FEEDER PROTECTION RELAY TYPE ADR241B

Introduction:

ASHIDA has designed economical & reliable Multifunction ADR241B Draw-out relay for Feeder Protection & Control System. The simple and compact construction of Aditya series, ADR241B relay provides integrated Protection, Control and Monitoring functions for Sub Transmission Lines, Underground cables, and Distributed Feeders.

Functional Overview:

Key Protection & Control Functions:

- Four Independent Settings Groups.
- Non Directional Phase & Ground Over Current Function (50/51/50N/51N).
- Two Non Directional Phase Over Current Protection functions with 4 nos. (Each) of independent stages.
- Four independent Stages of Non Directional Ground Over Current Protection.
- Three independent Stages of Non Directional Internally Derived Ground Over Current (3I0>) Protection.
- Inverse time Over Current Protection (IEC & IEEE curves according to IEC60255 + User define curve)
- High Impedance Restricted Earth Fault Protection (64R).
- Sensitive Earth Fault (SEF) Protection (Optional, Available with SEF model).
- Harmonic blocking and unblocking feature.
- Thermal Overload Protection (49)
- Inverse & Definite time Negative & Positive Phase Sequence Over Current Protection (46).
- Broken Conductor Protection (46BC)

- Single pole/ three pole Switch On To Fault Protection (SOTF).
- Single pole / three pole multi shot auto-Recloser.
- Single pole / three pole Breaker Failure detection (50BF).
- Single pole / three pole Trip Circuit supervision
- Under Current Protection (27).
- Residual over Voltage Protection (59N) (Optional, Available with VT model).
- CB Open Pole.
- Programmable Inputs & Outputs
- CB Close / Trip from HMI
- Programmable & Target LEDs for indications with dual colors (8 nos.)
- Self Supervision of relay
- Metering function
- Disturbance Recording (10 nos.)
- Event Recording (1024 nos.)
- Fault Recording on HMI display (10nos.)
- Non-Volatile memory
- Fully communicable with IEC standard open protocol IEC60870-5-103, MODBUS, IEC104 & IEC 61850.
- SCADA communication
- Single / Dual Ethernet (Copper / FO) port is provided at rear side.
- IRIG-B port for accurate Time synchronization. (Optional)
- PC front port communication for convenient relay settings.
- Separate communication port for SCADA Communication
- PRP/HSR option for fast & redundant network (Optional).
- User friendly local operation with key pad
- Large Liquid crystal display (16X2) with backlight
- Password Protection
- Draw out cabinet with automatic CT shorting.
- Measurement of current magnitude, symmetrical components, thermal state, trip counter etc.

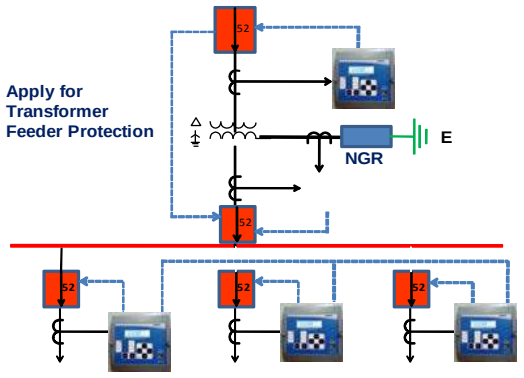
Software Support:

- Online / Offline Setting Editor.
- Programmable scheme logic Editor.
- Settings upload / download.
- Online Measurement.
- Event & Fault analysis.
- Disturbance analysis.

Applications:

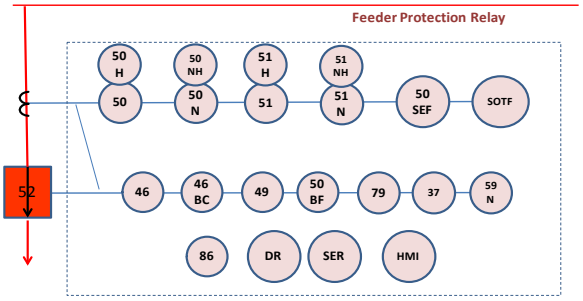
ADR241B numerical multifunction relay designed for Sub Transmission line protection, Underground cable & Distributed feeder protection applications. Relay designed with fast and selective tripping ensures the stability and availability of electrical power system.

ADR241B relay apply for protection, control & monitoring of radial and ring main feeder to achieve sensitivity and selectivity on phase and ground faults.



Radial feeder application

The functional overview of ADR241B:



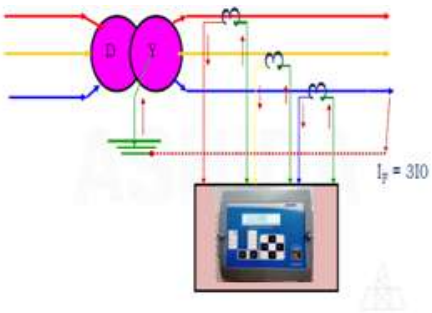
Protection functions Overview

ANSI Code	Description
50	Instantaneous/Definite Time Phase Over current Protection
50N	Instantaneous/Definite Time Ground Over current Protection
51	Inverse Time Phase Over current Protection
51N	Inverse Time Ground Over current Protection
SEF	Sensitive Ground Over current Protection
64R	High Impedance Restricted Earth Fault Protection
37	Under Current Protection
46	Negative Phase Sequence Protection
46BC	Broken Conductor (I2/I1)
50BC	Broken Conductor(I0/I1)
49	Thermal Overload Protection
50BF	Breaker Failure
79	Auto reclosing
SOTF	Switch On To Fault
86	Lockout (Trip command)
74	Alarm Output
62	Timer Element

Non Directional Over Current Protection (50/50N/51/51N):

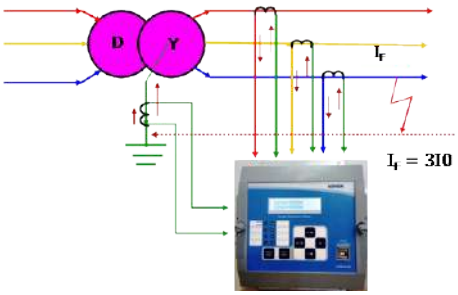
The core functionality of ADR241B relay is equipped with multi function feeder protection. The relay provides Non Directional phase and ground over current protection with multiple settings (four stages for phase over current and ground over current) for various power system applications and wide range of protection settings. The function is equipped with digital filter algorithms, providing the rejection of higher harmonics & DC offset. Selectable IEC / IEEE inverse time curves & user define curve with non directional over current protection will be providing greater selectivity, flexibility and sensitivity to users for better relay co-ordinations.

ADR241B relay provides three stages of definite time/inverse time internally derived zero sequence over current (3I0>) protection to detect asymmetrical faults in electrical network. It can be applied to over head transmission line, underground cable, and feeder. The ground current (3I0>) can be calculated from three line currents.

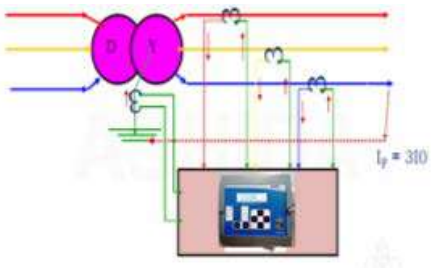


Internally derived residual over current application

ADR241B relay provides externally measured ground over current protection function with four stages. ADR241B relay measures ground fault current through neutral CT input. Externally ground CT input can also be applied for high impedance restricted earth fault protection or sensitive ground fault protection through CBCT.



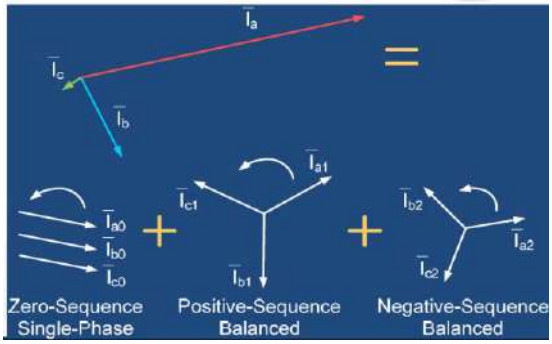
Externally measured ground over current through neutral CT



Externally measured ground over current through CBCT

Phase Sequence over Current Protection (46):

Three stages of Definite and Inverse time Negative and Positive sequence over current protection provides back up protection for over head transmission line / underground cable / feeder / transformer against unbalanced faults, very high resistive phase/ground faults and unbalanced loads. Protection can also be applied in a condition when there is a very high resistive ground fault and ground element may not sense the fault current.



