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CSNEX-I 350

Intelligent Measuring & Protection Device

CSENEX
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CSENEX
Series

Over Current Protection Relay

Catalog

C&S electric

PMD Division

CONTENTS

1) Introduction

CSENEX Series offers a compact Multi-functional Over-current protection solution for Feeder, Generator, Motor & Transformer segment.

CSENEX-I Family of protective relays are numeric relays that provides multi protection and monitoring with reliable and fast protection solution in a single unit.

In this family of CSENEX series, the CSENEX-I 350 is an advanced feeder protection solution which has fast, sensitive and secure protection for feeder internal & external faults.

CSENEX-I offers different model based features to cover the wide range of user.

2) Features

- 1A & 5A rated CT input (programmable)
- Draw out with self CT shorting
- DI/DO programmable matrix
- Protection blocking through DI
- Three phase time over-current protection
- Three phase instantaneous protection
- Protection against Cold Load
- Earth time over-current and earth instantaneous over current
- Circuit breaker failure detection
- Trip circuit supervision
- Thermal Over load
- Auto Re-closing function
- Four sets of setting groups
- Programmable Scheme Logic
- Disturbance recording
- Fault recorder
- Event recorder
- Communication (Local & Remote)

3) Application

The CSENEX-I relays have been designed for controlling, protecting and monitoring industrial, utility distribution networks and substations. They can also be used as part of a protection scheme for feeders, transformers and generators.

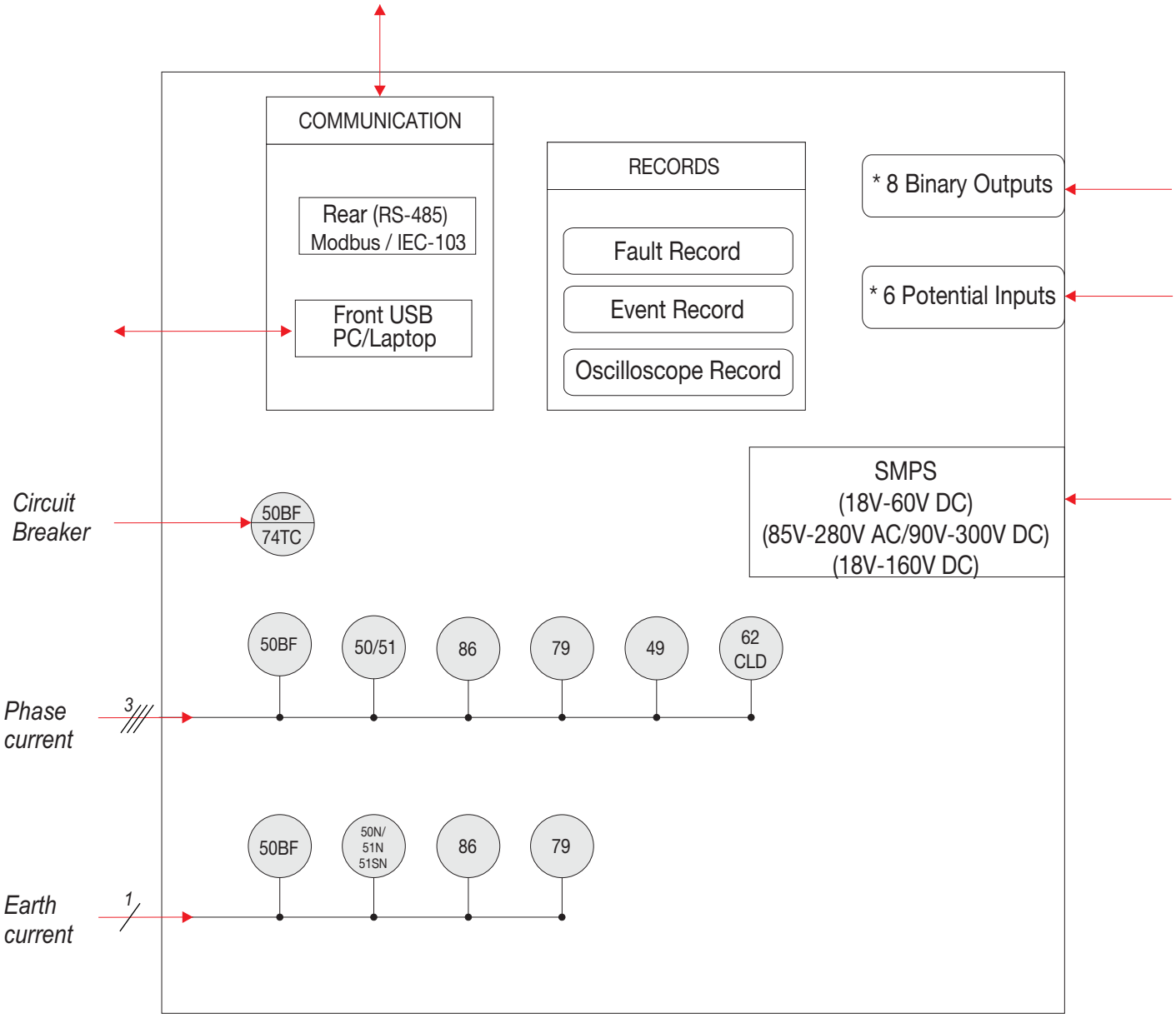
4) Hardware

- Measures true RMS with DFT filter
- 4 Current analog inputs for phase & earth fault current
- Max. 6 Digital Inputs
- Max. 8 Digital Outputs
- 16 x 2 Alpha-numeric LCD
- RS-485 & USB communication
- 1A & 5A site selectable
- 16 LEDs for Pickup & fault annunciation
- CT Terminal with Self shorting

5) Protection Features

- Three phase time over current protection (51)
- Three phase instantaneous protection (50)
- Earth time over-current (51N)
- Earth instantaneous over-current (50N)
- Thermal over load (49)
- Circuit breaker failure protection (50BF)
- Harmonic Restrain (50H)
- Trip Circuit Supervision (74TC)
- Cold Load (62 CLD)
- Auto Re-closer (79)
- Sensitive Earth fault protection (51SN)

6) Functional Diagram



(Figure 1)

* Based on Ordering Information

Protection Functions

Three Phase Over-current Protection (50/51)

The independent two stages are available for phase fault protection. For I> the user may independently select definite time delay or inverse time delay with different type of curves. The second Hi-Set stage can be configured with definite time only.

Earth Fault Protection (50N/51N)

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

Relay Latching (86)

Relay can be configured to Latch /Unlatch depending on configuration. (Latching is possible in presence of Auxiliary supply voltage only)

Trip Circuit Supervision (74TC)

This feature continuously supervises trip circuit of both pre closing and post closing conditions in circuit breaker. It detects tripping mechanism failure like circuit breakage contact degeneration in wires, contacts and coils.

Note: Trip counter is incremented on the basis of getting trip command from relay and not on the basis of external mechanism (circuit breaker) operation.

Harmonic Blocking

Harmonic setting is by default 20% of injected current. Phase/Earth Harmonics can be Blocked/Unblocked & time setting can also be edited through MMI. If the Pickup current has %harmonics above 20%, the protection will blocked for the harmonics blocking time .Tripping occurs according to the higher time setting i.e. if the harmonics time setting is greater it will trip according to the harmonics time setting otherwise according to the fault time setting.

Circuit Breaker Failure Protection (50 BF)

The CB Failure Protection is based on supervision of phase and earth currents after tripping events. The test criterion is whether all phase currents have dropped to less than 5% of In within 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.

Reset Delay

This parameter introduces a delay in opening of relay contacts, when the current goes below the drop out value for over current, short circuit, earth fault, earth high set etc. This parameter will not work when manual reset mode is selected.

Auto Re-closer (79)

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

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

DI Inputs:

AR Blocking - To block the auto re-closer through remote DI CB Close DI - To get the circuit breaker status
CB Ready - To get the CB ready or to give the closing command

Configurable Outputs:

79 AR Close CB
79 Lockout

AR-Blocked:

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

Activating of AR:

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

Dead time (td):

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

User programmable dead times are available for each protection trip operation.
The dead time is initiated when the trip output contact resets, the pickup is reset and the CB is open.

The CB close output relay is energized after the dead time has elapsed If CB ready input is present.

The dead time (dead time td1, dead time td2 dead time td3 dead time td4) starts when the feedback on 'CB CLOSE DI' is not available.

NOTE: Trip Test is available in HMI to check all LEDs and Digital Output (Relay)

Reclaim Time (tr):

This is the time during which after switching on or after AR a subsequent re-closing is prevented. If the number of the set shots is reached, the relay is locked for this time after the last re-closing attempt. If CB Ready DI is not available relay will not generate closing command.

If the circuit breaker dose not trip again, the auto re-close cycle resets to original STATE-1 at the end of the reclaim time.
If the protection operates during the reclaim time of the relay:

- ❖ either advances to the next AR cycle that is expected in next auto re-close state or
- ❖ if all the programmed re-closer attempts have been accomplished, it locks out.

The reclaim time is started with the automatic closing command.

Once a CB has re-closed and remained closed for a specified time period (the reclaim time), the AR sequence is reinitialized and a successful close output issued. A single common reclaim time is used (Reclaim Timer). when an auto re-close sequence does not result in a successful re-closure the relays goes to the lock out state.

Starting Condition for Auto Re-closer

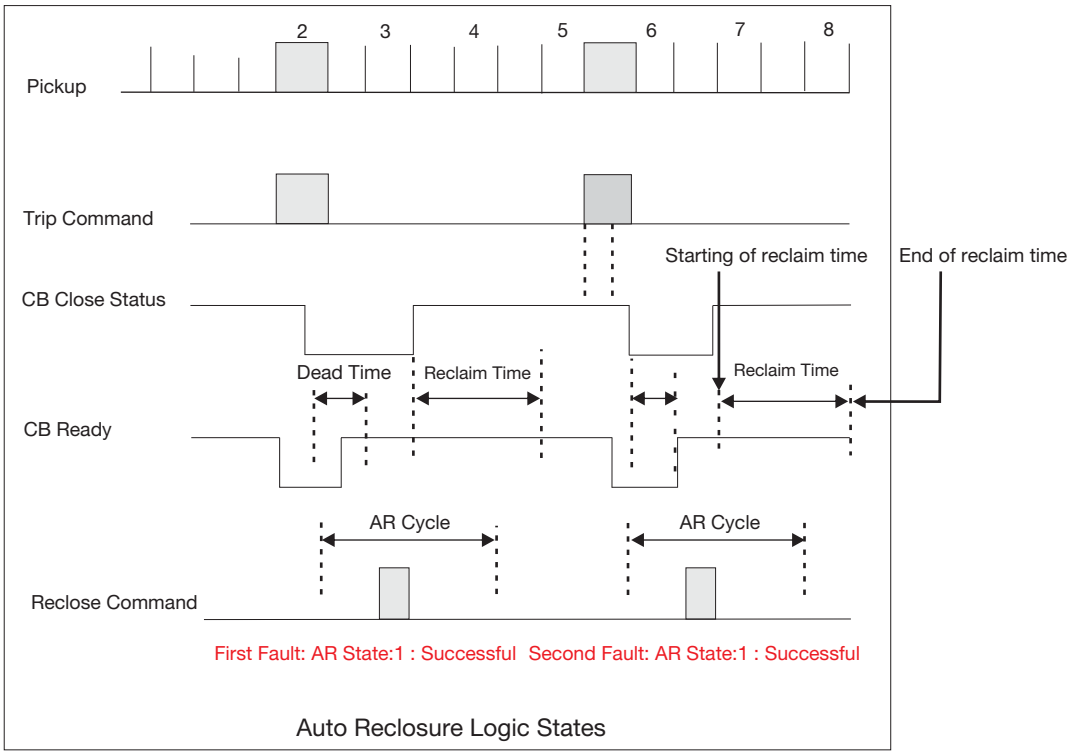
1) AR should be enabled by manual setting.
2) AR blocked DI is not available
3) Respective protection AR cycle should not in exit condition.

