Self Powered Relay: ADR241S – AM–511–06

Introduction:

ASHIDA has designed economical & reliable Multifunction Self/Dual Powered Relay ADR241S Protection & Control System. The simple and compact construction of ADITYA Series, ADR241S relay provides integrated Protection, Control and Monitoring functions for Distributed Ring Main Unit (RMU) Feeders.

Protection Features:

- 4 Element (3 Phase + EF) Over Current IDMT/DMT with instant Trip.
- 16 x 2 back-lit LCD display for settings.
- Display of Load Current in terms of primary & secondary.
- Phase Over current, Earth Fault, Cold Load Pickup, Thermal Overload, Under Current and Inrush Blocking Protection Functions.
- Separate curve selection for Phase and Earth Fault.
- Relay can be made either IDMT or Definite Time
- Selection of Curve: Eleven selectable curves Definite Time / IEC S Inverse / IEC S Inverse (1.3 Sec) / IEC V Inverse / IEC E Inverse / UK LT Inverse / IEEE M Inverse / IEEE V Inverse / IEEE E Inverse / US Inverse / US ST Inverse.
- Design using DSP technology.
- Latching of fault current up to last 5 faults with time stamping.
- Disturbance Recorder: Actual waveform of current along with logical and physical status are captured and saved in the built-in memory, with date time stamping for analyzing fault condition & fault location.
- Password protection for all settings.

- Programmable (Non- Volatile) setting by local keys as well as remote setting by communication port.
- 2 Setting Groups.
- Fully communicable with IEC standard open protocol IEC 60870-5-103 & MODBUS.
- IP5X Compliance.

Relay Design Features:

- An Auxiliary Voltage Supply is not required. (Aux. supply is Optional)
- Low energy pulse output tripping for RMU
- Self Power Design.
- USB (at front) and RS422/ RS485 (at rear side) Communication Port for remote SCADA
- Continuous monitoring of internal hardware modules and error message generation in case of failure of any critical components.
- Facility to synchronised Relay time from SCADA.
- Site Selectable Frequency i.e. 50/ 60 Hz.
- Available with 1Amp or 5Amp Rated CT secondary.
- 4 Optically isolated digital inputs.
- One dedicated input for CB status (CBNO), one dedicated input for Remote Trip and two spare status inputs for SCADA. (Same as selected Auxiliary supply voltage).
- External latching & non-latching type potential free changeover contacts.

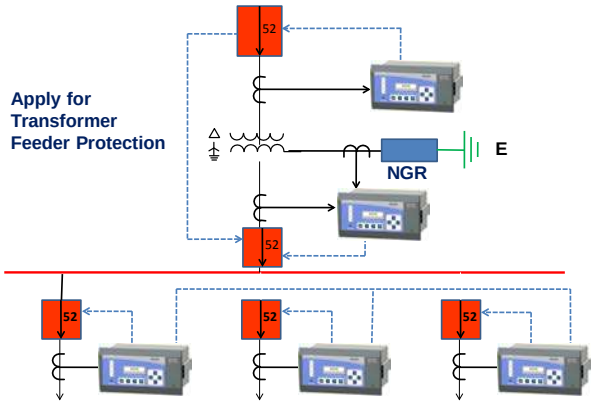
Software Support:

- Setting Editor.
- Settings upload / download.
- Offline Settings Editor.
- Online Measurement.
- Sequence of Event monitoring
- Disturbance analysis.

Applications:

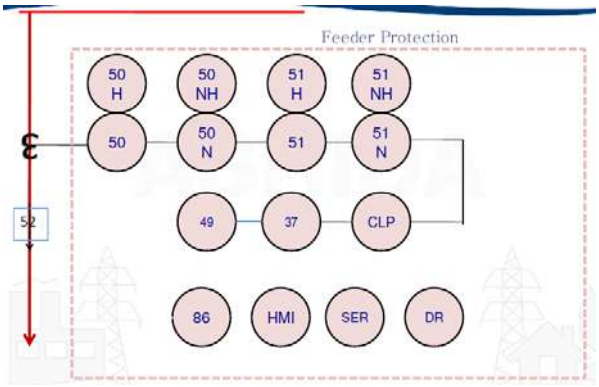
ADR241S self powered numerical multifunction relay designed for distributed Ring Main Unit (RMU) feeder protection applications. Relay designed with fast and selective tripping ensures the stability and availability of electrical power system.

