



Features

- 4 Element (3 Phase + EF) over current IDMT with instant trip.
- Back - lit LCD display for settings.
- Display of Load current in terms of primary.
- Selection of Curve: Seven selectable curves Normal Inverse1 (C1), Normal Inverse2 (C2), Very Inverse (C3), Extremely Inverse (C4), Extremely Inverse (C4A) EE Equivalent, Long Time Inverse (C5) & Definite Time (C6).
- Separate curve selection for Phase and EF.
- **Design using DSP technology.**
- Latching of fault current up to last 5 faults with time stamping.
- Password protection for setting.
- **Site selectable CT secondary i.e. 1A/5A**
- Relay can be set either as IDMT or Definite time
- Programmable operating time in instantaneous element
- Cold Load pickup for prolong inrush current.
- Inbuilt Breaker Fail & Trip Circuit Supervision Function
- Programmable Annunciation Contact.

- **USB (at front) and RS422/RS485 (at rear) Communication Port for remote SCADA (only for ADR241A i.e. communicable Relay).**

General

The ADR141A/ ADR241A is member of Ashida Numerical Relay family (**Aditya Series**) design to meet demand of low and medium switchgear control. The ADR141A/ ADR241A are 3 OC and 1 EF relay with Instantaneous high-set and programmable output to simplify feeder protection wiring. The ADR141A/ ADR241A continuously monitors all phases and earth current, through CT connections. The high-speed micro-controller **samples** this current through a **12-bit A/D converter**. The micro-controller performs powerful **Numerical Algorithms** to find out RMS of current signal, and then these values are used for protection and metering function. All measurement is tuned to fundamental frequency. Each input current is also displayed on 16 x 2 LCD display for metering.

The Relay is having three main functions 1) Protection 2) Self-Supervision 3) Measurement

1. Protection Functions

The ADR141A/ ADR241A give maximum benefit/cost ratio. The ADR141A/ ADR241A give all the advantage of numerical relay at affordable cost. Following is summary of different protection functions provided by relay.

ANSI	IEC	Protection Functions
50	I >>	Instantaneous Over current Protection (OC-Inst.)
50N	I _E >>	Instantaneous Earth Fault Protection (EF-Inst.)
50,51	I>t, I _p	Time Over current Protection (Phase-IDMT.)
50N, 51N	IE>t, IEP	Time Over current Protection (EF-IDMT.)
CLP	-	Cold Load Pickup
50BF	-	Breaker Failure
TCS	-	Trip Circuit Supervision

1.1. Over current / EF protection

The ADR141A/ ADR241A relay has 4 sensing element 3 OC and 1 EF. The tripping current can be set from 5% to 250% for Phase and 5% to 250% for Earth Fault in steps of 1% by Keys provided on front panel. The unit has selection of IDMT characteristic of international IEC standard, i.e. Very inverse / Extremely Inverse / Long Inverse and Standard inverse (both 3.0 sec and 1.3sec at 10 times). The Time Multiplier Setting (TMS) can be set from x0.01 to x1.5 in steps of x0.005 for IDMT delay multiplication. Separate operating curve can be programmed for phase and EF.

The each stage thresholds for phase (earth) over current can be selected with an Inverse Definite Minimum Time (IDMT) characteristic.

The Time Delay is calculated with a mathematical formula

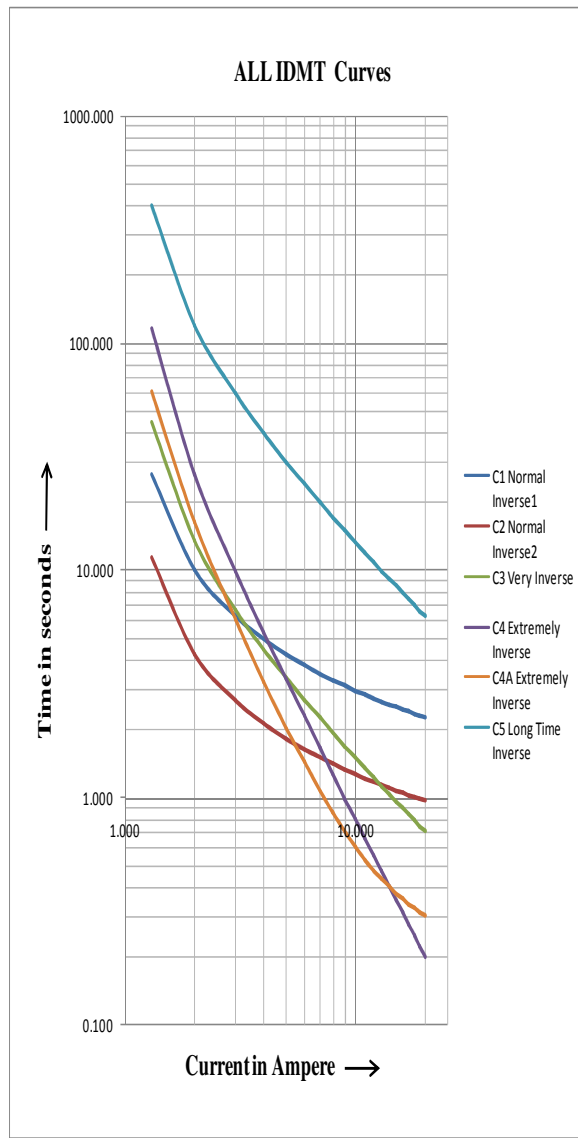
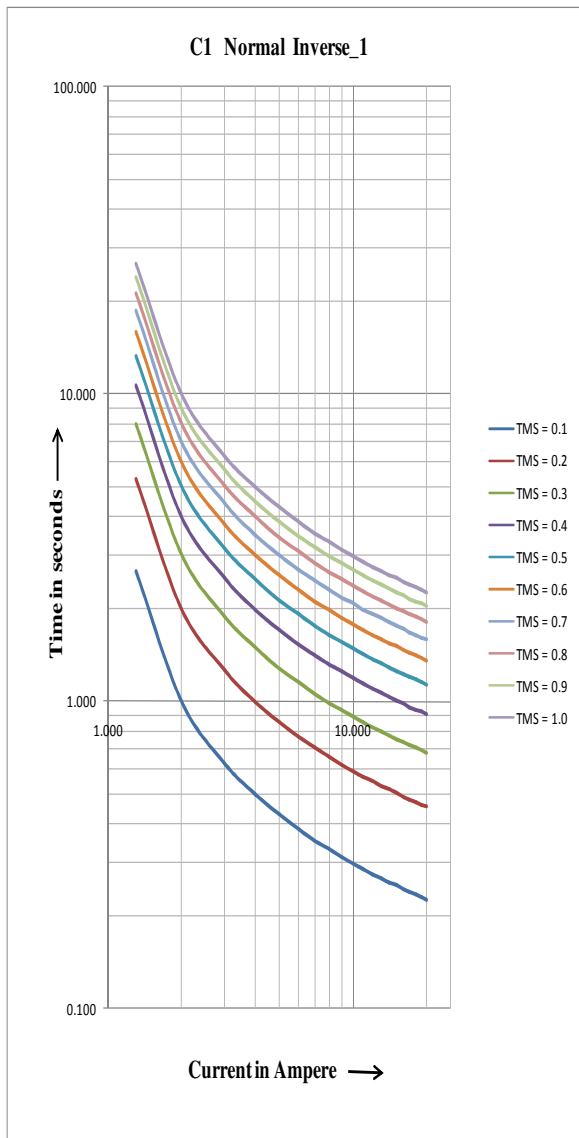
For IEC Inverse Curve