The phase sequence over current element can be programmed as IDMT or definite time characteristic. ADR241B relay provides ten selectable IEC / IEEE inverse curves for each stage.

IDMT Characteristics:

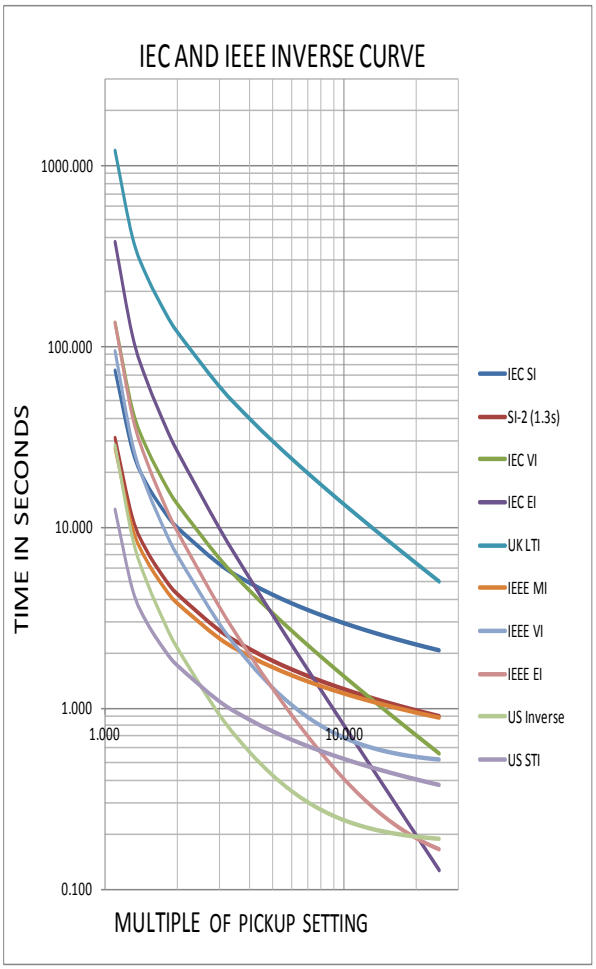
ADR241B relay provides inverse time over current characteristic for Max Phase OC (1 & 2), phase OC, Ground OC, residual OC & Sequence OC elements. Each stage of Max Phase OC (1 & 2), phase OC, Ground OC, residual OC & Sequence OC elements are

independently settable with inverse time or definite time characteristic.

The following tripping characteristics are available;

$$t = T * \left\{ \frac{K}{\left(\frac{I}{I_s} \right)^{\alpha} - 1} + L \right\}$$

Description	K	α	L
Define Time	-	-	-
IEC S Inverse	0.14	0.02	0
ST Inverse 1.3S	0.06	0.02	0
IEC V Inverse	13.5	1	0
IEC E inverse	80	2	0
UK LT Inverse	120	1	0
IEEE M Inverse	0.0515	0.02	0.114
IEEE V Inverse	19.61	2	0.491
IEEE E Inverse	28.2	2	0.1217
US Inverse	5.95	2	0.18
US ST Inverse	0.0239	0.02	0.0169
User Define Curve-1	-	-	-
User Define Curve-2	-	-	-



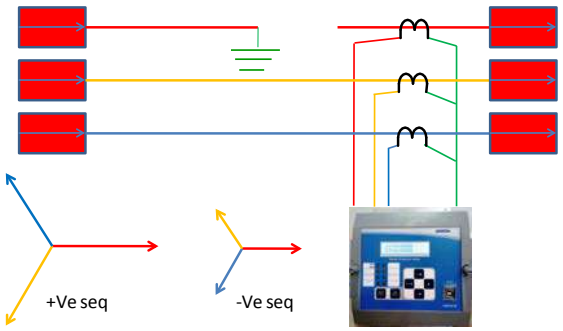
IEC/ IEEE Inverse curves for tripping of over current elements

Harmonic blocking / Unblocking for Over Current Protection (50H/51H/50NH/51NH):

Harmonic blocking / unblocking feature equipped in ADR241B relay provide stability on inrush current during transformer energization. Harmonic blocking/unblocking feature is independent for each stage of phase and ground over current protection.

Broken Conductor Protection (46BC):

ADR241B equipped with broken conductor detection protection. Broken conductor condition can be detected by ratio of Negative sequence current to Positive sequence current (I2/I1) provides higher sensitivity on High resistive fault.

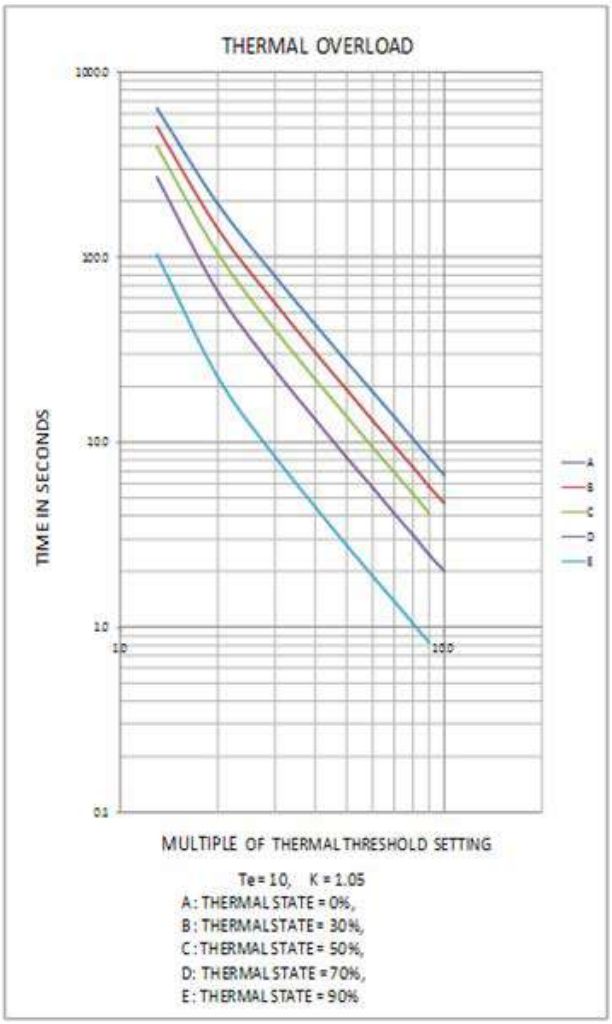


Broken Conductor Protection (50BC):

ADR241B provide independent I0/I1 function for sensitive ground fault detection. Relay measure the ratio of zero to positive sequence current precisely.

Thermal overload Protection (49):

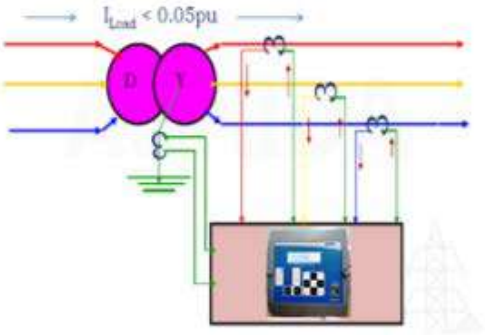
ADR241B relay provides thermal over load protection of transformer against over load conditions. Relay estimate thermal contents and initiate alarm & tripping if the thermal contents are higher than the preset value. Trip time of relay follows the according to the thermal time constant value set in to relay.



Graph of Thermal Overload Characteristic.

Under current detection (37):

ADR241B provide under current protection with definite time delay option.



Residual Over Voltage Protections (59N)(Optional):

ADR241B relay provides residual over voltage protection with definite time delay range. Protection can be achieved by externally measured residual voltage through open delta VT.

