MOTOR PROTECTION RELAY : ADR244B

Introduction:

ASHIDA has designed economical & reliable Multifunction ADR244B Protection & Control System. The simple and compact construction of ADITYA series ADR244B relay provides integrated Protection, Control and Monitoring functions integrated Protection, Control and Monitoring functions for Electric Motors.

Functional Overview:

Key Protection & Control Functions:

- Four Independent Settings Groups.
- Non Directional Phase & Ground Over Current Function (50/51/51N/51).
- Four Independent Stages for Directional/ Non Directional Phase Over Current Protection.
- Three Stages of Directional/ Non Directional Ground Over Current Protection.
- Internally Derived (3I0>)/ Externally Measured Ground Over Current Protection.
- Inverse time Over Current Protection (IEC curves according to IEC60255).
- High Impedance Restricted Earth Fault Protection (64R).
- Inverse & Definite Time Negative Phase Sequence Over Current Protection (46).
- Broken Conductor Protection (46BC)
- Negative Phase Sequence Over Voltage Protection (47).
- Under and Over Voltage Protections (27 /59).
- Externally Measured/ Internally Calculated Residual Over Voltage Protection (59N).

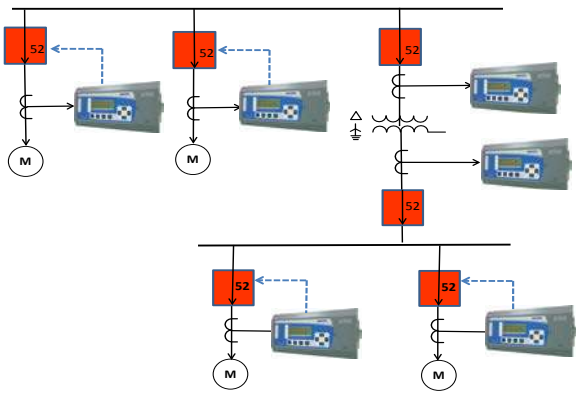
- Locked rotor/ Motor stall Protection (50LR)
- Prolong start Protection (66)
- Too many starts / Number starts function
- Phase reversal Protection (47)
- Under current Protection (37)
- Under/Over Power Protection (32P)
- Reverse Power Protection (32R)
- Power factor Protection (55)
- Under and Over Frequency Protection (81U/O)
- SOTF (Optional)
- Breaker Failure detection (50BF)
- VT and CT supervision function
- Trip circuit supervision function
- Programmable Inputs & Outputs
- CB Close / Trip from HMI
- Programmable & Target LEDs for indication with dual colours
- Self Supervision of relay
- Metering function
- Disturbance Recording (10 nos.)
- Event Recording
- Fault Recording on HMI display (10nos.)
- Non-Volatile memory.
- Fully communicable with IEC standard open protocol IEC60870-5-103, MODBUS & IEC 61850.
- SCADA communication.
- Single / Dual Ethernet ports (RJ45)
- RS485 port
- PC front port communication for convenient relay settings
- User friendly local operation with key pad
- Large Liquid crystal display (20X4) with backlight
- Password Protection

Software Support:

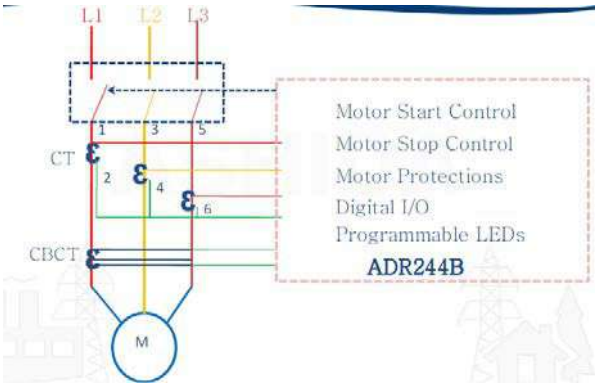
- Online/ Offline Setting Editor.
- Programmable scheme logic Editor.
- Settings upload / download.
- Offline Settings Editor.
- Online Measurement.
- Disturbance analysis.
- Relay assistant for testing relay at site

Applications:

ADR244B numerical multifunction relay designed for electric motor protection applications. Relay designed with fast and selective tripping ensures the stability and availability of electrical power system. ADR244B relay apply for protection of motor feeder to achieve sensitivity and selectivity on phase & ground faults as well as on abnormal conditions.



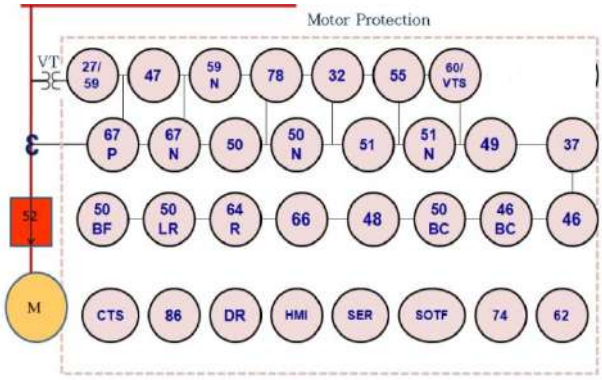
Motor Protection Application



Motor Protection Application

ANSI Code	Description
27/59	Under/Over Voltage Protection
32	Directional Power Protection
37	Under current Protection
46	Negative Phase Sequence Protection
46BC	Broken Conductor Protection
47	Negative Phase Sequence Over Voltage Protection
48	Motor Prolong Start Protection
49	Thermal Overload Protection
50	Instantaneous/Definite Time Phase Over current Protection
50N	Instantaneous/Definite Time Ground Over current Protection
50BC	Broken Conductor Protection
50BF	Breaker Failure Detection
50LR	Locked rotor Protection
51	Inverse Time Phase Over current Protection
51N	Inverse Time Ground Over current Protection
55	Power factor Protection
59N	Residual Over Voltage Protection
62	Time Delay Stopping or Opening Relay
64R	High Impedance Restricted Earth Fault Protection
60/VTS	VT Supervision Detection
CTS	CT Supervision Detection
66	Number of starts
74	Trip Circuit Supervision
81O/U	Frequency Protection
86	Lockout (Trip command)
SOTF	Switch On To Fault

The functional overview of ADR244B:

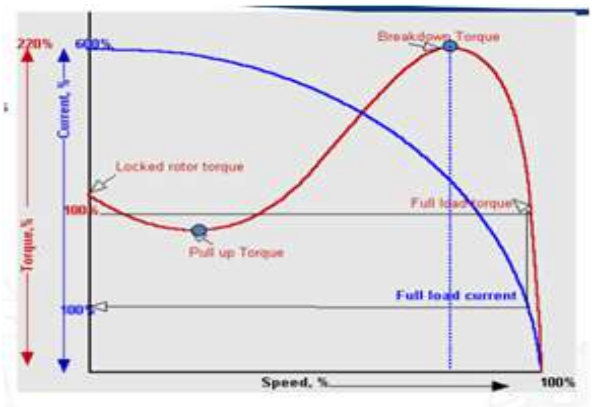


Protection functions Overview of ADR244B

The core functionality of ADR244B relay is equipped with Motor protection & Control functions.

