ASHIDA Numerical Single Pole OC/EF Protection Relay

Type: ADR111C
ADR211C
(ADITYA Series)
(Preliminary)

Protection Features:

- ✓ ***Suitable for Single Pole Phase Over Current Relay with IDMT/DMT.***
- ✓ ***Suitable for Single Pole Earth Fault Relay with IDMT/DMT.***
- ✓ ***Restricted Earth Fault Relay (REF) relay***
- ✓ Selection of Curve: Five selectable curve (Normal Inverse 1 (C1), Normal Inverse 2, (C2) Very Inverse (C3), Extremely Inverse (C4), Long Time Inverse (C5)) and Define Time (C6).
- ✓ Instantaneous Over-Current Protection with adjustable timer.
- ✓ Breaker Failure detection.
- ✓ In-built CB Trip Circuit Supervision function during pre closing and post closing of CB.
- ✓ On site CT Secondary selection 1A or 5A.
- ✓ **Wide range Power supply input 24V to 230V AC/DC(±20%)**
- ✓ ***RS422/RS485 (at rear) Communication Port for remote SCADA (only for ADR211C i.e. communicable Relay).***

Relay Design Features:

- ✓ 16 x 2 LCD Backlit display for Parameter and setting display.
- ✓ Online display of CB status and other digital and logical status.
- ✓ Continuous monitoring of module's internal hardware and alarm generation in case of failure of any critical components.
- ✓ 4 Digital Output contacts for local alarm as Trip.
- ✓ 2 dedicated status input for Trip Circuit Monitoring.
- ✓ 5 nos of Fault data stored with keypad interface and time stamping.

Description:

ADR111C is second generation Numerical Single Pole Over Current Relay. It consist all the

necessary protection and monitoring functions required for normal Feeder. It consist of

1. High Speed Digital DSP Controller.
2. Analogue Measuring Module.
3. Power supply Module.
4. Digital Input / output module.

The High speed Digital Signal Controller continuously monitors current along with different optical isolated status connections. The high-speed micro-controller samples these current signals through an **A/D converter**. The Digital Signal performs powerful **Numerical Algorithms** to find out RMS of fundamental & harmonic contents of the current then this value is used for protection and metering function. ***All measurement is tuned to fundamental frequency i.e. 50Hz, thus relay remains stable during distorted waveform generated by electronics loco-motive***. All these measured values are then used for different protection function such as IDMT/DMT Over Current Protection, Instantaneous Over Current Protection, Earth Fault Protection, etc. These measured values are also displayed on large 16 x 2 LCD display for metering purpose. The **DSC** also monitors different digital inputs through optical isolator and performs some monitoring function such Trip Circuit Supervision, and control potential free contact for control CB and generate ALARM and Tele-signalling.

The power supply module is basically DC – DC converted designed using modern PWM based Switching mode technique to convert station battery supply to the 12V and 24Vdc low voltage supply for relay electronics and control circuit. It also provides necessary isolation from station battery. The power supply module is design using very advance PWM controller which allow very wide input supply variation i.e. 24V to 230V AC/DC (±20%) covering 24Vdc, 30Vdc, and 110Vdc and 220Vdc station battery requirement.

The relay is having total 4 nos of high intensity dual LED for easy identification of type of fault for easy user interface. All LEDs and control output R1 to R4 are fully programmable via keypad interface

Main Functions

The ADR111C are having following protection functions.

1. Non Directional Phase Over Current element. (I>, and I>>) can be used as OC/EF protection
2. Inrush Detection
3. Trip Circuit Supervision.
4. Breaker Failure Detection.
5. Monitoring Functions.

Each of these functions are independently programmable and can be enabled or disabled by user depending upon requirement.

Over Current / EF Element:

The ADR111C is member of Ashida Numerical Relay family designed for protection of general Feeder. The relay has one stage of IDMT/DMT setting and one stage of instantaneous setting. (I>, I>>). All major international IDMT curves are available. Range for first stage is 5% to 200% for I> and 10% to 2000% for instantaneous stage. Although the curves tend towards infinite when the current approaches Is (general threshold), the minimum guaranteed value of the operating current for all the curves