$$t = \frac{K \cdot a}{\left(\frac{I}{I_{ref}}\right)^b - 1}$$

For Extremely Inverse C4A Curve

$$t = \frac{K \cdot a}{\left[\left(\frac{I}{I_{ref}}\right)^b \cdot 1.3\right] - 1} + 0.22$$

Curve Type	Description	a	b
C1	Normal Inverse_1	0.14	0.02
C2	Normal Inverse_2	0.06	0.02
C3	Very Inverse	13.5	1
C4	Extremely inverse	80	2
C4A	Extremely Inverse as per EE relays	80	2.2
C5	Long Time Inverse	120	1
C6	Definite Time	-	-



The instantaneous tripping function is having range of 50% to 3000% in step of 1% for Phase and EF.

The high speed CPU continuously monitors the all four current inputs and compare with IDMT as well as instantaneous setting. If anyone current is above instantaneous setting the relay provides immediate trip command bypassing IDMT delay. If input current is less than instantaneous setting but more than IDMT setting, CPU calculates IDMT delay as per selected IDMT characteristic and TMS setting and provides trip command if fault persist even after this time delay.

All the settings are password protected to prevent unauthorised change.

1.2. Breaker Fail Function (BF or LBB)

Normally after tripping the current should become Zero within 100 to 200ms depending upon type of fault and breaker mechanism. After Fault Relay starts one internal timer (settable from 000 to 800 ms) if fault is not cleared during this time then relay declares as Breaker Fail (LBB function)

1.3. Cold Load Pickup

Relay also equipped with cold load pickup feature. During switching of load relay sense closing of CB by auxiliary contact of CB (through dedicated Status input marked as CB NO). Once CB closing is detected relay automatically switch settings to cold load setting (which independently adjustable) for pre define time (adjustable). After this cold load time relay switch back to original setting automatically and avoid wrong operation of relay.

1.4. Trip circuit Supervision & Status

The ADR141A/ ADR241A is having 2 separate digital opto-coupler status inputs which can be used to continuously monitors continuity of trip-circuit. The general scheme is as shown in fig.

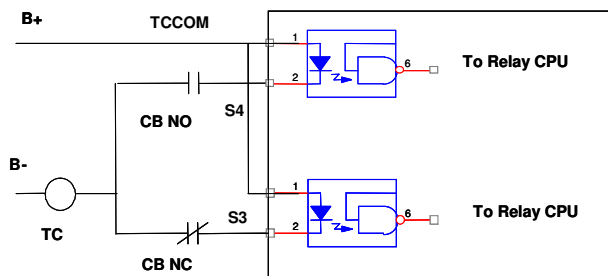


Fig. Trip Circuit Logic

Relay monitors Trip coil continuity through CB NO during Close condition and through CB NC during Trip condition. If any discontinuity

observed it generates Alarm signal. One changeover contact is provided for ALRAM and will operate when input status S3 and S4 both are active or inactive. i.e CB NO as well as CB NC are both close or open.

Along with this two general purpose Status inputs S1 and S2 are given for SCADA application

1.5. Extra Alarm Contact

Protection panel requires extra contacts for visual ALARM and ANNUNCIATION indication for operator. Also some status contacts for SCADA or remote indications. Usually separate electromechanical relays are used for contact multiplication of protection relay contacts. This added extra wiring and extra hardware. The ADR141A/ ADR241A provides separate programmable ALARM contact for such application. 4 nos. of extra annunciation contacts are provided. These contacts can be programmed as follows:

	ANN. TYPE 1	ANN. TYPE 2	ANN. TYPE 3	ANN. TYPE 4
RELAY 1	OC1	OC HF	HF	COM. ALARM
RELAY 2	OC2	OC IDMT	IDMT	PROTH.
RELAY 3	OC3	EF HF	PHASE	PHASE
RELAY 4	EF	EF IDMT	EF	EF

2. Supervision Function

2.1 Self-supervision

The ADR141A/ ADR241A relay continuously keeps track on its internal hardware and the movement it detects any failure of any component, it give message on LCD display, This feature is very useful to give pre information to avoid any mal-operation. In such situation it uses some default setting and remains in protection mode.