Trip circuit supervision (74T):

The trip circuit supervision is used to monitor healthiness of circuit breaker. The trip circuit extends beyond the relay enclosure and passes through more components, such as fuse, wires, relay contacts, auxiliary switch contact and so on. The failure of any component result bypassing the protection.

The ADR241B relay is provide with Gang operated / Pole Operated trip circuit supervision function which continuously monitor continuity of trip circuit, any discontinuity observed it generates Alarm signal.

Breaker Failure detection (50BF):

The ADR241B relay provide two 50BF timers with Gang operated / Pole Operated scheme.

If the fault current is not interrupted after a time delay expired, circuit breaker failures detected, and execute trip command to upstream circuit breaker. ADR241B relay incorporates circuit breaker failure protection to detect failure of tripping command execution due to mechanical or electrical problems in circuit breaker.

Reclosing / Auto reclosing (79):

The ADR241B relay provides Gang operated / Pole Operated Auto Recloser with 4 shots Numbers of shots are selectable. There are 4 timer for auto recloser 1) Dead Time for shot 1 (DT1) 2) Dead Time for shot 2 (DT2) 3) Dead Time for shot 3 (DT3) 4) Dead Time for shot 4 (DT4) and 5) Reclaim Time (RT). After clearing of fault ADR241B trigger dead Time 1 i.e. DT1. after the time delay Relay provide reclose command and start reclaim timer RT. If second fault occur during RT relay trigger Dead Time 2 i.e. DT2. If third fault occur during Reclaim Time relay trigger Dead Time 3 i.e. DT3, If Fourth fault occur during RT relay trigger Dead Time 4 i.e. DT4 and after time delay it again provide reclose command and retrigger RT. If fifth fault occur during Reclaim Time Relay generate Lock-Out alarm and block further reclose. The Lock-Out condition can be reset locally as well remotely by SCADA through communication digital status input.

Switch on to fault (SOTF) over current function (50S):

ADR241B relay provides switch on to fault (SOTF) protection against energizing faulty line by switching on circuit breaker. Switch on to fault initiation can be detected through digital input of “Manual close command from circuit breaker controls” or

"automatic reclosing of circuit breaker".

Programmable Inputs, Outputs & Logic:

The relay is provided with tool known as AproLogic, in which user can program his/her logics as per the requirement. such as Motor reacceleration/ Auto Bus Transfer Scheme (ATS) etc. All type of gates such OR/NOR/NOT/NAND/AND/XOR/XNOR/SR Flip-flop are available along with Operating / Resetting Timer. For more details please refer to Instruction Manual

The ADR241B relay equipped with 8 nos. of programmable digital outputs, 8 nos. of optically isolated programmable digital inputs and 8 nos. of programmable dual colour LED's.

IRIG-B port (Optional):

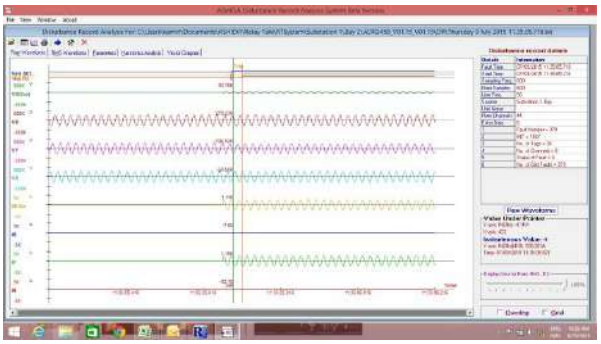
IRIG-B Port is provided at rear side of relay for Time Synchronisation. This port is used to enable or disable the option for the IRIG-B time synchronisation. Once the port is enbled then SNTP time synchrnisation will be disabled automatically.

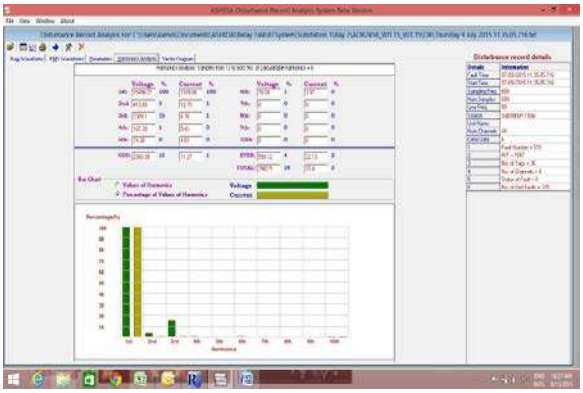
Event Recording:

ADR241B relay is providing feature to record and store 1024 nos. of events in non-volatile memory through internally by protection and control functions and externally by triggering of digital inputs, and can be extracted using communication port or viewed on front of LCD display. The event shall be trigger on time stamp through time synchronization or internal clock setting.

Disturbance recording:

ADR241B relay is provides built in disturbance recording facility for recoding of analogue and digital channels. Relay records 10 nos. of disturbances and store in to non-volatile memory. Disturbance records can be saved in IEEE COMTRADE format and same can be analyzed in disturbance analysis software.





Fault recording:

ADR241B relay is providing fault record facility. The fault records can be display either on HMI display or in RTV2 software. The relay can records 10 nos. of fault

records in non-volatile memory.

Metering:

Online metering feature of ADR241B relay is providing metering of parameters (i.e. current magnitude) on HMI display or in RTV2 software.

Independent Protection settings groups:

ADR241B relay provides four independent setting groups which allows the relay to operate on different power system conditions.

IEC 60870-5-103 Protocol:

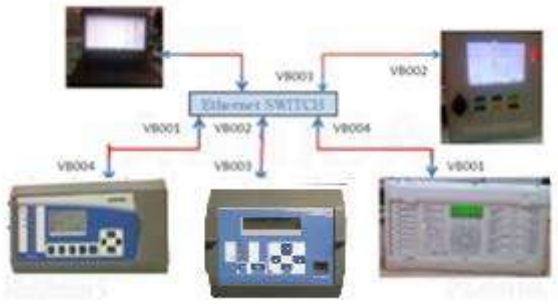
ADR241B relay provides internationally standardized protocol for communication via RS485 port of protection relays. IEC 60870-5-103 protocol used worldwide and supported by relay manufacturers.

IEC 61850 Protocol:

ADR241B relay provides internationally standardized protocol IEC61850 for substation automation via Ethernet port of protection relays.

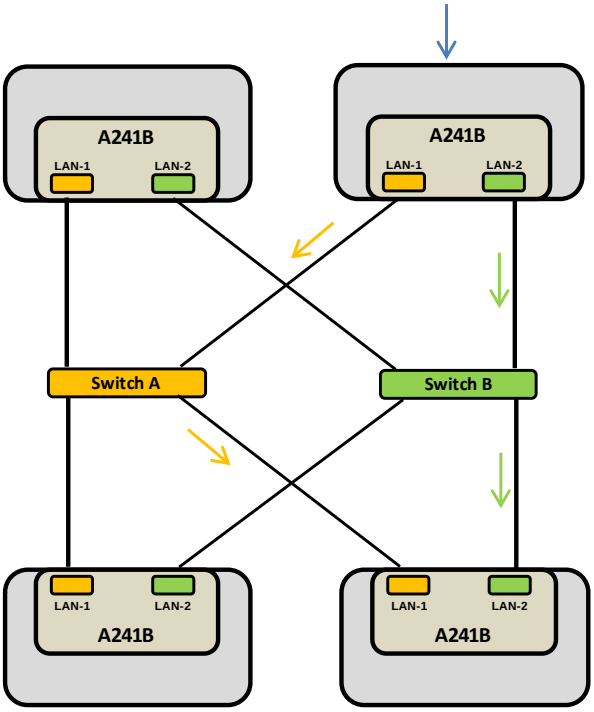
IEC61850 GOOSE and Interoperability:

ADR241B support standard GOOSE messaging for relay to relay communication. Any logical (pickup, trip, etc) and physical (Digital Optical Isolated signal such CBNO /NC etc) can be publish via GOOSE configurator. ADR241B support total 16 simultaneous GOOSE signals which can publish and received by other relays having IEC61850 protocol. Similarly ADR241B can able subscribed total 16 nos. of simultaneous signal published by other relays and can be use for interlocks. The ADR241B is tested for most of other make relays.

