are in front fascia. For these 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.

Programmable Scheme Logic

Programmable scheme logic is configured using the front end interface CSE Designer Suite-M12. This interface uses Boolean equations. Flexible logic allows user to create logic diagram to be assigned digital output or LED.

The designed logic is event driven to ensure that protection is not delayed.

The following figure describes the use of protection schemes using the over current pickup & under voltage pickup from downstream relays to block operation of upstream relays using a digital output.

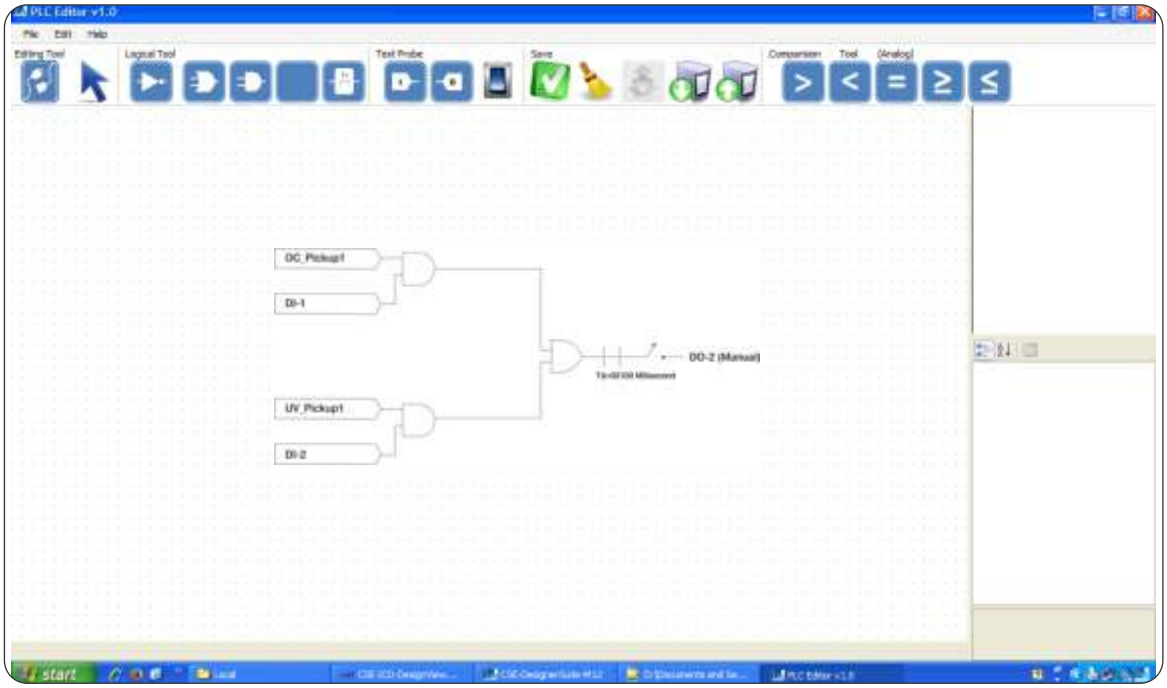


Figure-13

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 Charactristics	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 m0<k1 and k1<k2). (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
REF Selection (Low-High Impedance)	Lo/Hi Z	Low-Z	High-Z	-----	Low-Z
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
Winding selection	WINDNG	Primary	Secondary	-----	Primary

Note: (4) (4) Refer Figure-4 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)

Over Excitation Protection Setting (24)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Overexcitation Function Stage1	Oext STG1	Disable	Enable	----	Disable
Pickup threshold (V/Hz) Stage1	Pkup S1>	1.5V/Hz	3.5V/Hz	0.01V/Hz	2.3V/Hz
Curve type	Curve S1	DEFT	IDMT	----	DEFT
Definite time (V/Hz) Stage1	td S1	0.03sec	300sec	0.01sec	0.1sec
TMS Setting (V/Hz) Stage1	TMS S1	0.01	12	0.01	0.1
Overexcitation Function Stage2	Oext STG2	Disable	Enable	----	Disable
Pickup threshold (V/Hz) Stage2	Pkup S2>	1.5V/Hz	3.5V/Hz	0.01V/Hz	2.3V/Hz
Definite time (V/Hz) Stage2	td S2	0.03sec	300sec	0.01sec	0.1sec

(Table-11)

DO Assignment Setting

S.No.	Parameters
1	HV Winding Over-current Pickup
2	HV Winding Over-current Trip
3	LV Winding Over-current Pickup
4	LV Winding Over-current Trip
5	HV Winding Short-circuit Pickup
6	HV Winding Short-circuit Trip
7	LV Winding Short-circuit Pickup
8	LV Winding Short-circuit Trip
9	Earth Over-current Pickup
10	Earth Over-current Trip
11	Earth Hi-set Pickup
12	Earth Hi-set Trip
13	Percentage Differential Pickup
14	Percentage Differential Trip
15	Differential Hiset Pickup
16	Differential Hiset Trip
17	Restricted Earth Pickup
18	Restricted Earth Trip
19	HV Winding Negative Phase Sequence Pickup
20	HV Winding Negative Phase Sequence Trip
21	LV Winding Negative Phase Sequence Pickup
22	LV Winding Negative Phase Sequence Trip
23	Overexcitation Stage1 Pickup
24	Overexcitation Stage1 Trip
25	Overexcitation Stage2 Pickup
26	Overexcitation Stage2 Trip

S.No.	Parameters
27	HV Winding Trip Circuit Supervision
28	LV Winding Trip Circuit Supervision
29	HV Winding Circuit Breaker Fault Protection
30	LV Winding Circuit Breaker Fault Protection
31	HV winding Circuit Breaker Open
32	HV winding Circuit Breaker Close
33	LV winding Circuit Breaker Open
34	LV winding Circuit Breaker Close
35	Remote Trip1
36	Remote Trip2
37	Remote Trip3
38	Remote Trip4
39	Remote Trip5
40	Remote Trip6
41	Backup Relay Trip
42	BUCHHOLTZ Alarm
43	BUCHHOLTZ Trip
44	OLTC Alarm
45	OLTC Trip
46	WTI Alarm
47	WTI Trip
48	OTI Alarm
49	OTI Trip
50	PRV Alarm
51	PRV Trip

(Table-12)

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	Earth Overcurrent Blocking
19	Earth Hiset Blocking
20	Differential Blocking
21	Differential Hiset Blocking
22	Restricted Earth Blocking
23	HV Winding NPS Current Blocking
24	LV Winding NPS Current Blocking
25	Overexcitation Stage1 Blocking
26	Overexcitation Stage2 Blocking
27	Backup Relay Trip
28	BUCHHOLTZ Alarm
29	BUCHHOLTZ Trip
30	OLTC Alarm
31	OLTC Trip
32	WTI Alarm
33	WTI Trip
34	OTI Alarm
35	OTI Trip
36	PRV Alarm
37	PRV Trip

(Table-13)