3. Measurement Function

In normal condition the relay displays actual current flowing through the relay. Using the front keyboard all relay settings can be viewed. If current is in fault range the relay gives trip command. The type of the fault is displayed on LCD display. During the fault condition, the relay

measures the fault current and stores it in non-volatile memory. The fault current can be read using keyboard on LCD display. Last 5 fault values along with tripping counter can be view using keyboard. All settings can be done locally as well as remotely via communication port and saved in non-volatile memory.

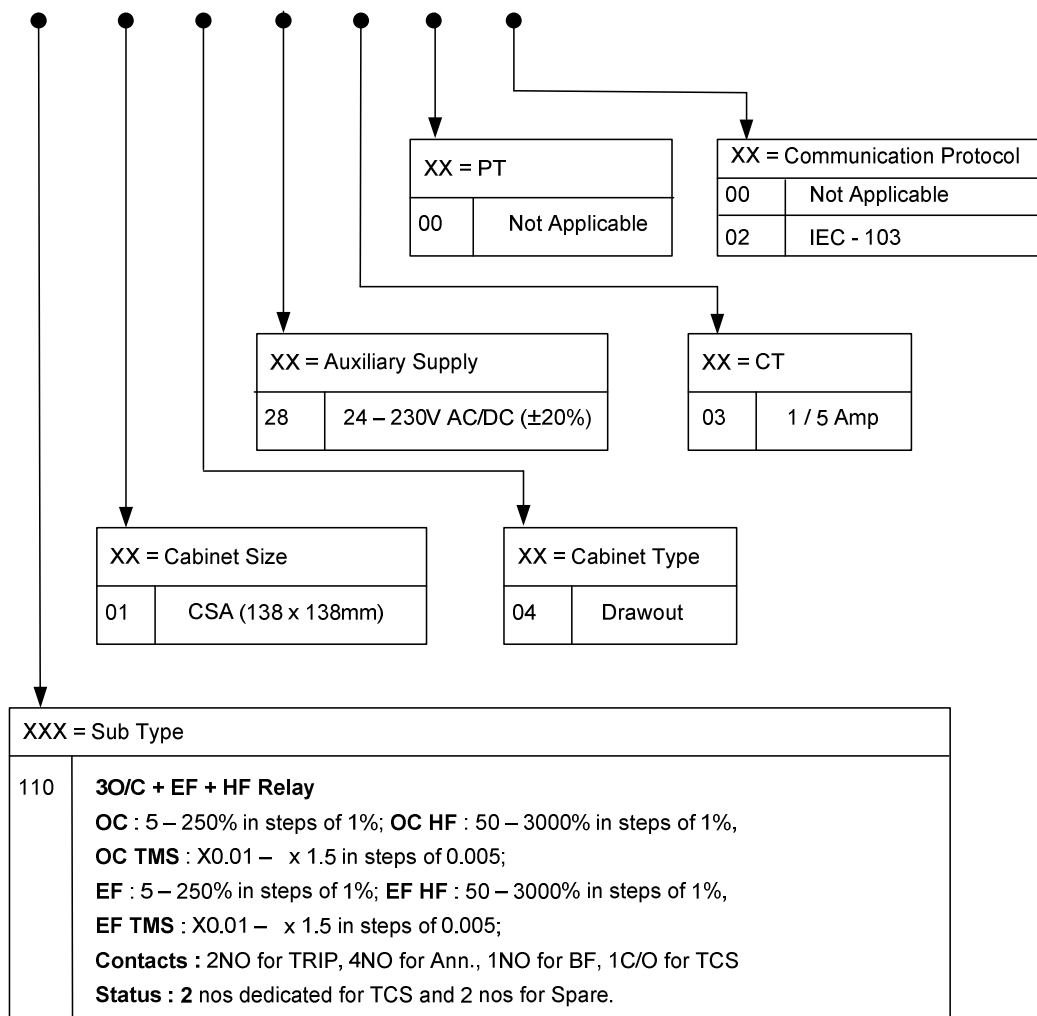
Ordering Information

The relay is available with different model option. It is user's responsibility to specify correct model no. while ordering.

While Ordering Specify the following Information for **ADR141A/ADR241A** Relay

Definition of Model No For Aditya Series Relays

AM XXX – XX – XX – XX – XX – XX – XX



Ordering information:

ADR241A	-	AM	-	XXX	-	XX	-	XX	-	XX	-	XX	-	XX	-	XX
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Available Models:

- ADR141A – AM-110-01-04-28-03-00-00 (Draw out cabinet)
- ADR241A – AM-110-01-04-28-03-00-02 (Draw out cabinet)

Technical Specifications:

AC Measuring Input:			
I.	Measurement Accuracy	Typical $\pm 2\%$ In for Phase and EF	
II.	Frequency measurement range	45 Hz – 55 Hz	
Current Input:			
I.	CT secondary	1 / 5 Amp. (Selectable)	
II.	Nominal Burden at In (without tripping condition)	< 0.20 VA at rated current (In)	
III.	Thermal Withstand Capacity	40 x rated current (In) for 3sec 2 x rated current (In) continuous for Phase and EF CT	
IV.	Measurement Linearity Range for Non – Offset AC Current	Linear up to 40 In	
Auxiliary Supply Input:			
I.	Nominal operating range	24 – 230V AC/ DC	
II.	Voltage operating range	80% of lower nominal range and 120% of upper nominal range (For DC Supply) 80% of lower nominal range and 110% of upper nominal range (For AC Supply)	
III.	Nominal Burden on 24 – 230V Auxiliary Power Supply	24 – 230 VAC	< 12 VA
		24 – 230 VDC	< 5 W
IV.	Tolerable AC ripple	Up to 15% of highest dc supply, As per IEC 60255-26: 2013	
V.	Relay power up time	< 2.5 Sec	
Opto Isolated Input:			
I.	Opto Isolated input operating Range	24 – 230 VDC	
II.	Threshold Voltage for DC	18V +/- 3volts	
	Maximum operating voltage range	250 VDC	
III.	Drop out	Within 85% of threshold voltage value	
IV.	VA Burden of Opto Isolated Status Input	For each status < 1.5 Watt / VA	
V.	Filtering Time	< 40ms	
VI.	Logic input recognition time	: For all Status filtering time + 5ms \pm 5 ms	
Output contact:			
I.	Output Contacts	Continuous	5A/250Vac
		Make & carry	30Amp for 3sec AC /DC
		Short time withstand	50Amp for 1sec AC /DC