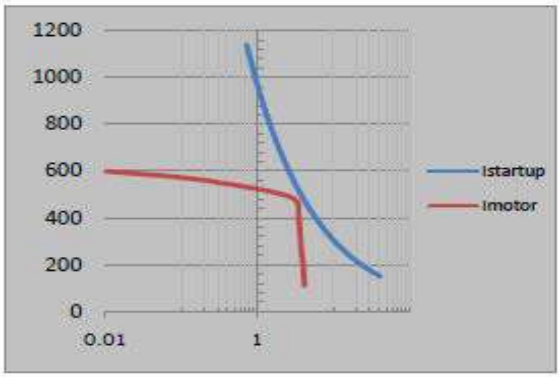
Motor Prolong start Protection (48):

For an induction motor to stall during normal operation (during motor starting conditions), load torque may exceeds very high and above the breakdown torque, may cause damages of stator winding and rotor bars. Stator draws heavy current due to the heavy current flows in rotor bars.



The ADR244B relay detects motor prolong start conditions effectively and provides protections to motor.

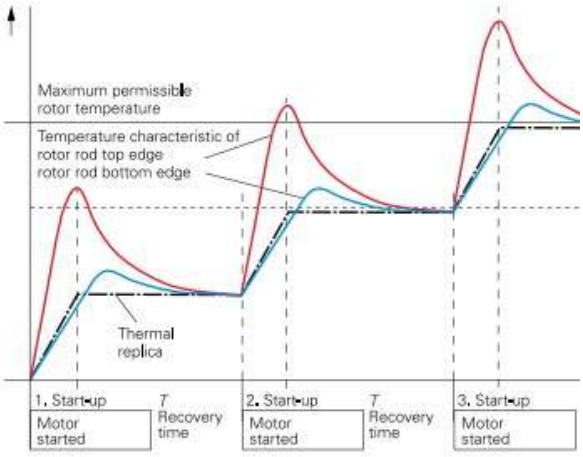
Delay = (Istartup / I)^2 * Tstartup



Number of Starts (66):

Induction motor can be start frequently/periodically based on their rotor bar thermal capacity design. ADR244B provides number of start protection for motor against too many / frequent starts (cold or hot starts per hour) per hour. The rotor temperature rise drastically high if the motor starts frequently (beyond duty cycle mentioned in motor datasheet). The rotor temperature can be calculated from stator current. The number of starts only permits, if the rotor can have sufficient thermal reserves for complete start up. The cooling time between starts allowed to restart motor, when the calculated rotor temperature falls down to safe level.

ADR244B allows user to program number of cold / hot starts per hour as per the information available from motor datasheet. Users can set the number of starts protection (number of starts and time between starts) according to motor start data available from motor datasheet.



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

The core functionality of ADR244B relay is equipped with multi function Motor protection. The relay provides Directional/ Non Directional phase and ground over current protection with multiple settings (four stages for phase over current and three stages for 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 with directional/non directional over current protection will be providing greater selectivity, flexibility and sensitivity to users for better relay co-ordinations.

ADR244B relay provides inverse time over current characteristic for phase and ground over current elements. Each stages of phase and ground over current elements are independently settable with inverse

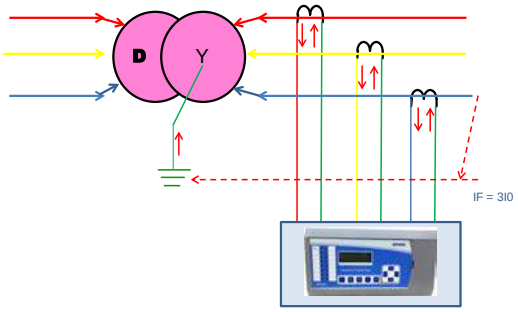
time or definite time characteristic. The following tripping characteristics are available;

- All IEC Curves
- All IEEE Curve
- Definite time Over current
- User Define over current

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

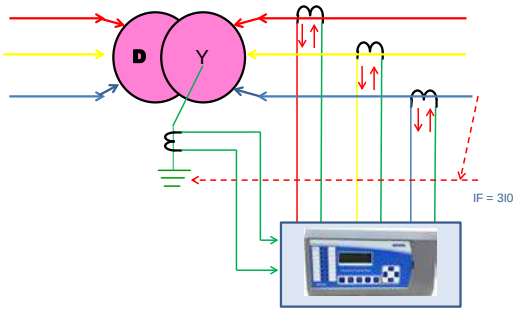
Curve Description	K	α	L
Definite Time	-	-	-
IEC S Inverse	0.14	0.02	0
S Inverse 1.3s	0.06	0.02	0
IEC V Inverse	13.5	1	0
IEC E inverse	80	2	0
IEC LT Inverse	120	1	0
Define Time	-	-	-
IEEE M Inverse	0.0515	0.02	0.114
IEEE V Inverse	19.61	2	0.491
IEEE Inverse	28.2	2	0.1217
US Inverse	5.95	2	0.18
US ST Inverse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

ADR244B relay provides three stages of definite time/inverse time internally derived zero sequence over current (3I0>) protection to detects asymmetrical faults in electrical network. It can apply to over head transmission line, underground cable, and feeder. The ground current (3I0>) calculated from three line currents.

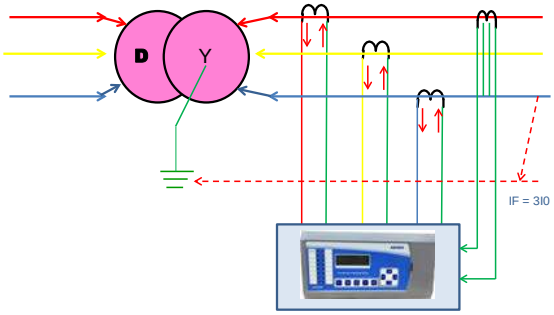


Derived Zero sequence over current from three phases

ADR244B relay provides three stages of externally ground over current protection. ADR244B relay measures ground fault current through neutral CT input. Externally ground CT input can also apply for high impedance restricted earth fault protection or sensitive ground fault protection through CBCT.



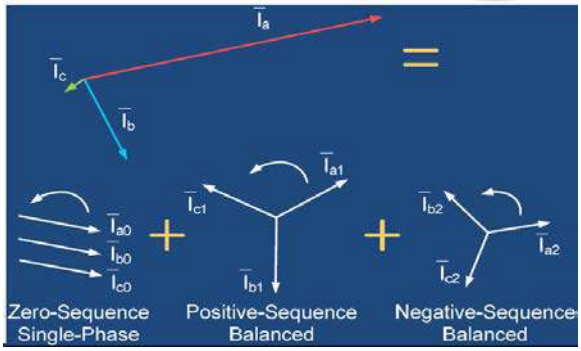
Externally measured ground over current through neutral CT



Externally measured ground over current through CBCT

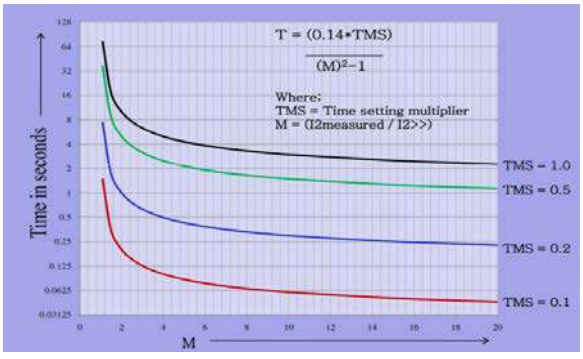
Negative Phase Sequence Protection (46):

ADR244B provides sequence over current against unbalance faults/condition or high impedance faults over transmission line/under ground cable or over load condition. Sequence over current function provided in two modes; Positive sequence and Negative sequence over current function. User can select the mode based on their application and requirement.