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	Earth Overcurrent Pickup
10	Earth Overcurrent Trip
11	Earth Hiset Pickup
12	Earth Hiset Trip
13	Percentage Differential Pickup
14	Percentage Differential Trip
15	Differential Hiset Pickup
16	Differential Hiset Trip
17	Restricted Earth Pickup
18	Restricted Earth Trip
19	HV Winding Negative Phase Sequence Pickup
20	HV Winding Negative Phase Sequence Trip
21	LV Winding Negative Phase Sequence Pickup
22	LV Winding Negative Phase Sequence Trip
23	Overexcitation Stage1 Pickup
24	Overexcitation Stage1 Trip
25	Overexcitation Stage2 Pickup
26	Overexcitation Stage2 Trip
27	HV Winding Trip Circuit Supervision
28	LV Winding Trip Circuit Supervision
29	HV Winding Circuit Breaker Fault Protection
30	LV Winding Circuit Breaker Fault Protection
31	Remote Trip1
32	Remote Trip2
33	Remote Trip3
34	Remote Trip4
35	Remote Trip5
36	Remote Trip6
37	Backup Relay Trip
38	BUCHHOLTZ Alarm
39	BUCHHOLTZ Trip
40	OLTC Alarm
41	OLTC Trip
42	WTI Alarm
43	WTI Trip
44	OTI Alarm
45	OTI Trip
46	PRV Alarm
47	PRV Trip

(Table-14)

LED Assignment Setting

S.No.	Parameters
1	HV Winding Over Current Pickup
2	HV Winding Over Current Trip
3	LV Winding Over Current Pickup
4	LV Winding Over Current Trip
5	HV Winding Short Circuit Pickup
6	HV Winding Short Circuit Trip
7	LV Winding Short Circuit Pickup
8	LV Winding Short Circuit Trip
9	Earth Over current Pickup
10	Earth Over current Trip
11	Earth Hi set Pickup
12	Earth Hi set Trip
13	Percentage Differential Pickup
14	Percentage Differential Trip
15	Differential Hi set Pickup
16	Differential Hi set Trip
17	Restricted Earth Pickup
18	Restricted Earth Trip
19	HV Winding Negative Phase Sequence Pickup
20	HV Winding Negative Phase Sequence Trip
21	LV Winding Negative Phase Sequence Pickup
22	LV Winding Negative Phase Sequence Trip
23	Over excitation Stage1 Pickup
24	Over excitation Stage1 Trip
25	Over excitation Stage2 Pickup
26	Over excitation Stage2 Trip

S.No.	Parameters
27	HV Winding Trip Circuit Supervision
28	LV Winding Trip Circuit Supervision
29	HV Winding Circuit Breaker Fault Protection
30	LV Winding Circuit Breaker Fault Protection
31	HV winding Circuit Breaker Open
32	HV winding Circuit Breaker Close
33	LV winding Circuit Breaker Open
34	LV winding Circuit Breaker Close
35	Remote Trip1
36	Remote Trip2
37	Remote Trip3
38	Remote Trip4
39	Remote Trip5
40	Remote Trip6
41	Backup Relay Trip
42	BUCHHOLTZ Alarm
43	BUCHHOLTZ Trip
44	OLTC Alarm
45	OLTC Trip
46	WTI Alarm
47	WTI Trip
48	OTI Alarm
49	OTI Trip
50	PRV Alarm
51	PRV Trip
52	Battery Low

(Table-15)

Oscilloscope (Disturbance) Record

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

(Table-16)

Date & Time Setting

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-17)

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
PT Ratio	1	10000	1
Nominal frequency	50Hz	60Hz	----
Fault message status	Disable	Enable	----

(Table-18)

Communication

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-19)

RS-485 Communication		Default Setting
Baud rate selection (programmable)	9600/19200/38400/57600 bps	9600bps
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	------

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

(Table-20)

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 x I_n for 10 Sec : 30 x I_n continuously : 4 x I_n

(Table-21)

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-22)

Trip Time Accuracy for Voltage Protections

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

(Table-23)

Measurement Accuracy

Parameters	Range	Frequency Range	Accuracy
Current in Ampere	1.0-30xIn	50-60Hz	Less than±2%
Voltage	5-150%Un	50-60Hz	Less than±2%
Frequency	Fn ±10 Hz	40-70 Hz	Less than±0.01 Hz

(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	10000 operation minimum
Unloaded contact	30000 operation minimum

(Table-25)

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	UN80V-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-26)

Common Data

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

(Table-27)

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	IEC 60068-2-2	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 (Dust5x + 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)		IEC60255-6 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	IEC60255-113 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 1.4 x 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)	IEC 61000-4-8	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