	Breaking capacity	AC- 1250VA max @ 250V(PF 0.4)
		DC- 100W Resistive max. 5A or 300V
		50 Watt Inductive (L/R 45ms) max. 5A or 300V
	Operating Time	<10msec
	Minimum no. of operations	10,000 operation loaded condition & unloaded 100,000 operations
Operating condition:		
I.	Relative Humidity	: Humidity (RH) 95% maximum
II.	Operating temperature range	: -25 °C to +65 °C
III.	Storage temperature range	: -25 °C to +70 °C

Accuracy of protection function:			
I.	Phase Over current:		
	For operating Value	Pickup	1.05 x setting ±5%
		Drop-off	0.95 x setting ±5%
	For operating Time	IDMT Characteristic shape	As per class5 of 60255-151 cl.5.2** or 55ms whichever is greater
		DT Operation	±5% or 55ms whichever is greater*
		Note “ * “ indicates Reference Condition that is Fault current 2 times above set value.	
II.	Ground Over current (EF):		
	For operating Value	Pickup	1.05 x setting ±5%
		Drop-off	0.95 x setting ±5%
	For operating Time	IDMT Characteristic shape	As per class5 of 60255-151 cl.5.2** or 55ms whichever is greater
		DT Operation	±5% or 55ms whichever is greater*
		Note “ * “ indicates Reference Condition that is Fault current 2 times above set value.	
III.	Cold Load:		
	Cold Load Time	CL Time	Setting ± 10%
	For operating Value	Pickup	1.05 x setting ±5%
		Drop-off	0.95 x setting ±5%
	For operating Time	IDMT Characteristic shape	As per class5 of 60255-151 cl.5.2** or 55ms whichever is greater
		DT Operation	±5% or 55ms whichever is greater *
Note “ * “ indicates Reference Condition that is Fault current 2 times above set value.			

IV.	CB Fail:		
	For Operating Time	DT Operation	±5% or 55ms whichever is greater*
		CBF Reset	<60ms

**Note: As per IEC60255-151 Class 5 (assigned error 5%) the tolerance calculated as below;

Value of characteristic quantity as multiple of setting value (GS)	2N	5N	10N	20N
Limiting error as multiple of an assigned error	2.5	1.5	1	1
Percentage for time accuracy claim	12.5%	7.5%	5%	5%

Mechanical Details			
I.	: For Cabinet Type	CSA – 150 without IP cover	MAC01972
		CSA – 150 with IP cover	MAC01973
	: For Electrical Connection	3 Phase, 3 Wire System	APR06828
		3 Phase, 4 Wire System	APR06829
	: Net Weight	Approx. 2.5 Kg.	

Relay Setting:		
Sr. No	Parameter	Setting / Ranges
1.	Password	: 000 – 099 in steps of 001
2.	New Password	: 000 – 099 in steps of 001
3.	Unit ID	: 001 – 250 in steps of 001
4.	IP>	: 005 – 250 % in steps of 1%
5.	IP TMS	: 0.010 – 1.500 in steps of 0.005
6.	IP>>	: 0050 – 3000 % in steps of 1% (00 is Bypass)
7.	IE>	: 005 – 250 % in steps of 1%
8.	IE TMS	: 0.010 – 1.500 in steps of 0.005
9.	IE>>	: 0050 – 3000 % in steps of 1% (00 is Bypass)
10.	IP> Curve	: C1 – C6 in step of 1
11.	IE> Curve	: C1 – C6 in step of 1
12.	IP> C6 Time	: 00.0 – 99.9s in steps of 0.1s
13.	IE> C6 Time	: 00.0 – 99.9s in steps of 0.1s
14.	IP>> Delay	: 00.00 – 10.00s in steps of 0.01s
15.	IE>> Delay	: 00.00 – 10.00s in steps of 0.01s
16.	BF Delay	: 000 – 800ms in steps of 50ms
17.	CT Secondary	: 001 – 002 (001 = 1A, 002 = 5A)
18.	CT Primary	: 0010 – 5000A in steps of 1A
19.	Test Block	: 001 – 002 (001 = Yes, 002 = No)
20.	Trip Circuit	: 001 – 002 (001 = Yes, 002 = No)
21.	Ann. Type	: 1 – 4 in steps of 1
22.	Ann. Contacts	: 001 – 002 (001 = SR, 002 = HR)
23.	Trip Contacts	: 001 – 002 (001 = SR, 002 = HR)

24.	BF Contacts	: 001 – 002 (001 = SR, 002 = HR)
25.	Com. Port	: USB/ RS485
26.	Set Parity	: None / Even / Odd
27.	Baud Rate	: 001 – 008 (01=2400, 02=4800, 03=9600, 04=14400, 05=19200, 06=28800, 07=38400, 08=57600)

Cold Load Setting:

Sr. No	Parameter	Setting / Ranges
1.	Password	: 000 – 099 in steps of 001
2.	Cold Load	: 001 – 002 (001 = Yes, 002 = No)
3.	Cold Load Timer	: 0.01 – 10 sec in steps of 0.1s
4.	CL IP>	: 005 – 250 % in steps of 1%
5.	CL IP TMS	: 0.010 – 1.500 in steps of 0.005
6.	CL IP>>	: 0050 – 3000 % in steps of 1%
7.	CL IE>	: 005 – 250 % in steps of 1%
8.	CL IE TMS	: 0.010 – 1.500 in steps of 0.005
9.	CL IE>>	: 0050 – 3000 % in steps of 1%
10.	CL IP> Curve	: C1 – C6 in step of 1
11.	CL IE> Curve	: C1 – C6 in step of 1
12.	CL IP> C6 Time	: 00.0 – 99.9s in steps of 0.1s
13.	CL IE> C6 Time	: 00.0 – 99.9s in steps of 0.1s
14.	CL IP>> Delay	: 00.00 – 10.00s in steps of 0.01s
15.	CL IE>> Delay	: 00.00 – 10.00s in steps of 0.01s

Date & Time Setting:

Sr. No	Parameter	Settings / Ranges
1.	SET Hours	: 00 to 23 Hrs in step 1.
2.	SET Minutes	: 00 to 59 Mins in step 1.
3.	SET Seconds	: 00 to 59 Sec. in step 1.
4.	SET Date	: 01 to 31 Days in step of 1.
5.	SET Month	: 01 to 12 Months in step of 1.
6.	SET Year	: 00 to 99 Years in step of 1.