ADR241S 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

Functional Overview of ADR241S:



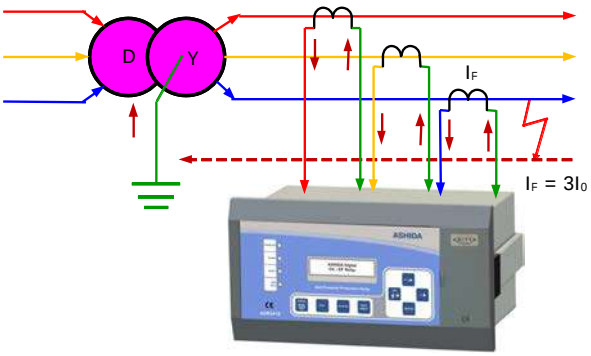
Protection functions Overview

ANSI Code	Description
50	Instantaneous/Definite Time Phase Over current Protection
51	Inverse Time Phase Over current Protection
50N	Instantaneous/Definite Time Ground Over current Protection
51N	Inverse Time Ground Over current Protection
50H/ 51H/ 50NH/ 51NH	Harmonic Blocking/ Unblocking
86	Lockout (Trip command)
CLP	Cold load pick up
37	Under current Protection
49	Thermal overload Protection

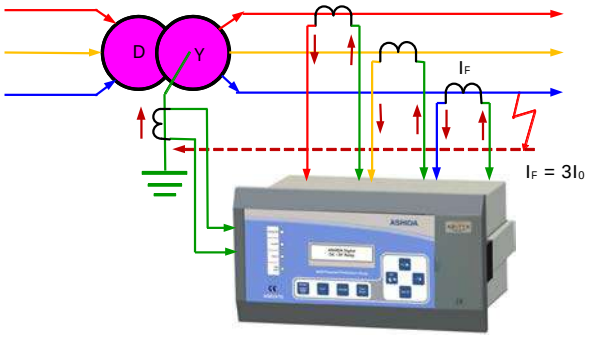
Non Directional Phase & Ground O/C Protection (50/50N/51/51N):

The core functionality of ADR241S relay is equipped with multi function feeder protection elements. The relay provides Non Directional phase and ground over current protection with multiple settings (Three stages for phase and ground over current) for various power system faults 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 with non directional over current protection will be providing greater selectivity, flexibility and sensitivity to users for better relay co-ordinations.

ADR241S relay provides three stages of externally ground over current protection. ADR241S relay measures ground fault current through residual connection of CTs or through neutral CT input.



Residual connection for ground over current protection



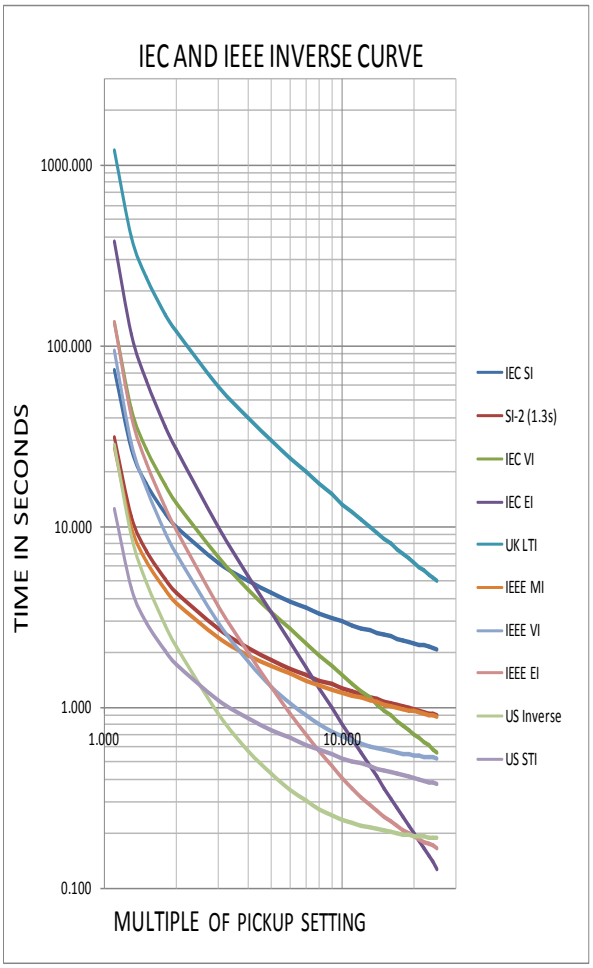
Externally measured ground over current through neutral CT