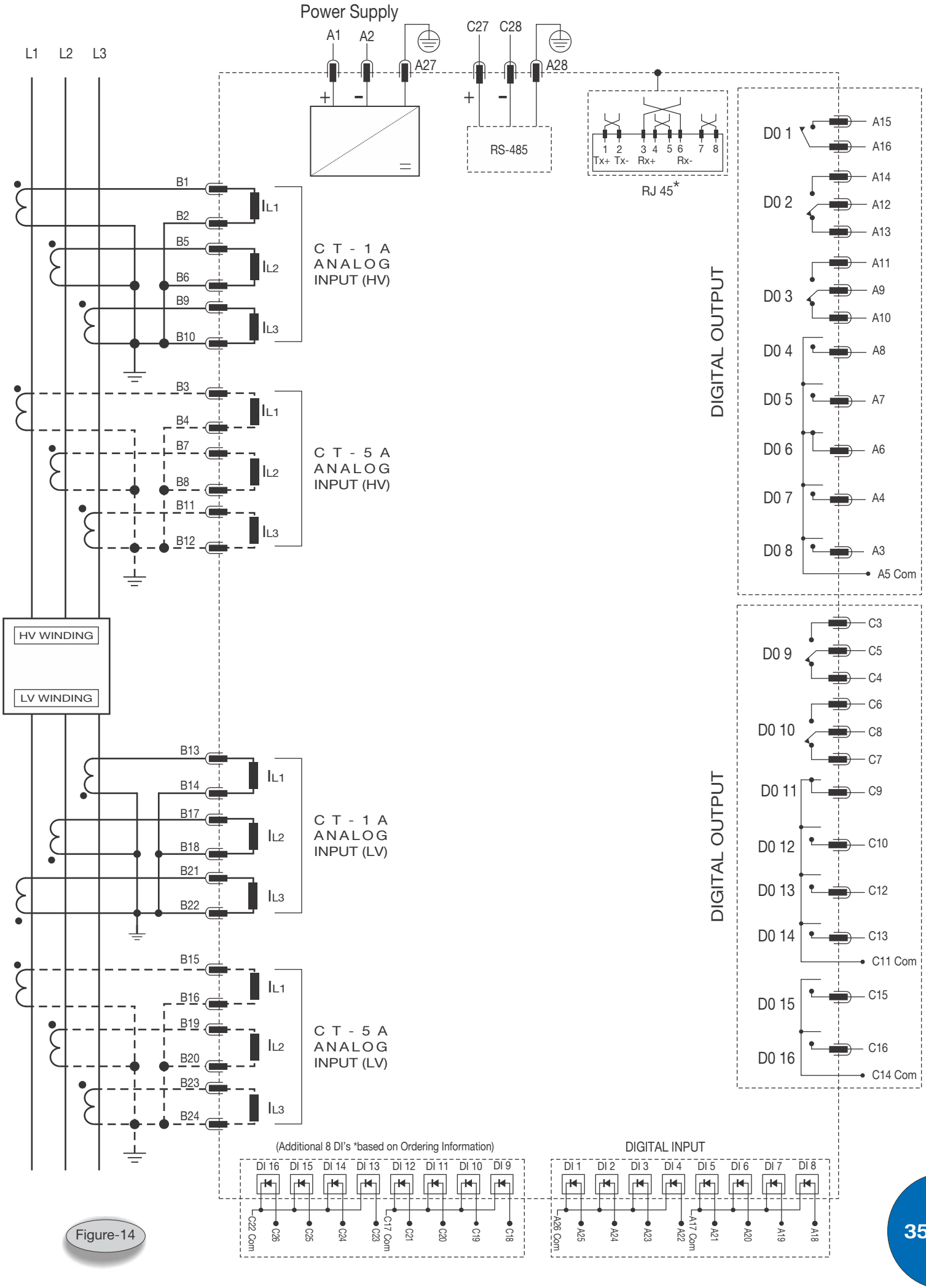

Power Supply
A1
A2
A27
C27
C28
A28
RS-485
RJ 45*
1 2 3 4 5 6 7 8
Tx+ Tx- Rx+ Rx-
L1
L2
L3
B1
B2
B5
B6
B9
B10
IL1
IL2
IL3
CT - 1A ANALOG INPUT (HV)
B3
B4
B7
B8
B11
B12
CT - 5A ANALOG INPUT (HV)
HV WINDING
LV WINDING
B13
B14
B17
B18
B21
B22
CT - 1A ANALOG INPUT (LV)
B15
B16
B19
B20
B23
B24
CT - 5A ANALOG INPUT (LV)
DIGITAL OUTPUT
D0 1
D0 2
D0 3
D0 4
D0 5
D0 6
D0 7
D0 8
A15
A16
A14
A12
A13
A11
A9
A10
A8
A7
A6
A4
A3
A5 Com
DIGITAL OUTPUT
D0 9
D0 10
D0 11
D0 12
D0 13
D0 14
D0 15
D0 16
C3
C5
C4
C6
C8
C7
C9
C10
C12
C13
C11 Com
C15
C16
C14 Com
(Additional 8 DI's *based on Ordering Information)
DI 16 DI 15 DI 14 DI 13 DI 12 DI 11 DI 10 DI 9
C22 Com C26 C25 C24 C23 C17 Com C21 C20 C19 C18
DIGITAL INPUT
DI 1 DI 2 DI 3 DI 4 DI 5 DI 6 DI 7 DI 8
A26 Com A25 A24 A23 A22 A17 Com A21 A20 A19 A18

Figure-14

18.1 Terminal Description

WITH 16 DI / DO

Terminal No.		Terminal Description		Contact Details
A1	:	Auxiliary Supply (+)		
A2	:	Auxiliary Supply (-)		
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-1 (DI-8)		
A19-A17	:	Digital Input-2 (DI-7)		
A20-A17	:	Digital Input-3 (DI-6)		
A21-A17	:	Digital Input-4 (DI-5)		
A22-A26	:	Digital Input-5 (DI-4)		
A23-A26	:	Digital Input-6 (DI-3)		
A24-A26	:	Digital Input-7 (DI-2)		
A25-A26	:	Digital Input-8 (DI-1)		
A27	:	Earth		
A28	:	Earth		
B1-B2	:	CT Terminal for Phase current (1A) input (HV Winding) in L1 Phase		
B5-B6	:	CT Terminal for Phase current (1A) input (HV Winding) in L2 Phase		
B9-B10	:	CT Terminal for Phase current (1A) input (HV Winding) in L3 Phase		
B3-B4	:	CT Terminal for Phase current (5A) input (HV Winding) in L1 Phase		
B7-B8	:	CT Terminal for Phase current (5A) input (HV Winding) in L2 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 L3 Phase		
B15-B16	:	CT Terminal for Phase current (5A) input (LV Winding) in L3 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 L1 Phase		
B23-B24	:	CT Terminal for Phase current (5A) input (LV Winding) in L1 Phase		
C3-C5-C4	:	Digital Output-9 (DO-9)	:	(NO-COMMON-NC)
C6-C8-C7	:	Digital Output-10 (DO-10)	:	(NO-COMMON-NC)
C9-C11	:	Digital Output-11 (DO-11)	:	(NO-COMMON)
C10-C11	:	Digital Output-12 (DO-12)	:	(NC-COMMON)
C12-C11	:	Digital Output-13 (DO-13)	:	(NO-COMMON)
C13-C11	:	Digital Output-14 (DO-14)	:	(NO-COMMON)
C15-C14	:	Digital Output-15 (DO-15)	:	(NO-COMMON)
C16-C14	:	Digital Output-16 (DO-16)	:	(NO-COMMON)
C18-C17	:	Digital Input-9 (DI-9)		
C19-C17	:	Digital Input-10 (DI-10)		
C20-C17	:	Digital Input-11 (DI-11)		
C21-C17	:	Digital Input-12 (DI-12)		
C23-C22	:	Digital Input-13 (DI-13)		
C24-C22	:	Digital Input-14 (DI-14)		
C25-C22	:	Digital Input-15 (DI-15)		
C26-C22	:	Digital Input-16 (DI-16)		
C27	:	RS-485 MODBUS (+)		
C28	:	RS-485 MODBUS (-)		