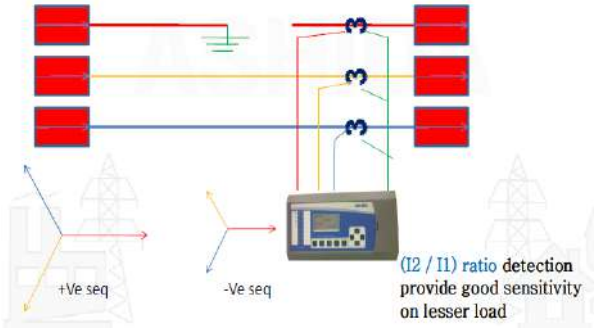
The negative phase sequence over current element can be programmed as IDMT or definite time characteristic. ADR244B relay provides five selectable IEC inverse curves for each stage.

Protection can also apply in condition when there is a very high resistive ground fault and ground element may not sense the fault current.



Broken Conductor Protection (46BC):

ADR244B equipped with broken conductor detection protection. Broken conductor condition can be detected by ratio of Negative sequence current to Positive sequence current (I2/I1). Protection provides higher sensitivity on High resistive fault.



Broken Conductor Protection (50BC):

ADR244B provide independent I0/I1 function for sensitive ground fault detection. Relay measure the ratio of zero to positive sequence current precisely.

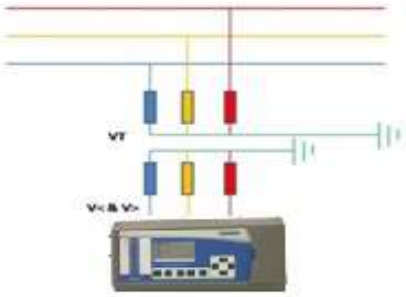
Thermal Overload Protection (49):

The thermal withstand capability of the power system equipment is affected by overheating prior to a fault. The temperature should not exceed the thermal withstands capability of power system equipment. The RMS currents are measured and analyzed to monitor the thermal state

Under & Over Voltage Protections (27/59):

ADR244B relay provides independent phase over and under voltage protections with

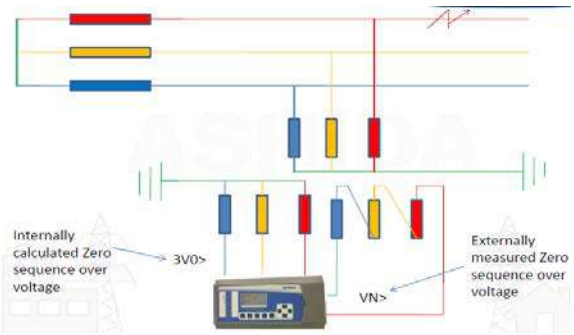
definite time delay range. Relay also provides the positive sequence over voltage protection with definite time characteristic option. Protection functions can be programmed for alarm signal or trip signal through programmable logic.



Under & Over voltage detection through 3-phase VT connection

Residual Over Voltage Protections (59N):

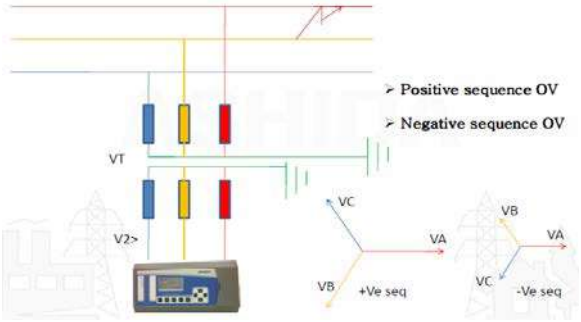
ADR244B relay provides zero sequence / residual over voltage protection with definite time delay range. Protection can be achieved by externally measured residual voltage through open delta VT or the zero sequence voltage internally calculated from three phases.



Zero sequence Over voltage / Externally measured residual Over Voltage detection through 3-phase VT & Open delta VT connections

Negative Phase Sequence Over Voltage Protections (47):

ADR244B relay provides positive/negative sequence over voltage protections with definite time delay range. It provides protection against high resistive faults and unbalance loading condition.



Positive / Negative Phase Sequence Over voltage detection through 3-phase VT connection

Directional Power Protection (32):

The directional power protection designed for protection against reverse power mode and over / under load protection in forward power mode. It can also be settable as a active / reactive power mode. ADR244B provides four elements for power protection with independent definite time delay characteristic.

Frequency Protection (81O/U):

Frequency protection function provides either under or over frequency protection of line/feeder/machine. ADR244B relay provides six independent stages with definite time delay characteristic. Stages can be settable in a under or over frequency mode. Protection function can also be use for load shedding scheme.

Time-delay stopping or opening Relay (62):

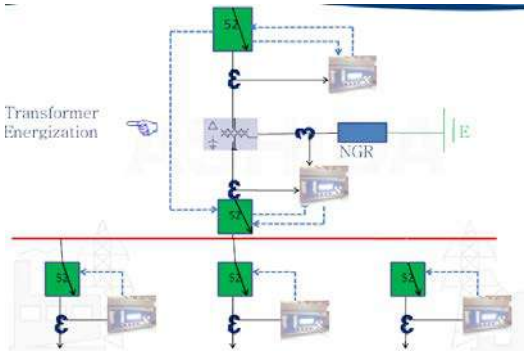
Time delay function in ADR244B can be derived from software RTV2. Number of timers, gates and flip-flops are available in each module which can be assigned to any of the contact output to achieve the desired delay for stopping or opening operation.

Breaker Failure detection (50BF):

If the fault current is not interrupted after a time delay expired, circuit breaker failures detected, and execute trip command to upstream circuit breaker. ADR244B relay incorporates circuit breaker failure protection to detect failure of tripping command execution due to mechanical or electrical problems in circuit breaker.

SOTF:

The ADR244B provides SOTF function to protection feeder against switch on to fault condition during motor energisation.



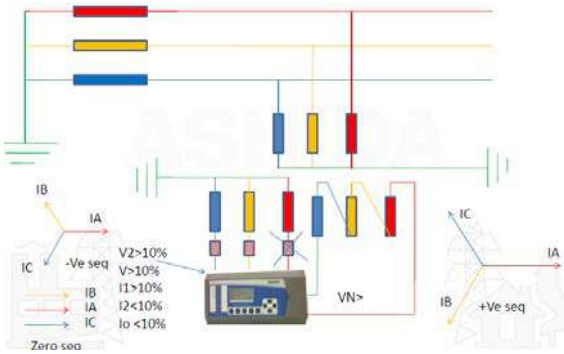
Trip circuit supervision (74):

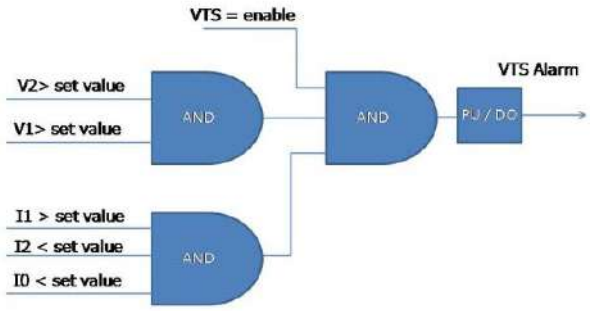
Any two binary inputs for circuit breaker poles can be used for monitoring the circuit breaker trip coils including connecting cables. Relay initiate alarm whenever the circuit breaker control/DC circuitry gets interrupted.