ADR241S relay provides inverse time over current characteristic for phase and ground over current elements. Each stage of phase

and ground over current 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
Definite Time (DT)	-	-	-
IEC S Inverse	0.14	0.02	0
S Inverse 1.3 Sec	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	0.02394	0.02	0.01694



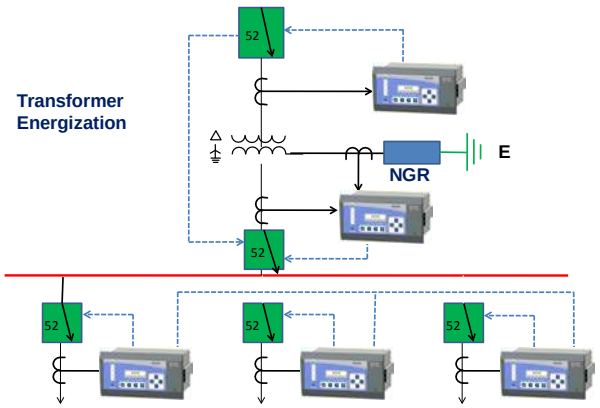
IEC / IEEE Inverse curves for tripping of over current elements

ADR241S relay provides the definite time dropout characteristic (electromechanical relay reset) for IDMT curves. The output of protection function shall be reset after dropout time delay.

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

Harmonic blocking / unblocking feature equipped in ADR241S relay provide stability on inrush current during transformer Energization. Harmonic blocking/

unblocking feature are independent for each stage of phase and ground over current protection.

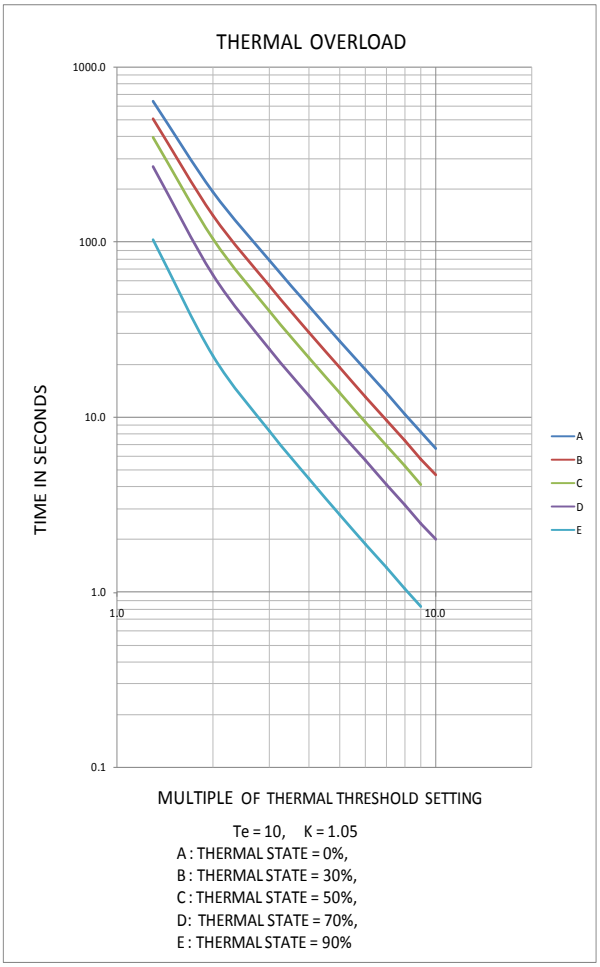


Cold Load Pickup (CLP):

ADR241S provides the cold load pick up (CLP) as an additional functions. User can use this function for user defines application. One of the application of this feature can be use to avoid wrong operation on inrush current during Transformer Energization without compromising sensitivity of over current protection.

Thermal overload Protection (49):

ADR241S 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.