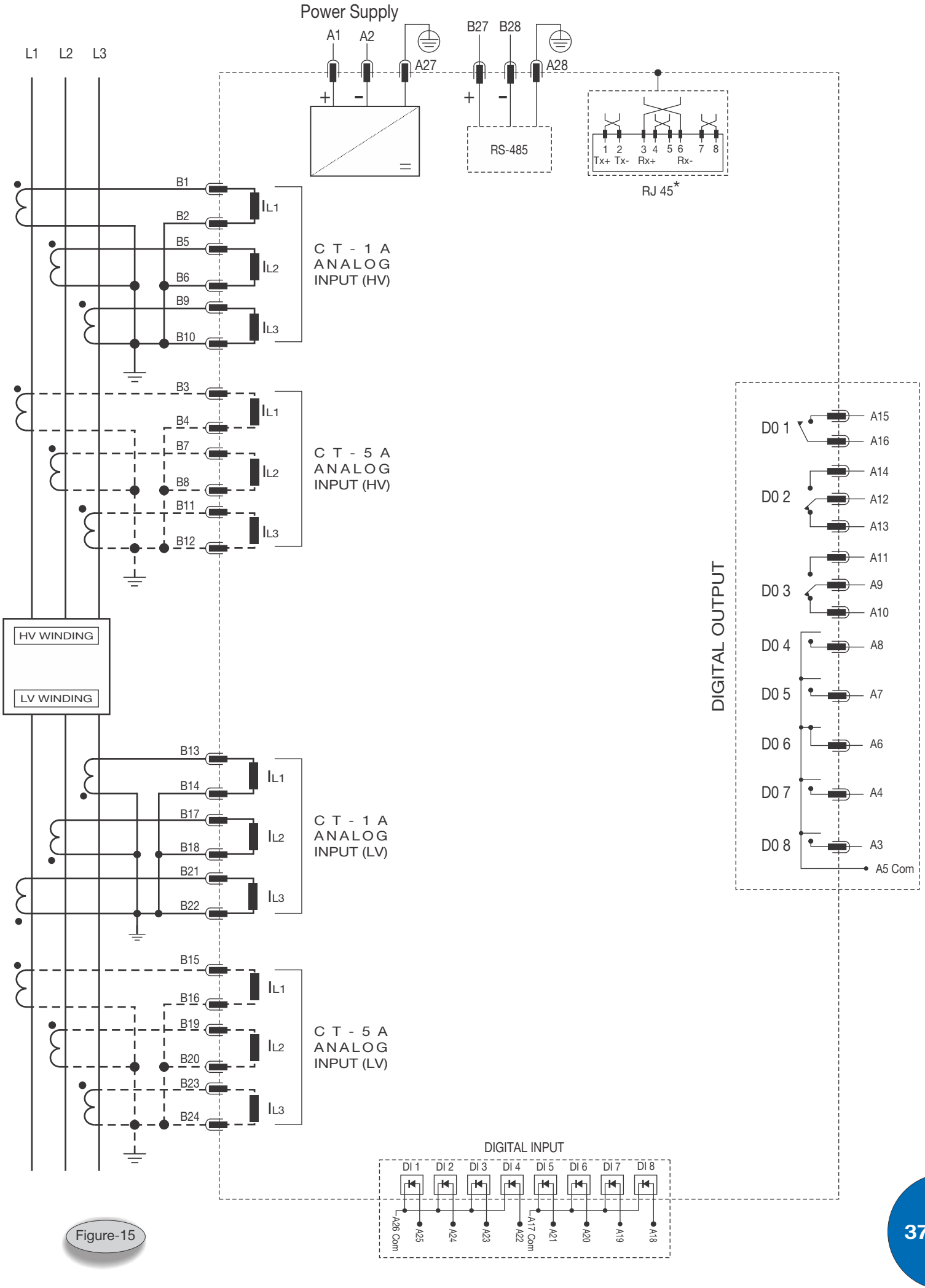

Power Supply
A1
A2
A27
B27
B28
A28
RS-485
1 2 3 4 5 6 7 8
Tx+ Tx- Rx+ Rx-
RJ 45*
L1
L2
L3
B1
B2
B5
B6
B9
B10
IL1
IL2
IL3
CT - 1A ANALOG INPUT (HV)
B3
B4
B7
B8
B11
B12
CT - 5A ANALOG INPUT (HV)
HV WINDING
LV WINDING
B13
B14
B17
B18
B21
B22
CT - 1A ANALOG INPUT (LV)
B15
B16
B19
B20
B23
B24
CT - 5A ANALOG INPUT (LV)
DIGITAL OUTPUT
DO 1
DO 2
DO 3
DO 4
DO 5
DO 6
DO 7
DO 8
A15
A16
A14
A12
A13
A11
A9
A10
A8
A7
A6
A4
A3
A5 Com
DIGITAL INPUT
DI 1
DI 2
DI 3
DI 4
DI 5
DI 6
DI 7
DI 8
A26 Com
A25
A24
A23
A22
A17 Com
A21
A20
A19
A18

Figure-15

18.1 Terminal Description

WITH 8 DI / DO

Terminal No.		Terminal Description		Contact Details
A1	:	Auxiliary Supply (+)		
A2	:	Auxiliary Supply (-)		
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-1 (DI-8)		
A19-A17	:	Digital Input-2 (DI-7)		
A20-A17	:	Digital Input-3 (DI-6)		
A21-A17	:	Digital Input-4 (DI-5)		
A22-A26	:	Digital Input-5 (DI-4)		
A23-A26	:	Digital Input-6 (DI-3)		
A24-A26	:	Digital Input-7 (DI-2)		
A25-A26	:	Digital Input-8 (DI-1)		
A27	:	Earth		
A28	:	Earth		
B1-B2	:	CT Terminal for Phase current (1A) input (HV Winding) in L1 Phase		
B5-B6	:	CT Terminal for Phase current (1A) input (HV Winding) in L2 Phase		
B9-B10	:	CT Terminal for Phase current (1A) input (HV Winding) in L3 Phase		
B3-B4	:	CT Terminal for Phase current (5A) input (HV Winding) in L1 Phase		
B7-B8	:	CT Terminal for Phase current (5A) input (HV Winding) in L2 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 L3 Phase		
B15-B16	:	CT Terminal for Phase current (5A) input (LV Winding) in L3 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 L1 Phase		
B23-B24	:	CT Terminal for Phase current (5A) input (LV Winding) in L1 Phase		
B27	:	RS-485 MODBUS (+)		
B28	:	RS-485 MODBUS (-)		