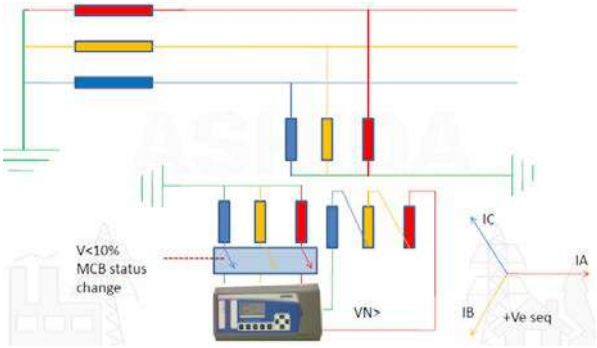
Relay monitor Trip coil healthiness through CB NO during close condition and through CB NC during Trip condition. If any discontinuity observed it generate Alarm signal.

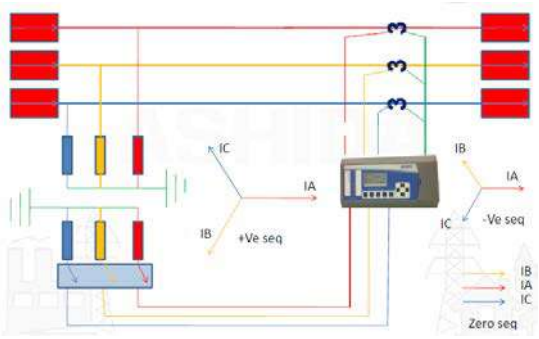
VT supervision Function (60/VTS):

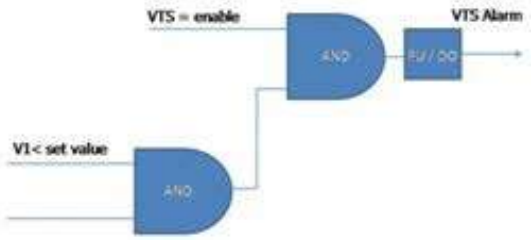
ADR244B relay provides VT supervision function to detecting a loss of phase voltage input such as that caused by failure of fuses (figure) or molded case/miniature circuit breaker (MCB). Relay declares the VT supervision when the below logic shall be stratified.











CT supervision function (CTS):

ADR244B relay provides CT supervision function to detecting a loss of phase current due to the failure of ct secondary wiring.

If the power system currents are healthy, negligible negative & zero sequence voltage could be derived. If, however, one or more of the AC current inputs are missing, a negative & zero sequence currents would be derived, even if the actual power system phase currents are healthy. CTS works by using these criteria; that is by detecting a ratio of derived negative to positive sequence currents & ratio of derived zero sequence to positive sequence currents in the absence of a corresponding derived negative & zero sequence voltage from VT.

Programmable Inputs, Outputs & Logic:

The ADR244B provides up to 16/ 11 nos. of digital output and 10 nos. of digital inputs. (ref. ordering option)

Back side terminal details: Plug-In

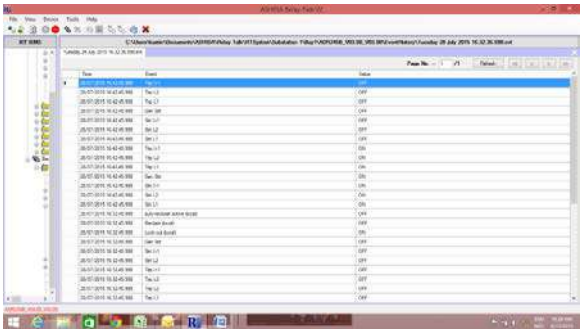
Programmable LEDs and Pushbuttons:

The ADR244B relay provides total 16 nos. of target and programmable LEDs with dual colors indication. The LEDs can be programmed either through HMI or through PC software (RTV2 software).

The ADR244B also provides the programmable pushbuttons for circuit breaker close and open from HMI of relay. Pushbuttons can be programmed through HMI or through RTV2 software.

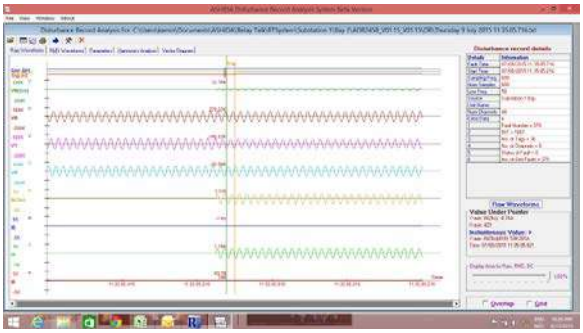
Event recording:

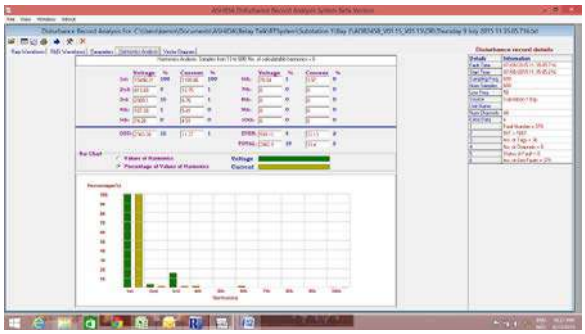
ADR244B relay is providing feature to record and store 512 nos. Of events in non-volatile memory through internally by protection and control functions and externally by triggering of digital inputs, and can be extracted using communication port or viewed on front of LCD display. The event shall be trigger on time stamp through time synchronization or internal clock setting.



Disturbance recording:

ADR244B 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:

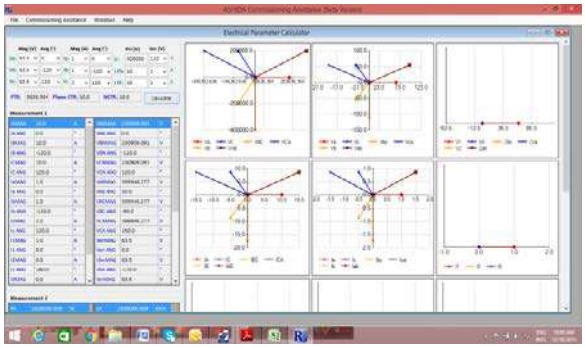
ADR244B relay is providing fault record facility. The fault records can be display either on HMI display or in RTV2 software. The relay can records 10 nos. of fault records in non-volatile memory.

Metering:

Online metering feature of ADR244B relay is providing metering of parameters (i.e. voltage/current magnitude, power, power factor measurement etc.) on HMI display or in RTV2 software.

Relay Assistant:

RTV2 software provides relay assistant tool for testing and commissioning of relay at site/field area.

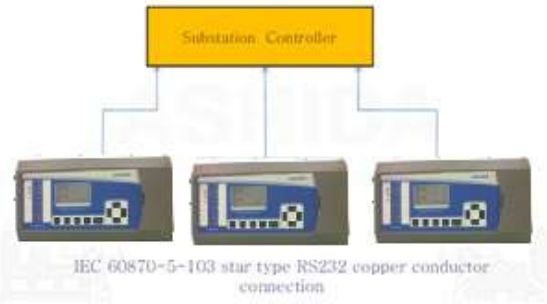


Independent Protection settings groups:

ADR244B relay provides multiple independent settings groups to allow operate relay on different power system operating conditions. The Enhance versions provides four independent settings groups.

IEC 60870-5-103 Protocol:

ADR244B 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.