Operational Indicators (Flags)

I.	ON / Error	: Green LED indicates Relay OK : Red LED indicates Problem in relay Hardware.
	PKP / HF	: Green LED indicates relay Pickup. : Red LED indicates relay operated at HF.
	OC Fault / EF Fault	: Green LED indicates the relay tripped by OC, Hand Reset (HR) Type : Red LED indicates the relay tripped by EF, Hand Reset (HR) Type
	TRIP / BF	: Green LED Indicates that Trip pulse is being executed. SR type when TRIP contact selected as SR and HR type when TRIP contact

	selected as HR. : Red LED indicates BF operated. SR type when BF contact selected as SR and HR type when BF contact selected as HR.
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Typical Tests Information:

Electromagnetic Compatibility Type Test:			
Sr. No.	Standard		Test
I.	High Frequency Disturbance Test	IEC60255-22-1, IEC60255-26 (ed3): 2013	1) 2.5 kV Common Mode 2) 1 kV Differential Mode EUT Condition Energized
II.	Electrostatic Discharge Test-Direct Application	IEC60255-22-2, IEC60255-26 (ed3) : 2013	1) 8kV air discharge 2) 6kV contact discharge Test Mode Direct and Indirect Method EUT Condition Energized
III.	Fast Transient Disturbance Test	IEC60255-22-4, IEC60255-26 (ed3) : 2013	Test Voltage : ±4 KV Repetition rate : 5 KHz and 100 KHz. EUT Condition : Energized
IV.	Surge Immunity Test	IEC60255-22-5, IEC60255-26 (ed3) : 2013	Front time / time to half value : 1.2/50 µS Source impedance : 2Ω Common Mode : ±4 KV Differential Mode : ±2 KV EUT Condition : Energized
V.	Pulse Magnetic Field Immunity Test	IEC61000-4-9, IEC60255-26 (ed3) : 2013	Class 5: 1000A/m field applied continuously in all planes for the EUT
VI.	Radiated Electromagnetic Field Disturbance Test	IEC60255-22-3, IEC60255-26 (ed3) : 2013	Voltage Level 10 V/m Frequency Range 80 - 1000 MHz Modulation 80% AM @ 1 KHz Spot Frequency 80, 160, 380, 450 & 900 MHz
VII.	Conducted Disturbance Induced By Radio Frequency Field	IEC60255-22-6, IEC60255-26 (ed3) : 2013	Voltage Level 10 V Frequency Range 0.15 – 80 MHz Modulation 80% AM @ 1 KHz EUT Condition Energized Spot Frequency 27, 68 MHz
VIII.	Power Supply Immunity Test	IEC60255-11 IEC61000-4-11 IEC61000- 4-29 IEC60255 – 26 (Ed3) : 2013	: AC voltage dip: 40%: 200 ms 70%: 500ms 80%: 5s AC Interruption: 10ms, 20ms, 50ms, 100ms, 200ms, 0.5s and 5s

			DC Voltage dip: 40% : 200ms 70% : 500ms DC Interruption: 10ms, 20ms, 30ms, 50ms, 100ms, 200ms, 0.5s, 1s & 5s
IX.	Conducted & Radiated frequency Emission Test	IEC60255-25, IEC60255-26 (ed3) : 2013	: Conducted Frequency Range Limit 0.15 – 0.5 MHz 79 dB/μV (Quasi peak) 66 dB/μV (Average) 0.5 – 30 MHz 73 dB/μV (Quasi peak) 60 dB/μV (Average) EUT Condition Energized : Radiated Frequency Range Limits 30 MHz – 230 MHz 50 dB (μV/m) 230 MHz – 1000 MHz 57 dB (μV/m) EUT Condition Energized

Insulation Tests:

I.	Dielectric Test	IEC60255-27	: At 2kV 50Hz a) Between all terminals connected together and case earth for 1 minute b) Between independent circuits with case earth for 1 minute.
II.	Impulse Voltage Test	IEC60255-27	Test Voltage 5kv, 1.2/50 μSec Energy 0.5 J No. of impulses 3 on each Polarity +ve and -ve EUT Condition Non Energized
III.	Insulation Resistance	IEC60255-27	: ≥ 100MΩ @ 500V DC

Environmental tests:

I.	Cold test	: IEC-60068-2-1
II.	Dry heat test	: IEC-60068-2-2
III.	Damp heat test, steady state	: IEC-60068-2-78
IV.	Change of Temperature	: IEC-60068-2-14