Lock out State

Lockout state of the breaker means no further attempts to AR in these conditions

1) Lockout occurs when all auto re-closure attempts are over and protection operates during the final Reclaim Time.
2) If CBFP failure appeared in relay (if CBFP enable).
3) At the end of the each reclaim timer if the CB is in the open position (Close DI is not present).
4) If a Close pulse of AR relay is given and the CB fails to close through close DI input or expiry of Trip Contact Sense time.
5) If a open pulse given to CB and CB fails to open in between Trip Contact Sense time.

In any of these cases, Manual reset will be required to reinitiate the AR.



(Figure 2)

Thermal Over load Protection (49)

Thermal overload protection can be applied to prevent damages to the electrical plant equipment when operating at temperatures in excess of the designed maximum withstand. A prolonged over loading causes excessive heating, which may result in premature deterioration of the insulation or in extreme cases, insulation failure.

CSENEX-I relays incorporate a current based thermal replica, using load current to reproduce the heating and cooling of the equipment to be protected. The element thermal overload protection can be set with both alarm and trip stages.

The heating within any plant equipment, such as cables or transformers, is of resistive type
(I^2R x t), thus the quantity of heat generated is directly proportional to current squared (I^2). The thermal time characteristics used in the relay is based on current squared, integrated over time.
The CSENEX-I relays automatically use the highest phase current as input information for the thermal model.

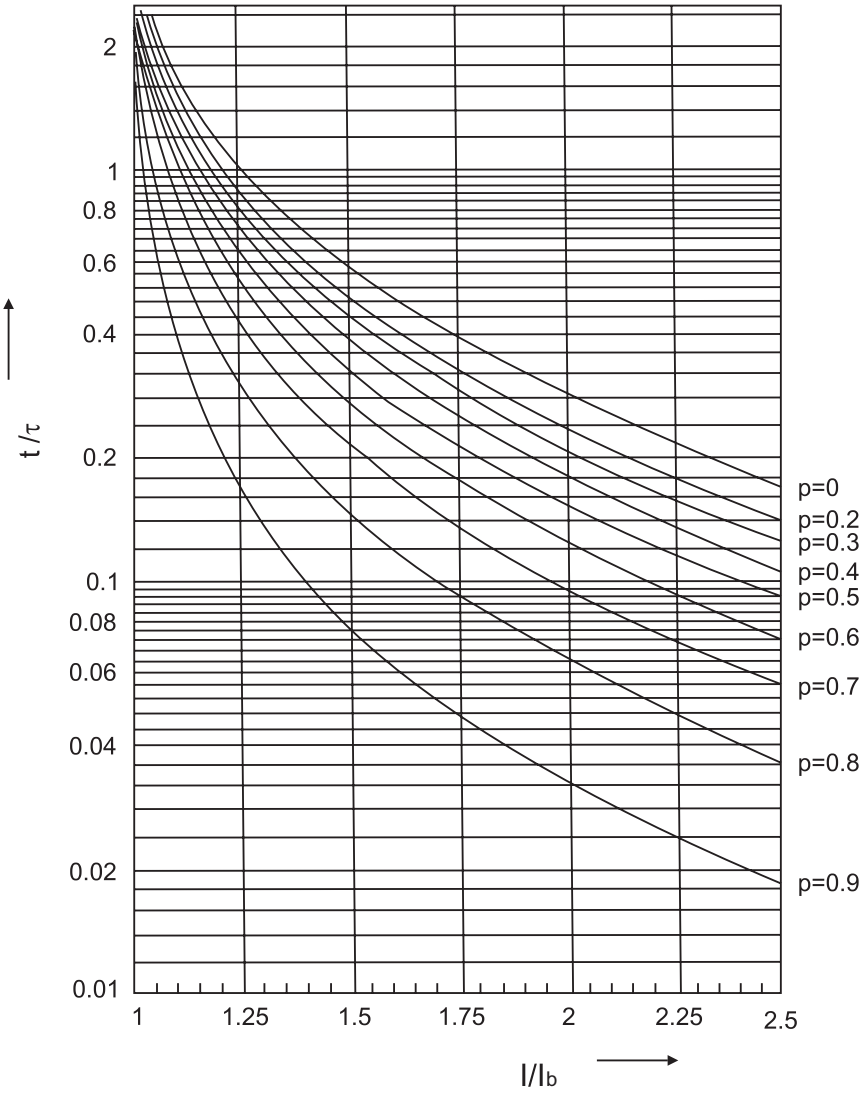
The thermal time characteristic is given by following formula:-

The formula for calculating the trip characteristics is as follows:

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

with τ = thermal time constant of the object to be protected.
I_b= Basic current
I_P= Initial load current
p= Initial load factor (p=0 means cold operating component)
k= constant
for thermal characteristics user has two choices
Thermal is based on highest measured RMS current

In CSENEX-I relay three modes are available for saving of thermal memory during power reset. These modes are programmable.
M1: On Power Reset thermal memory becomes 0.
M2: On Power Reset thermal memory starts from the same value as at the time of Power Off.
M3: On Power Reset thermal memory subtracts for the time it is in Off state & starts from the remaining value.



Cold Load Pickup (62 CLD)

This function aims to avoid non-desired trips in the following situation: after being the line de-energized for a period of time and re-energized later, the load exceed the protection setting without the presence of a fault. This may be due to the fact that the "off" period of all the loads (furnaces, heaters, coolers etc.) is elapse and they are all connected at the same time, producing a strong inrush current in the line, but which can be supported within certain time. This phenomenon can occur not only at the moment of the breaker manual closing, after having remained open for a certain time, but also with the breaker permanently closed due to the operation of another upstream breaker.

What the function does, is detecting when those conditions are given and changing the tripping settings during a programmable time.

The function is activated when the current in the 3 phases is below 0.08A, then the programmed time starts to run to determine that the load is "cold" (this time can be 0, what means that any circuit breaker opening could lead to the cold load situation). Once that time has expired and the current has not exceed again 0.15A, the protection usual setting values are replaced by the cold load pickup ones (cold load group settings). When any of the phase current exceed 0.15A a counter with programmable time starts, during which the setting are the cold load pickup ones (cold load group settings). When expiring this time, the settings are again the usual ones. For settings Refer Cold Load Pickup Table in Setting Ranges.

7) Fault Record

CSENEX-I records last 10 faults in its non volatile memory with it's Date & time stamp. Each record has the following information:

Fault Format

[F] IL1	:	00.00A
[F] IL2	:	00.00A
[F] IL3	:	00.00A
[F] Ie	:	00.00A
HOUR MIN	:	HH:MM
SEC mSEC	:	Sec:mSec
DATE	:	DD:MM:YY
F-TYPE	:	FAULT TYPE

Where

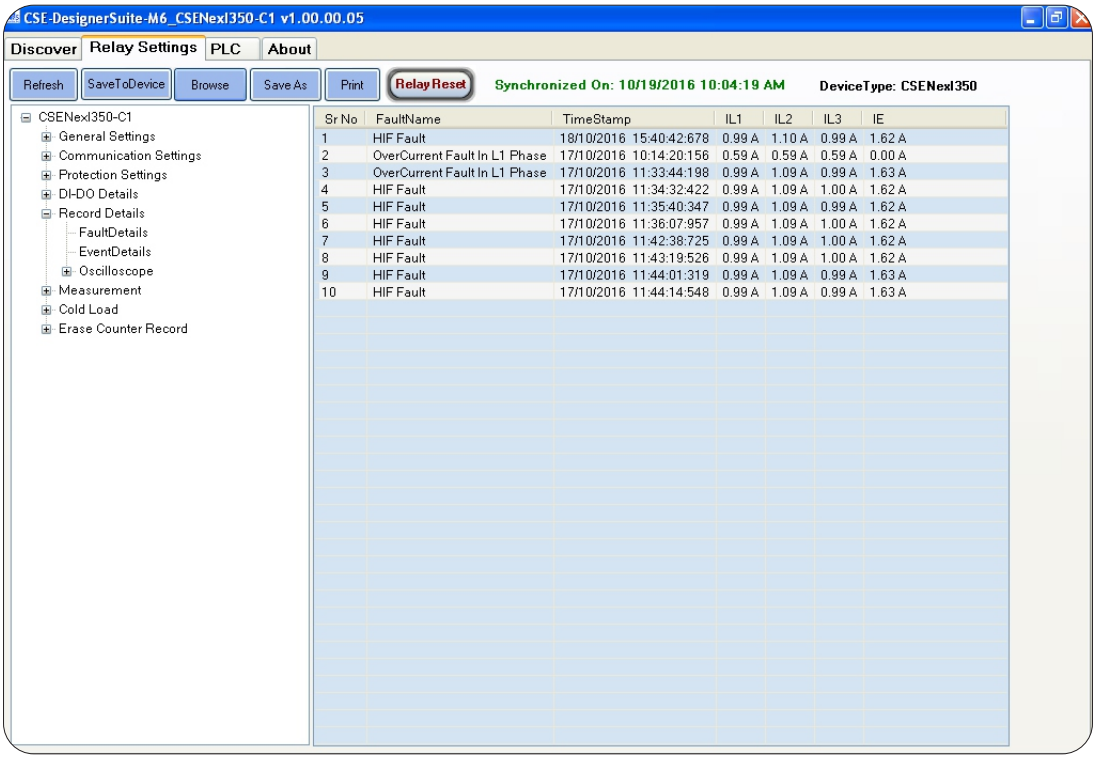
[F][ILx] Magnitude of phase current's.

[F]Ie Magnitude earth fault current's

F-Type Origin of fault (over current etc.) (See Figure 3)

whenever the available memory space is exhausted the new fault automatically over writes the oldest fault. When the relay trips the description of fault in the feeder will appears on the LCD screen automatically and by pressing 'i'key one can easily get all the detailed information of that fault.