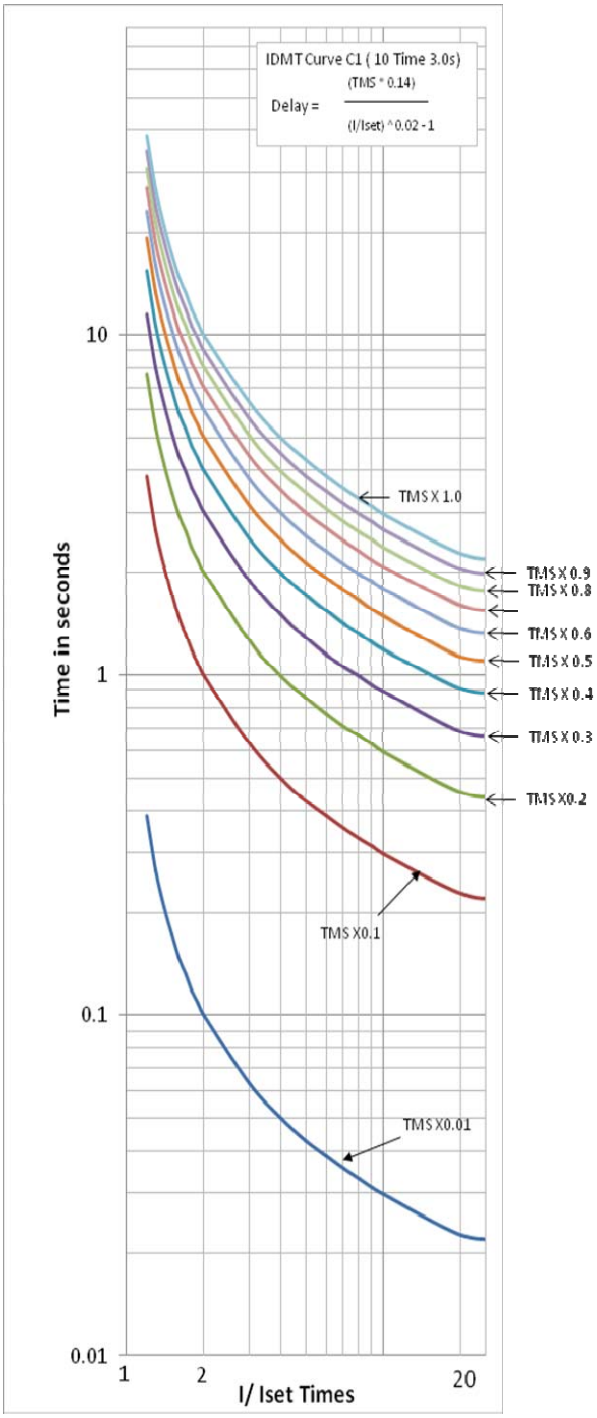
with the inverse time characteristic is 1.1Is (with a tolerance of ± 0.05Is).