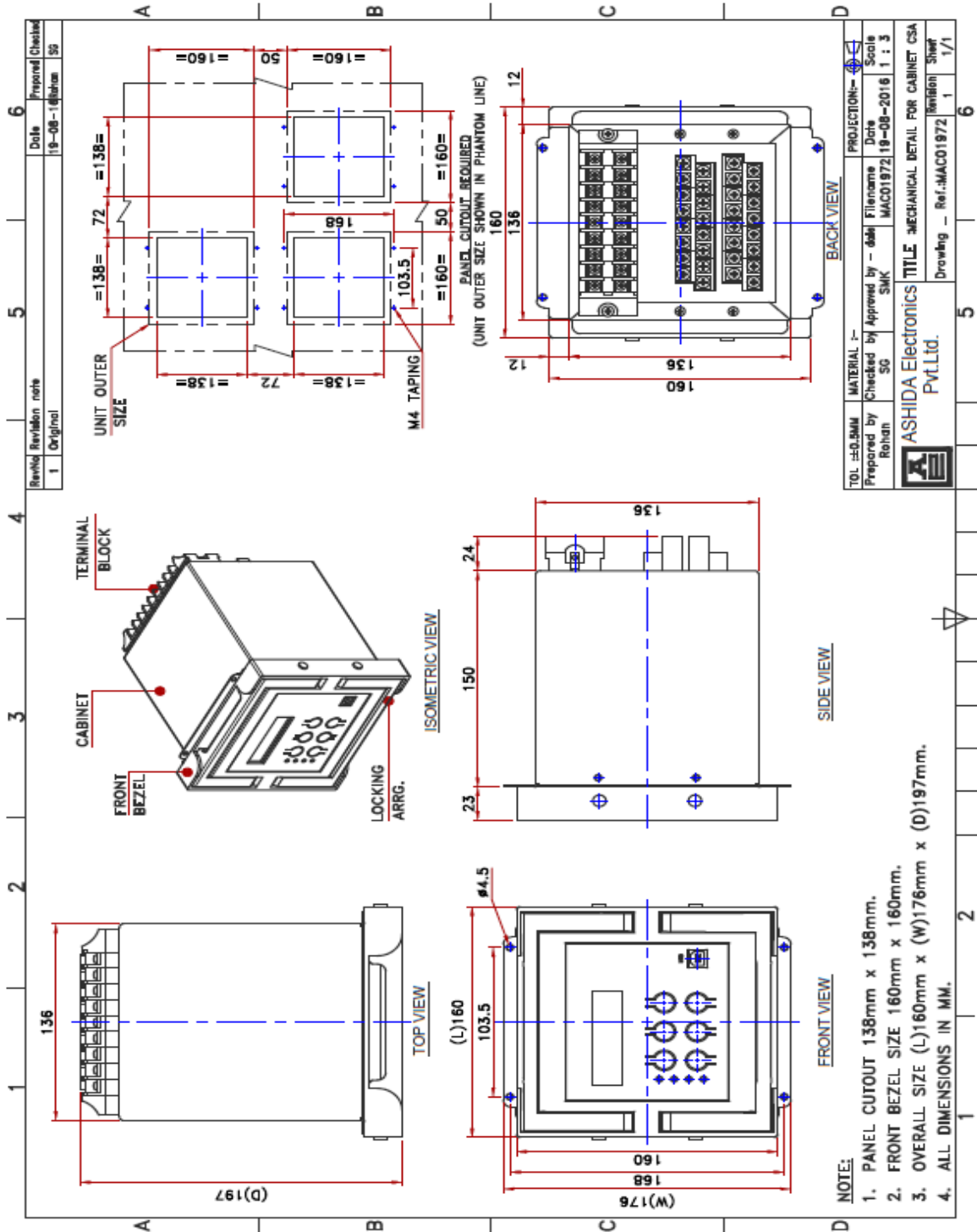
V.	Damp heat test, cyclic	: IEC-60068-2-30
VI.	Enclosure Protection Test IP52 (with optional IP cover) IP31 (without optional IP cover)	: IEC 60529

CE compliance

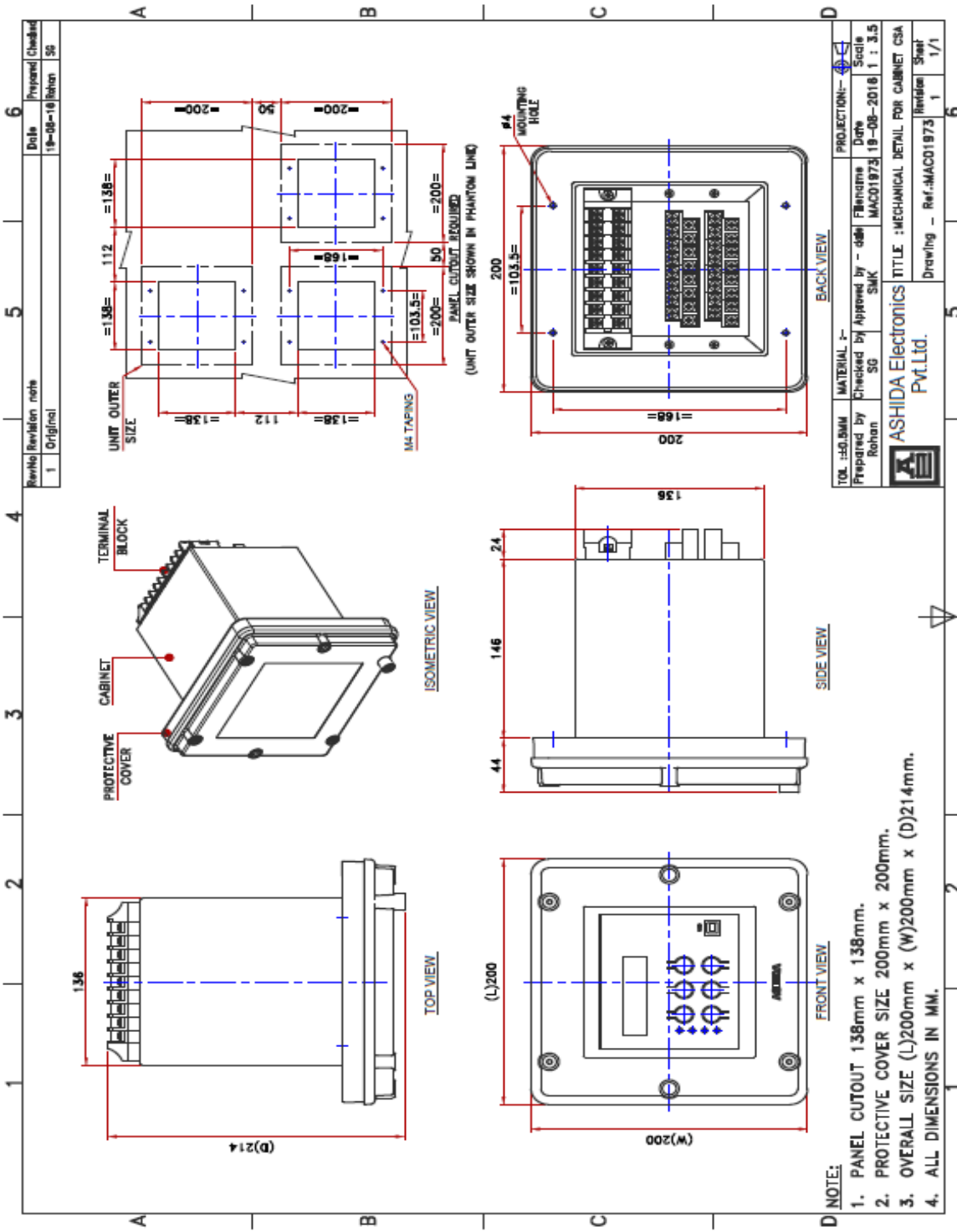
I.	Immunity	: IEC-60255-26
II.	Emissive Test	: IEC- 60255-26
III.	Low voltage directive	: EN-50178

