We touch your electricity everyday!

CSDPR-V2-400D

Intelligent measuring & protection device

Draw out Relay Catalog

C&S electric

PMD Division

CONTENTS

1) Introduction

In the family of protection relay, CSDPR-V2-400 is numeric multi powered Over-current relay specially designed for ring main units & feeder protection.It consist all the necessary protection and monitoring functions required for RMU, The advance Controller continuously monitors line load current and E/F currents with standard CTs. These measured values are then used for different protection function such as IDMT / DT Over current protection, E/F protection, Cold load pickup etc. Metering is available on LCD display. The power module derives power from current flowing through line; therefore external power supply is not required. Relay provides pulse output to Trip the RMU or compact CB having low energy series tripping coil. Along with that, Relay provides potential free output contacts for Alarm/Annunciation.

2) Main Features

- Self Power Design : Starting from 10% / 20% of Load current as per model selection.
- Two set of protection setting group
- Energy pulse output tripping 24V@0.4Ws
- DEFT & Inverse characteristics for O/C and E/F, individually selected for phase & earth fault
- 2 Optically isolated digital inputs for Remote Trip, Protection blocking
- 4 Digital Output contacts for annunciation
- Relay get energize either from Current, Aux. voltage, Front USB (whichever is available)
- Last 5 Fault and 10 Event record with Date & Time stamp
- USB port for data downloading/uploading via PC / Laptop
- RS-485 port with communication protocol of IEC 103 or MODBUS for SCADA communication
- Wide operating range of the Aux supply voltage (AC/DC)
- Battery Free Environment friendly Product
- In-built energy harvesting power backup works in absence of Aux / Load current to energize the Display/LCD.

3) Protection Features

- Over current protection
- Short circuit protection
- Earth Fault protection
- Earth Fault High set protection
- Cold Load protection
- Harmonic Blocking protection
- Unbalance / Asymmetric protection
- Circuit breaker failure protection

4) Design

Relay will get energized from any of the following available sources:

- Aux. supply
- CT current
- USB port
- Internal Energy Harvesting Bank

For 10% Load current Model :

In the absence of Aux supply / USB, LCD will get energized, if CT current is 10% of (single phase or sum of three phases) rated current or above. Trip coil will be operated, if CT current in single phase is at least 10% of rated current or 8% of rated current in three phases. Relay is not powered from Earth CT, so for earth fault protection, phase current is mandatory. Relay is equipped with internal energy bank to power its display, which helps to access the relay display, settings, records in absence of Aux. supply/Load currents.

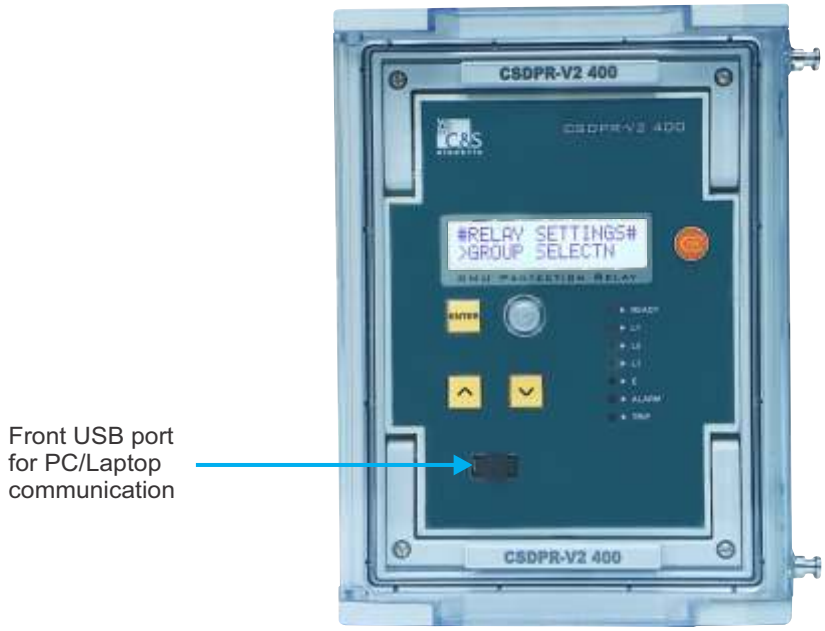
For 20% Load current Model :

In the absence of Aux supply / USB, LCD will get energized, if CT current is 20% of (single phase or sum of three phases) rated current or above. Trip coil will be operated, if CT current in single phase is at least 20% of rated current or 12% of rated current in three phases. Relay is not powered from Earth CT, so for earth fault protection, phase current is mandatory. Relay is equipped with internal energy bank to power its display, which helps to access the relay display, settings, records in absence of Aux. supply/Load currents.

a) Analog Input

The analog input signal of the CT secondary currents as per the terminal detail on page 15, are fed to the protective device via separate input transformers. The continuously measured current values are galvanically isolated, analog & digitally filtered and finally fed to the analog/digital converter to get the True RMS value. Relay displays the load current in all the phases. Residual connection is internally configured so that earth/unbalance current can be measured. The load current display starts at a minimum of 3%.

Front Interface



b) LED / LCD Display

There are 07 LEDs on the front panel,

Their functions are indicated by the appropriate inscriptions along with them. These LEDs are with memory backup & they will maintain the previous status until fault is acknowledged through manual reset. The front panel of the protective device Relay comprises the following operation and indication elements:

- LCD : 16x2 Alpha Numeric LCD display
- READY : READY LED indicates the Relay is in Ready conditions
- L1 : Phase LED for Pickup/Trip indication
- L2 : Phase LED for Pickup/Trip indication
- L3 : Phase LED for Pickup/Trip indication
- E : Earth fault LED for Pickup/Trip indication
- ALARM : LED for Alarm indication
- TRIP : Red Steady indicates the Trip on faulty conditions

c) Keypads

The front panel keypad consists of five soft-touch keys. These keys are marked as below :-

Note: Under Self powered condition (i.e. absence of Auxiliary Supply), Back-light will be available in product if current is more than 20% in all phases or 40% in single phase by pressing ENTER Key.

	Key is used to ON the Display (in absence of Aux supply & USB).
	Key is used to set the parameters. It act as a ENTER key for HMI (also used to ON display in presence of Aux supply & USB).
	Key is used to reset the fault status. (Manual Reset on pressing for 2 sec.)
	Key is used to scroll in upward direction for parameters / to increase the value of parameters.
	Key is used to scroll in downward direction for parameters / to decrease the value of parameters.

Note :

1) Relay will go into sleep mode after 30 seconds, If no activity happens on the front HMI keys. Press  key to wake up the display.
2) The Internal energy bank requires at least initially 20 min. of Load current or Aux. supply. Once the internal energy bank gets charge up with the energy, it remains in reserve for a longer duration to give the power to display the records/settings of the relay.

d) Trip Output

In presence of Aux supply:

4 Potential Free contacts and 1 Potential O/P (24V/12V@0.4Ws /50msec ON Pulse). Duty cycle will depend upon the strength of available current.