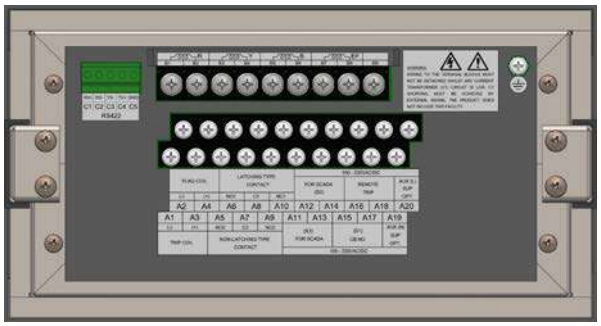
Under current detection (37):

ADR241S relay provides under current protection with definite time delay.

Digital Inputs & Outputs:

The ADR241S relay equipped with 4 nos. of digital outputs and 4 nos. of optically isolated digital inputs. 1 nos. of digital input is dedicated for monitoring status of circuit breaker (CBNO) and 2 nos. are spare digital inputs to be configured for desired applications. One input is provided for remote trip status.

One digital output is for potential free latch type contact, one digital output is for potential free non latch type contact, one pulse output provided for Flag coil (local as well as remote/external flag coil) and one pulse output provided for CB trip coil. The trip energy for pulse output will be provided by built-in capacitor in relay. Pulse train will be continued until the CB operates and circuit breaker current falls to zero.



Backside Terminals

LED for Indication:

The ADR241S relay provides total 4 nos. of dedicated target LEDs indication. One LED is provided for relay power ON, One LED is provided for start/ pickup, One LED is provided for FAULT indication and One LED is provided for Trip Test.

Self Supervision Function:

The ADR241S relay have built-in self supervision function which is continuously monitors the state of internal hardware and the operation of relay software (firmware). When a relay internal fault detected, the LED 1 will indicate and Error message is pop up on display.

The description of error log is mention in bellow table;

Error Log	Descript-ion	Proposed Action
1	SETTING ERROR	Go to configuration menu and restore default all settings and then save settings Press Target Reset + PROT. Reset.
4	RTC ERROR	Set correct values for Date and Time and Press Target Reset + PROT. Reset.
16	ADC ERROR	Press Target Reset + PROT. Reset
32	FRAM 1 ERROR	Press Target Reset + PROT. Reset
64	FRAM 2 ERROR	Press Target Reset + PROT. Reset
256	FRAM 3 ERROR	Press Target Reset + PROT. Reset

Battery function:

The ADR241S relay is Self Power Relay is powered through CT for its operation, once the relay trip; then the relay is powered through Battery. (I.e. no load or auxiliary supply)

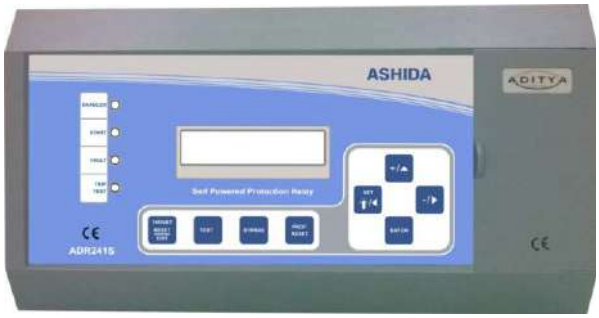
Battery Specification: Capacity 4.5Volt (1.5V x 3) AA non-rechargeable battery (recommended Lithium)

Note: - The relay uses battery only for indication purpose. Battery is not required for protection purpose.

Front View details:

The ADR241S relay provides front end PC communication through USB port. HMI

keys can be used to set and configure Relay settings. HMI Display provides metering function and 4 no's of LEDs for indication purpose.