19.0 Connection Diagram for T-200 model

with earth analog input

CSEZEN-T 200

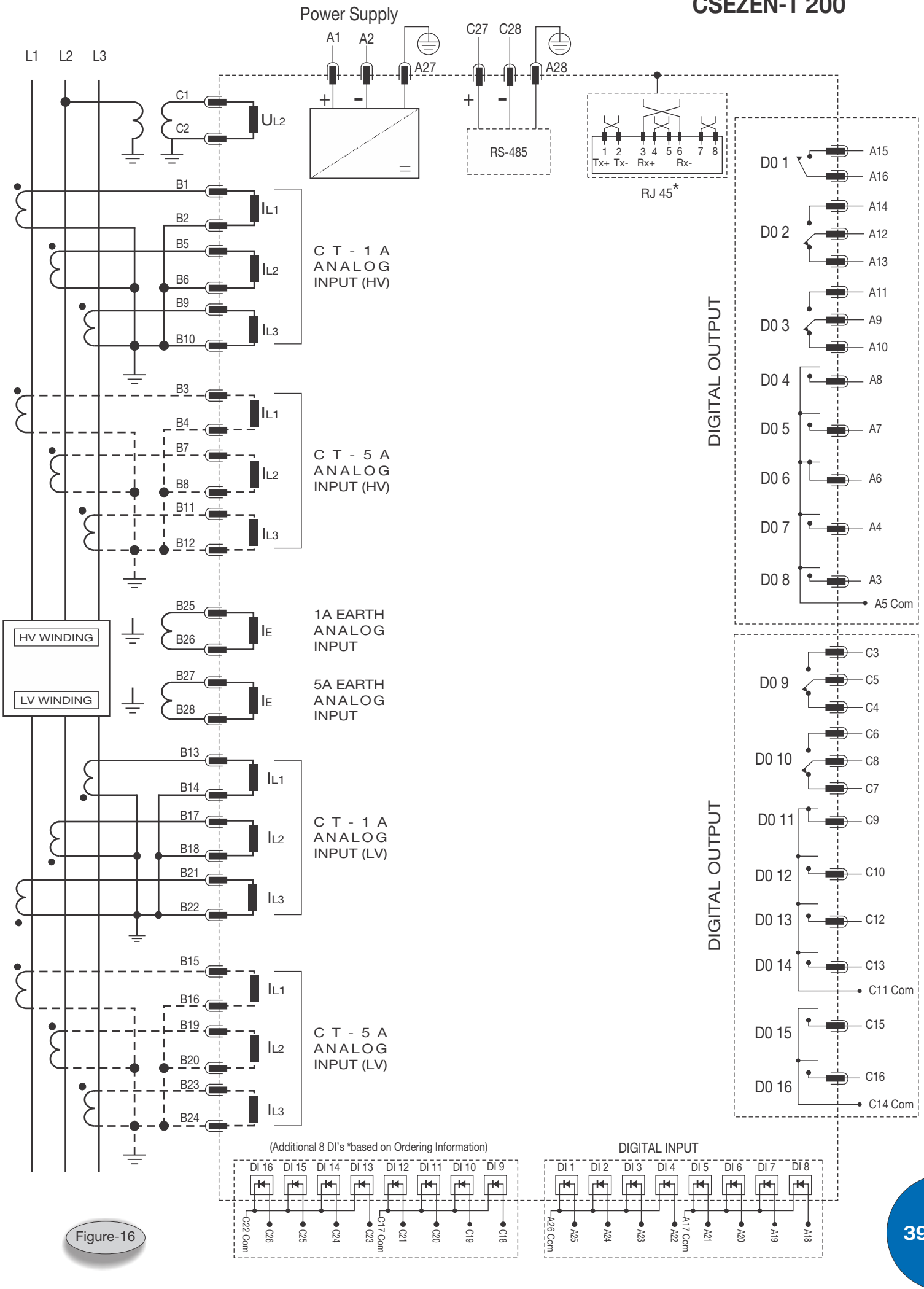


Figure-16

19.1 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)		
B27-B28	:	Earth Analog Input (5A)		
C1-C2	:	Phase voltage input		
C3-C5-C4	:	Digital Output-9 (DO-9)	:	(NO-COMMON-NC)
C6-C8-C7	:	Digital Output-10 (DO-10)	:	(NO-COMMON-NC)
C9-C11	:	Digital Output-11 (DO-11)	:	(NO-COMMON)
C10-C11	:	Digital Output-12 (DO-12)	:	(NC-COMMON)
C12-C11	:	Digital Output-13 (DO-13)	:	(NO-COMMON)
C13-C11	:	Digital Output-14 (DO-14)	:	(NO-COMMON)
C15-C14	:	Digital Output-15 (DO-15)	:	(NO-COMMON)
C16-C14	:	Digital Output-16 (DO-16)	:	(NO-COMMON)
C18-C17	:	Digital Input-9 (DI-9)		
C19-C17	:	Digital Input-10 (DI-10)		
C20-C17	:	Digital Input-11 (DI-11)		
C21-C17	:	Digital Input-12 (DI-12)		
C23-C22	:	Digital Input-13 (DI-13)		
C24-C22	:	Digital Input-14 (DI-14)		
C25-C22	:	Digital Input-15 (DI-15)		
C26-C22	:	Digital Input-16 (DI-16)		
C27	:	RS-485 MODBUS (+)		
C28	:	RS-485 MODBUS (-)		
A28	:	Communication Ground		