In presence of only adequate CT current:

2 Potential free latch contact and 1 Potential Output (24V/12V@0.4Ws/50msec ON Pulse). Duty cycle will depend upon the strength of available current.

Average 20% of the rated current must required in the phases to trip the breaker.

e) Assignment of the Output DOs

Relay has 4 output relays (DOs). Two latch Relay (DO-3 & DO-4) is available in all conditions. Two programmable output relays (DO-1 & DO-2) available only in presence of auxiliary supply. Relay reset operation can be configurable in automatic reset or manual reset mode from HMI.

In automatic reset mode : DO will be reset after the current goes below the pickup level i.e fault condition is clear.

In manual mode : DO will get reset by pressing reset button.

*Auto/Manual option is not applicable for latch relay.

NOTE : Latch Contact (DO-3 & DO-4) will get actuate only in presence of min. load current. RESET of latch contact is possible under presence of energizing current or Auxiliary supply or internal energy harvesting block.

f) Potential Input

Relay is having Two digital inputs (Dis)

Predefined Two Potential Digital Inputs are available for Remote Block & Remote Trip.

DI-1: Remote trip

DI-2: Remote block for 50/50N/51/51N & unbalance protection

DI-1: Remote Trip

Irrespective of any pickup or fault user can trip the Circuit breaker, by applying voltage to Remote trip DI.

DI-2 : Blocking the protection functions

When this input, becomes high it will block the selected protections such as OC/SC/Earth/Earth-high set/ U0>. The selection of protections for blocking is done from HMI. Blocking will remain active till the potential is available on DI terminal.

g) Reset Function

RESET function in CSDPR-V2-400 is available with :

1) Long press of reset key for 2 seconds.

2) **Through Communication** : via RS-485 communication command.

5) Protection Functions

Relay offers 50/51 / 50N/51N / Unbalance / CBFP / Cold load pickup protections.

Over Current Protection

The relay is designed for Over Current Protection Function with two independent stages I> & I>>.

a) I> stage can be programmed as IDMT or Definite Time (DT) provided with range of

I) **For 10% Model** : 0.10xIn to 2.50xIn for IDMT

ii) **For 20% Model** : 0.20xIn to 2.50xIn for IDMT.

All major international IDMT curves are available. Over-current Characteristic : DEFT/VINV/EINV/ NINV3.0 /NINV1.3, LINV, RI, HV-FUSE. The stages of over current are programmable as per IDMT characteristic based on IEC standards.

b) I>> is designed for Short circuit Protection Function with independent stages. I>> stage can be programmed as DMT Definite mean time provided with range of 0.50xIn to 30.0xIn for DMT.

Earth Fault Protection

The relay is designed for Earth Fault Protection Function with two independent stages Ie> & Ie>>.

a) Ie> Earth Low set stage can be programmed as IDMT or Definite Time (DT) provided with range of 0.05xIn to 2.50xIn for IDMT. All major international IDMT curves are available. The stages of earth fault function are programmable as per IDMT characteristic based on IEC standards.

b) Ie>> Earth Hiset Protection Function with Ie>> independent stages. Ie>> stage can be programmed as DMT Definite mean time provided with range of 0.5xIn to 15.0xIn for DMT.

Unbalance Protection

This is provided by the relay tripping in phase unbalance greater than setting % difference in terms of maximum vs minimum phase current

$$I_{unb} : \frac{(I_{MAX} - I_{MIN})}{I_{MAX}} \times 100\ [\%]$$

Circuit Breaker Failure Protection

The C.B. failure protection is based on supervision of phase current during tripping events. This protective function becomes active only after tripping. The criteria is whether all phase currents are dropped to below 5% x IN within set time of tCBFP. If not, then CB failure is detected and the assigned relay is activated. This Annunciation DO for CBFP available with manual reset only.

Cold Load Pickup

In this unit, this feature is provided to avoid non desired trips. When line de-energized for a period of time and re-energized later, the load exceed the protection setting without the presence of a fault. To avoid such condition, Relay switches from one protection setting group to another setting group for settable time. After expiry of settable time, it will shift back to original setting of protection.

Harmonic based Protection Blocking

To avoid any nuisance tripping, Relay provides 2nd harmonic (inrush) filtration. It helps to protect against nuisance tripping in the system and relay filters out the 2nd harmonic (inrush) content which can lead to nuisance tripping.

6) Communication

a) Front (USB) Communication

The front USB communication port is designed to communicate CSE LIVELINK front end Software. Front end software can be use for change of view/ protection settings, retrieval of fault/event records.

Note: Relay automatically get energizes from USB port. User can use a standard mobile bank to give the power to the relay as backup via this USB port.

b) Rear (RS-485) Communication

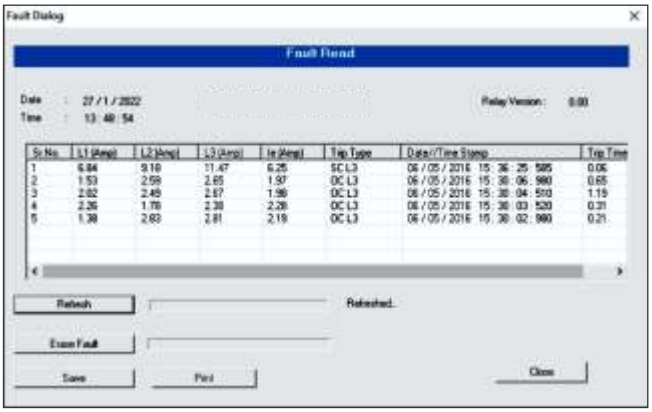
The Relay includes an RS-485 communication port. This port is available for MODBUS or IEC-103 protocol (as per model selection). Relay has feature to transmit the data such as settings, measurements and faults to the SCADA system. For this communication auxiliary supply is mandatory. A communication failure dose not affects protection function of the product. Through communication remote reset and change in relay settings are also possible.

7) Fault Record

Relay records last 5 faults in its non volatile memory with its time stamp. Each record has the following information:

Fault Format		
L1 (Amp)	:	XX.XXA
L2 (Amp)	:	XX.XXA
L3 (Amp)	:	XX.XXA
Ie (Amp)	:	XX.XXA
Trip Type	:	XX.XX
Date/Time Stamp	:	DD:MM:YY HR:MIN:SEC:MS
Trip Time (sec)	:	XX.XX

The user can view the fault record / various parameters via the front USB interface software.