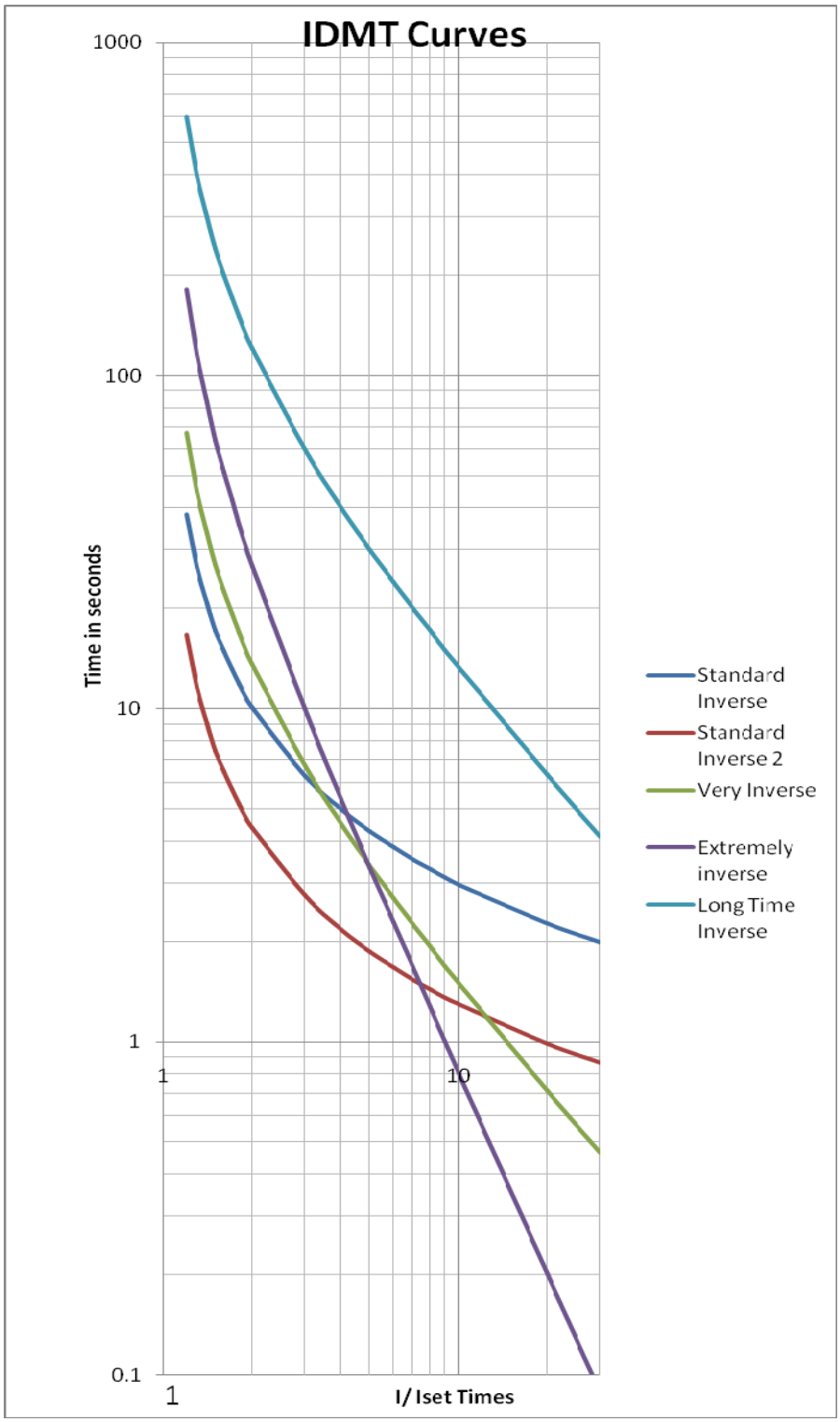
Inverse Time Curves:-

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. The time delay can be reduce by Time Multiplier Setting (TMS) as shown in fig.

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

Curve Type	Description	a	b
C1	Standard Inverse_1	0.14	0.02
C2	Standard Inverse_2	0.06	0.02
C3	Very Inverse	13.5	1
C4	Extremely inverse	80	2
C5	Long Time Inverse	120	1
C6	Define Time	-	-




IDMT Curves
1000
100
10
1
0.1
Time in seconds
1
10
1
I/ Iset Times
Standard Inverse
Standard Inverse 2
Very Inverse
Extremely inverse
Long Time Inverse

Inrush Detection:

During switching of load there is sudden surge of magnetising inrush current. The ordinary protection may sense this current as fault current and give wrong tripping. Normal practice is to increase time or current setting so that it will not operate during switching ON. But this will desensitize the protection. To avoid this ADR111C relay is having special feature to detect this magnetising current by measuring harmonics of current wave form and restrain tripping operation.

Trip Circuit Supervision:-

The ADR111C is having 2 dedicated digital Opto-isolated status inputs which can be used to continuously monitor continuity of trip-circuit. The general scheme is as shown in figure.

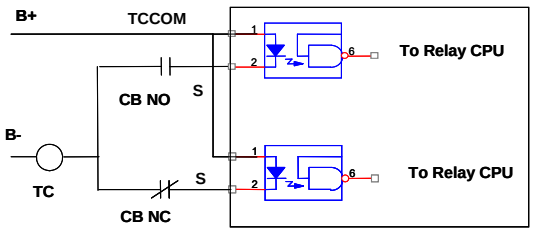


Fig. Trip Circuit Logic

The Relay monitors Trip coil continuity through CB NO during close condition and through CB NC during Trip condition. If any discontinuity is observed it generates Alarm signal.

The output can be assigned to any of 4 relays RL1 to RL4, The Trip circuit supervision logic set Reset PROTH (Protection healthy) bit, it is normally ON and become OFF at following condition

- ✓ When DC supply is not sufficient (DC Fail).
- ✓ When CB NO and CB NC both active and both inactive. CB NO as will as CB NC is close or open.
- ✓ Relay detects any internal hardware Error.

Breaker Failure Detection:-

Normally after tripping, current should become Zero within 100 – 200ms time depending upon type of fault and breaker mechanism. After Fault ADR111C triggers internal timer (settable from 50ms to 800ms) if fault is not cleared during this time then relay declares as Breaker Fail (LBB function) and set BF bit. This bit can be assigned to any of the output relay.

Programmable DI/DO and LED:-

The ADR111C has 4 digital outputs, 2 Opto-isolated input and 4 general purpose LEDs. These can be programmed by local key board. Any logical of physical status can be assigned to any relay contact The logic of digital status input as well as logical status can be formed and assigned to any of the relay output. The RL1 relay is by default assign to tripping CB.

Monitoring Functions (Event Record) :

Apart from the basic protection functions, Relay continuously monitors all substation operations through status, it internal functions, internal hardware etc. if any changed is observed it is marked as event. Such types of events are stored in internal non-volatile memory along with time stamped. Following are some of the events. Relay PKP, Relay Reset, CB Trip, CB close, change of any digital status input, Relay setting changed etc.

Up to 100 such event can be stored and can be downloaded for detailed analysis.

Relay Talk Software:

The general communication software is provided to communicate with relay, known as Relay Talk. By using this software data such as event log, setting, Fault history etc can be down loaded and can be used for further analysis.

While Ordering Specify the following Information for **ADR111C** Relay

Definition of Model No for ADR111C Relay

AM XXX – XX – XX – XX – XX – XX - XX

XX = CT.	
03	1/5 Amp.