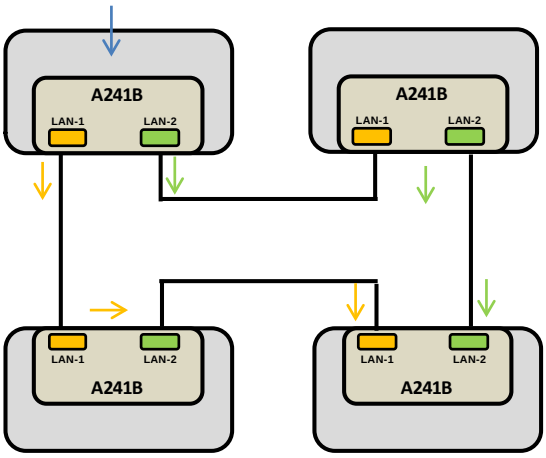


Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR):

Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) provides redundant communication over station bus running the available communication protocols. Redundant communication is obtained through the built-in PRP and HSR features which can be used in star or ring bus architectures.



Parallel Redundancy Protocol (PRP)



High Availability Seamless Redundancy (HSR)

Typical Tests Information:

The ADR241B Relay Confirms to following standard

Sr. No.	Test	Standard
Electromagnetic Compatibility Type Test:		
1.	High Frequency Disturbance Test	IEC 60255-22-1
2.	Electrostatic Discharge Test- Direct Application	IEC 60255-22-2
3.	Fast Transient Disturbance Test	IEC 60255-22-4
4.	Surge Immunity Test	IEC 60255-26 & IEC 61000-4-5
5.	Power Frequency Immunity Test	IEC 60255-22-7
6.	Pulse Magnetic Field Immunity Test	IEC 61000-4-9
7.	Radiated Electromagnetic Field Disturbance Test	IEC 60255-22-3
8.	Conducted Disturbance Induced By Radio Frequency Field	IEC 60255-26
9.	Power Supply Immunity Test	IEC 60255-11 & IEC 61000-4-11
10.	Conducted & Radiated frequency Emission Test	IEC 60255-25

Insulation Tests:		
11.	High Voltage Test	IEC 60255-27
12.	Impulse Voltage Test	IEC 60255-27
13.	Insulation Resistance	IEC 60255-27

Environmental tests:		
14.	Cold test	IEC 60068-2-1
15.	Dry heat test	IEC 60068-2-2
16.	Damp heat test, steady state	IEC 60068-2-78
17.	Change of Temperature	IEC 60068-2-14
18.	Damp heat test, cyclic	IEC 60068-2-30
19.	Enclosure Protection Test (IP54)	IEC 60529

CE compliance		
20.	Immunity	IEC 60255-26
21.	Emissive Test	IEC 60255-26
22.	Low voltage directive	EN 50178

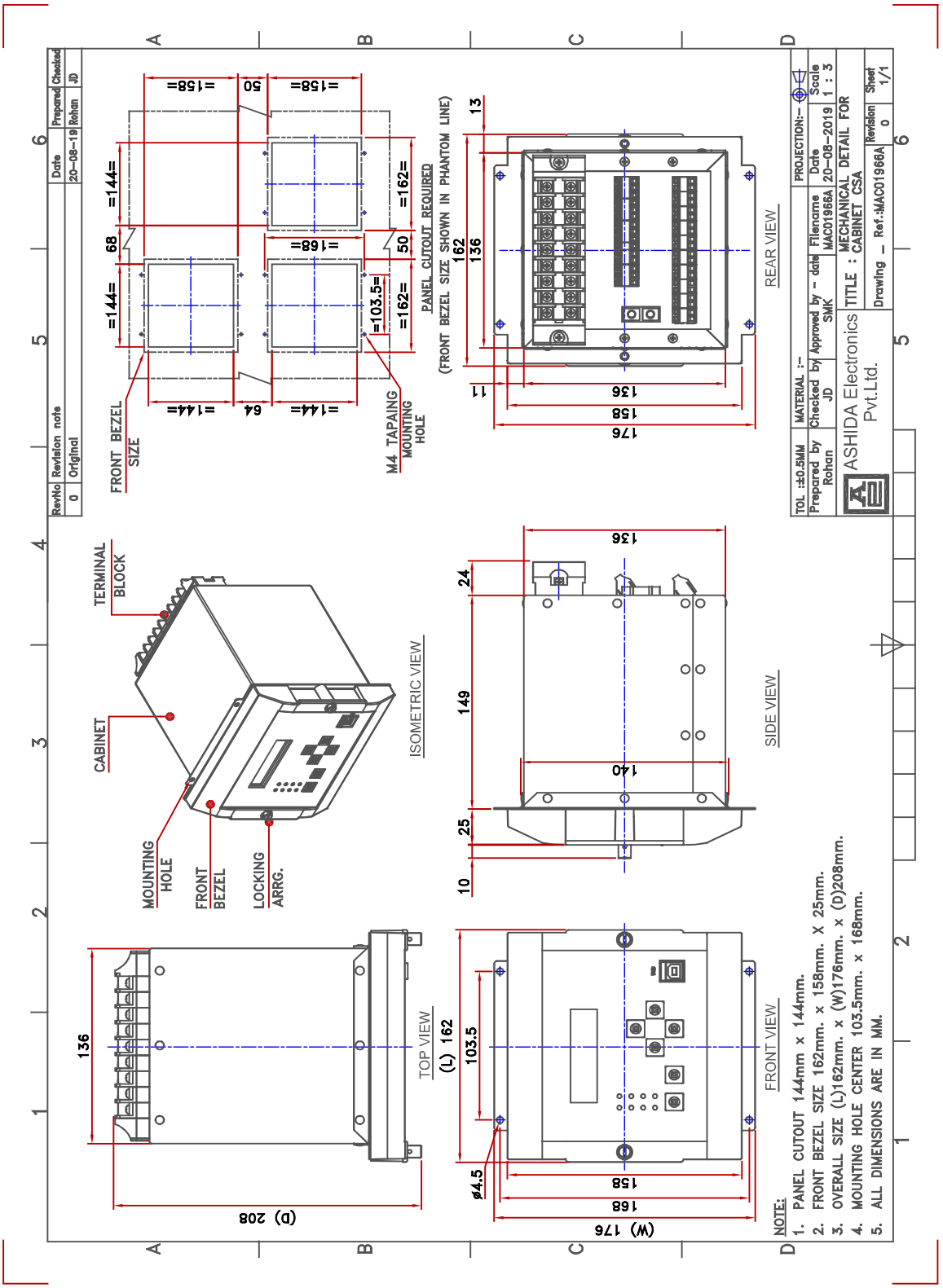
Mechanical tests		
23.	Vibration Endurance Test	IEC 60255-21-1 Class 1
24.	Vibration Response Test	IEC 60255-21-1 Class 2
25.	Bump Test	IEC 60255-21-2 Class 2
26.	Shock Withstand Test	IEC 60255-21-2 Class 2
27.	Shock Response Test	IEC 60255-21-2 Class 2
28.	Seismic Test	IEC 60255-21-3 Class 1