20.0 CT Connection Diagram

CT Schemes
Holmgreen Residual CT's Connection for 1A

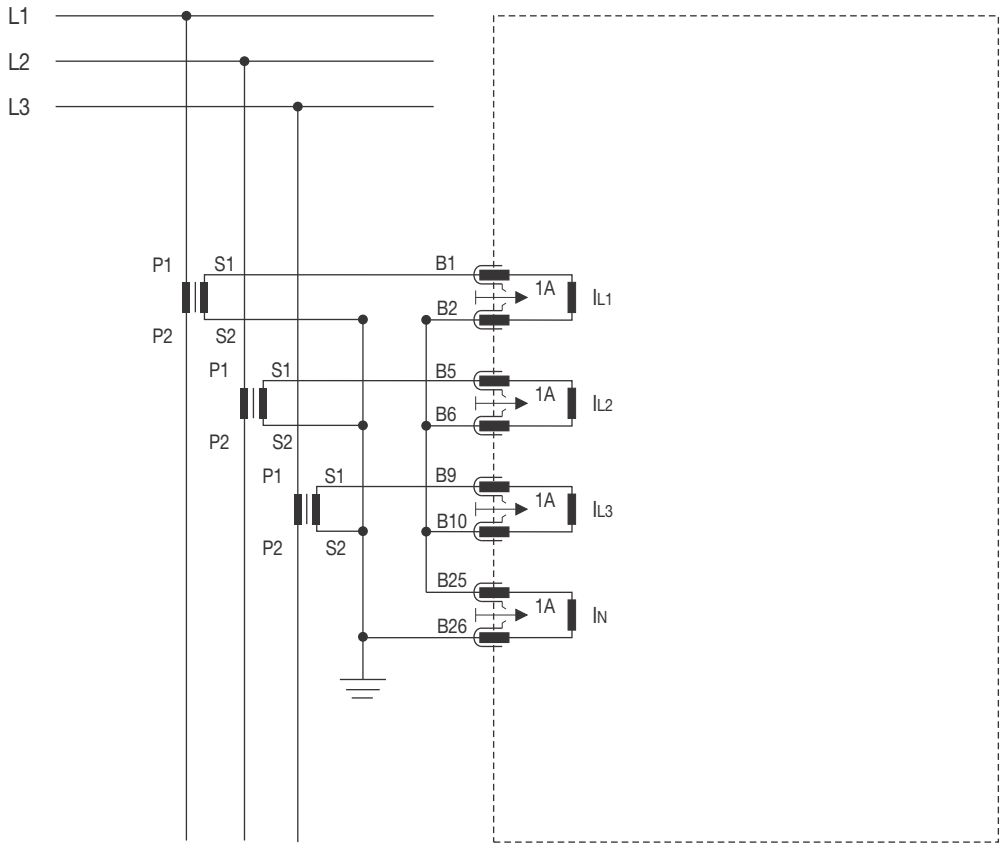


Figure-17

21.0 CT Connection Diagram

CT Schemes
Holmgreen Residual CT's Connection for 5A

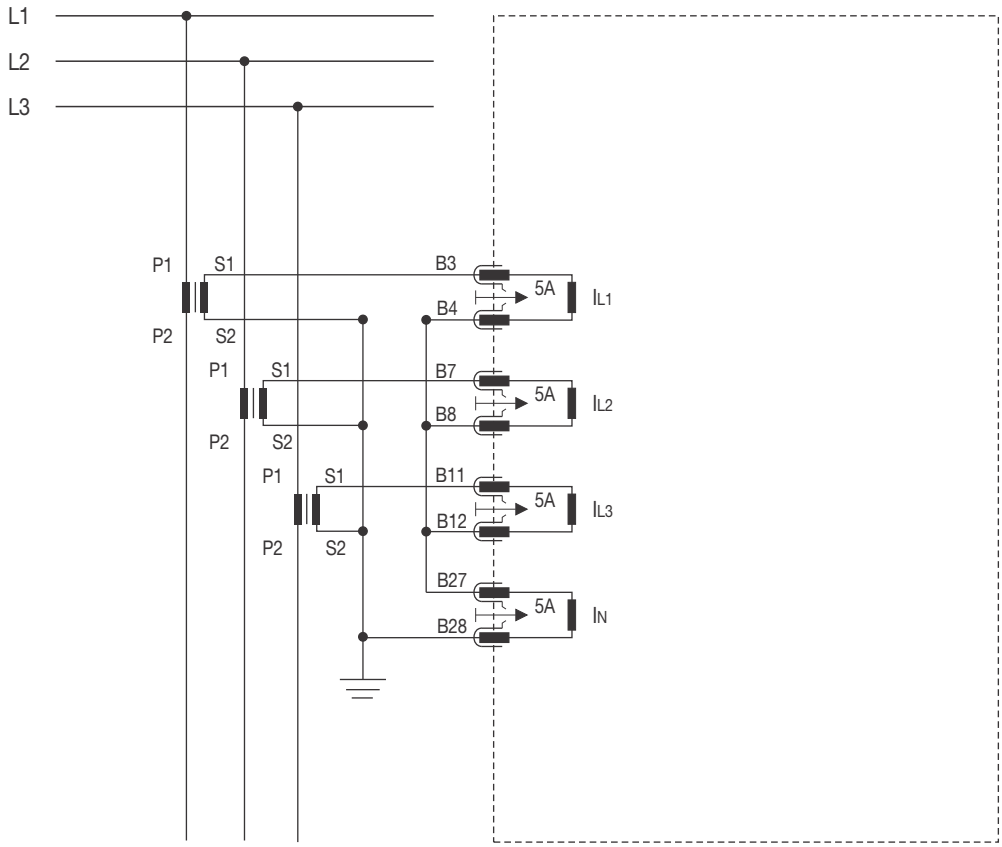
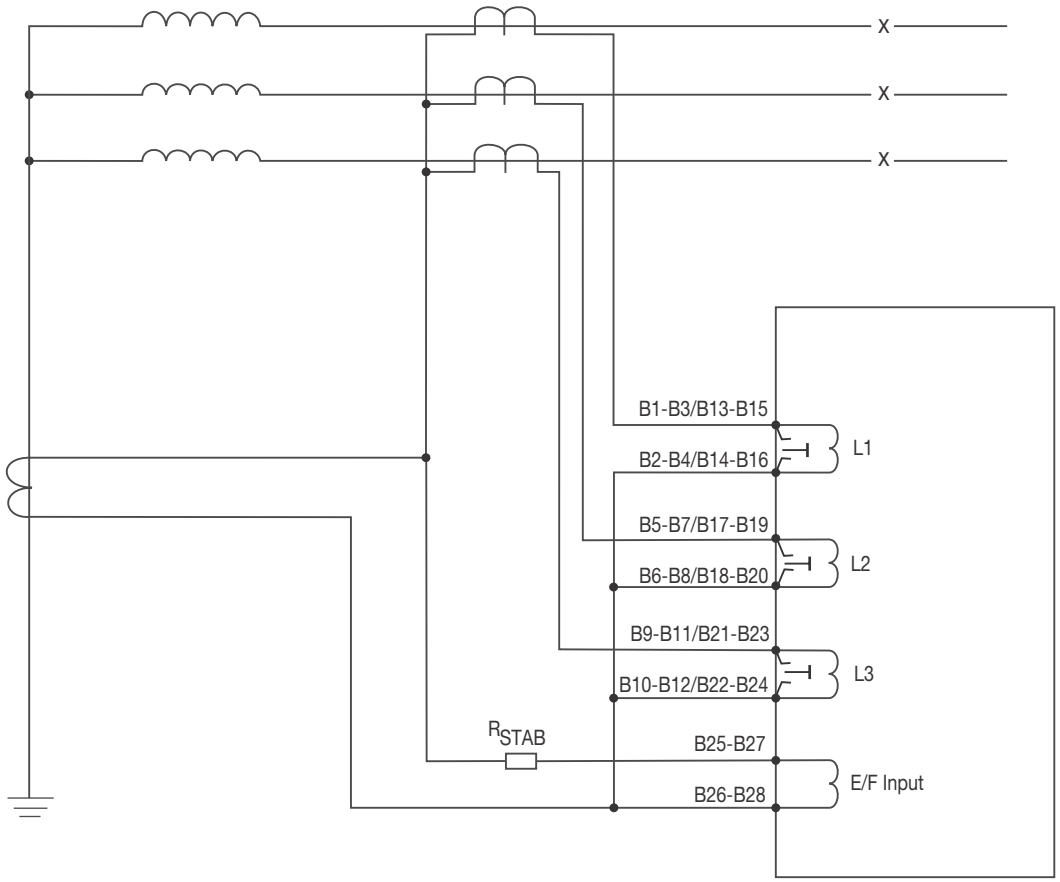


Figure-18

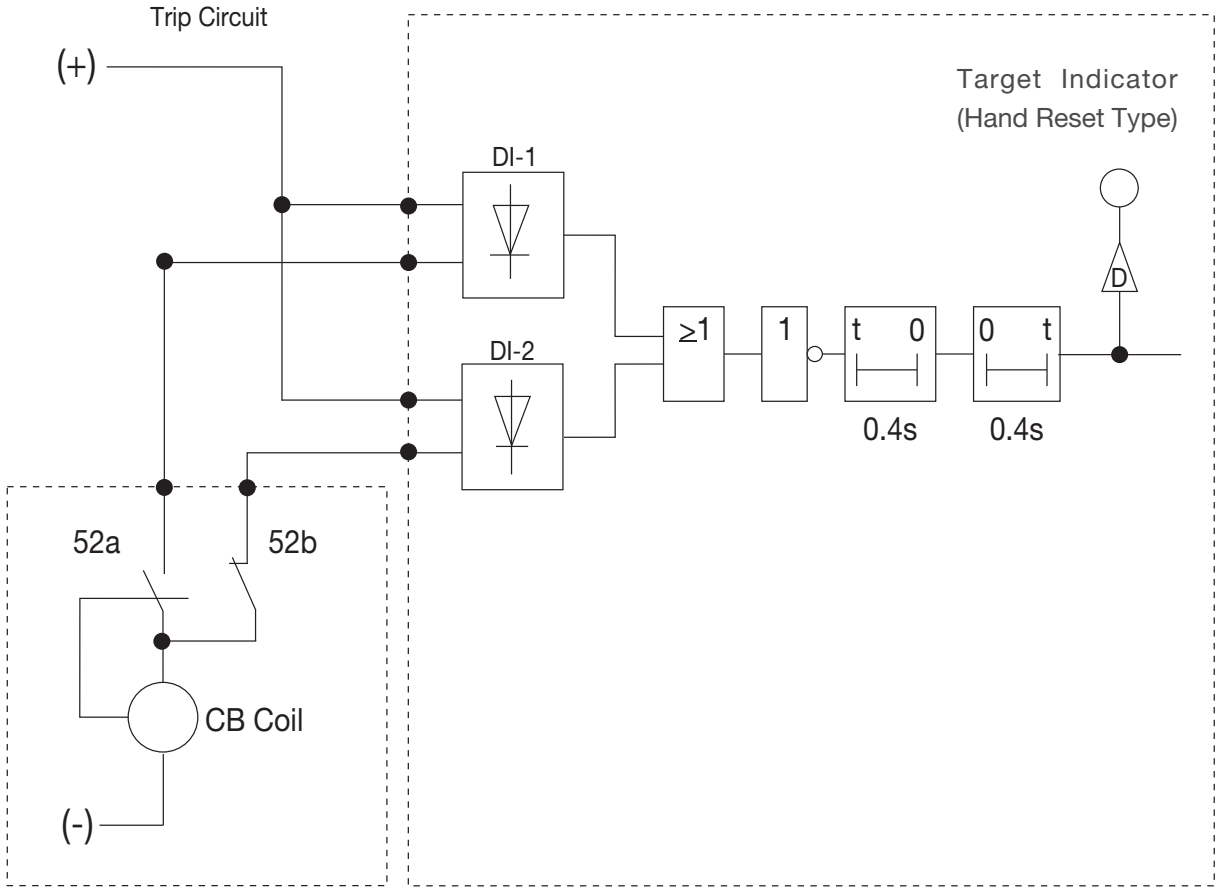
22.0 Connection Scheme for Restricted Earth