XX = PT.	
00	Not Applicable

XX = Communication Protocol	
00	Not Applicable
02	IEC60870-5-103 Protocol

XX = Cabinet Size	
07	CSF (123 x 103 mm)

XX = Cabinet Type	
01	Non Draw out

XX = Auxiliary Supply.	
36	24 – 50 VDC
35	100 – 230 VDC
28	24 – 230 V AC/DC (±20%)

Note: Communication Protocol is applicable only for ADR211C.

XXX = Sub Type	
110	**OC/ EF + HF Relay** **Setting :** 5 – 250% in steps of 1%, **HF:1**0 – 2000 % in steps of 10%, **OC TMS:** X0.01 – X1.5 in steps of X0.01 **Contacts :** 4 NO Programmable **Status :** 2 nos. Dedicated for TCS.

Ordering information:

ADR111C	-	AM	-	XXX	-	XX	-	XX	-	XX	-	XX	-	XX	-	XX

Ordering information:

Available Models:

OC /EF + HF Relay:

- **ADR111C : AM – 110 – 07 – 01 – 28 – 03 – 00 – 00**

  Type: ADR111C

  St. Back terminal layout

  Cabinet Type: CSF -150 H

  Auxiliary Supply: 24-230V AC/DC

  CT sec: 1 Amp. / 5 Amp selectable

- **ADR211C : AM – 110 – 07 – 01 – 28 – 03 – 00 – 02**

  Type: ADR211C with communication

  St. Back terminal layout

  Cabinet Type: CSF -150 H

  Auxiliary Supply: 24-230V AC/DC

  CT sec: 1 Amp. / 5 Amp selectable

Technical Specifications:

General specifications			
Sr. No.	**Specification**	**Particulars**	
I.	Current Input	: Suitable for CT secondary 1A/ 5A site selectable	
II.	Aux. Supply	: 24 – 230VDC. (±20%)	
III.	VA burden on CT	: Less than 0.2VA	
IV.	VA burden on Aux.	: Less than 10 Watts	
V.	Operating Temp. range	: -10 deg. to + 65 deg.	
VI.	Continuous carrying capacity	: 2 x of rated for CT	
VII.	Pick up	: Within 1.1 times of set value.	
VIII.	Reset Value	: 95% to 90% of pick up.	
IX.	Output Contact	: 4 Trip duty user assignable	
X.	Contact Rating	: Continuous: 5A : Make & carry for 0.5 sec : 30A : Make carry for 3 sec : 15A	
XI.	Opto Isolated input	: 1 for CB NO & 1 for CB NC	
XII.	Thermal With stand for CT	: 20 x of rated for 3.0 sec.	
General Settings			
XIII.	***General setting***	: New PassWord	0 – 99 in steps of 1
		: Unit Id	0 – 250 in steps of 1
		: CT Sec	1A or 5A
		: CT Primary	10 – 2000 in steps of 10
		: Test Block	01: YES, 02: NO
		: Trip Ckt.	01: YES, 02: NO
		: BF Enable	01: YES, 02: NO
		: BF Delay	50-800 ms in steps of 50ms
		: Inrush Det	01: YES, 02: NO
Relay Settings			
XIV.	***Setting (I>)***	: I> Settings	5% – 250% in steps of 1%.
		: I> Time Multiplier (TMS)	x0.01 – x1.00 in steps of 0.01
		: I> Curve (Operating Time)	C1 – C6 (IDMT curve C1 – C5 or Define Time C6)
		: I> C6 Delay	0 – 100.00 Sec in steps of 0.02Sec.
		: I>> Settings	00% – 2000% in steps of 10% 00 means block
		: I>> Delay	0 – 2.00 Sec in steps of 0.01Sec.
Operational Indicators (Flags) 4 user assignable bicolour output LED Default assignment			
XV.	LED1 - PROT.H /ON	: Green LED indicates Relay OK (Protection Healthy) : Red LED indicates Fault in following conditions. 1. Problem in relay Hardware. 2. Trip Circuit Fault	
	LED 2 - PICK-UP	: Red LED indicate Start of timer Self Reset (SR) Type	
	LED 3 - FAULT	: Red LED indicate Relay Operated Flag (HR)	
	LED 4 - TRIP	: Red LED indicates Output TRIP relay contact closer (SR) Type	

Drawing References			
XVI.		: For Typical External connection	- ADV03504
		: For Cabinet Type	- MAC01501 (CSF)

Mechanical Specifications		
I.	Net Weight	: Approx. 1.6 Kg
II.	Enclosure Protection	EN 60529:2000 For Front : IP52 For Rear : IP20