***NOTE:-** The Detailed type test reports are available on request.

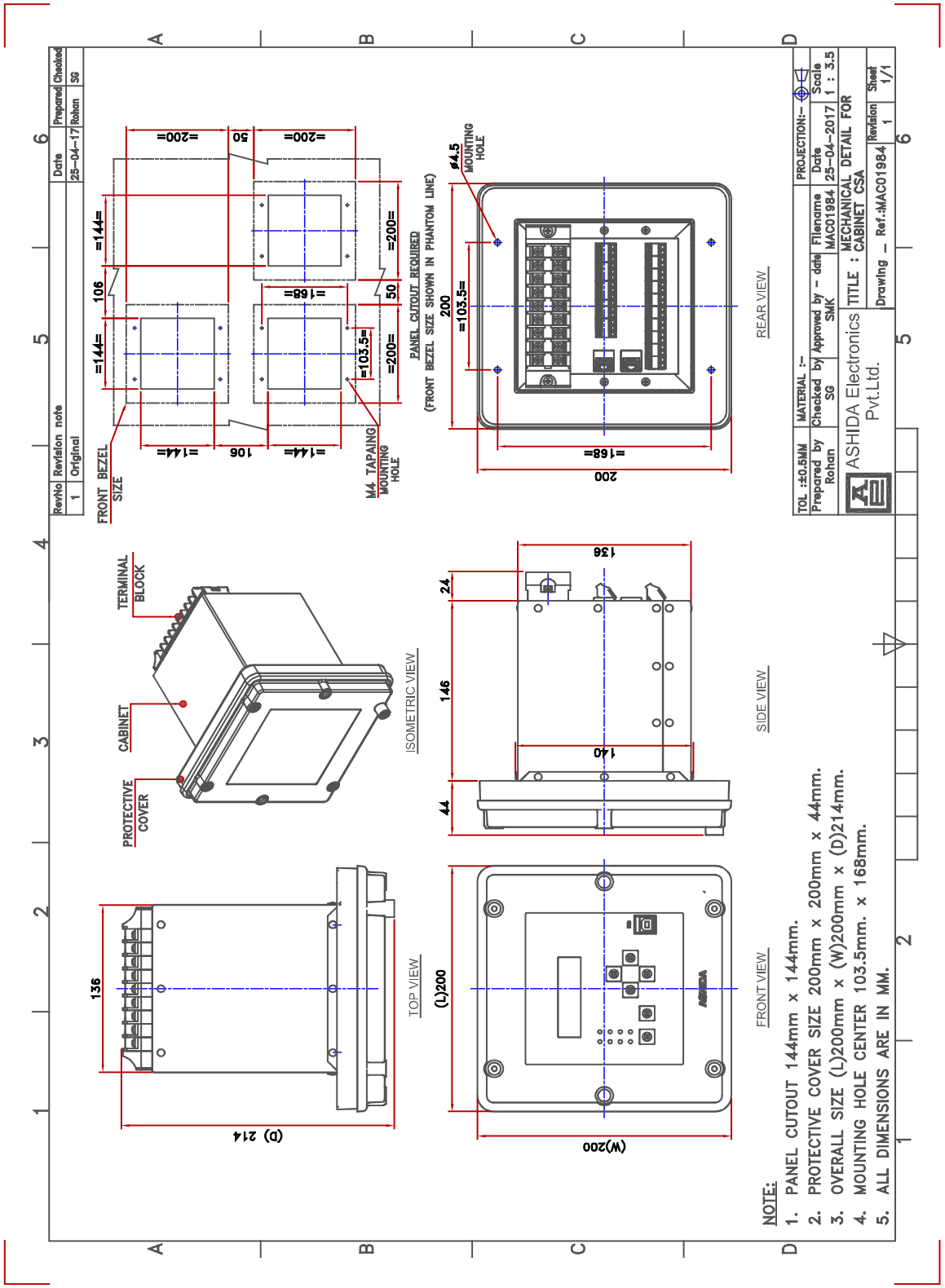
Drawings Information:

I.	Drawing References	: For Cabinet Type – without IP Cover	MAC01966A
		: For Cabinet Type – With IP Cover	MAC01984
		: For Back Connections (5CT)	APR10702
		: For Typical External Connections (5CT)	APR10802
		: For Back Connections	APR10902
		: For Typical External Connections	APR11002
		: For Back Connections	APR11101
		: For Typical External Connections	APR11201