CT Connection Diagram for High Impedance REF Aplication

Figure-19

23.0 Trip Circuit Supervision Diagram



(Trip Circuit Supervision Function)

Figure-20

24.0 Dimensional Details

All the dim are in mm (gen. Tol.: ± 1.0 mm)

Front View

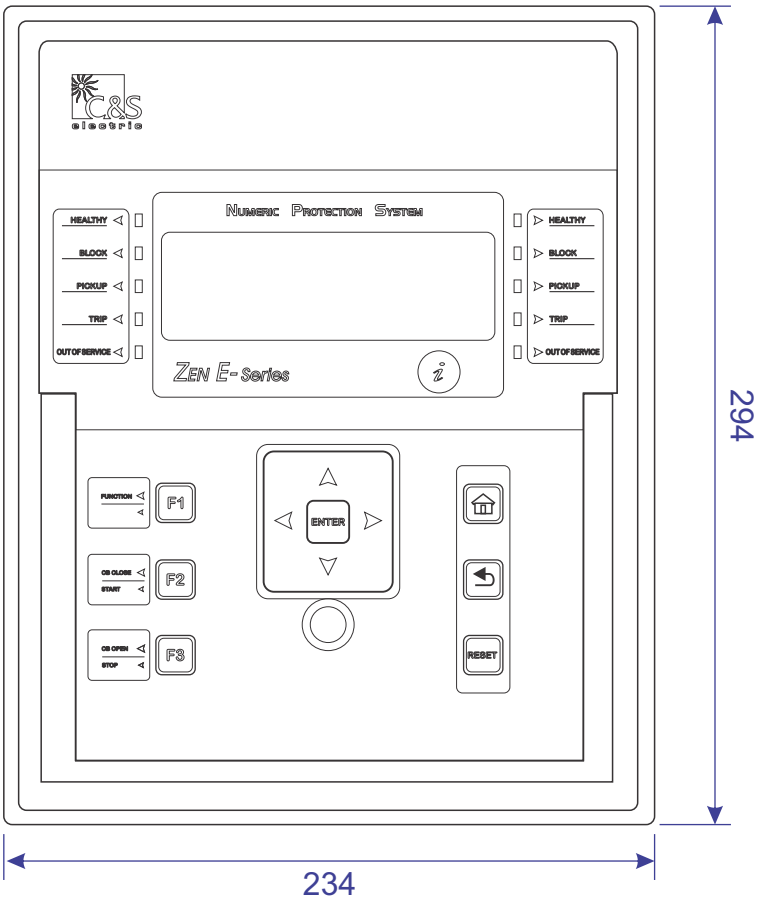


Figure-21

Side View

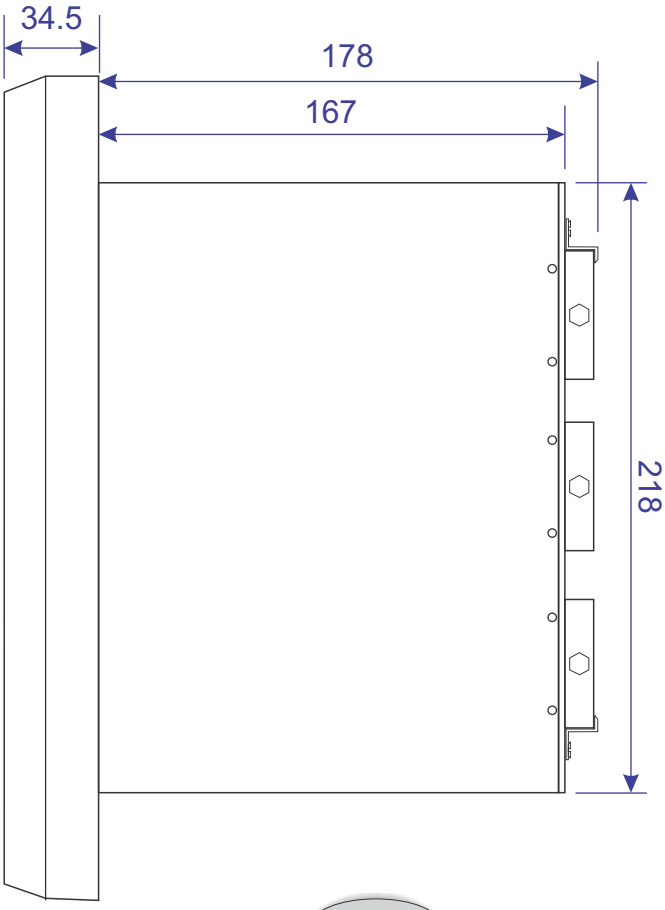


Figure-22

Top View

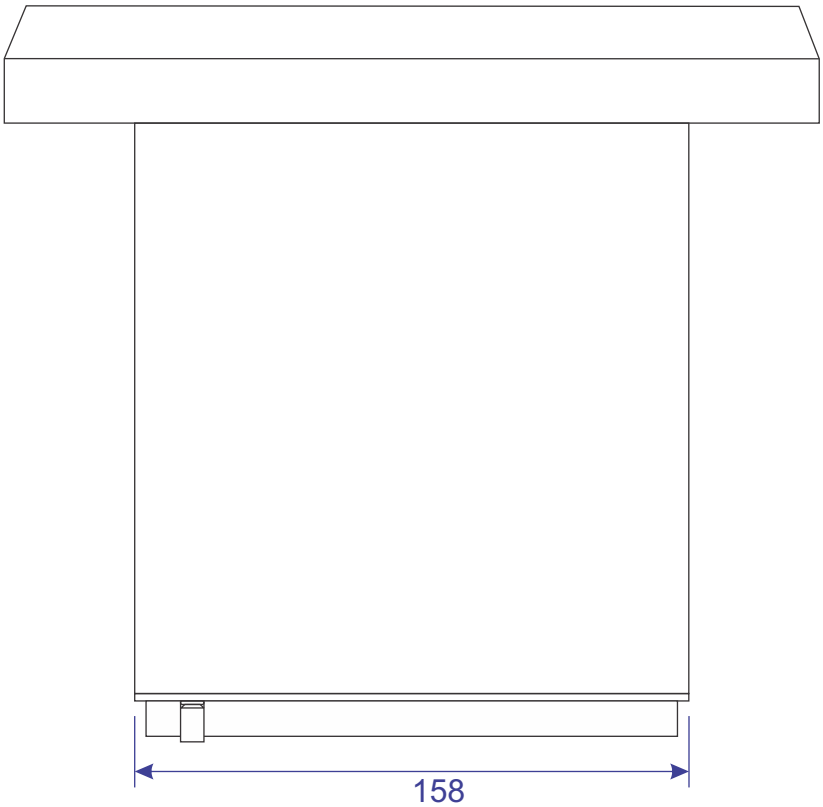


Figure-23

25.0 Panel mounting of the Relay

for Panel mounting		
Screw	:	M6x15mm
Qty	:	8 Nos.