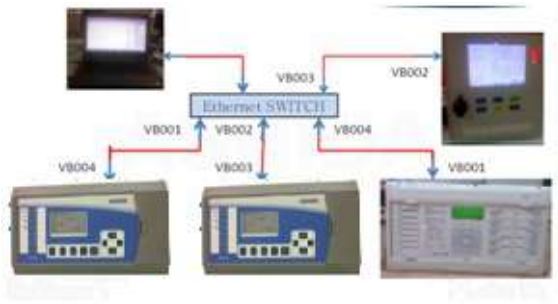


Ethernet base Protocol (IEC 61850 / MODBUS TCP):

ADR244B relay provides internationally standardized protocol such as IEC61850 / MODBUS TCP for substation automation via Ethernet port of protection relays (Ref ordering information for details)

IEC61850 GOOSE and Interoperability:

ADR244B 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. ADR244B support total 16 simultaneous GOOSE signals which can publish and received by other relays having IEC61850 protocol. Similarly ADR244B can able subscribed total 16 nos. of simultaneous signal published by other relays and can be use for interlocks. The ADR244B is tested for most of other make relays.



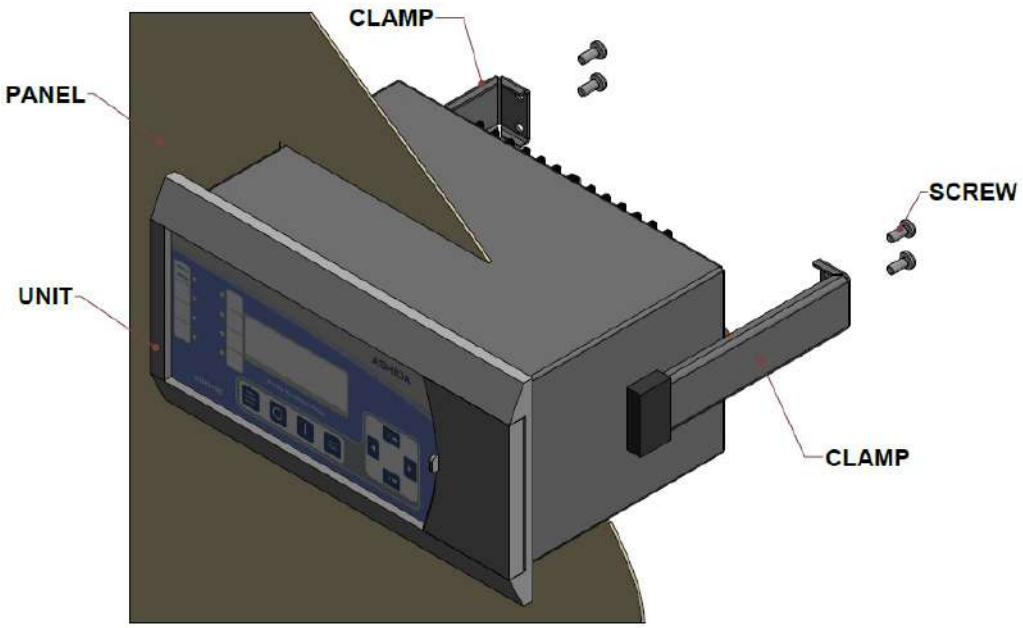
Typical Tests Information:

The Relay Confirm to following standard		
Electromagnetic Compatibility Type Test:		
Sr. No.	**Test**	**Standard**
1.	High Frequency Disturbance Test	IEC60255-26 (ed-3):2013, IEC60255-22-1
2.	Electrostatic Discharge Test	IEC60255-26 (ed-3):2013, IEC60255-22-2
3.	Fast Transient Disturbance Test	IEC60255-26 (ed-3):2013, IEC60255-22-4
4.	Surge Immunity Test	IEC60255-26 (ed-3):2013, IEC60255-22-5
5.	Power Frequency Magnetic Field Immunity Test	IEC60255-26 (ed-3):2013, IEC61000-4-8
6.	Radiated Electromagnetic Field Disturbance Test	IEC60255-26 (ed-3):2013, IEC60255-22-3
7.	Conducted Disturbance Induced By Radio Frequency Field	IEC60255-26 (ed-3):2013, IEC61000-4-6
8.	Power Supply Immunity Test	IEC60255-26 (ed-3):2013, IEC60255-11 & IEC61000-4-11
9.	Conducted & Radiated frequency Emission Test	IEC60255-26 (ed-3):2013, IEC60255-25
Insulation Tests:		
10.	High Voltage Test	IEC60255-27
11.	Impulse Voltage Test	IEC60255-27
12.	Insulation Resistance	IEC60255-27
Environmental tests:		
13.	Cold test	IEC-60068-2-1
14.	Dry heat test	IEC-60068-2-2
15.	Damp heat steady state test	IEC-60068-2-78
16.	Change of Temperature	IEC-60068-2-14
17.	Damp heat cyclic test	IEC-60068-2-30
18.	Enclosure Protection Test (IP54)	IEC 60529
CE compliance		
19.	Immunity	IEC-60255-26
20.	Emissive Test	IEC- 60255-26
21.	Low voltage directive	EN-50178
Mechanical tests		
22.	Vibration Endurance Test	IEC 60255-21-1
23.	Vibration Response Test	IEC 60255-21-1
24.	Bump Test	IEC 60255-21-2
25.	Shock Withstand Test	IEC 60255-21-2
26.	Shock Response Test	IEC 60255-21-2
27.	Seismic Test	IEC 60255-21-3

Drawings Information:

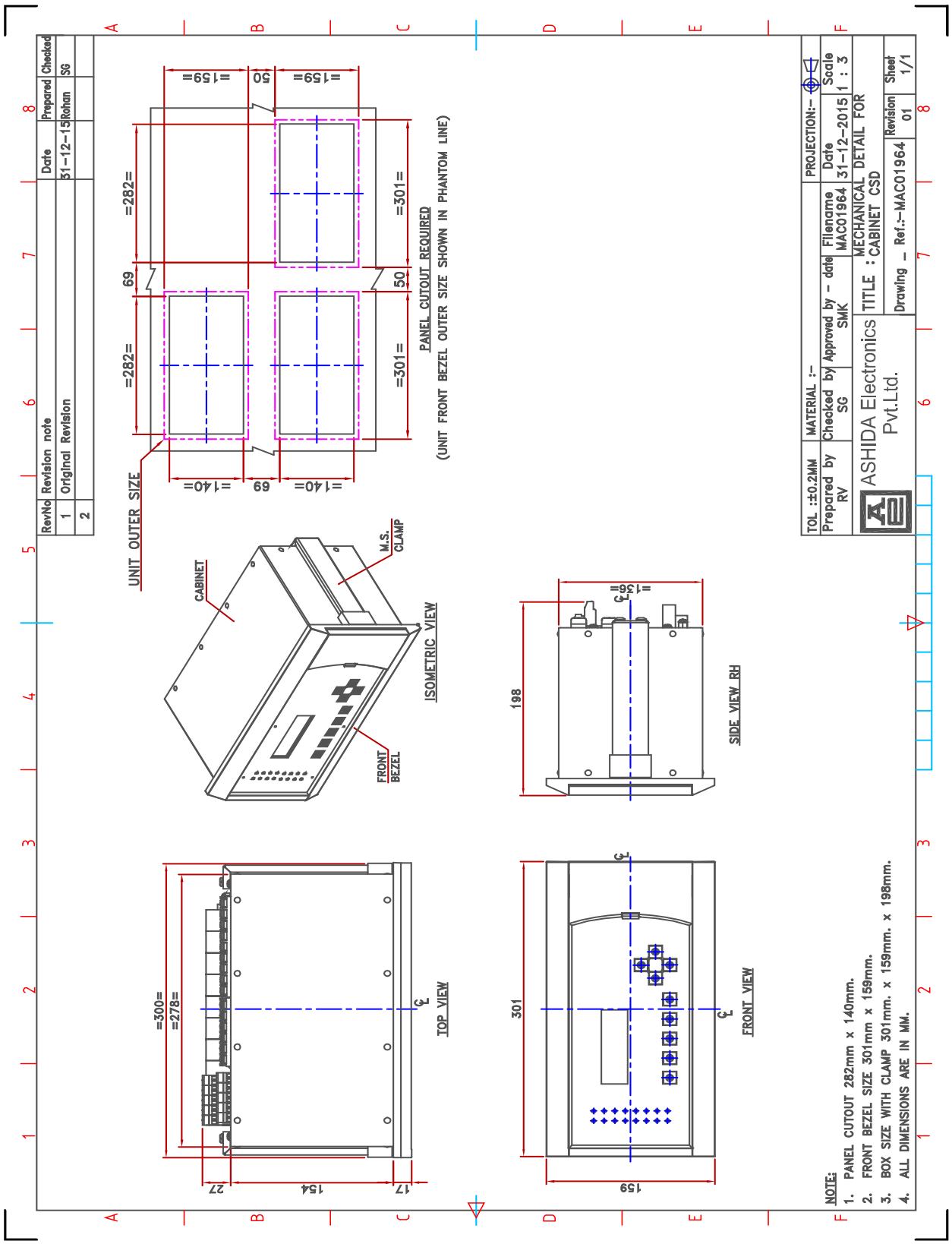
I.	Drawing References	: For Cabinet Type	- MAC01964
		: For Back Connections (16DO & 10DI)	- ADV10302
		: For Typical External Connections (16DO & 10DI)	- ADV06404
		: For Back Connections (11DO & 10DI)	- ADV10502
		: For Typical External Connections (11DO & 10DI)	- ADV09604