Compliance to Standards

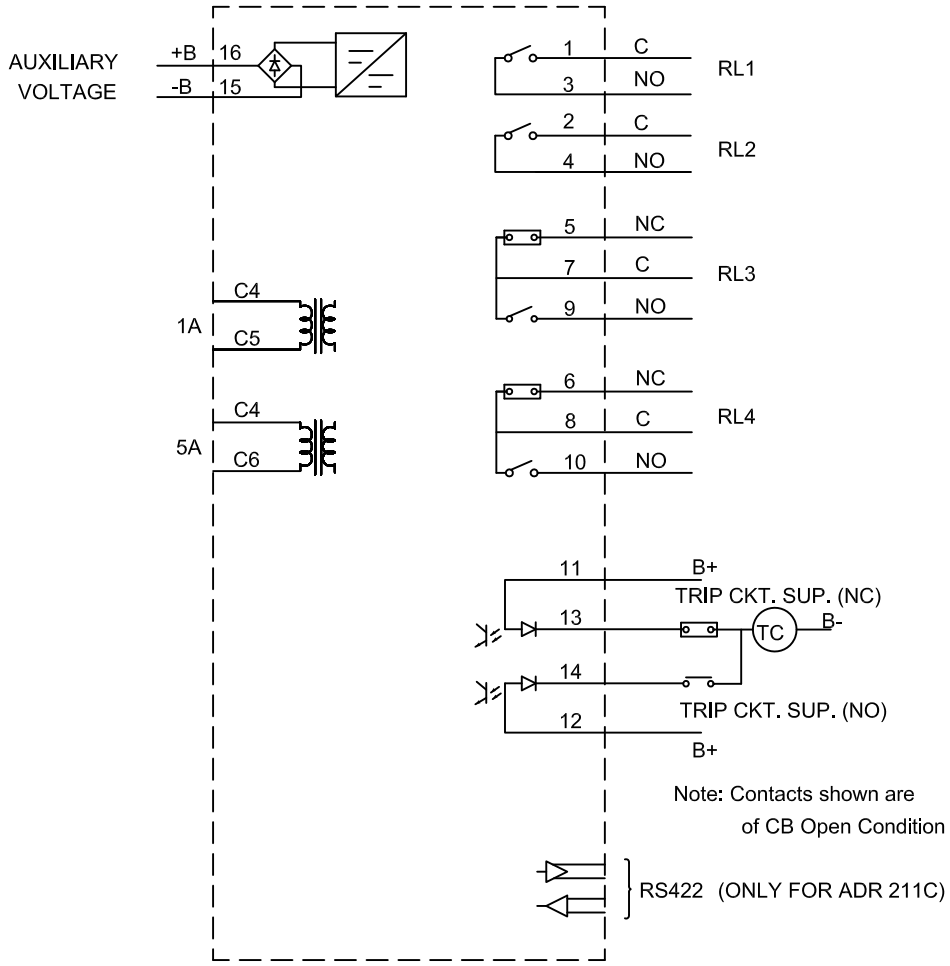
SR. NO.	TEST	STANDARDS	TEST SPECIFICATIONS
Impulse, Dielectric and Insulation Requirement			
i.	Impulse Voltage Test	IEC 60255-27:2005 (incl. corrigendum 2007)	Test Voltage 5kv, 1.2/50 µV Energy 0.5 J Polarity +ve and –ve No. of impulses 3 on each polarity Duration between impulses 5sec. EUT Condition Non Energized
ii.	Dielectric Voltage Withstand Test	IEC 60255-27:2005 (incl. corrigendum 2007)	Product shall withstand for 1 minute between 1) 2kV all terminals connected together with case earth. 2) 2kV independent circuit with case earth.
iii.	Insulation Resistance Test	IEC 60255-27:2005 (incl. corrigendum 2007)	Product shall have minimum insulation resistance of 100 MΩ at 500VDC Supply
Immunity Test			
iv.	High Frequency Disturbance Test	IEC60255-26(ed3.0)-2013	1) 2.5 kV Common Mode a) Between Independent Ckt. and case earth. b) Independent circuit. 2) 1 kV Differential Mode a) Independent circuit. EUT Condition : Energized
v.	Electrostatic Discharge	IEC60255-26(ed3.0)-2013	1) 8kV air discharge 2) 6kV contact discharge Test Mode : Direct and Indirect Method EUT Condition : Energized
vi.	Surge Test	EN61000-4-5. IEC60255-26(ed3.0)-2013	Front time / time to half value 1.2 / 50 (8 / 20) µs Source impedance 2 Ω Common Mode ±2 KV Differential Mode ± 1 KV EUT Condition Energized