Mechanical tests

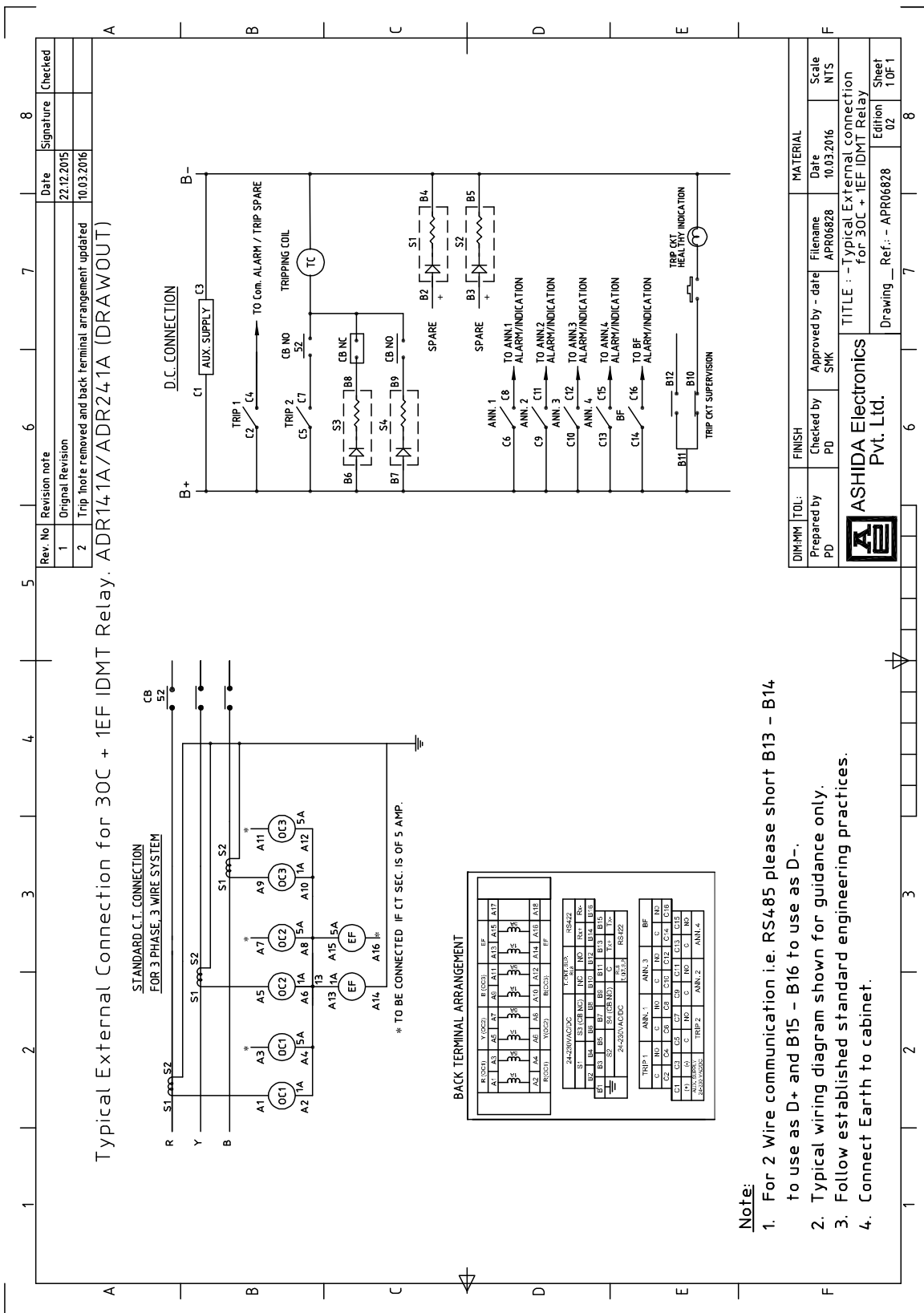
I.	Vibration Endurance Test	: IEC 60255-21-1 class 2 : Frequency Range = 10Hz – 250Hz, acceleration. = 2gn : Sweep rate 1 octave/min; 20 cycle in 3 orthogonal axis.
II.	Vibration Response Test	: IEC 60255-21-1 class 2 : Frequency Range = 10Hz – 150Hz , acceleration. = 1gn : Sweep rate 1 octave/min; Displacement =0.075mm, in 3 orthogonal axis.
III.	Bump Test	: IEC 60255-21-2 Class-1 : 1000 bumps / direction of 10gn peak acceleration and 16ms pulse duration in each of the two opposite direction per axis as per No. of axes. 3.
IV.	Shock Withstand Test	: IEC 60255-21-2 Class-2 30g, 11ms : 3 shocks of 15gn peak acceleration and 11ms pulse in each of two opposite direction. No. of axis : 3
V.	Shock Response Test	: IEC 60255-21-2 Class-2 : 5 shocks of 10gn peak acceleration and 11ms pulse in each of two opposite direction. No. of axis : 3
VI.	Seismic Test	: IEC 60255-21-3 Class-2 : Sweep 1/Axis (@a sweep rate of 1 octave/minute) vibration in the frequency range (5-35 Hz) at displacement X-axis: 7.5mm, Y-axis: 3.5mm amplitude of 3.5mm with acceleration of X-axis: 2gn, Y-axis: 1gn.