Mounting Information:

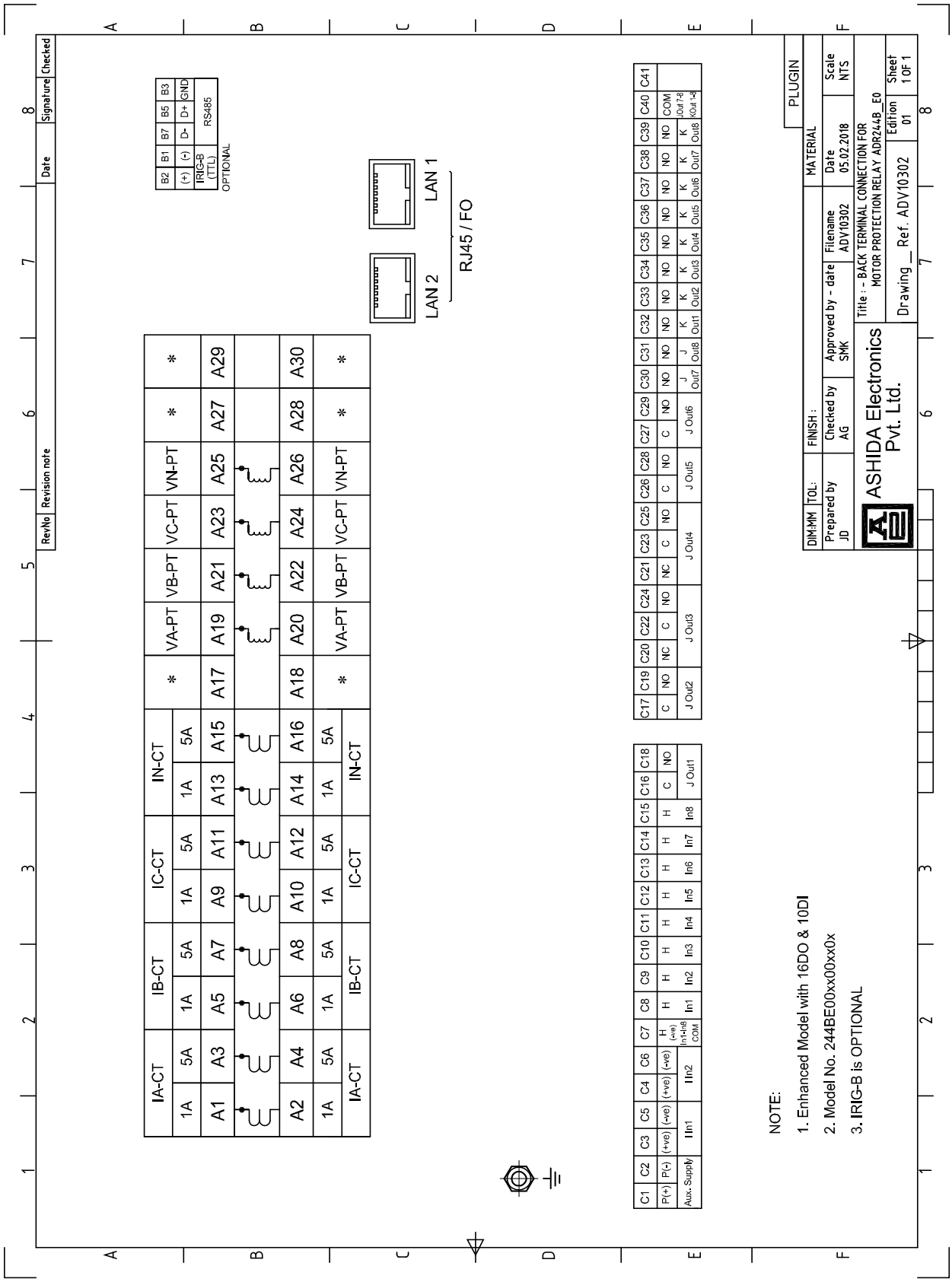


ADR244B – Flush mounting arrangement

Mechanical Details :