vii.	Fast Transient	EN 61000-4-4:2004, IEC60255-26(ed3.0)-2013	Rise time(Tr)/Duration time (Td) Repetition rate Test Voltage EUT Condition	5 / 50 ns 5 KHz and 100 KHz ± 2 KV Energized
viii.	Radiated radio freq. Electromagnetic field	EN 61000-4-3: 2006+A1:2008 IEC60255-26(ed3.0)-2013	Voltage Level Frequency Range Modulation Spot Frequency	10 V/m 80 - 1000 MHz 80% AM @ 1 KHz 80, 160, 380, 450 & 900 MHz
Mechanical Tests				
ix.	Vibration Response Test	EN 60255-21-1:1996 Class 2	Frequency Range Cross Over Frequency Peak displacement before Cross Over Peak acceleration after Cross Over No. of Sweep Cycles per Axis EUT condition	10 Hz to 150 Hz 58 to 60 Hz 0.075mm 1 gn 1 Energized
x.	Shock Response Test	EN 60255-21-2:1996 Class 2	Peak Acceleration Pulse Duration No. of Pulses in each Direction EUT Condition	10 gn 11 ms 5 Energized
Environmental Tests				
xi.	Dry Heat Operational Test	IEC 60068-2-2 Bd	Operating Temperature Maximum rate of change of temperature Duration EUT Condition	+20°C to +70°C 1° C per min 16 hour Energized
xii.	Dry Heat Storage Test	IEC 60068-2-2 Bd	Operating Temperature Maximum rate of change of temperature Duration EUT Condition	+20°C to +70°C 1° C per min 16 hour Not Energized
xiii.	Cold Operational Test	IEC 60255-1, EN 60068-2-1	Test Temperature Rate of change of temperature Duration of Cycle EUT Condition	-25°C 1°C/min 16 hrs. Energized
xiv.	Cold Storage Test	IEC 60255-1, EN 60068-2-1	Test Temperature Rate of change of temperature Duration of Cycle EUT Condition	-25°C 1°C/min 16 hrs. Energized

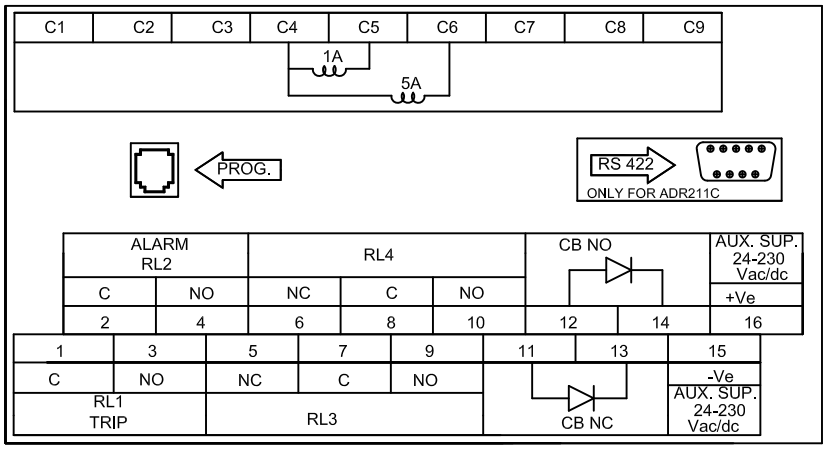
Revision Note

Rev. No.	Date	Description
01	06.03.2012	Original specifications
02	24.05.2012	a. Inrush Feature added b. Communication added c. IDMT Graph Added
03	07.05.2013	Relay mounting modified
04	21.11.2015	Compliance to Standard modified

RevNo	Revision note	Date	Signature	Checked



BACK TERMINAL DETAILS



Dim : MM	TOL :	FINISH:	MATERIAL:		
Perpaed by JEFFREY	Checked by SJ	Approved by - date SMK	Filename ADV03504	Date 21.11.2015	Scale NTS

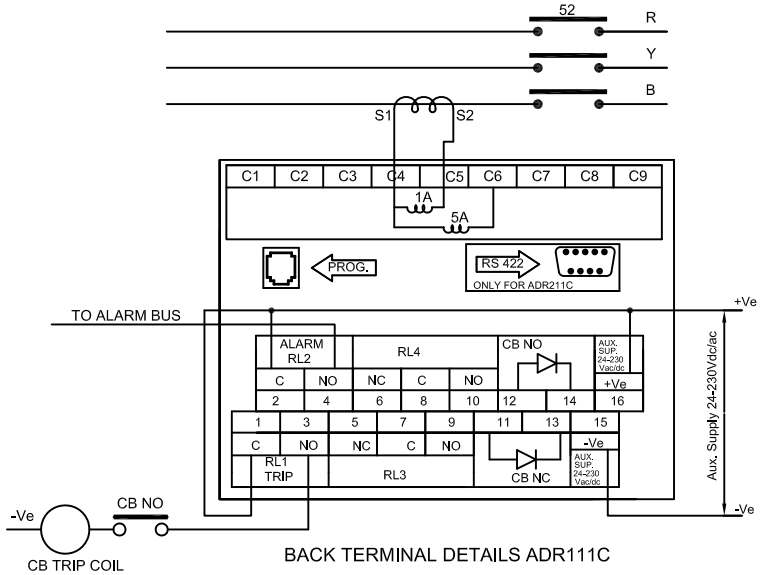
ASHIDA Electronics Pvt. Ltd.