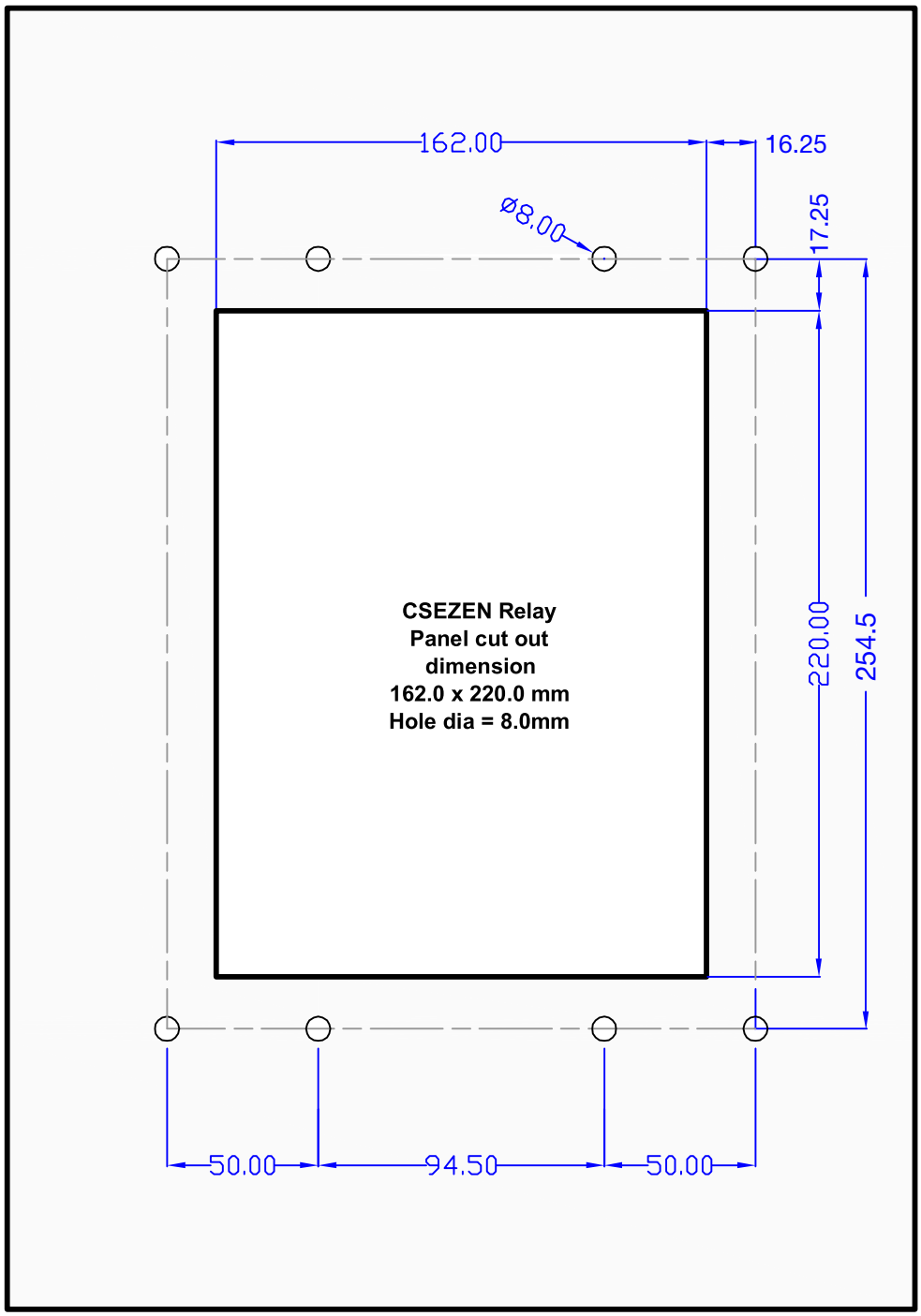


Figure-24

Pictorial view of Panel mounting of the Relay

Figure-25

View from Front side of the Relay

Figure-26

View from Back side of the Relay

Figure-27

26.0 Draw out Process of CSEZEN Relay

First Open the Captive screw (M4x18) using the appropriate screw driver by twisting it on the left side as shown in the Left image.

Up lift the handle to bring out the Relay from the enclosure

Bring out the Relay gently by dragging it outside

Similary while bringing in the Relay, Handle should be in uplift condition.

27.0 Model Selection Table

CSEZEN-T	ANSI	T140	T200
CT Inputs		6	7
VT Inputs		-	1
Opto Inputs (Max)		16	16
Output Contacts (Max)		16	16
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	-	✓
High Impedance Restricted Earth Fault (REF)	64N	-	✓
Output Relay Latching	86	✓	✓
Circuit Breaker Failure Detection	50BF	✓	✓
Over Excitation	24	-	✓
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		✓	✓

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.

28.0 Ordering Information

CSEZEN - T - x - x - D - x - x - x - x - E

MODEL	
	140
	200

VOLTAGE INPUT	
No Voltage input	0
110V	1
400V	4

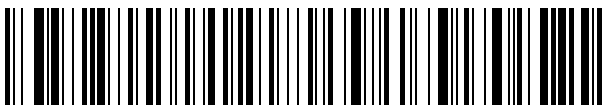
DIGITAL I O CARD	
8 DI / DO	0
16 DI / DO	1

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 RJ-45	C

TIME SYNCHRONIZATION	
None	0
SNTP on RJ-45	S

Issue Date : 22.10.14
Rev. No : 14
Rev. Date : 08.11.16



Revision History

S.No.	Rev.No.	Details	Date
01	01	Change in conn diagram and its description	30.05.15
02	02	Change in conn diagram and its description	21.07.15
03	03	Change in HMI Details of the front sticker	19.08.15
03	04	Change in connection diagram and its terminal description	04.09.15
04	05	Change in connection diagram CT-1A analog input & CT-5A analog input terminal numbers	12.09.15
04	05	Inclusion of High Impedance Restricted Earth Protection description & its diagram on page 9 & page 39 respectively	23.09.15
05	06	Change in CBFP description 55 changed to 10%	24.10.15
06	07	Change in Dimension Details	24.10.15
07	08	Change in Dimension details, REF description and its connection scheme diagram	27.10.15
08	09	Change in Connection diagram of T140 and more information in Dimension details.	08.12.15
09	10	Inclusion of over excitation formula & graph on Page 10 & 11 respectively.	04.02.16
10	11	Change in details of Measuring input table 21 on Page 28	09.02.16
11	12	Change in Conn. Diagram & Term.Description on Page 37 & 38	15.02.16
12	13	Change in USB communication & Standards description	08.03.16
13	14	Change in communication part of ordering information	08.11.16