The user can view the fault record either via the front USB interface software or remotely via the RS-485 communication. (See figure-3)



(Figure 3) (Fault Data Recording on PC software)

8) Event Record

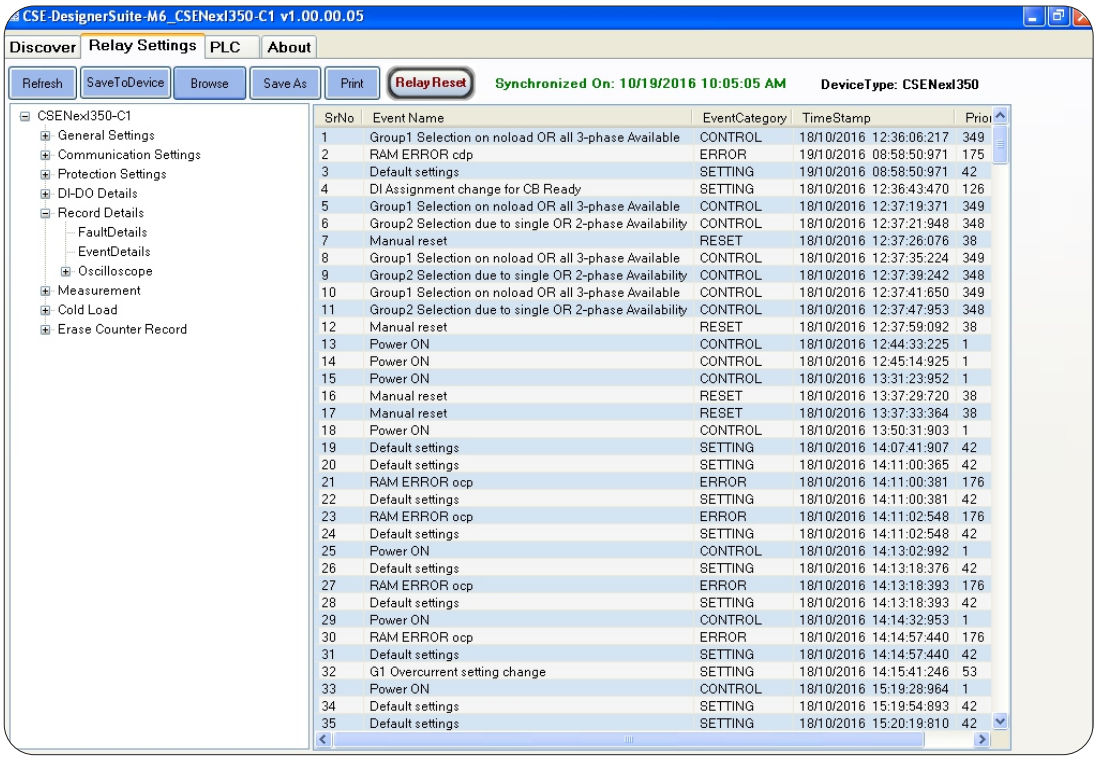
The unit stores in non volatile memory the last 100 events. When the available memory space is exhausted, the new event automatically overwrites the oldest event which can be retrieved from a PC, with the following format:

EVENT	:	EVENT NUMBER
HOUR	:	HH:MM
SEC mSEC	:	SEC:mSEC
DATE	:	DD/MM/YY

- ❖ Date and time of the event
- ❖ Descriptive text of the even

The user can view event records via the front USB interface software (See Figure 4)

* Description of event number available in event list or in front end software, Pickup & Trip events are recorded.



(Figure 4) (Event Data Recording on PC Software)

Output Contacts

No. of digital outputs	:	08 Nos. (configurable)
Type of outputs	:	Relay
Programmable (DO Assignment)	:	Yes
Relay reset type	:	Programmable (Auto/Manual)

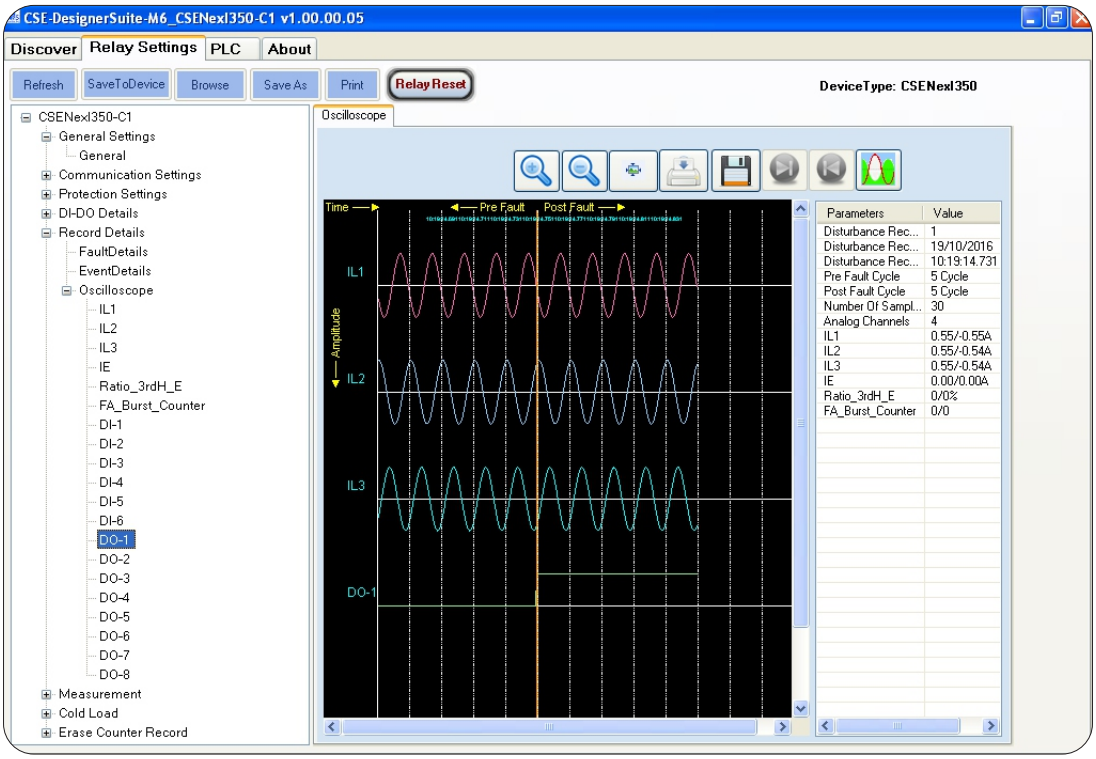
Input Contacts

No of digital inputs	:	06 Nos. (configurable)
Programmable (DI Assignment)	:	Yes

9) Disturbance Record

The 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 4 analog signals and the status of 6 digital inputs and 8 digital outputs. There will be 30 samples per cycle.
- Relay saves maximum 1200 cycles, and the number of cycles per record is programmable (for example: if 40 cycles are selected, then there will be maximum 30 records of 40 cycles each).
- The pre-fault and post-fault cycles are programmable of oscilloscope (disturbance) record setting).
- Records are in the non volatile memory.
- The records are transferred to PC using USB interface. The data is graphically displayed & can be taken on printer.
- Record 1 is always latest record. 2nd record is older than 1st..... and so on.
- Disturbance record in comtrade format as per IEC60255-24.



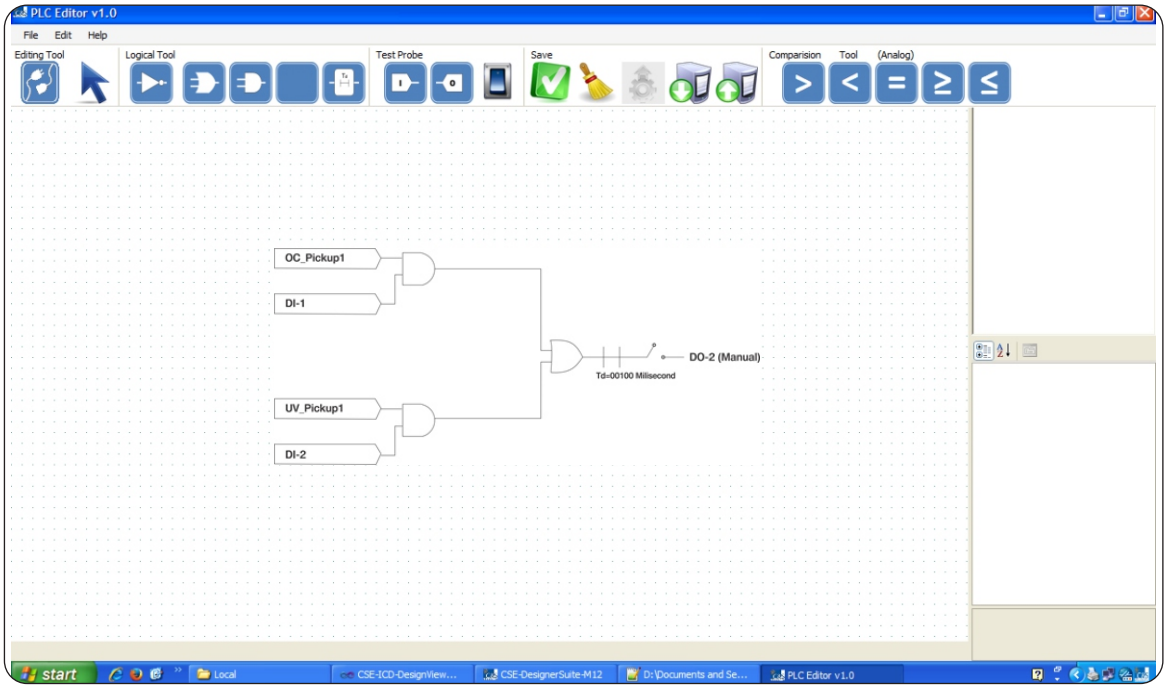
(Figure 5) (Disturbance Recording on PC software)

10) Programmable Scheme Logic

Programmable scheme logic is configured using the front end interface PLC Editor. This interface uses Boolean equations. Flexible logic allows user to create logic diagram to be assigned digital output.

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.

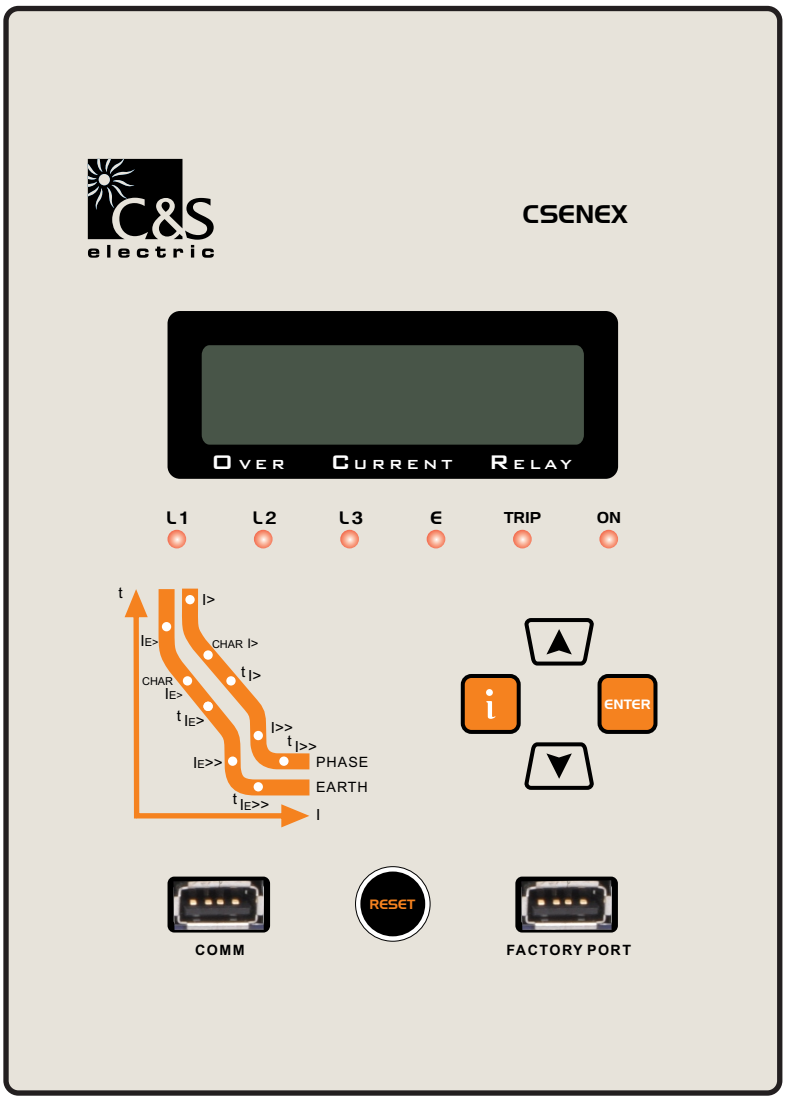


(Figure 6)

11) Human Machine Interface

It comprises of bright LCD display

- ❖ Four push switches for setting values of normal tripping characteristics and other operations for local access.
- ❖ One ‘RESET’ push switch.
- ❖ LEDs for pickup or tripping on fault and event in any phase.