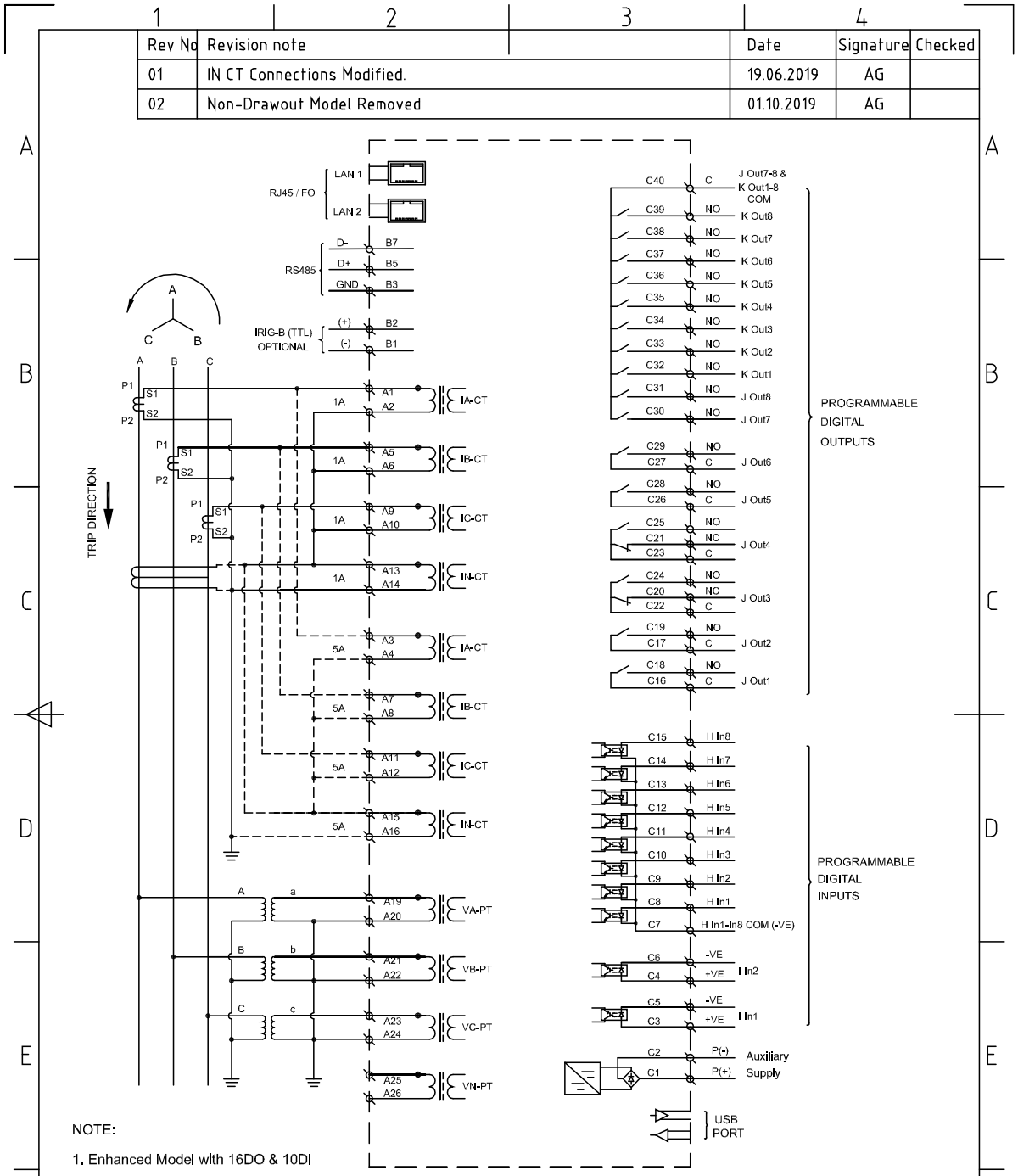


Back Terminal Details (16DO & 10DI):



Electrical Connection Details (16DO & 10DI):

Rev No	Revision note	Date	Signature	Checked
01	IN CT Connections Modified.	19.06.2019	AG	
02	Non-Drawout Model Removed	01.10.2019	AG	



NOTE:

1. Enhanced Model with 16DO & 10DI
2. Model No. 244BE00xx00xx0x
3. IRIG-B is OPTIONAL

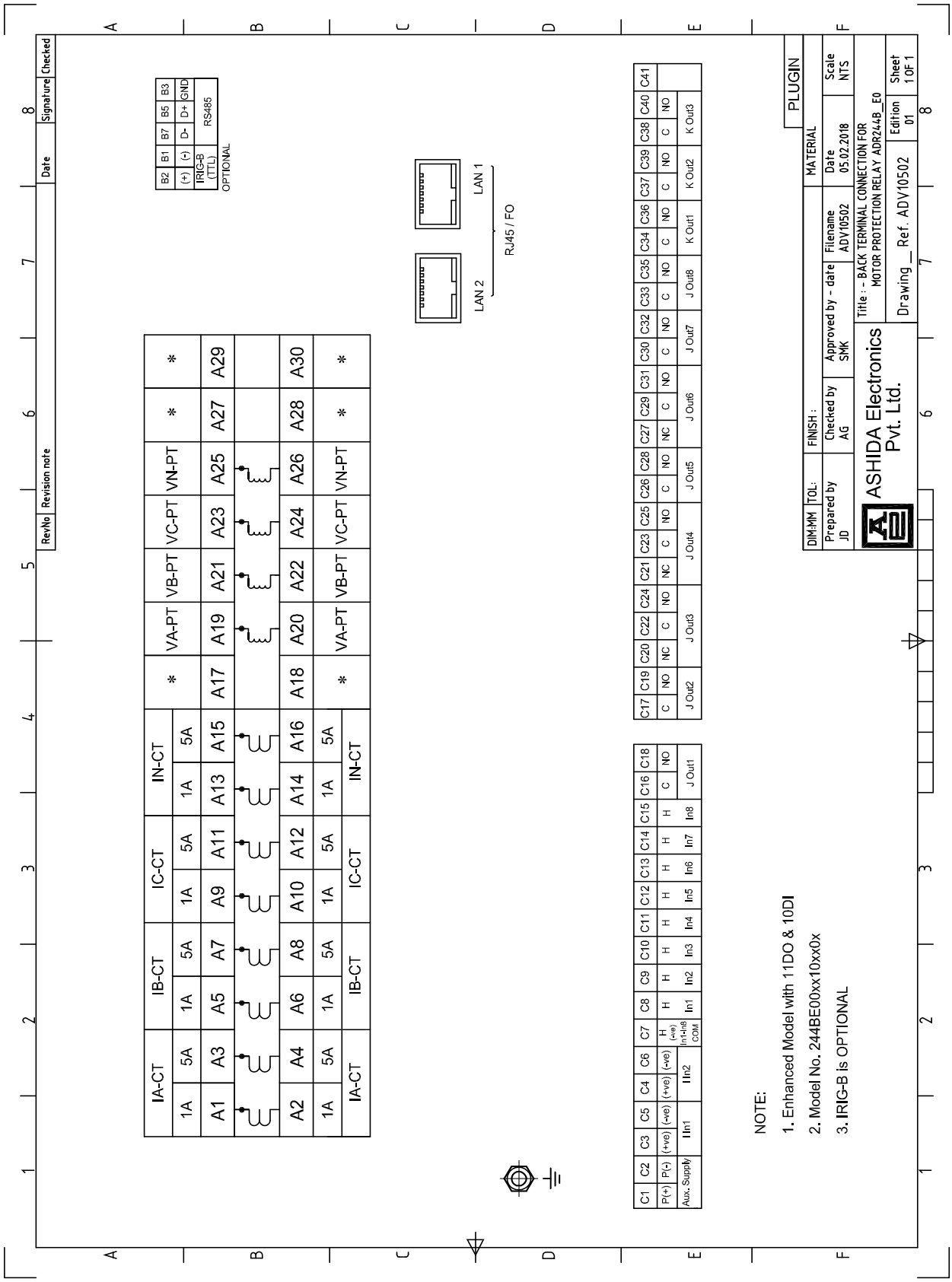
Perpaed by	Checked by	Approved by - date	Filename	Date	Plugin / Scale
JD	AG	SMK	ADV06404	01.10.2019	NTS

ASHIDA Electronics Pvt. Ltd.