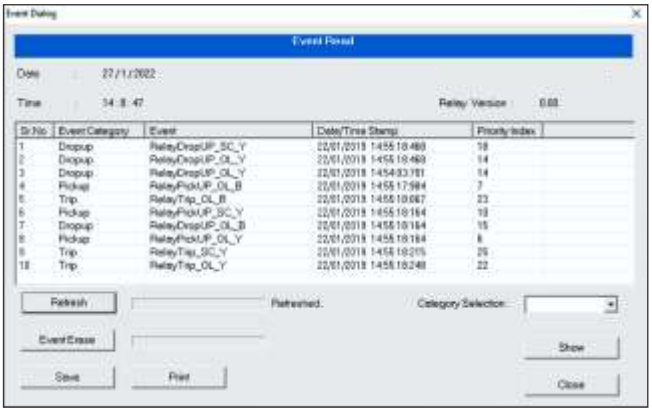


(Fault Data Recording on PC Software)

Picture shown here for have an idea only

8) Event Record

The unit stores in its non-volatile memory the last 10 events with its time stamp. When the available memory space is exhausted, the new vent automatically overwrites the oldest event, which can be retrieved from the PC.



(Event Data Recording on PC Software)

NOTE : Once data has been downloaded after that offline this data can also be visualize in front end software.

9) Setting Ranges

Group Setting

Parameter	Display	Setting Range
Group No.	ACT.GRP	Group1 / Group2

Protection Settings

Parameter	Display	Setting range	Step size
CT Ratio for primary current display	Ct Rt	1 - 2500	1
Frequency	Freq	50/60Hz	1
Phase Characteristics	PChr	DEFT, EINV, VINV, NINV3.0, NINV1.3 LINV, RI, HV-FUSE	1
Earth Characteristics	EChr	DEFT, EINV, VINV, NINV3.0, NINV1.3 LINV, RI, HV-FUSE	1
For 10% Load current 1st Stage phase pickup	I>	0.10 - 2.5 x IN	0.01 x IN
For 20% Load current 1st Stage phase pickup	I>	0.20 - 2.5 x IN	0.01 x IN
DEFT Trip time for 1st stage over-current	t>	0.10 - 150 s	0.01 s
Inverse TMS for 1st stage phase over-current	ti>	0.01 - 1.500	0.005
2nd Stage phase pickup	I>>	0.5 - 30 x IN	0.05 x IN
2nd Stage phase trip time	t>>	0.00 - 20 s	0.01 s
Earth fault 1st stage pickup	Ie>	0.05 - 2.5 x IN	0.01 x IN
DEFT trip time for 1st stage earth fault	te>	0.05 - 150 s	0.01s
Inverse TMS for 1st stage earth fault over-current	tie>	0.01 - 1.500	0.005
2nd Stage earth fault pickup	Ie>>	0.5 - 15 x IN	0.05 x IN
2nd Stage earth fault trip time	te>>	0.00 - 20 s	0.01s
Phase unbalance pickup	Unb	5 - 80%	1%
Phase unbalance trip time	tUnb	0.1 - 150 s	0.01 s
Enable CBFP protection	CBFP	YES / NO	-
CBFP time	tCBFP	0.05 - 2.0 s	0.01 s

Relay Assignment

Parameter	Display	Setting Range
Over current	I>	DISABLE/RLY1/RLY2/RLY1RLY2
Short Circuit	I>>	DISABLE/RLY1/RLY2/RLY1RLY2
Earth Low set	Ie>	DISABLE/RLY1/RLY2/RLY1RLY2
Earth High set	Ie>>	DISABLE/RLY1/RLY2/RLY1RLY2
Unbalance	Unb	DISABLE/RLY1/RLY2/RLY1RLY2
Circuit Breaker Failure Protection	CBFP	DISABLE/RLY1/RLY2/RLY1RLY2
Digital Input	Remote	DISABLE/RLY1/RLY2/RLY1RLY2
All Fault	AlFlt	DISABLE/RLY1/RLY2/RLY1RLY2

Relay Reset

Parameter	Display	Setting Range
Digital output1	RLY1	Auto/Manual
Digital output2	RLY2	Auto/Manual

Note : Relay 3 & Relay 4 are the latch relay.

DI Blocking

Parameter	Display	Setting Range
Phase Over current Low set	I>	Unblock/Block
Phase Over current High set	I>>	Unblock/Block
Earth Over current Low set	Ie>	Unblock/Block
Earth Over current High set	Ie>>	Unblock/Block
Unbalance	Unb	Unblock/Block

Cold Load Protection

Parameter	Display	Setting Range	Step
Selection of Cold Load Protection	CldLdPr	DISABLE/ENABLE	-
Cold Load Active Time	tCdLd	0.1 Sec -20 Sec	0.01 Sec

Thermal Withstand Capacity

Thermal withstand capacity for In=1A	Continuously	2.5A
	10s	15A
	1s	80A

Trip Type

Parameter	Display	Setting Range
Mode of tripping	Trip Type	TRIP COIL/LATCH RLY/DUAL

Front (USB) Communication

Front Port	CSE protocol with CSE LIVELINK on mini USB cable type A/A

Rear (RS-485) Communication

Parameter	Display	Setting Range
Slave Address	SLV Add	1-32
Baud Rate	BD Rate	9600/19200
Parity	Parity	NONE/EVEN/ODD

General Data

Rated Auxiliary voltage U_H	L : (18V - 60V DC)	H : (85V - 260V AC / 85V - 300V DC)
Rated supply for digital input	Normal voltage U_N	L : (18V - 60V DC)
		H : (85V - 260V AC / 85V - 300V DC)
Power consumption of Aux supply	Quiescent approx. 3W	Operating approx. 6W
Dropout pickup ratio	> 95 %	

Measuring Input

Rated data	Rated current I_N (1A)
Frequency	F_N: 50/60 Hz
Measurement	Measurement of Phase / Earth current starts from 5%
Phase / Earth VA Burden	For 20% Load current <1.2VA @ Rated current

Accuracy

Tripping times with pre-fault	DMT : ± 5% of the setting value or ±40 mSec
	IDMT : Accuracy as per IEC-255-3 (2xIs to 20 Is)
	For VINV/RI : ± 5% or ± 55 mSec
	For NINV : ± 5% or ± 50 mSec
	For LINV/EINV/HV-Fuse : ± 7.5% or ± 70 mSec
Pickup accuracy	+5%
Boot-up time in self powered mode	≤ 100 mSec

Measurement Accuracy

Quantity	Range	Frequency Range	Accuracy
Current	0.1 - 30 x I_p	50 / 60 Hz	±2% or 10mA (whichever higher)

Output Contact (Relay Specs)

Number of Relays	4
Relay contacts (RLY: 1, 2) configurable &	Relay 1 and 2 are user programmable for I>, I>>,
available only with Auxiliary supply model	Ie> and Ie>>, CBFP, Unbalance ($U_{0>}$) etc.
Relay contacts: 3, 4	Latch type of relay
Max. breaking capacity	1250VA / 150W resistive
	500VA / 90W inductive
Max. breaking voltage	400V AC, 125 VDC
Max. continuous AC current	5A