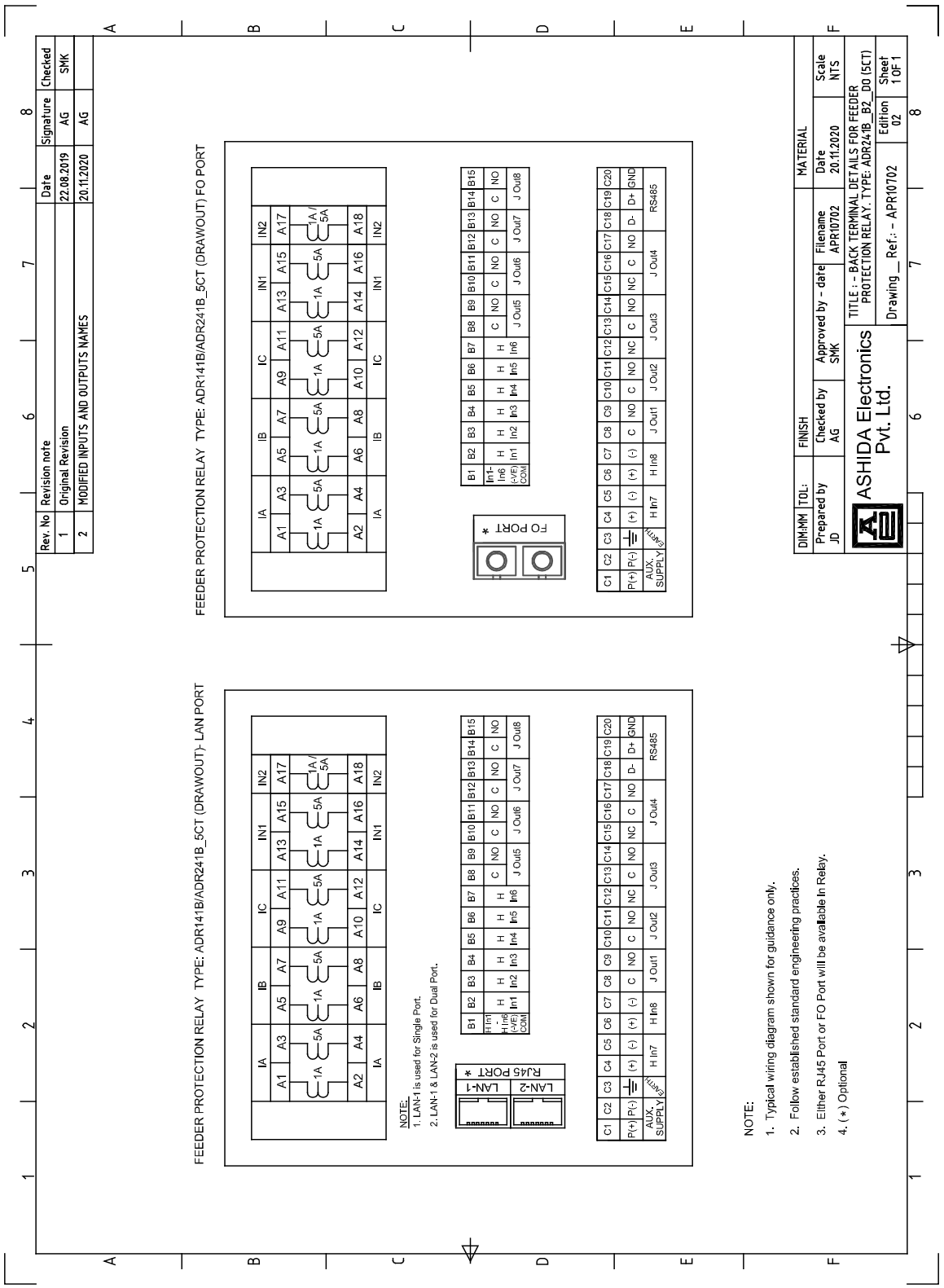
Mechanical Details without IP Cover



Mechanical Details with IP Cover

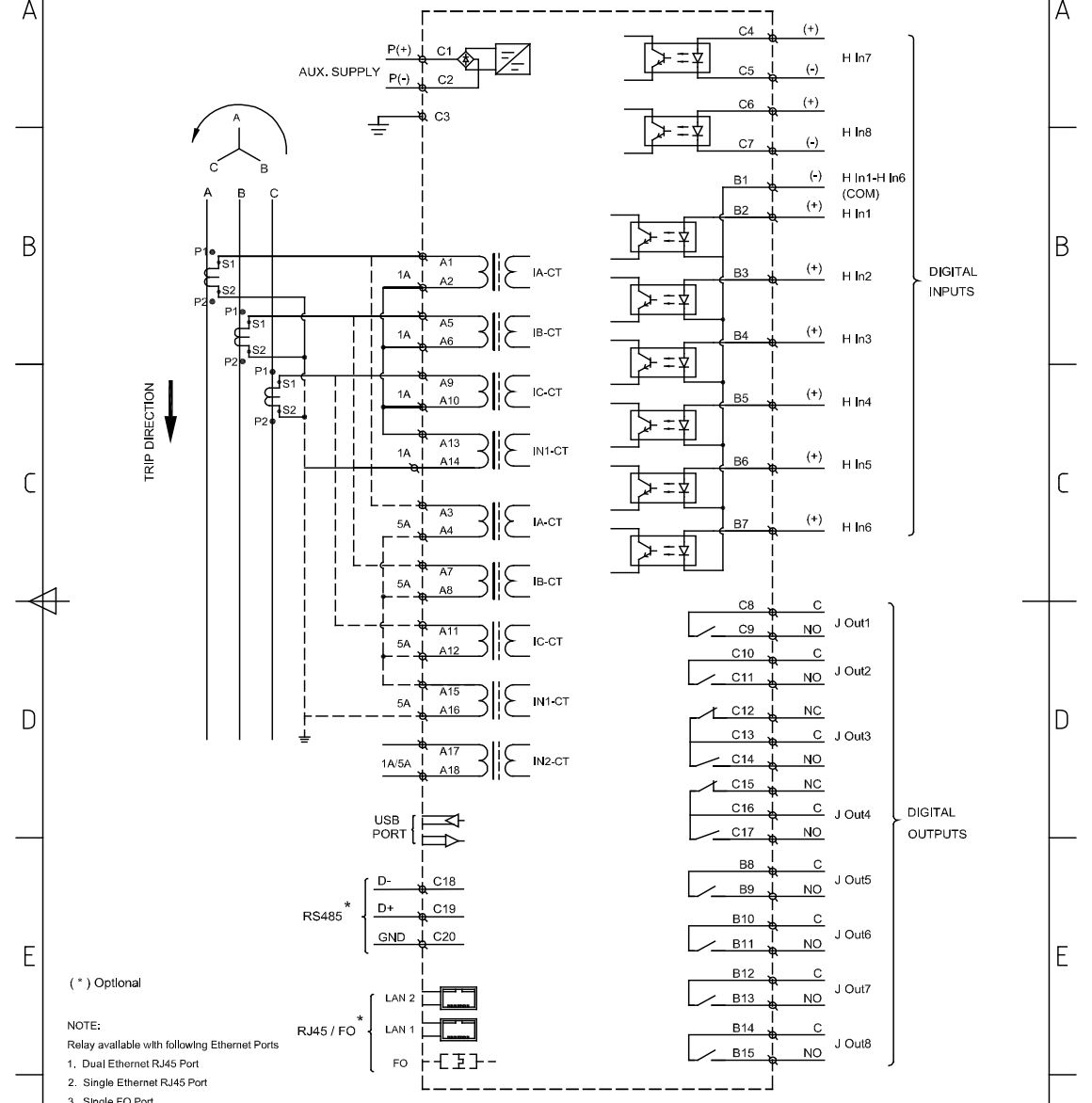


Back Terminal Details (5CT)



Electrical Connection Details (5CT)

RevNo	Revision note	Date	Signature	Checked
01	ORIGINAL VERSION	22.08.2019	AG	SMK
02	MODIFIED INPUTS AND OUTPUTS NAMES	20.11.2020	AG	



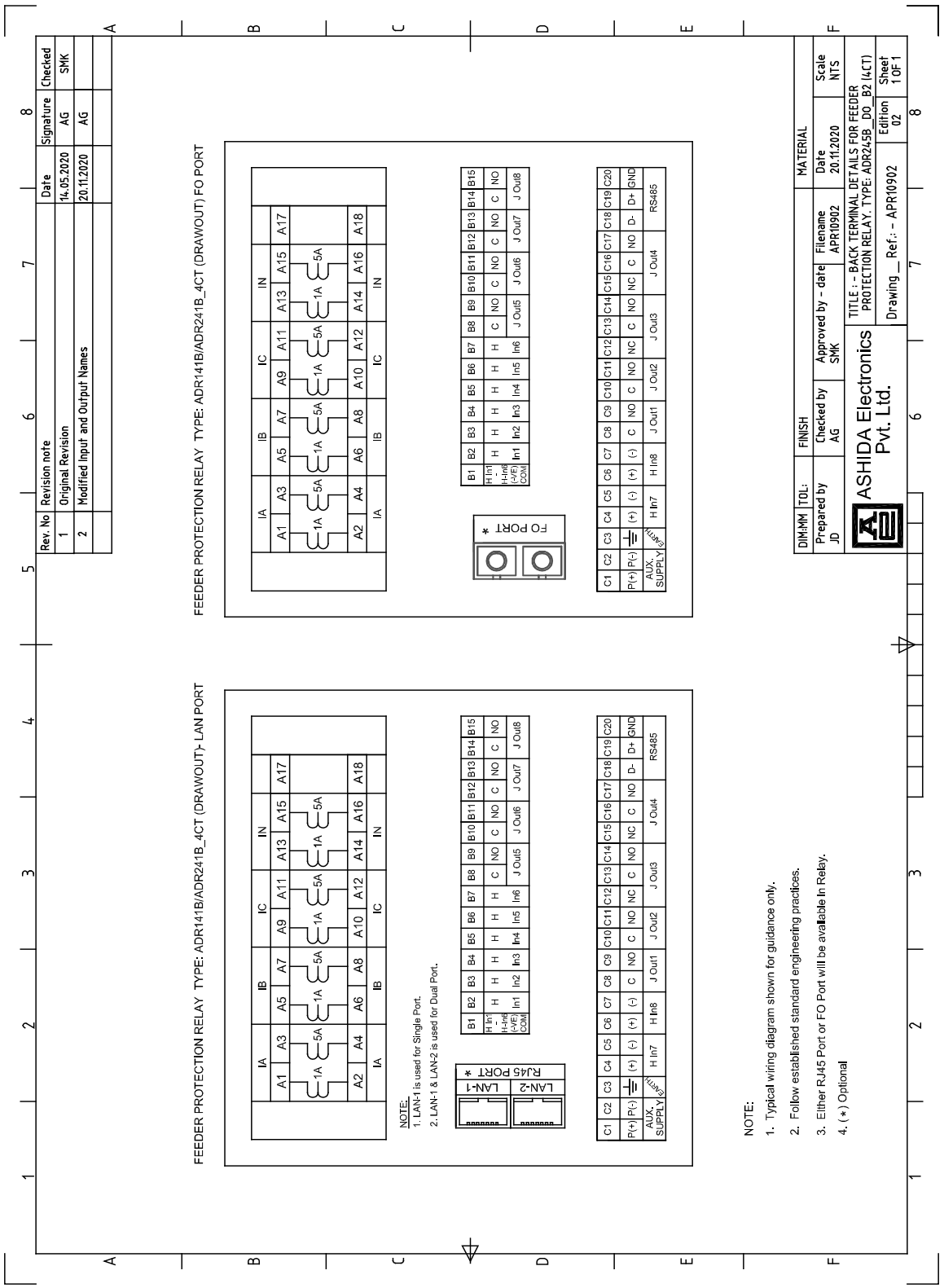
Dim : MM / TOL :	FINISH:			MATERIAL:	
Perpaed by JD	Checked by AG	Approved by – date SMK	Filename APR10802	Date 20.11.2020	Scale NTS

ASHIDA Electronics Pvt. Ltd.