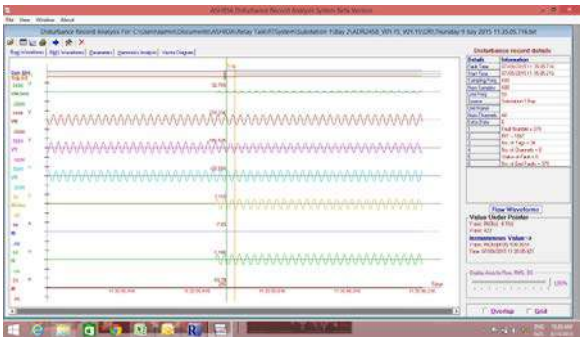


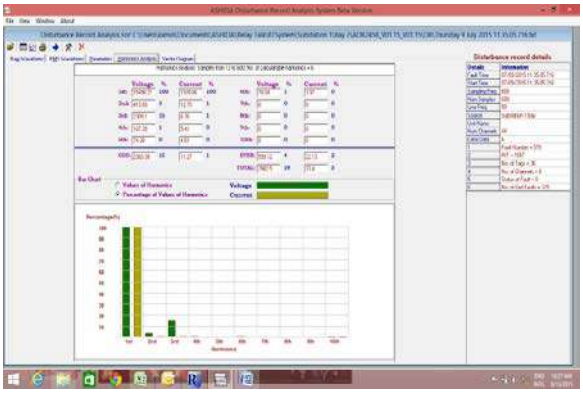
Event recording:

ADR241S relay is providing feature to record and store 100 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:

ADR241S relay is provides built in disturbance recording facility for recoding of analogue and digital channels. Relay records 5 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:

ADR241S relay is providing fault record facility. The fault records can be display either on HMI display or in RTV2 software. The relay can records 5 nos. of fault records in non-volatile memory.

Metering:

Online metering feature of ADR241S relay is providing metering of parameters (i.e. phase & earth current magnitude in terms of CT primary and secondary etc.) on HMI display or in RTV2 software.

Settings Groups:

ADR241S relay provides two independent setting groups to allow operate relay on

different power system operating conditions.

IEC 60870-5-103 Protocol:

ADR241S 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.

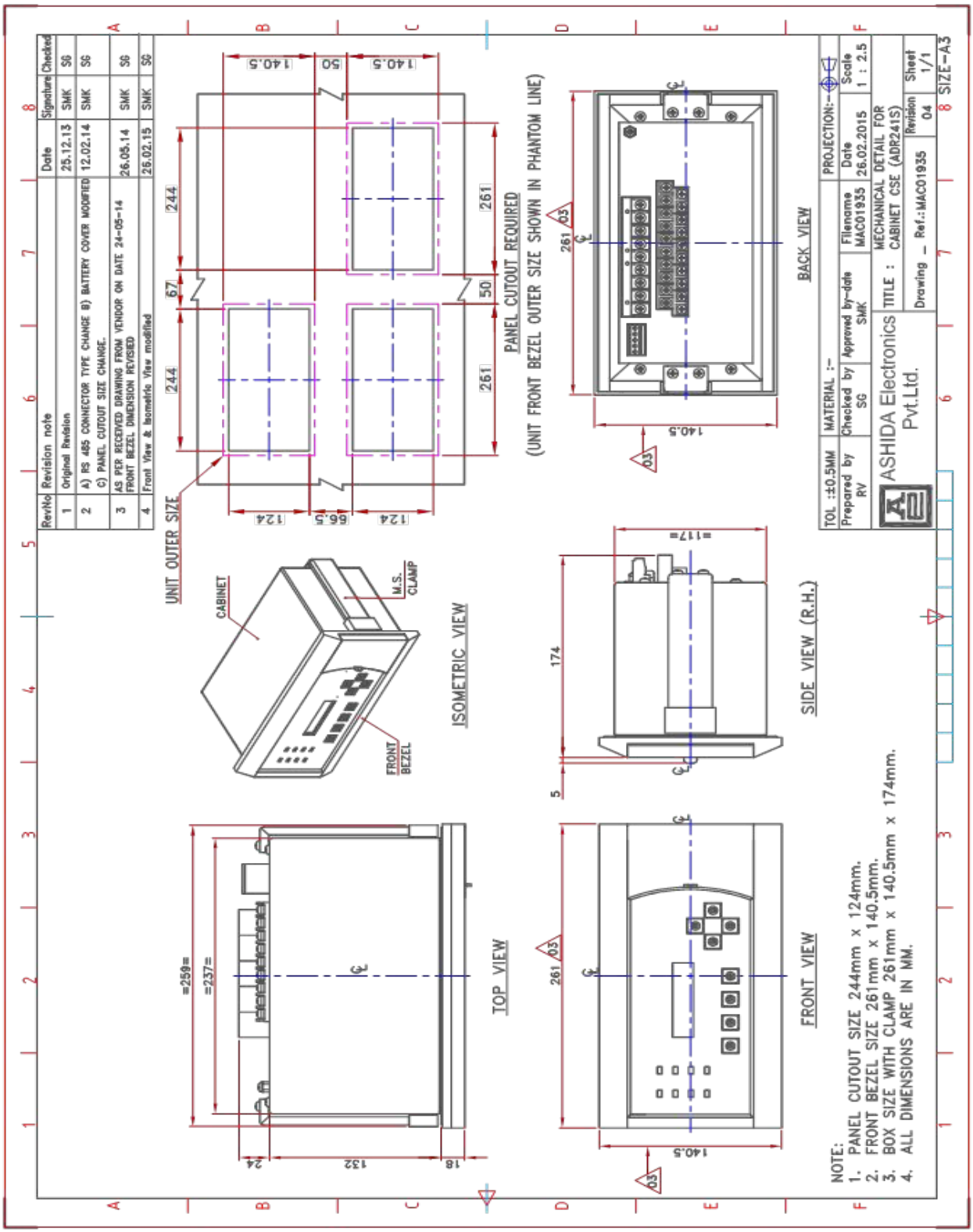
Typical Tests Information:

The Relay Confirm to following standard

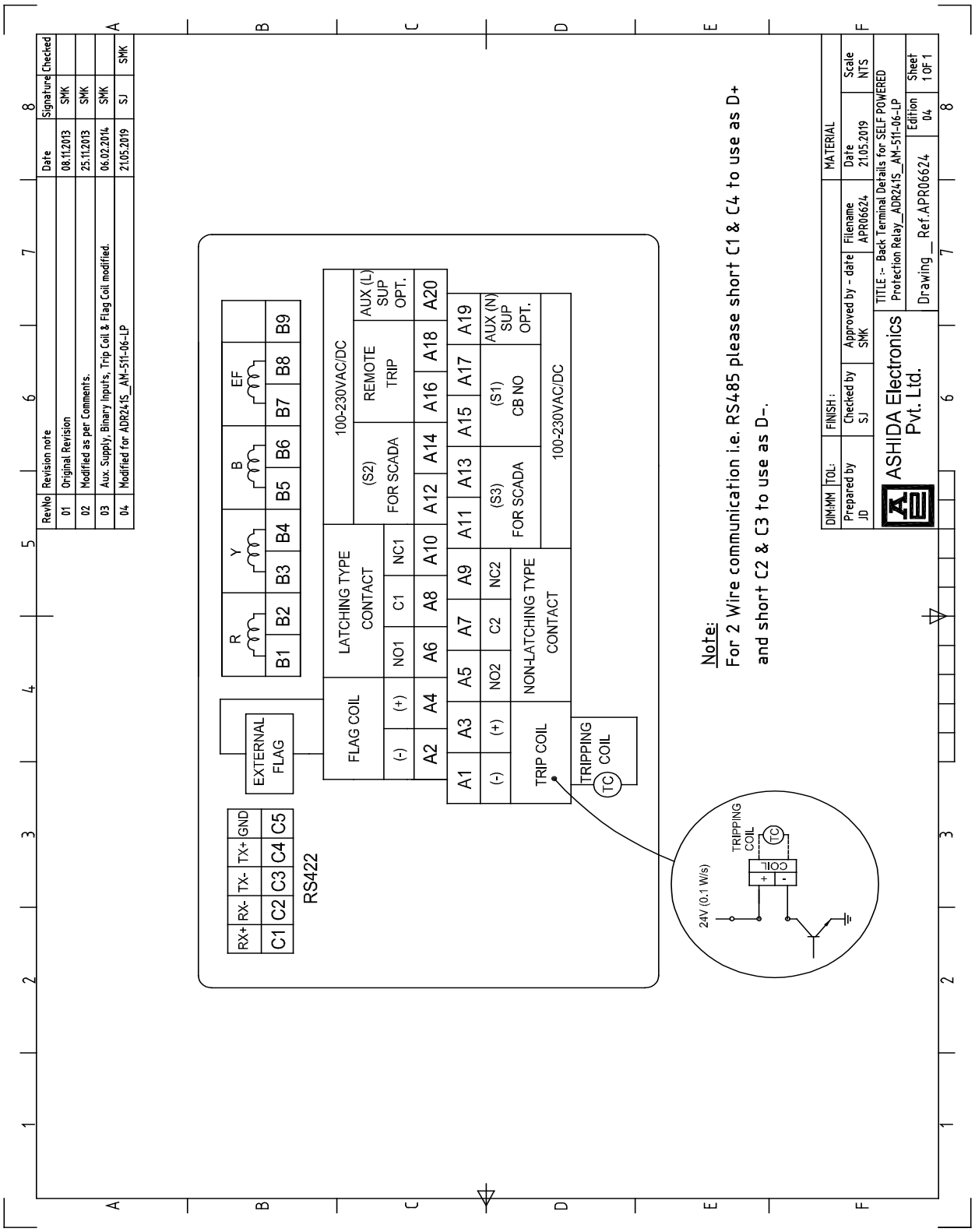
Sr. No.	Test	Standard
Electromagnetic Compatibility Type Test:		
1.	High Frequency Disturbance Test	IEC 61000-4-18
2.	Electrostatic Discharge Test- Direct Application	IEC 60255-26 & IEEE C37.90.3
3.	Fast Transient Disturbance Test	IEC 60255-26 & IEEE C37.90.1
4.	Surge Immunity Test	IEC 60255-26 & IEC 61000-4-5
5.	Power Frequency Immunity Test	IEC 60255-26, IEC 60255-1
6.	Radiated Electromagnetic Field Disturbance Test	IEC 60255-1, IEEE C37 90.2 & IEC 61000-4-3
7.	Conducted Disturbance Induced By Radio Frequency Field	IEC 60255-26 & IEC 61000-4-6
8.	Power Frequency Magnetic Field Immunity Test	IEC 61000-4-8, IEC 60255-1 & IEC 60255-26
9.	Power Supply Immunity Test	IEC 60255-11 & IEC 60255-26
10.	Conducted & Radiated frequency Emission Test	IEC 60255-26
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 60255-1, IEC 60068-2-1 Ab
15.	Dry heat test	IEC 60255-1, IEC 60068-2-2 Bb
16.	Damp heat test, steady state	IEC 60255-1, IEC 60068-2-78
17.	Change of Temperature	IEC 60255-1, IEC 60068-2-14 Nb
18.	Damp heat test, cyclic	IEC 60255-1, IEC 60068-2-30
19.	Enclosure Protection Test: IP54	IEC 60255-1 : 2009, IEC 60259
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 1
25.	Bump Test	IEC 60255-21-2 Class 1
26.	Shock Withstand Test	IEC 60255-21-2 Class 1
27.	Shock Response Test	IEC 60255-21-2 Class 1
28.	Seismic Test	IEC 60255-21-3 Class 1