10) Conformance of Standards

S.No.	Type of Test	Applicable IEC Standards
1	Functional Tests under normal operating conditions (a) Operating value test (b) Operating time test (c) Inverse characteristics	IEC 60255-6 IEC 60255-3,4
2	Conducted Emission	As per CISPR 11
3	Radiated Emission	As per CISPR 11
4	Impulse Voltage Test	8 of IEC 60255-5 / IEC 255-5
5	High Frequency Disturbance Test	IEC 61000-4-18
6	Radiated Radio Frequency electromagnetic field Immunity Test	IEC 60255-22-3:2000 / IEC 61000-4-3
7	Surge Immunity Test	IEC 61000-4-5 / IEC 60255-22-5 : 2002
8	Power Frequency Magnetic Field Immunity Test	As per IEC 61000-4-8
9	Electrostatic Discharge Test	As per IEC 60255-22-2 / IEC 61000-4-2
10	Fast Transient Disturbance Test	IEC 60255-22-4 : 2002
11	Dielectric Test	As per IEC 60255-5
12	Insulation Test	As per IEC 60255-5

Tripping Characteristics (IEC 255-3 or BS 142)

Normal Inverse 3.0/1.3 $= \dfrac{0.14 / 0.06}{(I / I_s)^{0.02} - 1}$ ti [s]

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

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

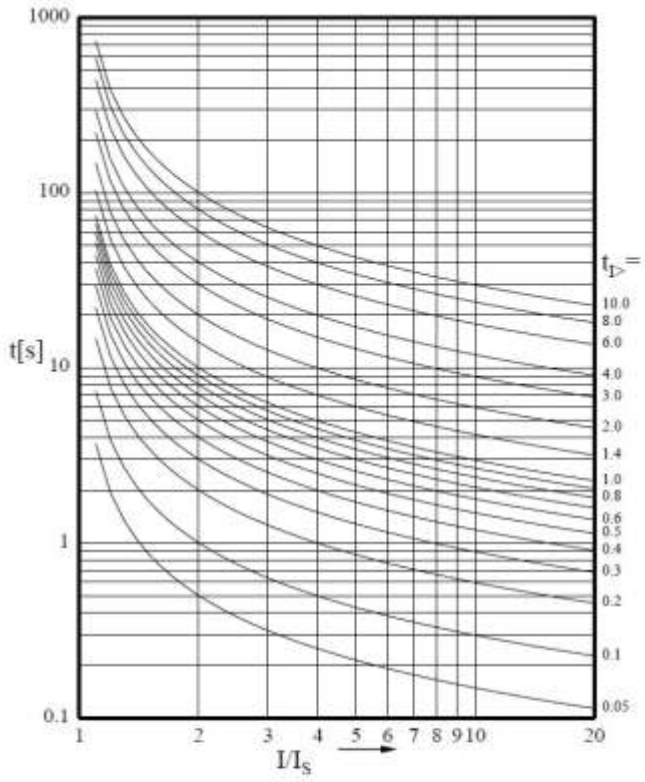
I : Injected current
Is : Pickup set level
ti : TMS for inverse characteristic
t : Definite delay in DEFT

!!! **CAUTION** !!!

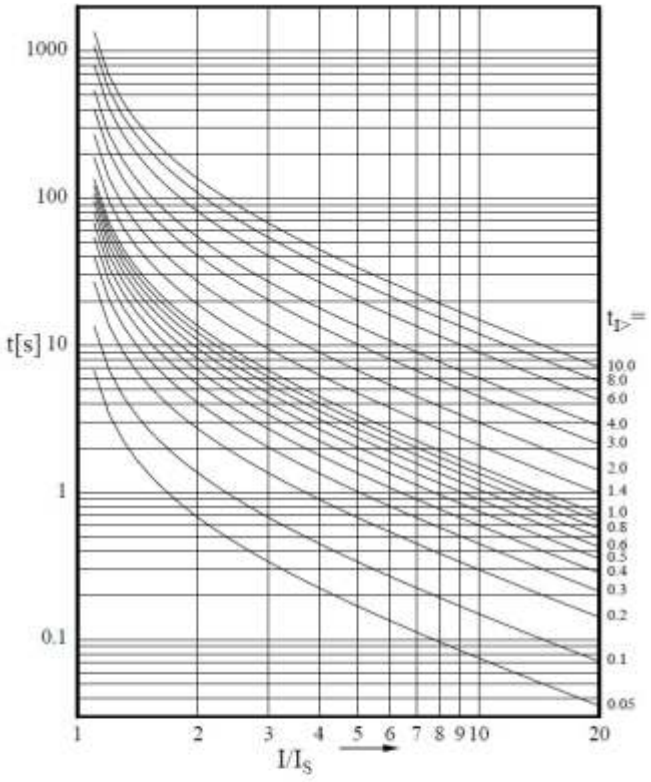
O/C, S/C, E and EH protections are available with DISABLE option in HMI.