(Figure 7)

Keys	Manual Key
i	is used as intelligent key to see the details of last fault and Relay status.
ENTER	is used as a “ENTER” key.
RESET	is used to manual reset (after pressing for 2 sec).
▲	is used to scroll in upward direction.
▼	is used to scroll in downward direction.

12) Communication (Local and Remote)

The unit has:

- ❖ 1 Front USB port for direct connection to a PC
- ❖ 1 Rear RS-485 communication port

12.1) Rear Communication

The protocol for the rear port is MODBUS-RTU.

12.2) Front Communication

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

13) Setting Ranges

Phase Over Current Protection (50P/51P)

S.No	Parameter	Display	Setting Range		Step Size	Default Setting
			Min	Max		
1	Phase over-current low set pickup setting	I>	0.05xIp	4.00xIp	0.01xIp	Disable
2	Phase characteristics	PCurve	DEFT/EINV/VINV//LINV/NINV1.3/NINV3.0/NINV0.6			DEFT
3	Phase over-current inverse timing	ti>	00.01	15.00	00.01	00.10
4	Phase over-current definite timing	t>	000.10s	150.00s	000.01s	000.10s
5	Phase over-current hi-set pickup setting	I>>	00.05xIp	30.00xIp	00.01xIp	Disable
6	Phase over-current hi-set definite timing	t>>	00.02s	20.00s	00.01s	00.10s

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

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

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

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

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

Trip timing Accuracy : DEFT/ NINV 0.6 / NINV 3.0 / 1.3 : ±5% OR ±30mSec (whichever is higher)
EINV / VINV / LINV : ±7.5% OR ±40mSec (whichever is higher)

Cold Load Protection (62 CLD)

S.No	Parameter	Display	Setting Range		Step Size	Default Setting
			Min	Max		
1	Cold Load Pickup	CLP PKUP	Enable	Disabl	-------	Disable
2	Cold Load Time	tcold	0.00s	100.00s	-------	0.10s
3	Cold Load Pickup Time	tclp	0.00s	100.00s	-------	0.10s
4	Phase over-current low set pickup setting	I>	0.05xIp	4.0xIp	0.01xIp	Disable
5	Phase characteristics	PCurve	DEFT/EINV/VINV//LINV/NINV1.3/NINV3.0/NINV0.6			DEFT
6	Phase over-current inverse timing	ti>	0.01	15.0	0.01	0.10
7	Phase over-current definite timing	t>	0.05s	150.00s	0.01s	0.10s
8	Phase over-current hi-set pickup setting	I>>	0.05xIp	30xIp	0.01xIp	Disable
9	Phase over-current hi-set definite timing	t>>	0.02s	20.00s	0.01s	0.10s
10	Earth over-current low set pickup setting	Ie>	0.05xIn	2.5xIn	0.01xIn	Disable
11	Earth Characteristics	ECurve	DEFT/EINV/VINV/LINV/NINV1.3/NINV3.0/NINV0.6			DEFT
12	Earth over-current low set inverse timing	tie>	0.01	15.0	0.01	0.10
13	Earth over-current low set definite timing	te>	0.03s	150.00s	0.01s	0.10s
14	Earth over-current hi-set pickup setting	Ie>>	0.05xIn	20xIn	0.01xIn	Disable
15	Earth over-current hi-set definite timing	te>>	0.02s	20.00s	0.01 Sec	0.10s

Trip Circuit Supervision Protection (74TC)

S.No.	Parameter	Display	Setting Range		Step Size	Default Setting
			Min.	Max.		
1	TCS	td	0.03s	2.00s	0.01s	Disable

Circuit Breaker Failure Protection (50BF)

S.No.	Parameter	Display	Setting Range		Step Size	Default Setting
			Min.	Max.		
1	CBFP	tCBFP	0.03s	2.00s	0.01s	Disable

Earth Setting (50N/51N)

S.No	Parameter	Display	Setting Range		Step Size	Default Setting
			Min	Max		
1	Earth over-current low set pickup setting	Ie>	0.05xIn	2.50xIn	0.01xIn	Disable
2	Earth Characteristics	ECurve	DEFT/EINV/VINV/LINV/NINV1.3/NINV3.0/NINV0.6			DEFT
3	Earth over-current low set inverse timing	tie>	0.01	15.00	00.01	00.10
4	Earth over-current low set definite timing	te>	0.03s	150.00sc	000.01s	000.10s
5	Earth over-current hi-set pickup setting	Ie>>	0.05xIn	20.00xIn	00.01xIn	Disable
6	Earth over-current hi-set definite timing	te>>	00.02s	20.00s	00.01s	00.10s

Auto Re-closer Mode (79)

S.No.	Parameter	Display	Setting Range		Step Size	Default Setting
			Min.	Max.		
1	Enable Auto-recloser	Enable	YES	NO	-------	NO
2	Dead time 1	D1	000.20s	300.00s	0.01s	0.20s
3	Dead time 2	D2	000.20s	300.00s	0.01s	0.20s
4	Dead time 3	D3	000.20s	300.00s	0.01s	0.20s
5	Dead time 4	D4	000.20s	300.00s	0.01s	0.20s
6	Reclaim time	tR	000.20s	300.00s	0.01s	0.20s
7	Phase over-current low set max AR cycle	Cyc I>	2	4	1	2
8	Phase over-current hi-set max AR cycle	Cyc I>>	2	4	1	2
9	Earth over-current low set max AR cycle	Cyc Ie>	2	4	1	2
10	Earth over-current hi-set max AR cycle	Cyc Ie>>	2	4	1	2
11	Trip sense time	t_TST	0.05s	2.00s	0.01s	0.05s

Thermal Over load (49)

S.No.	Parameters	Display	Setting Range		Step Size	Default Setting
			Min	Max		
1	Thermal memory	MemMod	M1	M3	1.0	M1
2	Permissible basic current	Ib	0.20xIp	4.00xIp	0.02xIp	Disable
3	Constant	k	0.50	2.00	0.01	1.00
4	Heating time constant	Th	000.5min	180.0min	000.1min	000.5min
5	Cooling constant	Tc	1.00xTh	8.00xTh	0.01xTh	1.00xTh
6	Thermal alarm	Alrm_R	20%	99%	1%	20%
7	Thermal reset	TH_Rst	00%	99%	1%	70%

Harmonic Setting

S.No.	Parameter	Display	Setting Range		Step Size	Default Setting
			Min.	Max.		
1	Phase 2nd Harmonic	P2ndH	10%If	50%If	1%If	Disable
2	Phase 3rd Harmonic	P3rdH	10%If	50%If	1%If	Disable
3	Earth 2nd Harmonic	E2ndH	10%If	50%If	1%If	Disable
4	Earth 3rd Harmonic	E3rdH	10%If	50%If	1%If	Disable
5	tPHASE	tPHASE	0.0 Sec	20 Sec	0.1	00.00s
6	tEARTH	tEARTH	0.0 Sec	20 Sec	0.1	00.00s

Oscilloscope (Disturbance) Record

S. No.	Parameters	Display	Setting Range		Step Size	Default Setting
			Min	Max		
1	Oscilloscope record	RECORD	NO	YES	-	NO
2	Pre-fault cycle	PRE CYCLE	002C	298C	1C	002C
3	Post-fault cycle	POST CYCL	002C	298C	1C	002C
4	Triggering mode	TRIG MODE	PK-UP	PK-UP/TRIP/DI/ Anyon	-	PK-UP

DO Assignment

S.No	Parameter	Display	Setting Range	
			Min.	Max.
1	Phase over-current low set	I>	---	12345678
2	Phase over-current hi-set	I>>	---	12345678
3	Earth over-current low set	Ie>	---	12345678
4	Earth over-current hi-set	Ie>>	---	12345678
5	Trip circuit supervision	TCS	---	12345678
6	Circuit breaker failure	CBFP	---	12345678
7	Self supervision	SELF SUP	---	12345678
8	Auto Re-closer Relay	AR Close	---	12345678
9	Lockout relay	AR Lockout	---	12345678
10	Circuit breaker open	CB_Open	---	12345678
11	Circuit breaker close	CB_Close	---	12345678
12	Remote Trip	Rmt tp	---	12345678
13	Thermal Alarm	Thm-Alarm	---	12345678
14	Thermal Relay	Thm-Relay	---	12345678

DI Assignment

S.No	Parameter	Display	Setting Range	
			Min.	Max.
1	CB Close	CB Cls	---	123456
2	CB Open	CB Opn	---	123456
3	CB Ready	CB Rdy	---	123456
4	Remote Trip	Rmt tp	---	123456
5	Group toggling	GRP tg	—	123456
6	Remote Reset	RMT Rt	—	123456
7	Oscilloscope Toggling	OSC Tg	—	123456
9	Phase Over current Lo-set Blocking	I> BLK	—	123456
10	Phase Over current Hi-set Blocking	I>> BK	---	123456
11	Earth Over current Lo-set Blocking	E> BLK	—	123456
12	Earth Over current Hi-set Blocking	E>> BK	---	123456
13	Auto Reclose blocking	AR BLK	—	123456
14	Thermal Blocking	Th BLK	—	123456
14	Cold Load Blocking	Cld BLK	—	123456

Function Reset

S.No.	Parameter	Display	Setting Range		Default
			Min.	Max.	Setting
1	Phase over-current low set	I>	AUTO	MANUAL	AUTO
2	Phase over-current hi set	I>>	AUTO	MANUAL	AUTO
3	Earth over-current low set	Ie>	AUTO	MANUAL	AUTO
4	Earth over-current hi set	Ie>>	AUTO	MANUAL	AUTO
5	Trip Circuit Supervision	TCS	AUTO	MANUAL	AUTO
6	Remote Trip	Rmt Trip	AUTO	MANUAL	AUTO
7	Auto recloser	AR Close	AUTO	MANUAL	AUTO
8	Thermal Trip	Thm Trip	AUTO	MANUAL	AUTO
9	Thermal Alarm	Thm Alrm	AUTO	MANUAL	AUTO

Erase Record

S.No.	Parameter	Display	Setting Range		Default
			Min.	Max.	Setting
1	Trip Count Record	Trip_Cntr	NO	YES	NO
2	Thermal Reset	ThrmLRset	NO	YES	NO
3	Event Erase Record	EventsErase	NO	YES	NO
4	Fault Erase Record	FaultsErase	NO	YES	NO
5	Oscilloscope Record Erase	OscRcrdEras	NO	YES	NO