Title : - ELECTRICAL CONNECTION & BACK TERMINAL DETIALS FOR NUMERICAL RELAY ADR111C/ADR211C

Drawing__ Ref. ADV03504 | Edition 00 | Sheet 1 OF 2

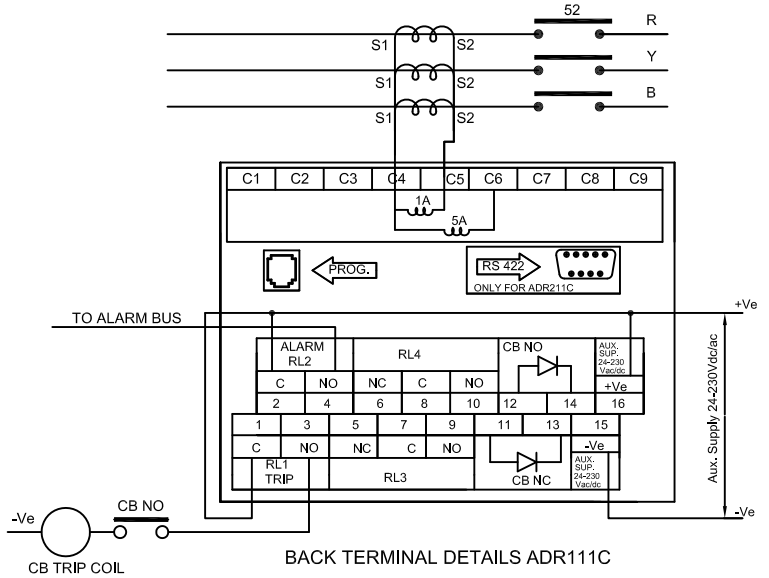
RevNo	Revision note	Date	Signature	Checked

Typical External wiring diagram for Over Current (OC) Relay



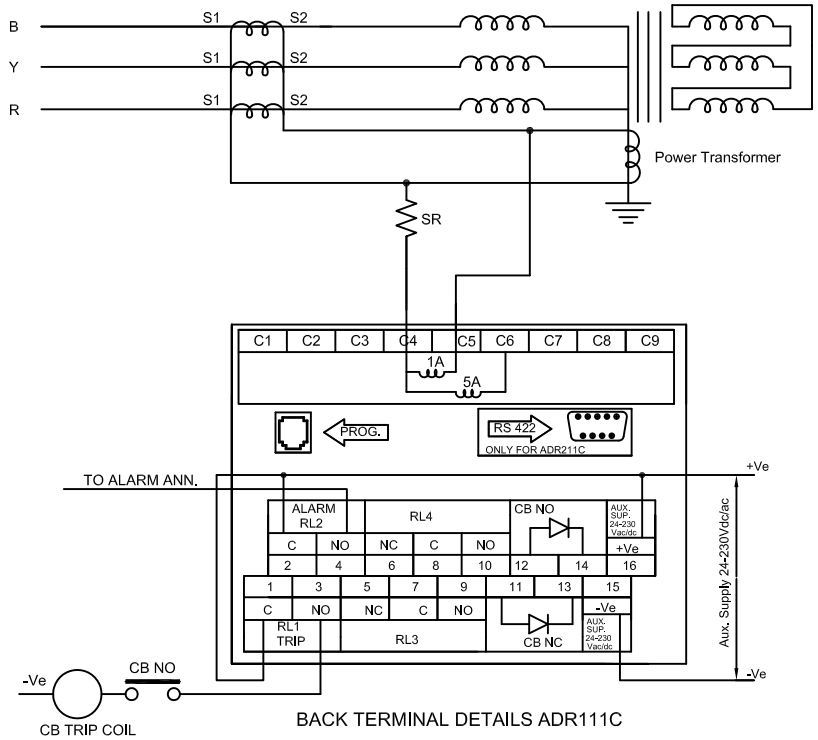
BACK TERMINAL DETAILS ADR111C

Typical External wiring diagram for Earth Fault (EF) Relay



BACK TERMINAL DETAILS ADR111C

Typical External wiring diagram for Resticted Earth Fault (REF) Relay



BACK TERMINAL DETAILS ADR111C

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ASHIDA Electronics Pvt. Ltd.		Title : - ELECTRICAL CONNECTION & BACK TERMINAL DETIALS FOR NUMERICAL RELAY ADR111C/ADR211C				
		Drawing __ Ref.ADV03504			Edition 01	Sheet 2 OF 2