11) Inverse Graph Representation

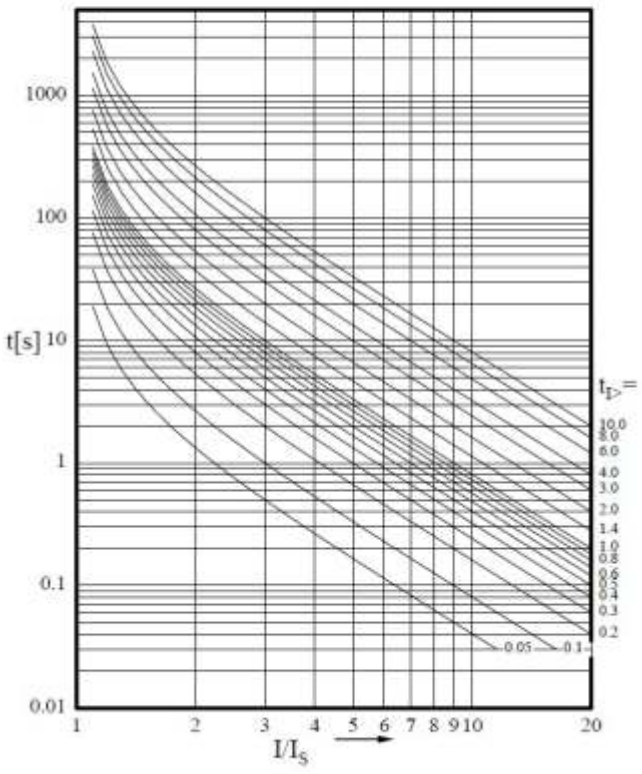
Inverse Time Characteristics



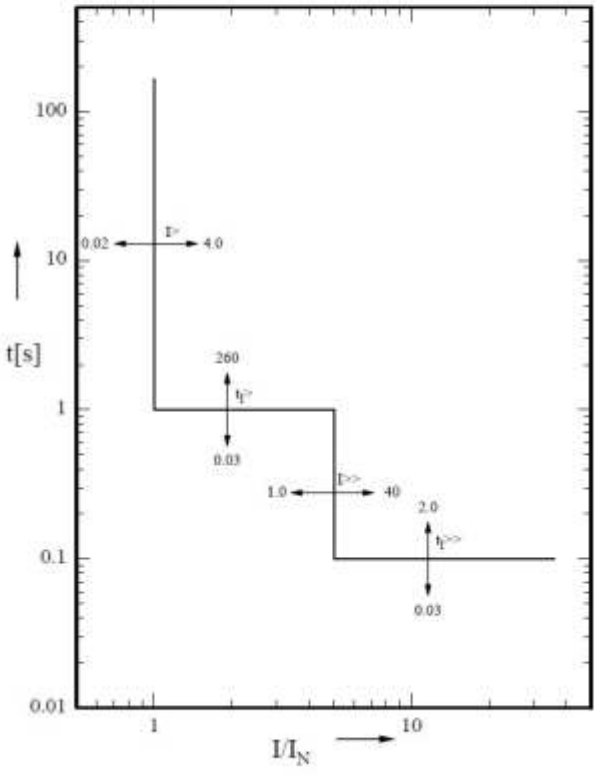
Normal Inverse



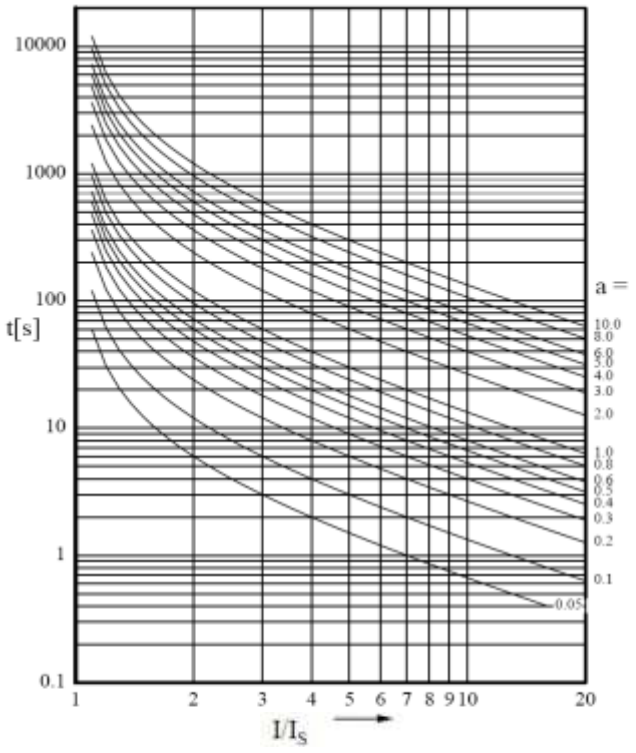
Very Inverse



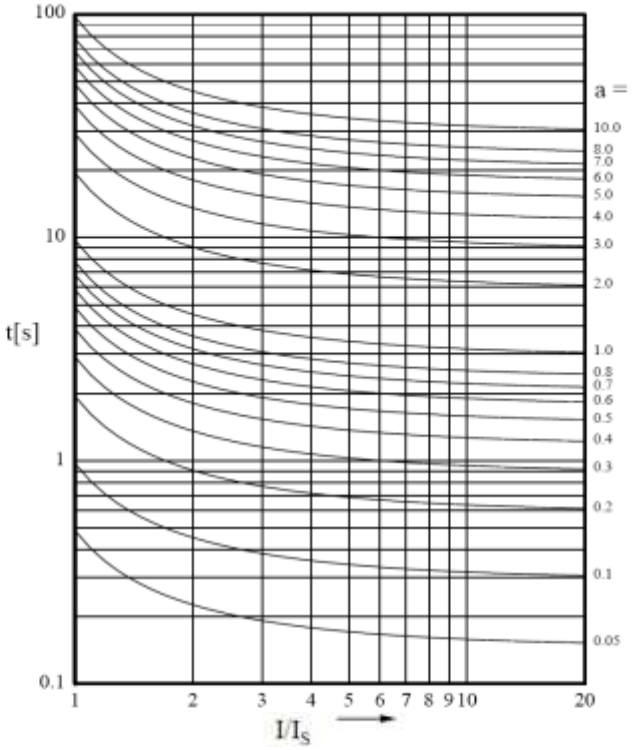
Extremely Inverse



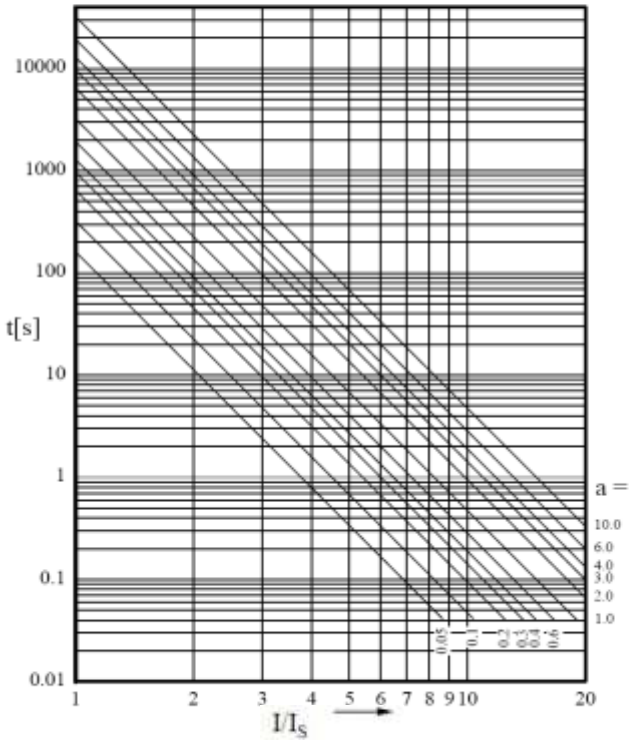
Definite time overcurrent relay



Long time inverse



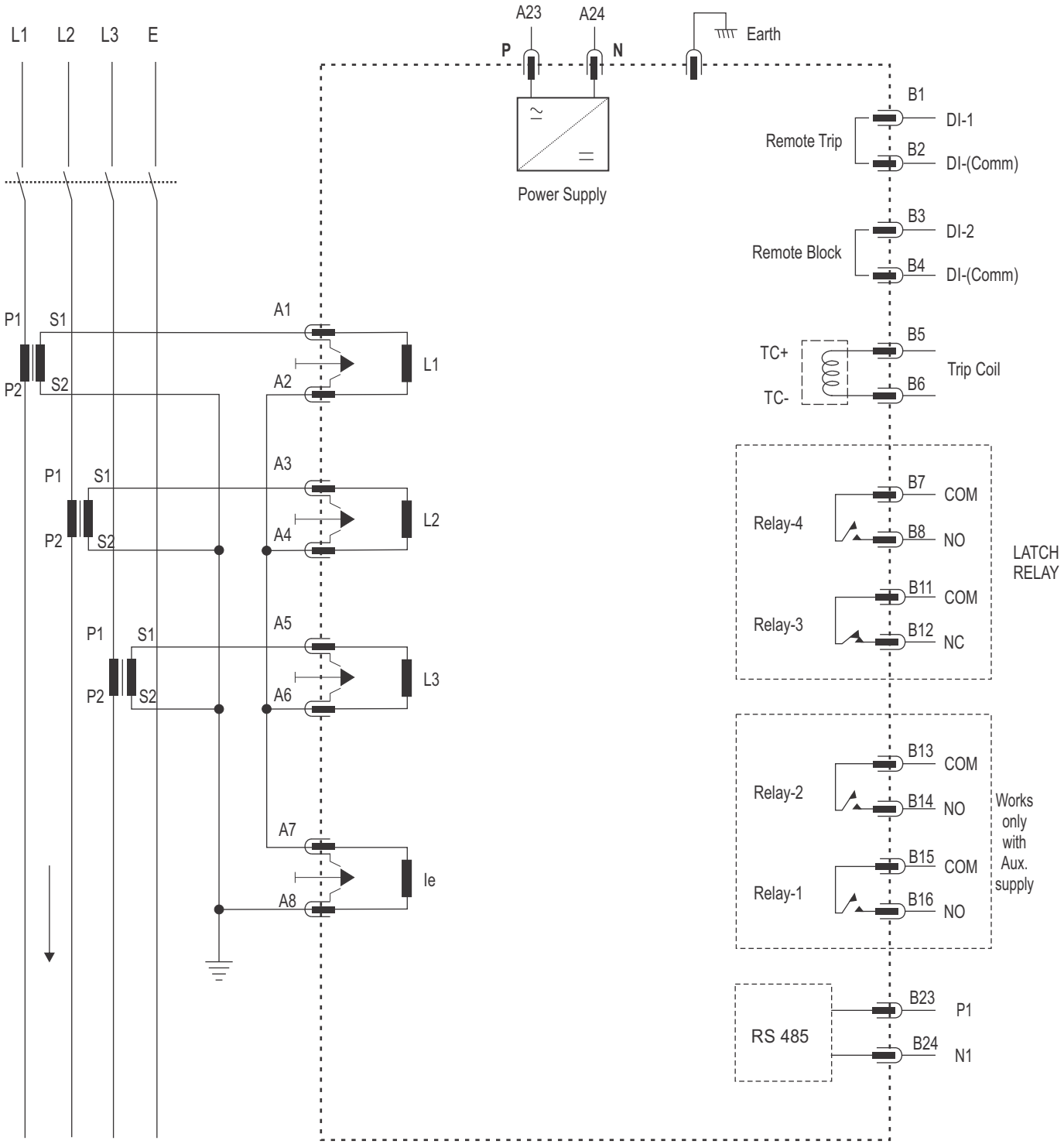
RI-Inverse



HV-fuse

12) Connection Diagram

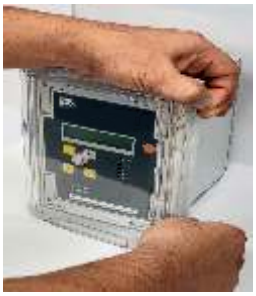
The following shows the terminals back of CSDPR-V2-400



NOTE: While doing the HV test, do not connect the MHT terminal (B5-B6) & RS-485 Comm (B23-B24), as internal capacitor bank could be in charged state & it can harm the circuitry.

13) Draw-out Process of the Relay