*Detailed Type Test Reports are available on request

Mechanical Details

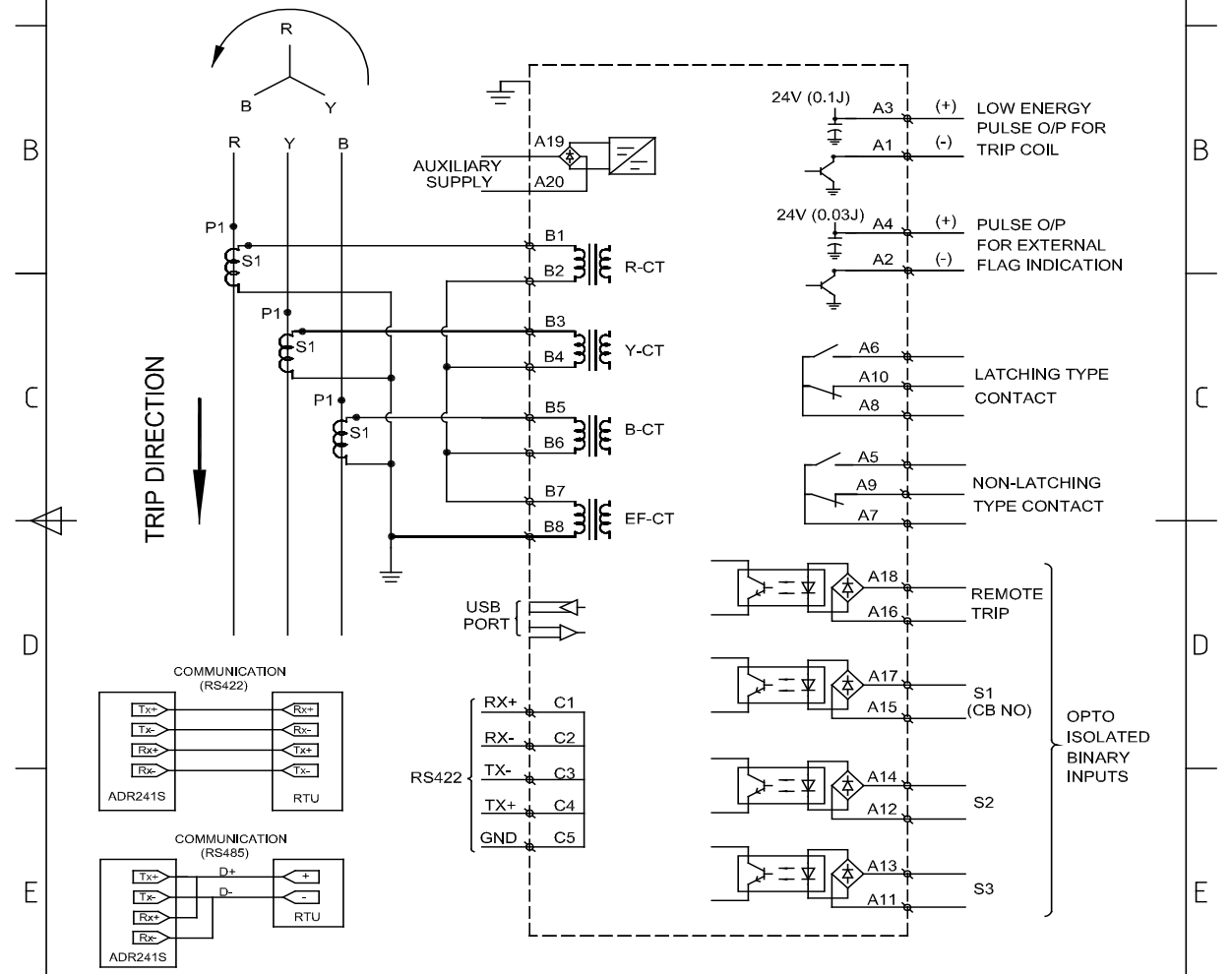


Back Terminal Details



Electrical Connection Diagram

RevNo	Revision note	Date	Signature	Checked
01	Original Revision	08.11.2013	SMK	
02	Modified as per Comments	25.11.2013	SMK	
03	Aux. Supply, Binary Inputs, Trip Coil & Flag Coil modified.	06.02.2014	SMK	
04	Modified for ADR241S__AM-511-06-LP	21.05.2019	SJ	SMK



Note:
For 2 Wire communication i.e. RS485 please short C1 & C4 to use as D+ and short C2 & C3 to use as D–.

Dim : MM	TOL :	FINISH:			MATERIAL:	
Perpaed by JD		Checked by SJ	Approved by – date SMK	Filename APR06625	Date 21.05.2019	Scale NTS
ASHIDA Electronics Pvt. Ltd.		TITLE :- Electrical Connection for SELF POWERED Protection Relay__ADR241S__AM-511-06-LP				
		Drawing __ Ref.APR06625			Edition 04	Sheet 1 OF 1

Model and Options

Model Selection Guide – ADR241S															
MODEL NO:	5	1	1	0	6	0	1	3	5	0	1	0	0	0	2
Sub Type															
Relay For RMU	5	1	1												
Settings: OC- for IDMT: 0.10In to 2.50In and for DT: 0.10In to 35.0In EF- for IDMT: 0.05In to 2.50In, DT: 0.05In to 35.0In and for DT: 0.10In to 35.0In With Cold Load, Thermal Overload, Under Current and Inrush Blocking. Status Input: 4 no's 2 potential free C/O contact: 1 latch type & 1 non latch type															
Cabinet Size															
CSE(240 x 120 mm)				0	6										
Cabinet Type															
NON Draw-out						0	1								
Auxiliary Supply															
100V - 230 VAC/DC								3	5						
24V - 50 VDC								3	6						
CT															
1Amp										0	1				
5AMP										0	2				
PT															
Not Applicable												0	0		
Communication Protocol															
Not Applicable														0	0
IEC 103 & MODBUS														0	2

NOTE: The IEC-103 and MODBUS protocols are software auto selectable i.e. relay will communicate as per the external communication software (IEC-103 or MODBUS) commands.

Auxiliary Supply is must for communication when using RS485 REAR Port

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