TITLE :– ELECTRICAL CONNECTIONS FOR FEEDER PROTECTION RELAY. TYPE: ADR241B_B2_DO (5CT)

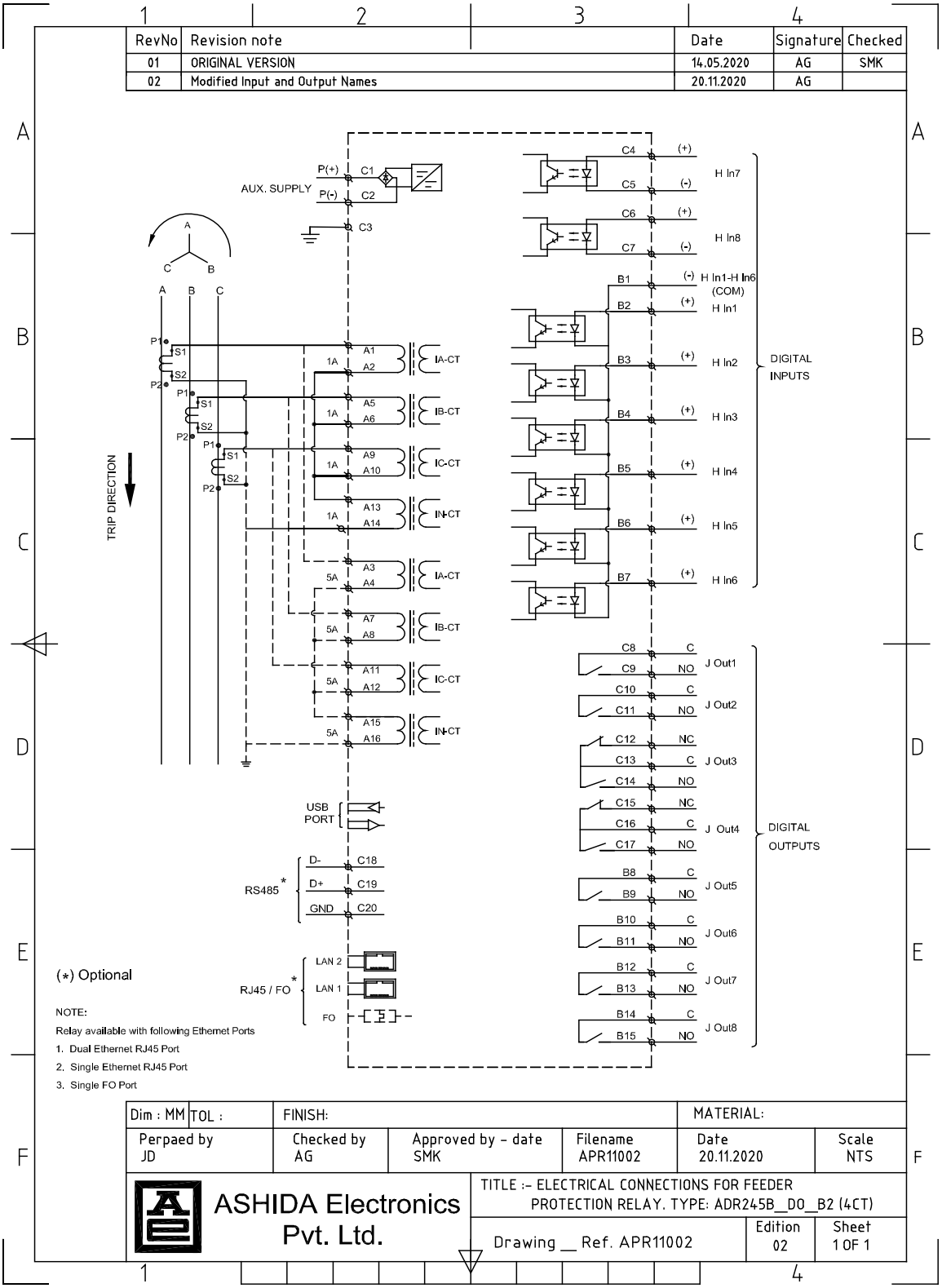
Drawing __ Ref. APR10802 | Edition 02 | Sheet 1 OF 1

Back Terminal Details (4CT)



Electrical Connection Details (4CT)

RevNo	Revision note	Date	Signature	Checked
01	ORIGINAL VERSION	14.05.2020	AG	SMK
02	Modified Input and Output Names	20.11.2020	AG	



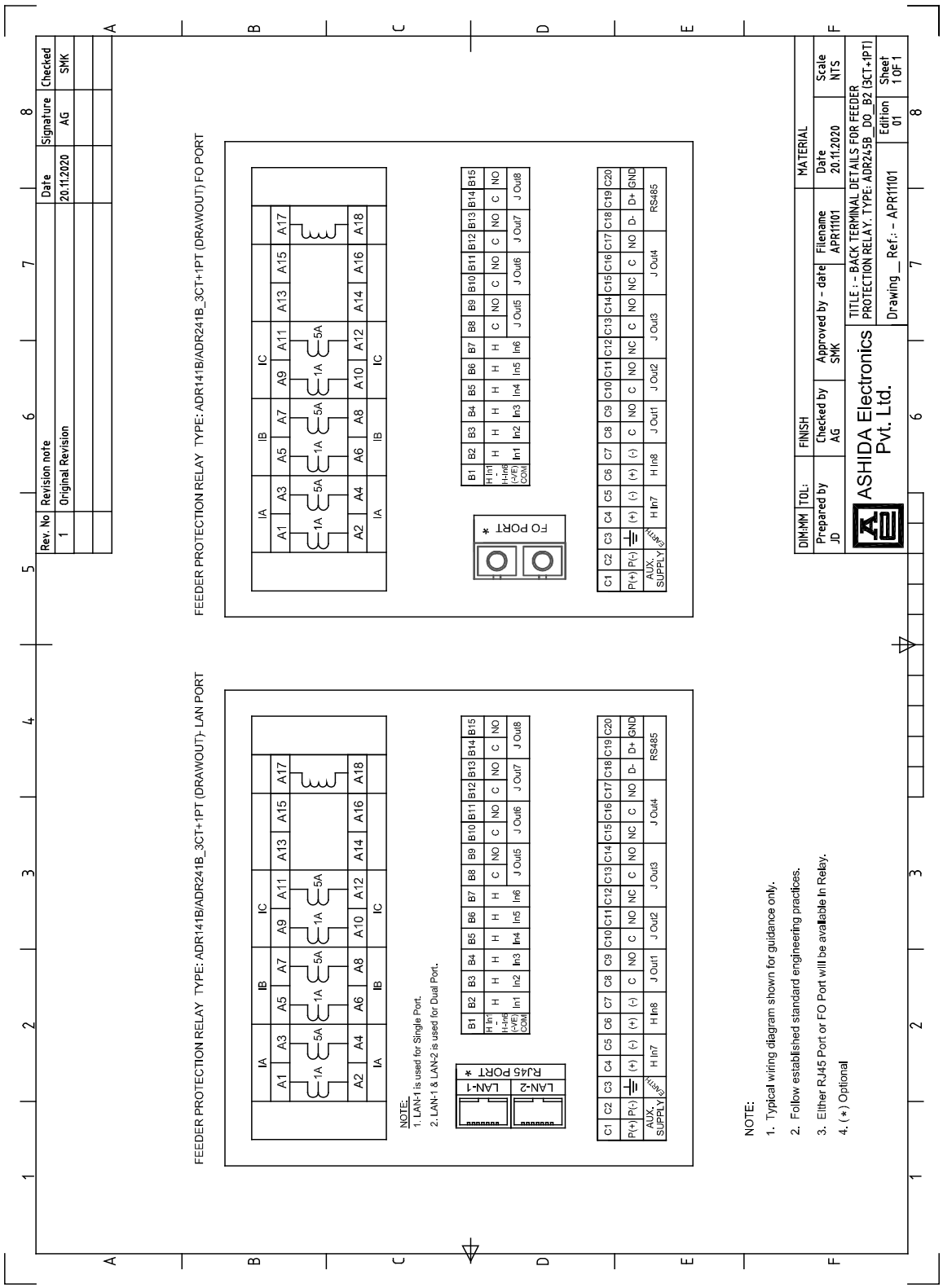
Dim : MM / TOL :	FINISH:			MATERIAL:	
Perpaed by JD	Checked by AG	Approved by – date SMK	Filename APR11002	Date 20.11.2020	Scale NTS

ASHIDA Electronics Pvt. Ltd.