locking knobs



User(s) are advised to side lift both the locking knobs gently one by one to open the front cover as shown in the left picture and then Slide side the front cover towards the left side.

mounting screw positions (circled)

Now unscrew all the 4 screws placed at the 4 corners of the relay, by using the appropriate screw driver gently, extra force may cause the damage in the relay.

Hold the Eject handle, as shown in the left picture. Twist the eject handle as shown in the picture.

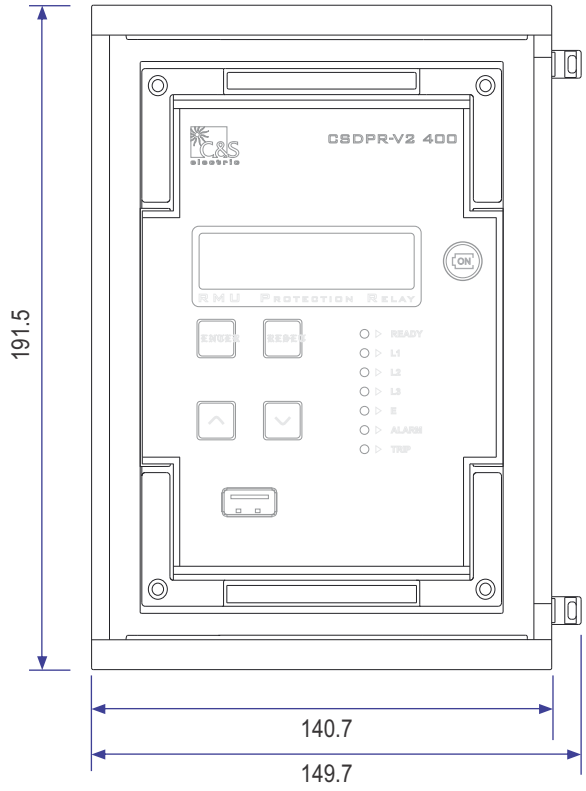
Then bring out the relay from the enclosure by using the eject handle.

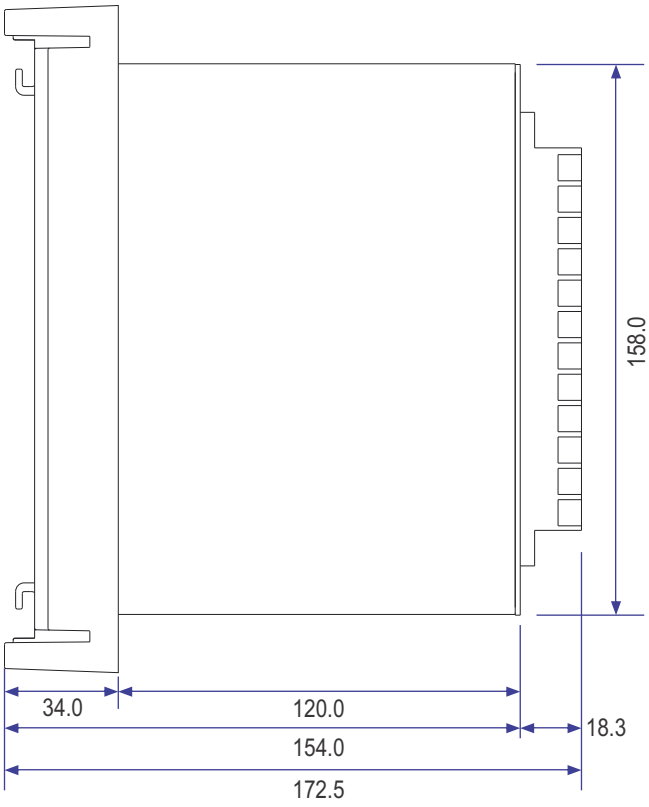
NOTE : Photos shown here are for general idea of draw out process and can be change in future without prior information.