Date & Time Setting

S.No.	Parameters	Display	Setting Range		Step Size
			Min	Max	
1	Hour	HOUR	00	23	1
2	Minute	MIN	00	59	1
3	Second	SEC	00	59	1
4	Date	DATE	1	31	1
5	Day	DAY	SUN	SAT	1
6	Month	MONTH	Jan	Dec	1
7	Year	YEAR(2000 Y)	00	99	1

Common Setting

S.No.	Parameter	Display	Setting Range		Step Size	Default Setting
			Min.	Max.		
1	Rated Phase Current	Ip	1.00A	5.00A	-----	1.00A
2	Rated Earth Current	In	1.00A	5.00A	-----	1.00A
3	Phase CT Ratio	Ph CTR	0001	9999	1	1
4	Earth CT Ratio	E CTR	0001	9999	1	1
5	Nominal Frequency	FREQ (Fn)	50 Hz	60 Hz	-----	50 Hz
6	Fault Status	FStat	Enable	Disable	-----	Disable

Active Group Setting

S.No.	Parameters	Display	Setting Range		Step Size	Default Setting
			Min	Max		
1	Active Group	ACTIVE	GROUP1	GROUP4	-	GROUP1

Rear Port Communication

RS-485 Communication	
Baud rate selection (programmable)	9600/19200/38400 bps
Parity selection (programmable)	None / Even / Odd
Protocol	MODBUS RTU / IEC-103
Slave Address (programmable)	(1 to 247)

Auxiliary Supply

Auxiliary Voltage Range	For 'L' Model	18V-60V DC
	For 'H' Model	85V-280V AC / 90V-300V DC
	For 'W' Model	18V-160V DC
Power Consumption		Quiescent approx. 3W
		Operating approx. <7W
Rated Supply for Digital Input	For 'L' Model	18V-150V DC (Active)
		<10V DC (Inactive)
	For 'H' Model	40V-280V AC (Active)
		40V-300V DC (Active)
		<25V AC/DC (Inactive)

Measurement Accuracy

S.No	Quantity	Range	Frequency Range	Accuracy
1	Current	1 - 30 xI_p	50 - 60 Hz	±2%

Pickup Accuracy

S.No	Quantity	Range	Frequency Range	Accuracy
1	Current	1 - 30 xI_p	50 - 60 Hz	+5% of Pickup setting

14) Technical Data

Measuring Input

Rated Data	Rated current I_p :1A or 5A Rated frequency F_n : 50 Hz/60Hz
Drop out to Pickup Ratio	>96%
Reset Time	30mSec
Power consumption in current circuit	At I_p=1A 0.1 VA At I_p=5A 0.2 VA
Thermal withstand capability in current circuit	Dynamic current withstand for 1 Sec : 100 x I_p for 10 Sec : 30 x I_p continuously : 4 x I_p

Trip Contact Rating

Contact Rating	
Contact relay	Dry contact Ag Ni
Make current	Max. 30A & carry for 3S
Carry capacity	8A continuous : Relay 1, Relay 2
	5A continuous : Relay 3, 4, 5, 6, 7, 8
Rated voltage	250V AC/ 30V DC
DC Current carrying capacity	8A@30VDC / 0.3A@110VDC/ 0.2A@220VDC
Breaking Characteristics	
Breaking capacity AC	1500VA resistive
	1500VA inductive (PF=0.5)
Breaking capacity DC	220V AC, 5A (cosØ <=0.6)
	135V DC, 0.3A (L/R=30ms)
	250V DC, 50W resistive or
	25W inductive (L/R=40ms)
Operation time	<10ms
Durability	
Loaded contact	10,000 operation minimum
Unloaded contact	30,000 operation minimum

Sensitive Earth Over Current Setting (51SN)* (based on Ordering information)

Parameters	Display	Setting Range		Step Size	Default Setting
		Min	Max		
Phase Characteristics	Curve Type	DEFT	EINV, VINV, NINV1.3, LINV NINV3.0, NINV0.6	-----	DEFT
Ie> Current Setting	Ie> Pickup	0.01 Amp	2 Amp	0.01 Amp	0.05 Amp
Ie> inverse timing	Ie> TD Multiplier	0.01 sec	1.5 sec	0.005 sec	0.1 sec
Ie> Definite timing	Ie> Deft Time	0.03 sec	150 sec	0.01 sec	0.03 sec
Ie>> Current Setting	Ie>> Pickup	0.01 Amp	2 Amp	0.01 Amp	0.1 Amp
Ie>> Definite timing	Ie>> Deft Time	0.03 sec	150 sec	0.01 sec	0.03 sec

15) Specification Table of I-350

Function	ANSI	NEX-I 350
CT inputs	–	4
PT Inputs	–	x
Over current	50/51	✓
Earth Fault	50N/51N/51SN	✓
CBFP	50BF	✓
Trip Circuit supervision (TCS)	74TC	✓
Harmonic Blocking	51H	✓
Cold Load Pickup	62 CLD	✓
Programmable Scheme Logic	-	✓
Auto Re-closer	79	✓
Thermal Over-load	49	✓
Fault Record	–	10
Event Record	–	100
Disturbance Record	–	✓
Selection of 1/5A	–	Site selectable
Digital Input	–	6
Digital Output	–	8
Enclosure Type	–	Draw out with CT shorting
Front Communication	–	✓
Rear Communication (RS-485)	–	✓

16.0 Standards

Type Test			
F1 *	Functional Tests	Internal Design	Performance in line with Specification & standards
		Specifications & IEC60255-6 IEC60255-3	Pickup/Drop down/Power consumption in Current/Voltage/Aux Supply/Trip timing accuracy: OC/ Directional/NPS/Thermal/OV/Zero Seq/Over Power/ freq/Rate of change of Freq.

Climatic Test			
C1	Temperature Dry Cold (Relay operational)	IEC60068-2-1	-20 deg C, 2 hours
C2	Temperature Dry Cold Transportation & Storage	IEC60068-2-1	-25 deg C, 16 hours
C3	Temperature Dry Heat (Relay operational)	IEC60068-2-2	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)	IEC60068-2-78	95% @ +55 / +25 deg C

Enclosure			
C6	Enclosure	IEC529	Front IP54 (Dust5x + Water x4)

Mechanical Test

Relay Operational			
M1	Vibration response / Endurance test	IEC60068-2-6	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	IEC60068-2-6	Class I Shock response (Relay operational) 5g 11mS 3 pulse in each axis 3 pulses in each axis

*** Model Dependent**

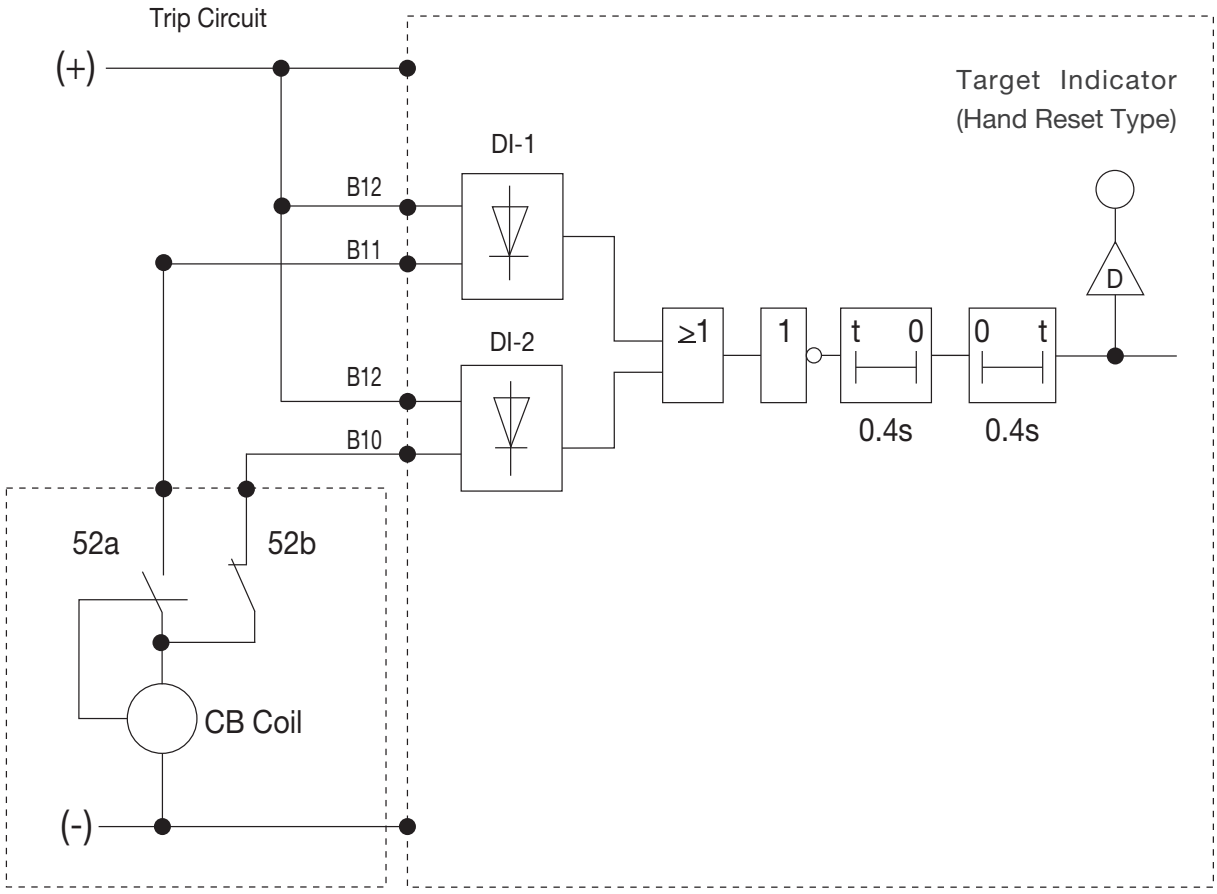
Electrical Test			
E1	Insulation Resistance >100MΩ	IEC60255-5	500V DC, 5 sec between all terminals & case earth, between terminals of independent circuits including contact circuits and across open contacts
E2	Ripple in DC supply (Relay operational)	IEC60255-11	AC ripple
E3	Dielectric Test (Relay de-energised) No breakdown or flash over Test voltage 45~65 Hz sinusoidal	IEC60255-5	2.0 KV @ 1min All circuit to Earth / Between IP & OP
E4	High Voltage Impulse (Relay de-energised)	IEC60255-5	5 kV peak 1.2/50uS, 0.5 J-3 positive, 3 negative between all terminals to case earth between independent circuits
E5	CT Input Thermal Withstand		100xIn for 1 second 30xIn for 10 second 4xIn continuously
E6	Contact performance & endurance tests	IEC60255-14,15 IEC60255-1	