Title : - ELECTRICAL CONNECTION DIAGRAM FOR MOTOR PROTECTION RELAY ADR244B_E0

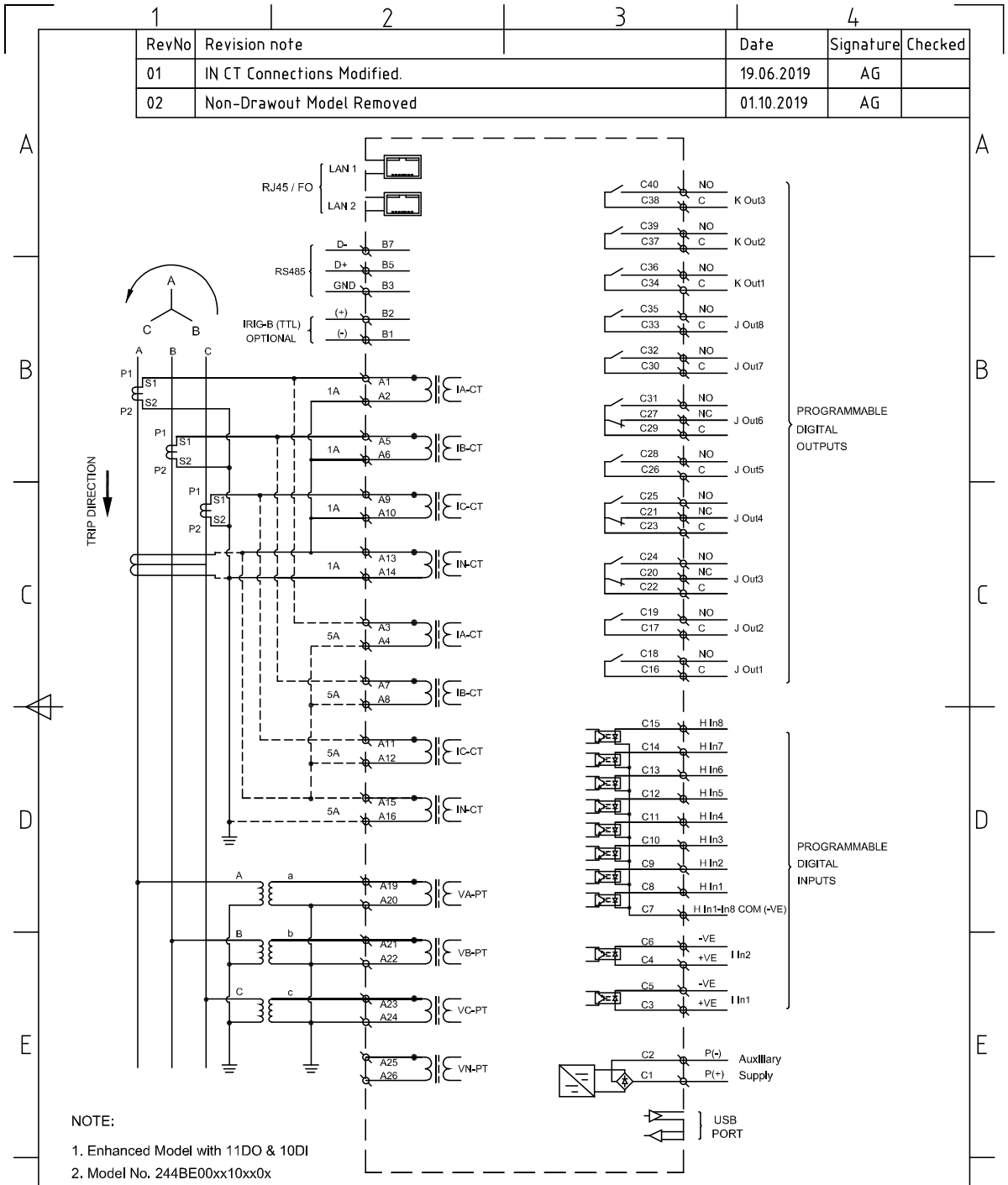
Drawing_ Ref. ADV06404 | Edition 02 | Sheet 1 OF 1

Back Terminal Details (11DO & 10DI):



Electrical Connection Details (11DO & 10DI):

RevNo	Revision note	Date	Signature	Checked
01	IN CT Connections Modified.	19.06.2019	AG	
02	Non-Drawout Model Removed	01.10.2019	AG	



NOTE:

1. Enhanced Model with 11DO & 10DI
2. Model No. 244BE00xx10xx0x
3. IRIG-B is OPTIONAL

Perpaed by	Checked by	Approved by - date	Filename	Date	Plugin / Scale
JD	AG	SMK	ADV09604	01.10.2019	NTS

ASHIDA Electronics Pvt. Ltd.

Title : - ELECTRICAL CONNECTION DIAGRAM FOR MOTOR PROTECTION RELAY ADR244B_E0

Drawing_ Ref. ADV09604 | Edition 02 | Sheet 1 OF 1

General Specifications:

AC Current Inputs:

1A Nominal

5A Nominal

Continuous Thermal Rating:

250 X In for 1s

20 X In for 3s

4 X In for Continuous duty

Dynamic Thermal rating

1250 for 10ms dynamic timing

Burden Rating:

< 0.2VA for 1A Nominal

< 0.2VA for 5A Nominal

AC Voltage Inputs:

2 X Vn for Continuous duty

2.6 X Vn for 10s

Over Voltage Category III

Pollution Degree 2

Rated Insulation Voltage: 2.5kV

Burden: <0.2VA

System Frequency:

50Hz / 60Hz

Frequency Tracking: 45 – 55Hz for 50Hz and 55 – 65 for 60Hz

Power Supply:

Range: 24 to 230Vac/dc

Burden: < 15watts for DC

Digital Outputs:

Continuous carry: 5A

Make: 30A for 3s & 50A for 1s

Breaking capacity: 1250VA @ 250Vac,

100 watts @ 250Vdc resistive,

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

Digital Inputs:

Operating range:	Threshold Voltage
24 – 230V AC/DC	18V
48 – 230V AC/DC	35V
110 – 230V AC/DC	77V
220VDC / 230VAC	154V

Communication Ports:

Front Port –USB

Rear Ports – RJ45 (10-100/Base T Copper) & RS485

IRIG Port – Demodulated (Optional)

Fiber Optic Port (Optional)

Operating Temperature:

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

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

Humidity: 95% RH

Weight: <3.5kg Approx.

Ordering Information:

Ordering Information (Enhanced Version)												
	1-4	5	6	7	8	9	10	11	12	13	14	15
Model	**244B**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
Example	244B	E	0	0	2	0	1	0	2	2	2	H
MOTOR PROTECTION												
Sub Type												
Enhanced Version		E										
Variant												
Standard			0									
With Sensitive EF			1									
Language												
English				0								
Protocol												
IEC 103					0							
IEC 61850					2							
MODBUS TCP					4							
CT / PT & RTD												
Default: 4CT, CT Selection: 1A/5A, 4PT: 63.5V						0						
Digital Outputs												
16DO							0					
11DO							1					
Digital Inputs												
10DI								0				
DI Setting Threshold												
18VDC									0			
35VDC									1			
77VDC									2			
154VDC									3			
Auxiliary Supply												
24 – 230 VDC / VAC										2		
Cabinet Details												
Plug In											2	
Communication Ports												
Disable / No Rear Port												0
RS-485 Rear Port												B
10/100 Base-T Ethernet RJ45 Rear Port												C
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
RS-485 Rear Port + IRIGB Port												I

10/100 Base-T Ethernet RJ45 Rear Port + IRIGB Port	J
10/100 Base-T Ethernet RJ45 Rear Port & RS-485 Rear Port + IRIGB Port	K
DUAL 10/100 Base-T Ethernet RJ45 Rear Port + IRIGB Port	L
DUAL 10/100 Base-T Ethernet RJ45 Rear Port & RS-485 Rear Port + IRIGB Port	M
DUAL FO Ethernet Rear Port & RS-485 Rear Port	N
Single FO Ethernet Rear Port & RS-485 Rear Port	O
DUAL FO Ethernet Rear Port & RS-485 Rear Port + IRIGB Port	P
Single FO Ethernet Rear Port & RS-485 Rear Port + IRIGB Port	Q

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