Rev.No	Revision note	Date	Signature	Checked
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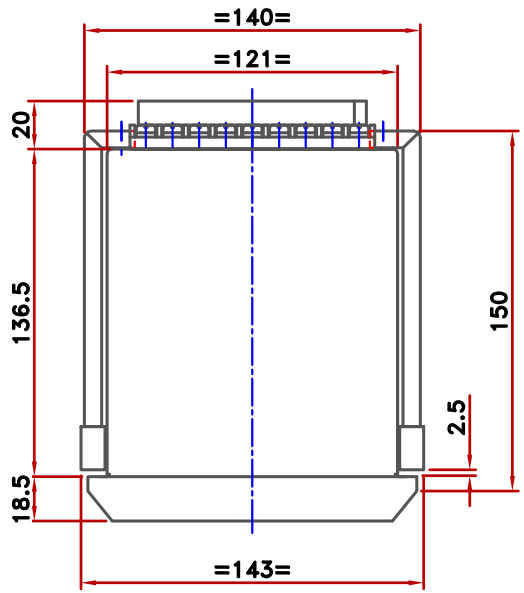
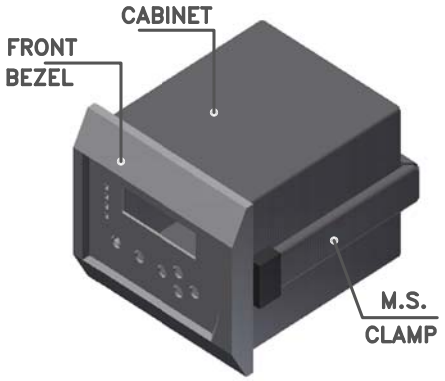
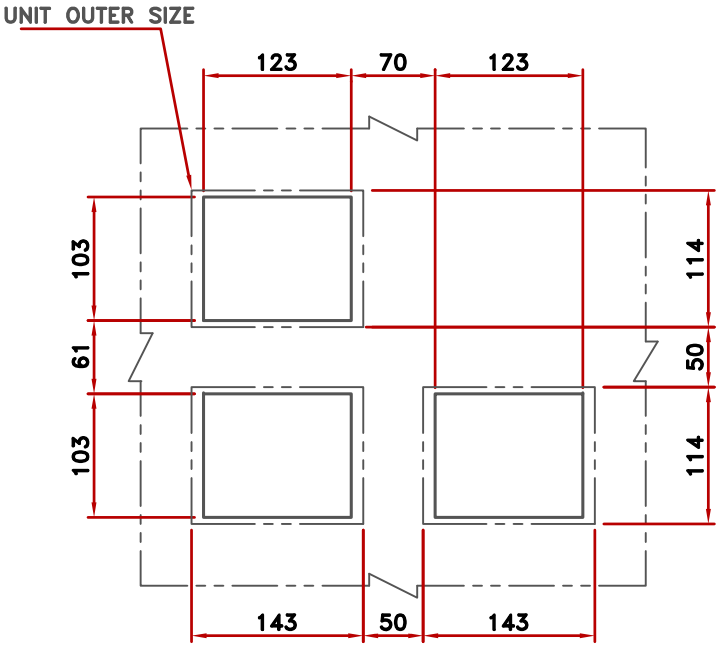
02				



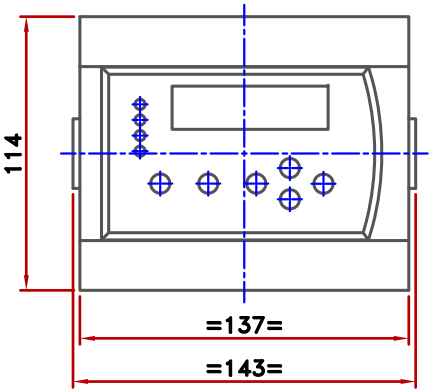


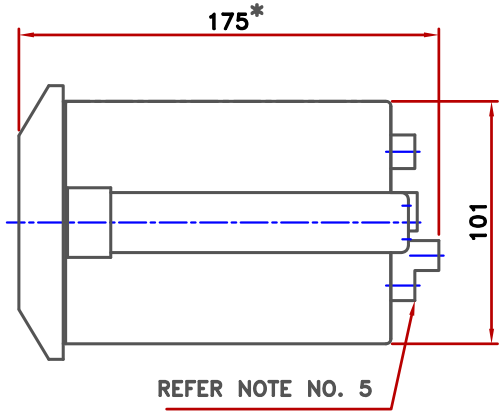
ISOMETRIC VIEW



PANEL CUTOUT REQUIRED

(UNIT OUTER SIZE SHOWN IN PHANTOM LINE)





NOTE:

1. PANEL CUTOUT SIZE 123mm x 103mm.
2. FRONT BEZEL SIZE 137mm x 114mm.
3. BOX SIZE WITH CLAMP 143mm x 114mm x 175mm.
4. THE DIMENSION MARK AS "*" IS HAVING TOLERANCE OF ±10mm.
5. THE TERMINAL BLOCK SHOWN IS FOR GUIDANCE ONLY. THE ACTUAL SIZE AND TYPE OF TERMINAL BLOCK DEPENDS UPON PRODUCT. REFER RESPECTIVE PRODUCT DETAILS.
6. ALL DIMENSIONS IN MM.

TOL :±0.2MM	MATERIAL :-			PROJECTION:-	
Prepared by RV	Checked by SG	Approved by SMK	Filename MAC01501	Date 01.10.2012	Scale 1:3.25

ASHIDA Electronics Pvt.Ltd.

TITLE : MECHANICAL DETAILS FOR HORIZONTAL CABINET CSF

Drawing Ref.: MAC01501 | Edition 01 | Sheet 1/1

Sheet Size- A4