Electro-magnetic Compatibility			
R1	Electrical fast Transient/Burst (Relay operational)	IEC60255-22-4 IEC61000-4-4	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)	IEC60255-22-1	Class III Longitudinal 2.5 kV peak, 2sec between independent circuits & case earth
R3	Electrostatic Discharge (Relay operational)	IEC60255-22-2 IEC61000-4-2	Class III 8kV air discharge, 6KV contact No of Discharge : 10 both polarities at 1 sec intervals
R4	Conducted Disturbance RF fields (Relay operational)	IEC61000-4-6 IEC60255-22-6	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)	IEC60255-22-3 IEC61000-4-3	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)	IEC61000-4-5 IEC60255-22-5: 2008 Latest: IEC60255-26:2013	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)	EN55011 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) Recommended Terminal Lugs Specifications

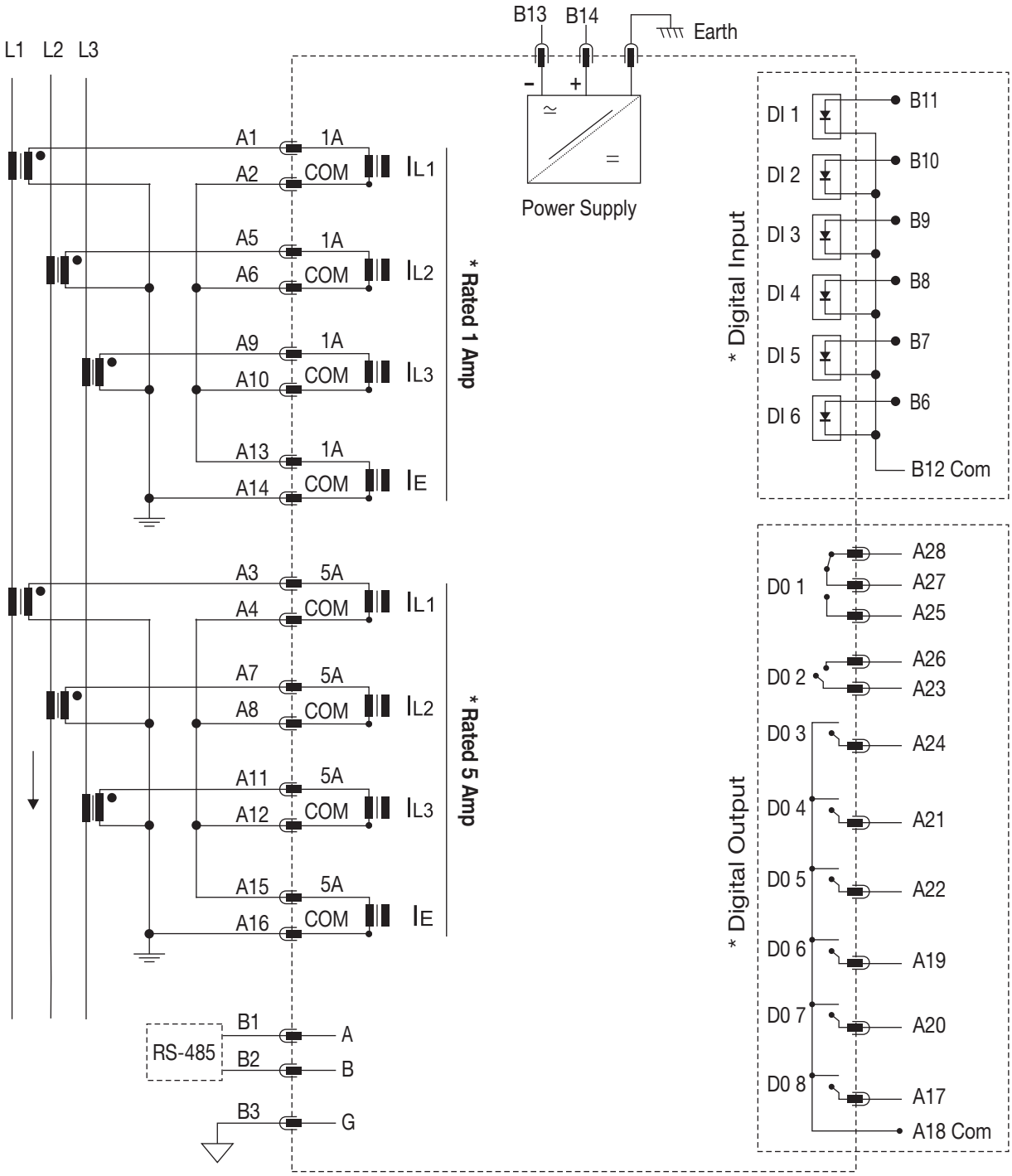
Term Blocks	Type/Cable Specifications
Current Inputs	Ring Type lug / 2.5mm^2 or 4 mm^2 control cable
Auxiliary Supply	Pin Type lug / 1.5 mm^2 / 2.5 mm^2 control cable
Rear Comm. Port	Pin Type lug / 1.5 mm^2 / 2.5 mm^2 control cable
Front Comm. Port	USB, Type A
Binary Input	Pin Type lug / 1.5mm^2 / 2.5mm^2 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

Trip Circuit Supervision Diagram



(Trip Circuit Supervision Function)

18) Connection Diagram



* Based on Ordering Information

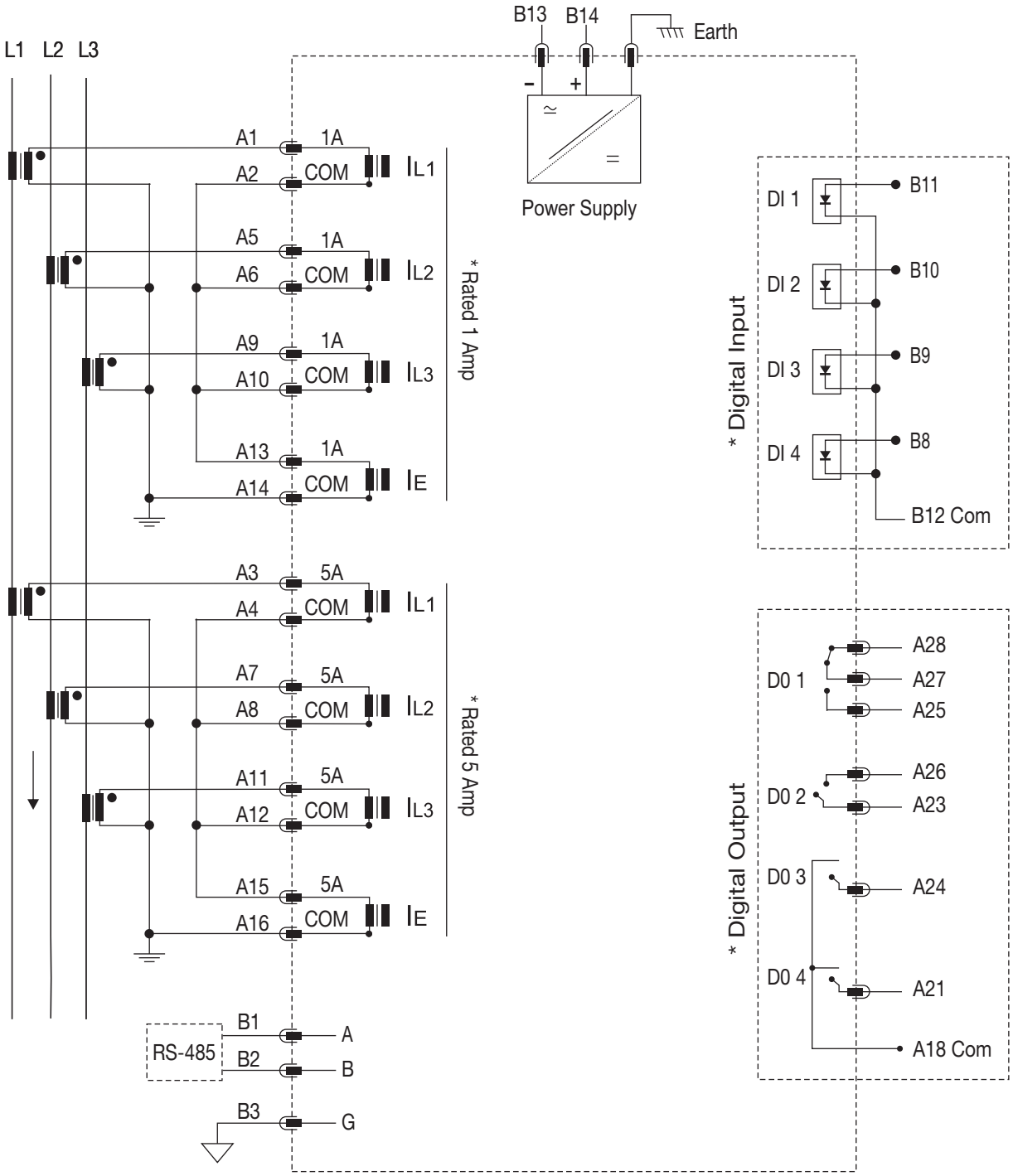
CSENEX-I for 6 DIs & 8 DOs

(Figure 8)

19) Terminal Description (for 6 DI & 8 DO)

Term Name	Terminal Description
A1-A2	CT Terminal for Phase current input (1A) in L1 Phase
A5-A6	CT Terminal for Phase current input (1A) in L2 Phase
A9-A10	CT Terminal for Phase current input (1A) in L3 Phase
A13-A14	CT Terminal for Phase current input (1A) in Neutral current
A3-A4	CT Terminal for Phase current input (5A) in L1 Phase
A7-A8	CT Terminal for Phase current input (5A) in L2 Phase
A11-A12	CT Terminal for Phase current input (5A) in L3 Phase
A15-A16	CT Terminal for Phase current input (5A) in Neutral current
A17-A18	Digital Output (DO-8) (NO-COM)
A20-A18	Digital Output (DO-7) (NO-COM)
A19-A18	Digital Output (DO-6) (NO-COM)
A22-A18	Digital Output (DO-5) (NO-COM)
A21-A18	Digital Output (DO-4) (NO-COM)
A24-A18	Digital Output (DO-3) (NO-COM)
A26-A23	Digital Output (DO-2) (NO-COM)
A28-A27-A25	Digital Output (DO-1) (NC-COM-NO)
B1-B2	RS-485 (A), RS-485 (B)
B3	RS-485 Ground
B6-B12	Digital Input (DI-6)
B7-B12	Digital Input (DI-5)
B8-B12	Digital Input (DI-4)
B9-B12	Digital Input (DI-3)
B10-B12	Digital Input (DI-2)
B11-B12	Digital Input (DI-1)
B13-B14	Aux supply (B13: '-' B14: '+')

Connection Diagram



* Based on Ordering Information

CSENEX-I for 4 DIs & 4 DOs

(Figure 9)