TITLE :- ELECTRICAL CONNECTIONS FOR FEEDER PROTECTION RELAY. TYPE: ADR245B__DO__B2 (4CT)

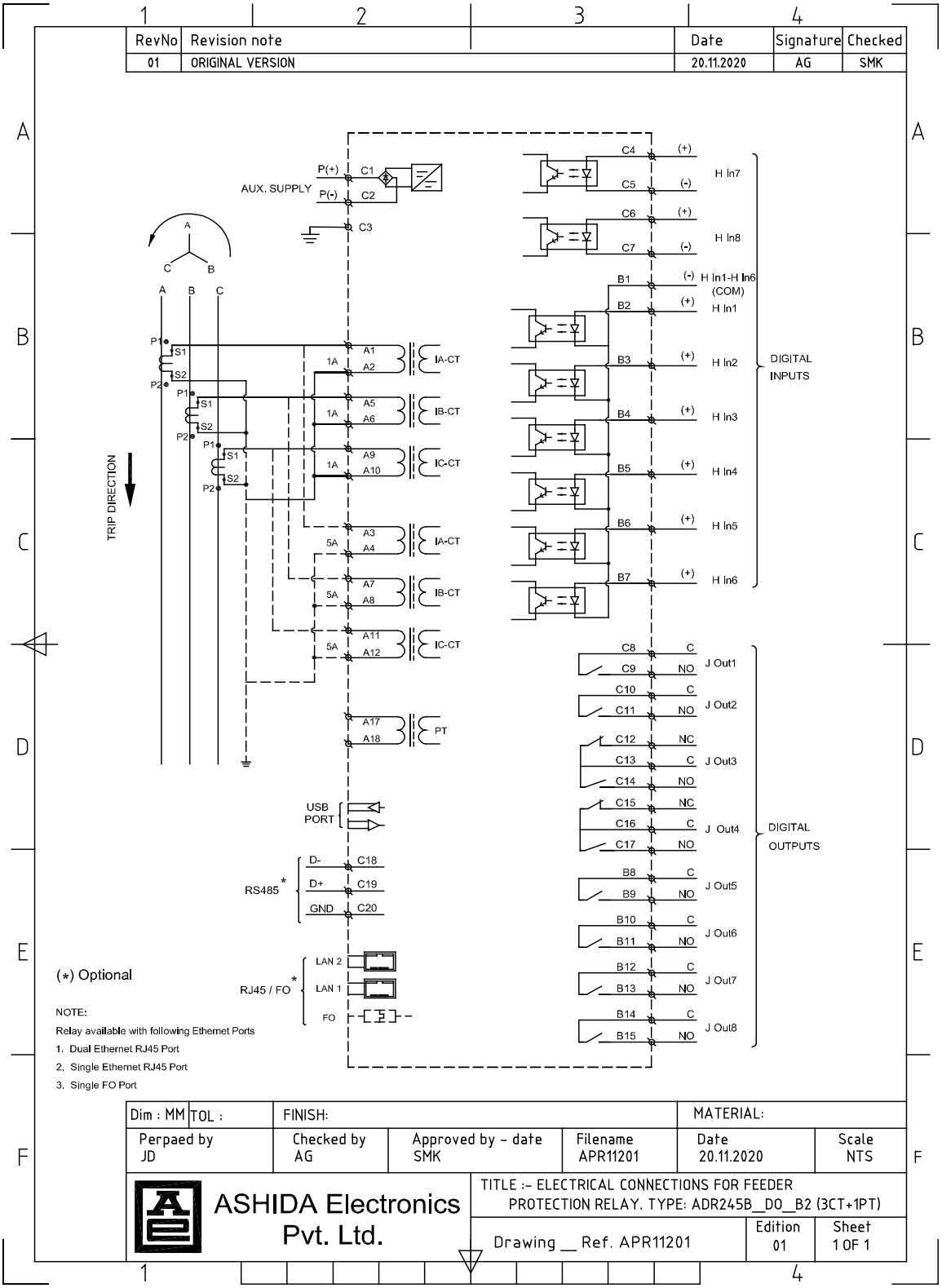
Drawing __ Ref. APR11002 | Edition 02 | Sheet 1 OF 1

Back Terminal Details (3CT + 1PT)



Electrical Connection Details (3CT+1PT)

RevNo	Revision note	Date	Signature	Checked
01	ORIGINAL VERSION	20.11.2020	AG	SMK



(*) Optional

NOTE:
Relay available with following Ethernet Ports
1. Dual Ethernet RJ45 Port
2. Single Ethernet RJ45 Port
3. Single FO Port

Dim : MM / TOL :	FINISH:			MATERIAL:	
Perpaed by JD	Checked by AG	Approved by – date SMK	Filename APR11201	Date 20.11.2020	Scale NTS

ASHIDA Electronics Pvt. Ltd.

TITLE :- ELECTRICAL CONNECTIONS FOR FEEDER PROTECTION RELAY. TYPE: ADR245B__DO__B2 (3CT+1PT)

Drawing __ Ref. APR11201 | Edition 01 | Sheet 1 OF 1

Ordering Information:

Ordering Information												
	1-4	5	6	7	8	9	10	11	12	13	14	15
Model	**241B**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Example	241B	B	2	0	2	4	1	1	2	2	1	H
FEEDER PROTECTION												
Cabinet Details												
Basic Version		B										
Variant												
Standard			0									
Advance AProLogic			2									
Language												
English				0								
Protocol												
IEC 103					0							
MODBUS RTU					1							
IEC 61850					2							
MODBUS TCP IP					4							
IEC 104					6							
CT / PT												
4CT, CT Selection: 1A/5A (With Standard EF CT)						0						
5CT, CT Selection: 1A/5A (With Standard EF + Sensitive EF)						4						
3CT, CT Selection: 1A/5A + 1PT						5						
Digital Outputs												
8 DO - Draw out Cabinet							1					
Digital Inputs												
8 DI - Draw out Cabinet								1				
DI Setting Threshold												
18VDC									0			
35VDC									1			
77VDC									2			
154VDC									3			
Auxiliary Supply												
24 – 230 VDC / VAC										2		
Cabinet Details												
Draw Out											1	
With IP54 protection cover											4	
Communication Ports												
Disable / No Rear Port												0
RS-485 Rear Port												B
10/100 Base-T Ethernet RJ45 Rear Port & RS-485 Rear Port												E
DUAL 10/100 Base-T Ethernet RJ45 Rear Port												F
DUAL 10/100 Base-T Ethernet RJ45 Rear Port & RS-485 Rear Port												H

Single FO Ethernet Rear Port & RS-485 Rear Port	O
DUAL 10/100 Base-T Eth RJ45 Rear Port & RS-485 Rear Port (with PRP / HSR)	R
DUAL FO Ethernet Rear Port & RS-485 Rear Port (with PRP / HSR)	S

***NOTE:** The protective cover is optional for IP54 compliance and will be provided with relay as per customer requirement. Please specify while ordering.*

General Specifications:

AC Current Inputs:

1A Nominal

5A Nominal

Continuous Thermal Rating:

2 X In for Continuous

40 X In for 3s

100 X In for 1s

Dynamic Thermal rating

200X In for dynamic timing

Burden Rating:

< 0.2VA for current(In)

System Frequency:

50Hz / 60Hz

Frequency Tracking:

45 – 55Hz for 50Hz and

55 – 65 for 60Hz

Power Supply:

Range: 24 to 230Vdc

Burden: <6 watts for DC

Digital Outputs:

Continuous carry: 5A

Make: 30A for 0.5s & 15A for 3s

Breaking capacity: 1250VA @ 250Vac,

100 watts @ 250Vdc resistive,

50 watts @ 250Vdc inductive (L/R = 45ms)

Digital Inputs:

Operating range: 24 – 230Vdc

Communication Ports:

Front Port – USB

Rear Ports – RS485 and

*Optional Dual RJ45 port or Single FO port

Operating Temperature:

Operating Temperature: -25^{O}C to +65^{O}C

Storage Temperature: -25^{O}C to +70^{O}C

Humidity: 95% RH

Weight: < 2.5Kg Approx.

ASHIDA Smart Solutions for Power Protection & Control
ISO 9001 Company

ASHIDA Electronics Pvt. Ltd.
ASHIDA House, Plot No. A-308, Road No. 21,
Wagle Industrial Estate, Thane - 400604, INDIA
Tel : +91 - 21 - 2582 7524 / 6129 9100
Fax : +91 - 21 - 2580 4262
Email : sales@ashidaelectronics.com
Web : www.ashidaelectronics