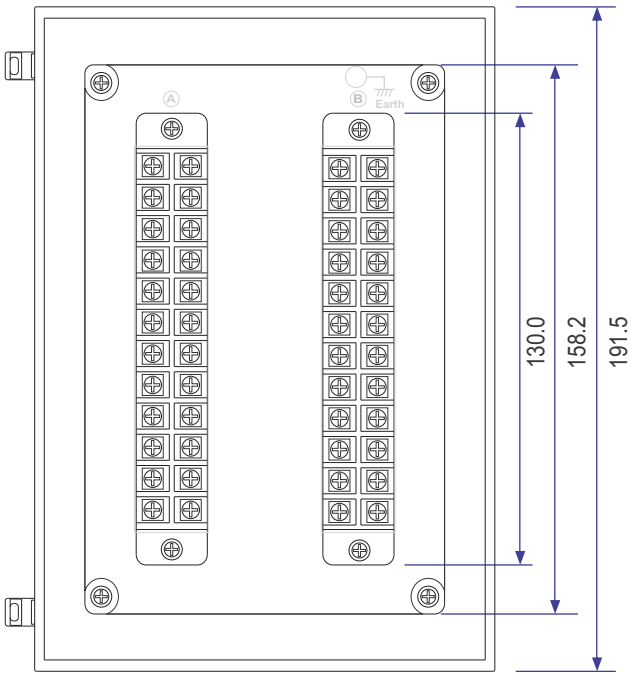
14) Dimension Details of the Relay

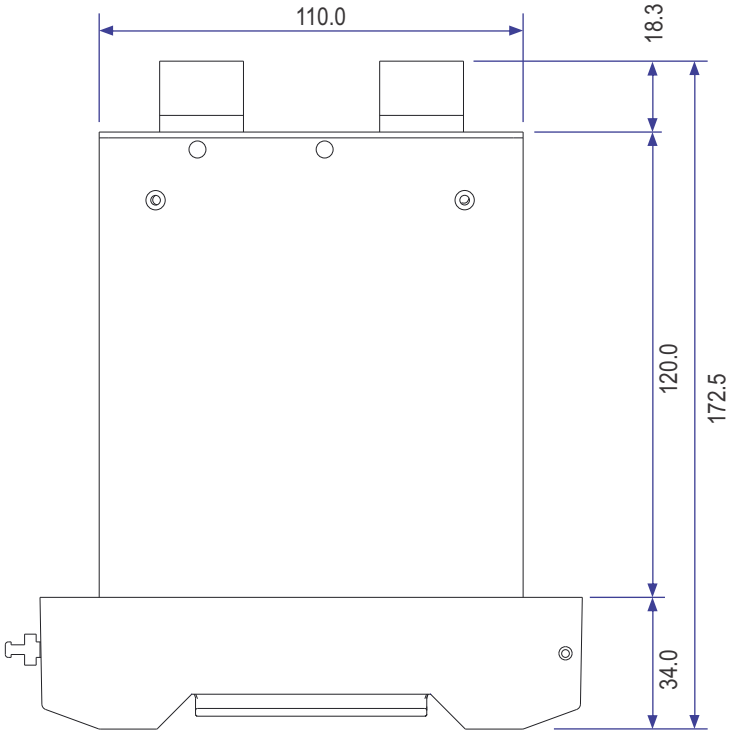
All the Dimension are in mm (Gen Tol.: ±1mm)

The Hi-Tech Self Powered Series Relay has been equipped with in-built press-fit mechanism. Without using any additional mounting accessories, the Relay can be easily flush mounted on the panel.
With appropriate mounting accessories the Relay can be mounted through panel cut-out for flush mounting:





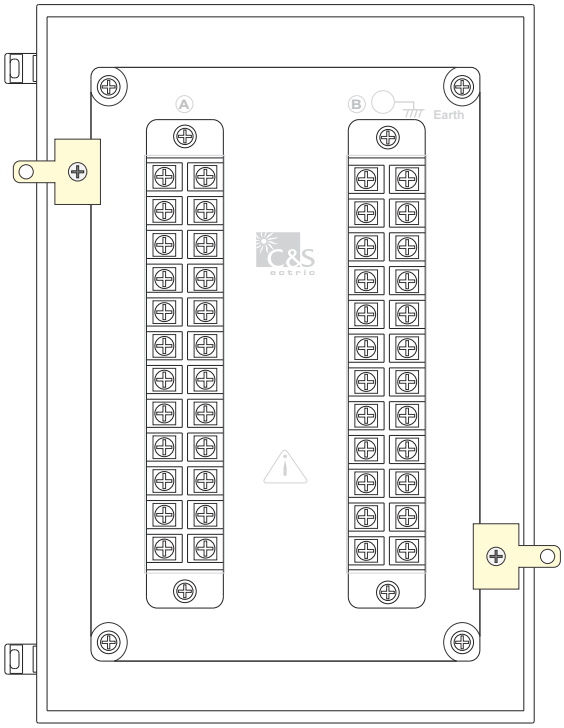




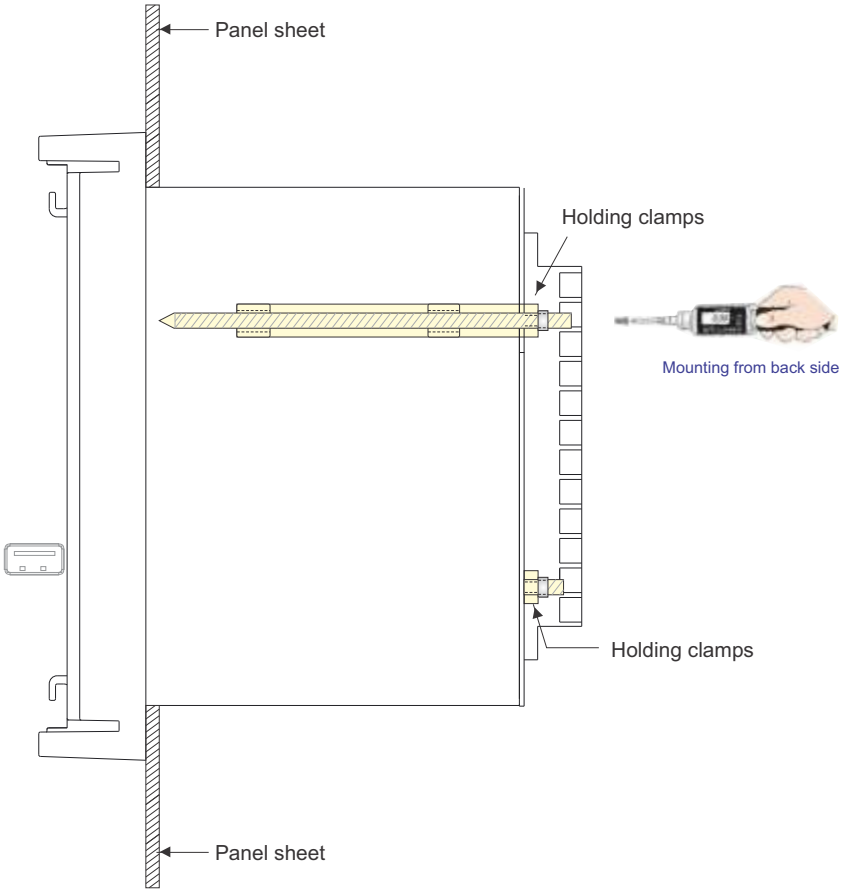
15) Panel mounting Details

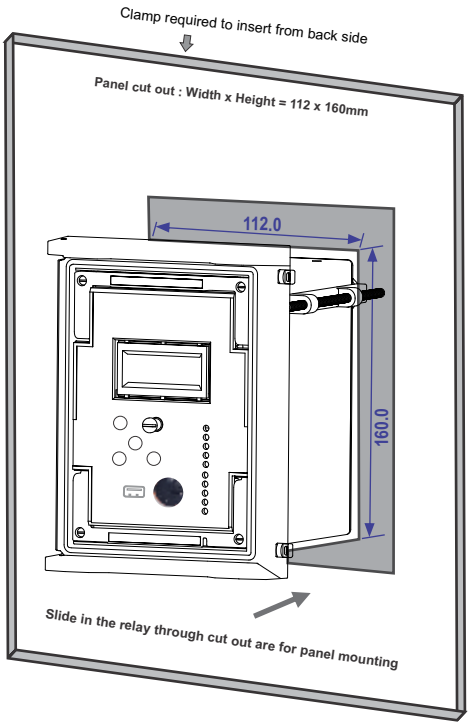
Panel cut out Dimension: Height x Width= 160 x 112mm

Back View

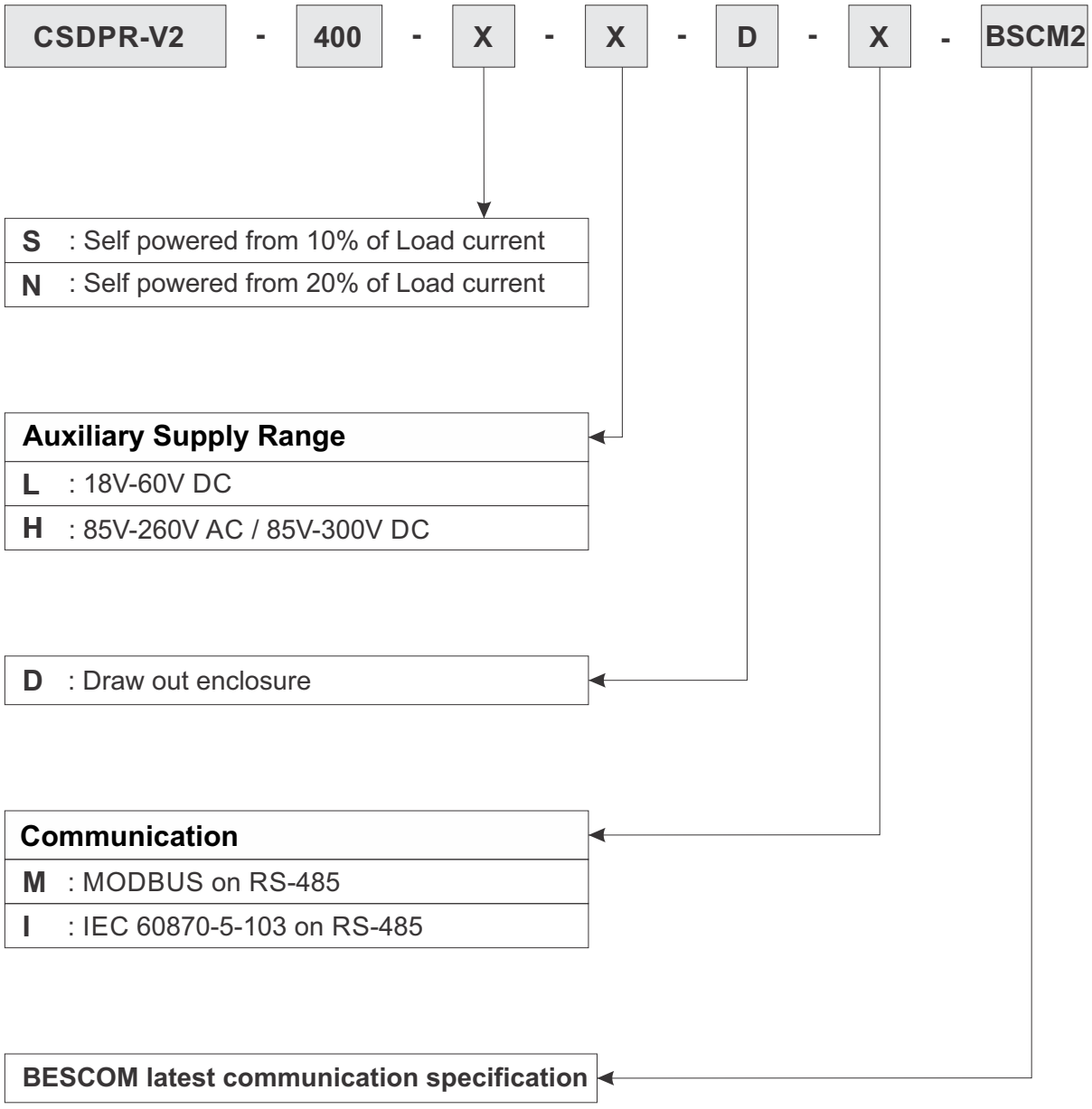


Side View





16) Ordering Information



17) Revision History

S.No.	Rev.No.	Details	Date
01	01	Change in order info. : Include S & N options on page 20, Change in Protection setting for I> on page 9	07.10.23
02	02	Include Reset Function details on page 6	20.11.23
03	03	Change in conn. diagram on page 15	01.12.23
04	04	Change in Introduction (page 3), LED/LCD Display (page 5), Relay assignment, Relay Reset (Pg 9)	08.12.23
05	04	Change in connection diagram on Pg 15	12.12.23
06	05	Change in Front fascia, HMI details of the product of the catalog	09.02.24
07	05	Change in no. of event record (from 20 to 10) of the product catalog	09.02.24
08	06	Change in VA burden details of Measuring input on page 11	20.03.24
09	07	Change in connection diagram change to match with V2-200 Bescom model	11.06.24
10	08	Change in VA burden from 1.5 to 1.2VA on page 11	16.07.24
11	09	Aux supp range H : 85-260V AC/ **110**V-300V DC change to H : 85-260V AC/ **85**V-300V DC in ordering info (Pg 19) & General Data (Pg 11)	04.10.24
12	10	On page 6, in Trip output “24V/12V@0.2Ws /50msec” ON Pulse is changed to “24V/12V@0.4Ws /50msec”.	02.04.25

NOTE

The content in this document is for general information, performance data and proper model selection. Although every attempt has been made to ensure that the information contained in this document is correct. C&S reserves the right to change the design, content or specification contained in this without prior notice.

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