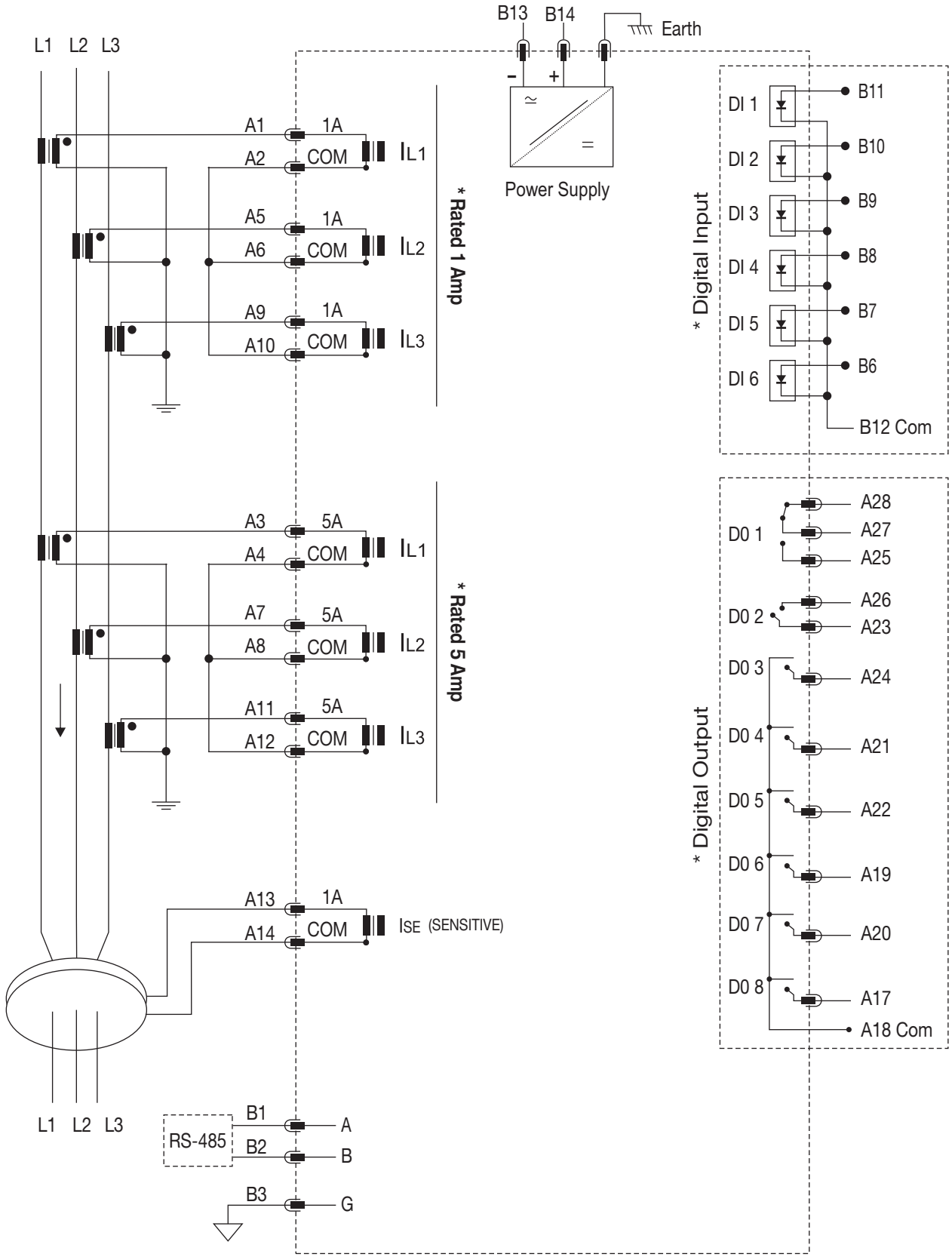
Terminal Description (for 4 DI & 4 DO)

Term Name	Terminal Description
A1-A2	CT Terminal for Phase current input (1A) in L1 Phase
A5-A6	CT Terminal for Phase current input (1A) in L2 Phase
A9-A10	CT Terminal for Phase current input (1A) in L3 Phase
A13-A14	CT Terminal for Phase current input (1A) in Neutral current
A3-A4	CT Terminal for Phase current input (5A) in L1 Phase
A7-A8	CT Terminal for Phase current input (5A) in L2 Phase
A11-A12	CT Terminal for Phase current input (5A) in L3 Phase
A15-A16	CT Terminal for Phase current input (5A) in Neutral current
A21-A18	Digital Output (DO-4) (NO-COM)
A24-A18	Digital Output (DO-3) (NO-COM)
A26-A23	Digital Output (DO-2) (NO-COM)
A28-A27-A25	Digital Output (DO-1) (NC-COM-NO)
B1-B2	RS-485 (A), RS-485 (B)
B3	RS-485 Ground
B8-B12	Digital Input (DI-4)
B9-B12	Digital Input (DI-3)
B10-B12	Digital Input (DI-2)
B11-B12	Digital Input (DI-1)
B13-B14	Aux supply (B13: '-' B14: '+')

Cable required for Front USB Communication (Type A to A)

(Figure 10)

20) Connection Diagram (for Sensitive Earth)

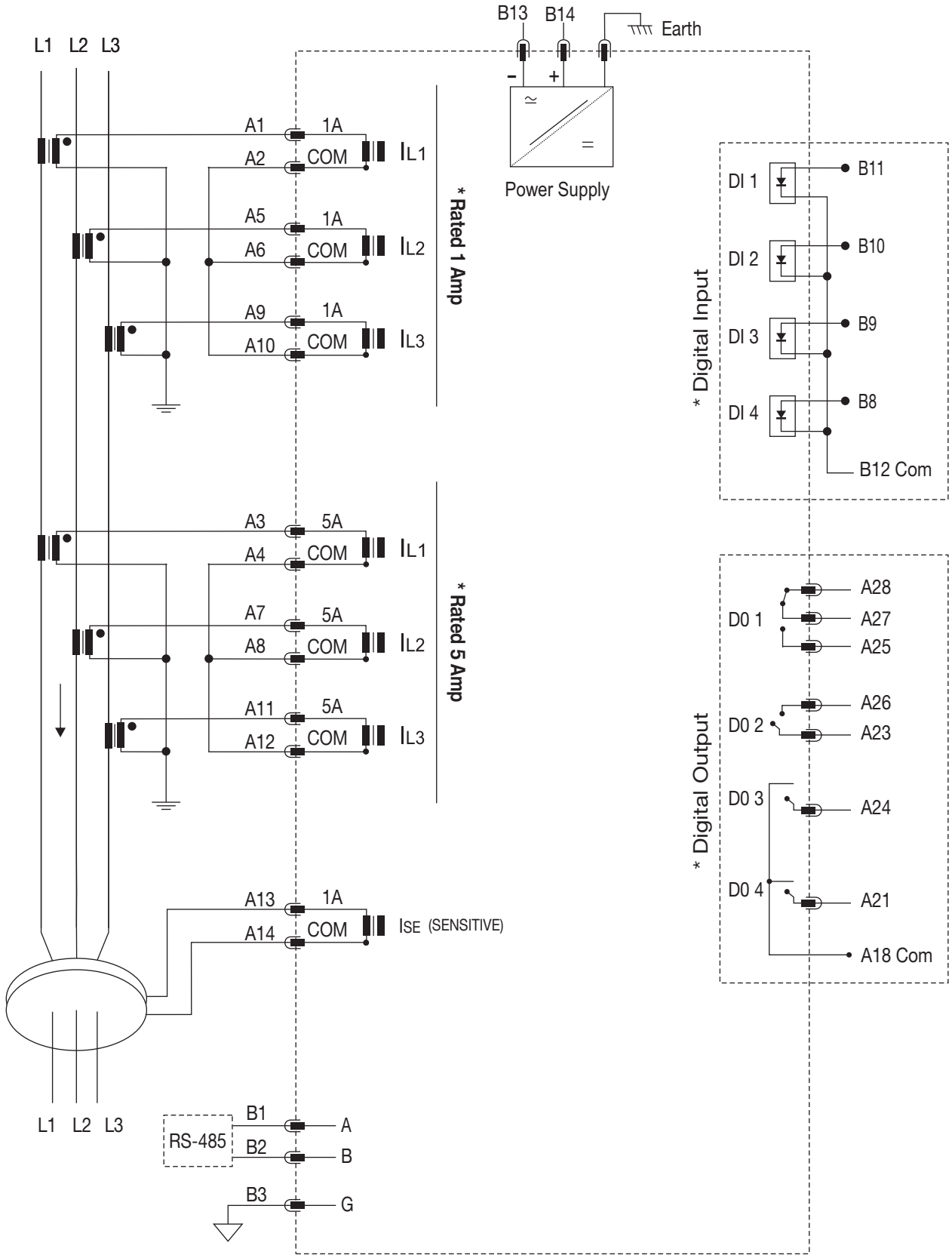


* Based on Ordering Information

CSENEX-I for 6 DIs & 8 DOs

(Figure 11)

Connection Diagram (for Sensitive Earth)



* Based on Ordering Information

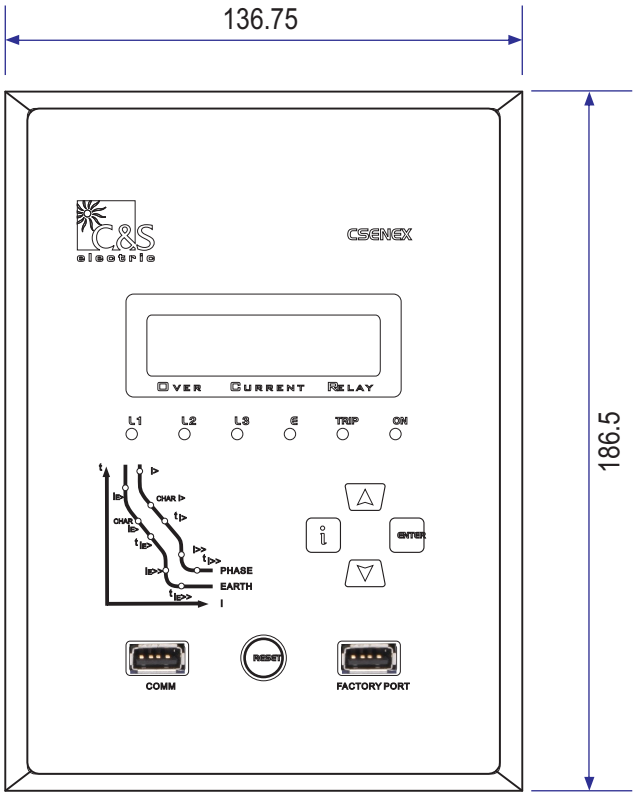
CSENEX-I for 4 DIs & 4 DOs

(Figure 12)

21) Dimensional Details

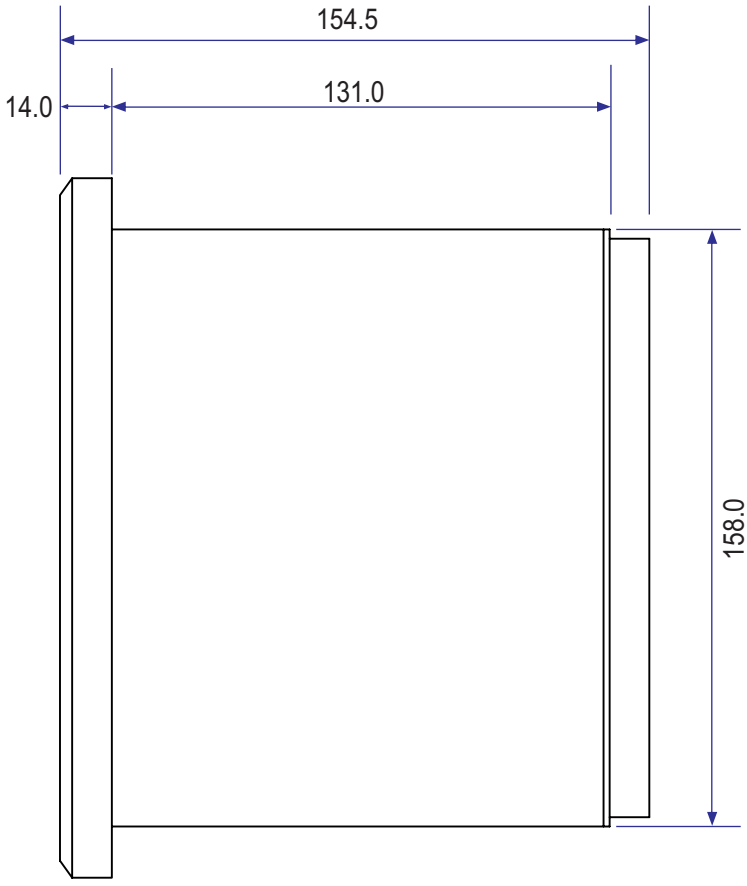
All the Dimension are in mm (Gen Tol.: ±1mm)