Note: All dimensions in mm.



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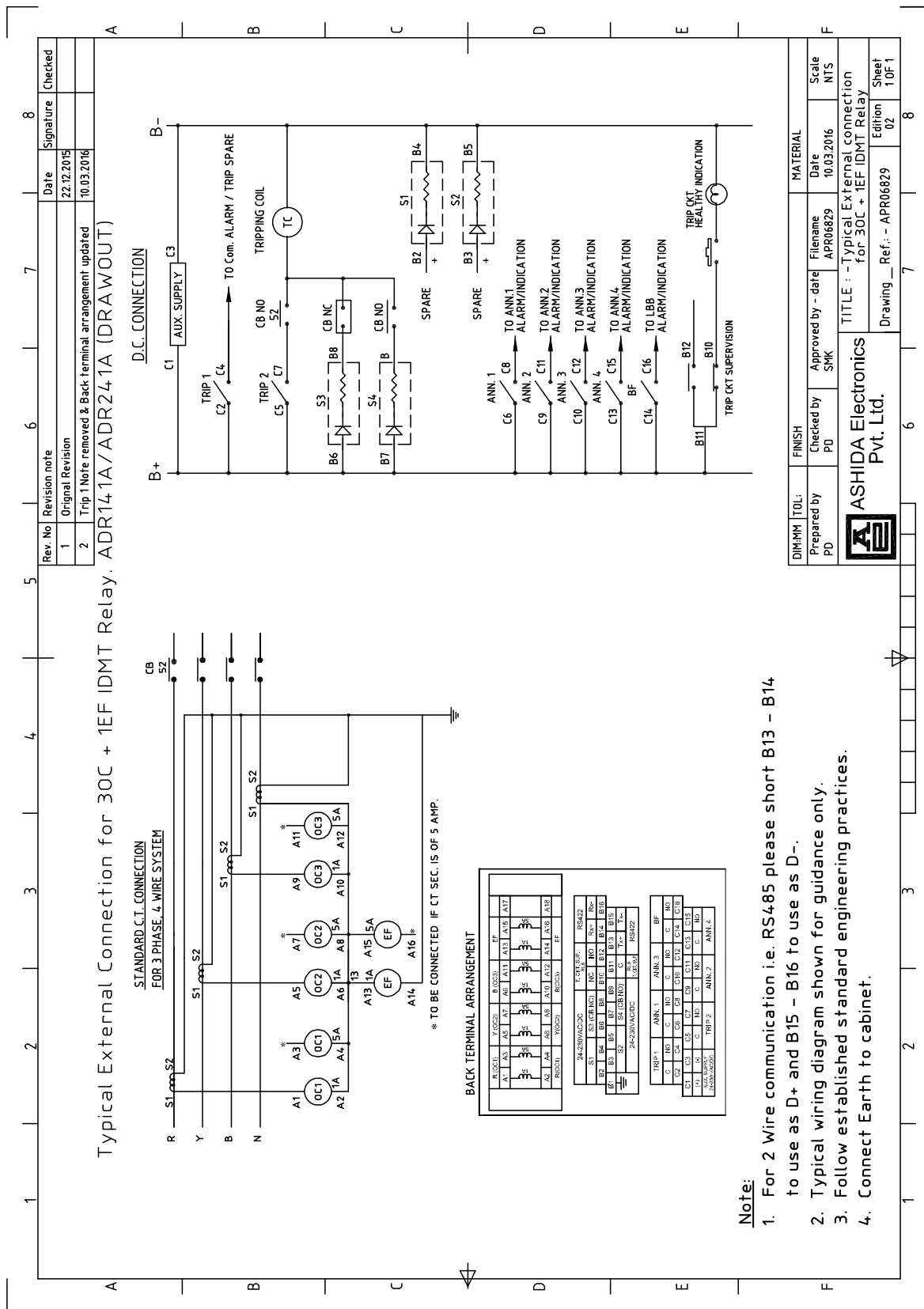
- Note:**
- For 2 Wire communication i.e. RS485 please short B13 – B14 to use as D+ and B15 – B16 to use as D-.
 - Typical wiring diagram shown for guidance only.
 - Follow established standard engineering practices.
 - Connect Earth to cabinet.

DIM/MTL TOL:	FINISH	MATERIAL
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PD	PU	SMK
		APR06828
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		Date
		Scale
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		10F-1
		Edition
		02
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ASHIDA Electronics Pvt. Ltd.

TITLE : - Typical External connection for 30C + 1EF IDMT Relay

Drawing Ref.: - APR06828



- Note:**
- For 2 Wire communication i.e. RS485 please short B13 – B14 to use as D+ and B15 – B16 to use as D-.
 - Typical wiring diagram shown for guidance only.
 - Follow established standard engineering practices.
 - Connect Earth to cabinet.

Rev. No	Revision note	Date	Signature	Checked
1	Original Revision	22.12.2015		
2	Trip 1 Note removed & Back terminal arrangement updated	10.03.2016		

DIN:MM TOL:	FINISH	MATERIAL	Date	Scale
Prepared by	Checked by	Approved by - date	File name	NTS
PD	SMK	APR06829	10.03.2016	
ASHIDA Electronics Pvt. Ltd. TITLE : - Typical External connection for 3OC + 1EF IDMT Relay				
Drawing _ Ref. : - APR06829			Edition	Sheet
			02	1 OF 1