Front View



(Figure 10)

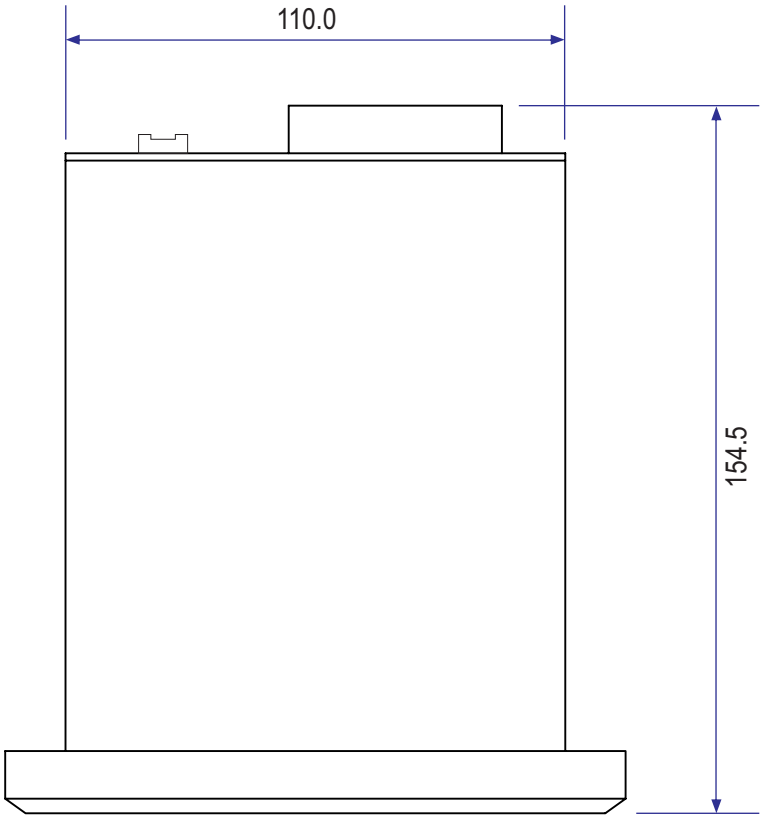
Side View



(Figure 11)

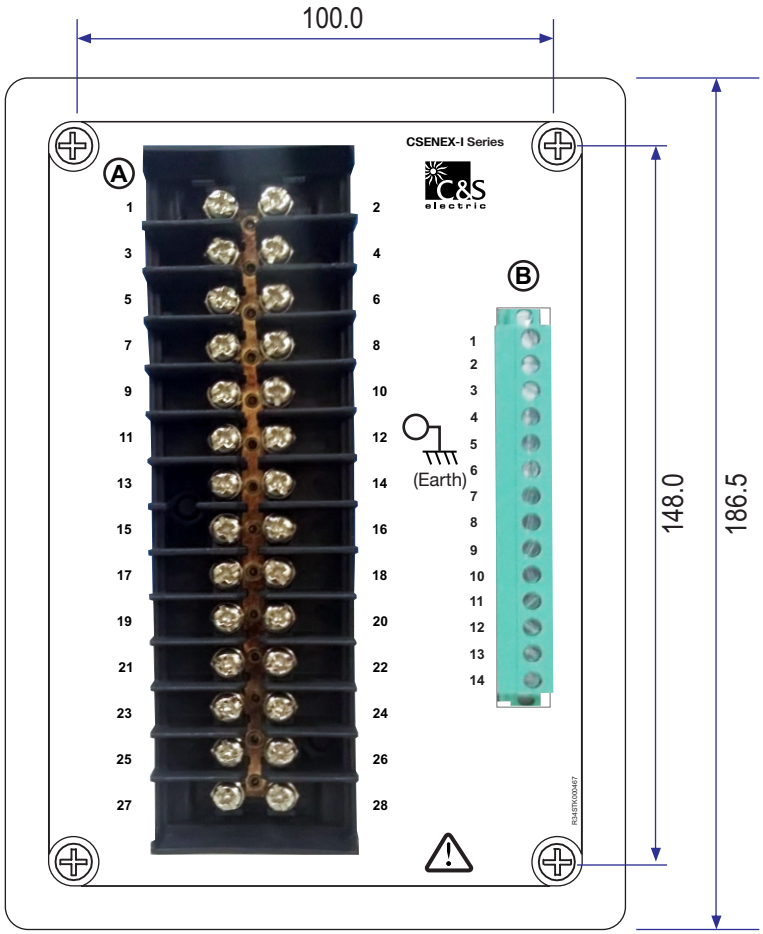
Dimensional Details contd..

Top View



(Figure 12)

Back View

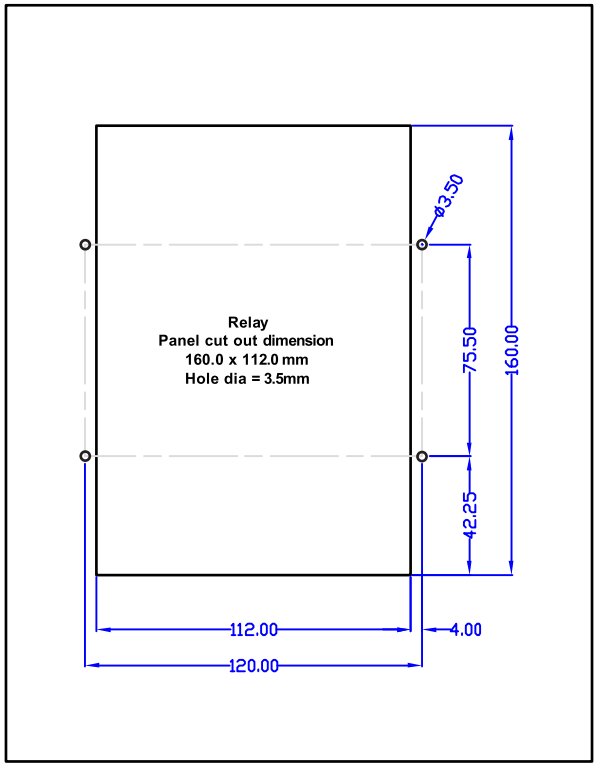


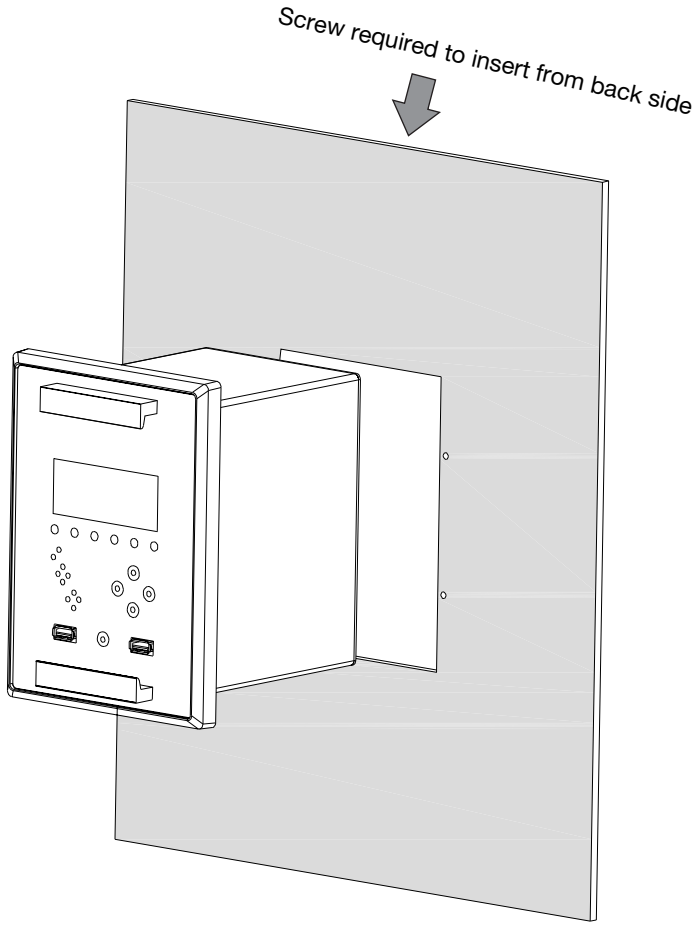
(Figure 13)

22) Panel Mounting Details

Panel cut out Dimension: HeightxWidth=160x112mm

Screw : M3, Qty : 04 Nos.





23) Ordering Information

CSENEX-I - 350 - X - X - X - X

DI-DO SELECTION
D1 : 4 DI + 4 DO
D2 : 6 DI + 8 DO

AUXILIARY SUPPLY
L : 18 - 60V DC
H : 85 - 280V AC / 90V - 300V DC
W : 18 - 160V DC

COMMUNICATION OPTION
M : MODBUS on RS-485
I : IEC-103 on RS-485

EARTH FAULT
S : Sensitive
N : Non Sensitive

Revision History

S.No.	Rev.No.	Details	Date
01	01	Inclusion of 'Reset Time' in Measuring Input Technical Data clause 14	20.07.15
02	02	Removed "Program Scheme Logic" details from the catalogue	07.08.15
03	03	Include "Cold Load Pickup" & "Program Scheme Logic" details in the catalogue	22.09.15
04	04	Change in Connection Diagram & its description	25.09.15
05	05	Change in Over current & Earth Protection Setting Ranges on Page 14	06.10.15
06	06	Change in Conn Diagram & its description on Page 21 & 22 respectively	07.10.15
07	07	Change in setting ranges of Over current, cold load pickup etc. & in DO, DI Max setting	15.10.15
08	08	Change in Measuring Inputs of Technical Data on page 20	04.11.15
09	09	Inclusion of Panel cut out dimension and its pictorial view	05.11.15
10	10	Modified "Two sets of setting group" as "Four sets of setting group" in Features Heading	25.11.15
11	11	Inclusion of Wide Range Aux Supply Rating in Ordering Information & Aux Supply Table	18.03.16
12	11	Inclusion of Lugs image on page 25	02.11.16
13	12	Inclusion of Sensitive Earth fault in order information and incude SEF connection diagram	18.09.17
14	13	In connection diagram, symbol of Earth (power supply) and Ground (Communication) change	15.03.18
15	14	Change in 'Sensitive Earth over current setting' on page 21	13.07.18
16	15	Change in 'back terminal view' on page 33	19.11.18
17	16	Change in **standards** data	20.12.19

Technical Question or After-sales Service

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Rev. Date: 20.12.19

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