

ADR111A / ADR211A
Single Pole Protection Relay
INSTRUCTION MANUAL

Preface

The ADR111A/ ADR211A single pole Relay Instruction Manual describes common aspects of feeder protection application and use of product. It includes the necessary information to safety, install, set, test, and operate the relay functionality. The instruction manual can be used by power engineers and other experienced protective relays application persons.

It is not the intention of this manual to cover all details and variations in equipment/relay, nor does this manual provide data for every possible contingency regarding installation or operation. The availability and design of all features and options are subject to modification without notice.

SAFETY AND GENERAL INFORMATION

INTRODUCTION

This guide and the relevant operating or service manual documentation for the equipment provides full information of safe handling, commissioning and testing of this equipment and also includes description of equipment label markings.

The technical data in this safety guide is typical; the user must refer to the technical data section of the relevant product publication(s) for specific data to particular equipment.



Before carrying out any work on the equipment the user should be familiar with the contents of this Safety Guide and the ratings on the equipment's rating label.

Reference should be made to the external connection diagram before the equipment is installed, commissioned or serviced.

HEALTHY AND SAFETY

The information in the Safety Section of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

It is assumed that persons who will be associated with the equipment must be familiar with the contents of Safety Guide.

When electrical equipment is in operation, hazardous voltages will be present in certain parts of the equipment. Failure to warning notices, incorrect use, or improper handling may endanger personnel / equipment, causing personal injury or physical damage.

Before working in the terminal strip area, the equipment must be isolated.

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, maintenance and servicing and careful operation. For this reason only qualified personal may work on or operate the equipment.

Qualified personnel are individuals who

- Are familiar with the installation, commissioning, operation of the equipment and of the system to which it is being connected.

- Are able to safely perform switching operation in accordance with accepted safety and to isolate ground and label it.
- Are trained in the care and use of safety apparatus in accordance with safety engineering practices.
- Are trained in emergency procedures (first aid).

The operating manual for the equipment gives instruction for its installation, commissioning and operation. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate person of Ashida Technical / Sales office and request the necessary information.

SYMBOLS AND EXTERNAL LABELS ON THE EQUIPMENT

For safety reasons the following symbols and external labels, which may be used on the equipment or referred to in the equipment documentation, should be understood before the equipment is installed or commissioned.

	
Caution: refer to equipment documentation	Caution: risk of electric shock
	
Protective Conductor (Earth*) terminal	Functional/Protective Conductor (*Earth) terminal.
	Note: This symbol may also be used for a Protective Conductor (Earth) Terminal if that terminal is part of a terminal block or sub-assembly e.g. power supply.

***NOTE: THE TERM EARTH USED THROUGHOUT THIS GUIDE IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.**

INSTALLING, COMMISSIONING AND SERVICING



Equipment connections

Personnel undertaking installation, commissioning or servicing work for this equipment to be aware of the correct working procedures to ensure safety. The equipment documentation should be consulted before installing, commissioning or servicing the equipment. Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated. Any disassembly of the equipment may expose parts at hazardous voltage; also electronic parts may be damaged if suitable electrostatic voltage discharge (ESD) precautions are not taken.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electric shock or energy hazards. Voltage and current connections should be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety.

To ensure that wires are correctly terminated. The correct crimp terminals, tools of the wire size should be used. The equipment must be connected in accordance with the appropriate connection diagram.

Protection Class I Equipment

Before energizing the equipment it must be earthed using the protective conductor terminal, if provided, or the appropriate termination of the supply plug in the case of plug connected equipment.

The protective conductor (earth) connection must not be removed since the protection against electric shock provided by the equipment would be lost.

The recommended minimum protective conductor (earth) wire size is 2.5 mm² or as per industries standard practice. The protective conductor (earth) connection must be of low-inductance and as short as possible.

All connections to the equipment must have a defined potential.

Before energizing the equipment, the following points should be checked:

- Voltage rating / polarity (rating label / equipment documentation);
- CT circuit rating (rating label) and integrity of connections;
- Integrity of the protective conductor (earth) connection (where applicable);
- Voltage and current rating of external wiring, applicable to the application.



Accidental touching of exposed terminals

If working in an area of restricted space, such as a cubicle, where there is a risk of electric shock due to accidental touching of terminals which do not comply with IP20 rating, then a suitable protective barrier should be provided.

**Equipment Use**

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

**Removal of the equipment front panel / cover**

Removal of the equipment front panel / cover may expose hazardous live parts which must not be touched until the electrical power is removed.

**UL and CSA/CUL Listed or Recognized equipment**

To maintain UL and CSA/CUL Listing / Recognized status for North America the equipment should be installed using UL or CSA Listed or Recognized parts for the following items: connection cables, protective fuses / fuse holders or circuit breakers, insulation crimp terminals and replacement internal battery, as specified in the equipment documentation.

For external protective fuses a UL or CSA Listed fuse shall be used. The Listed type shall be a Class J time delay fuse, with a maximum current rating of 15A and a minimum D.C. rating of 250 Vdc. for example type AJT15.

Where UL or CSA Listing of the equipment is not required, a high rupture capacity (HRC) fuse type with a maximum current rating of 16 Amps and a minimum D.C. rating of 250 Vdc. may be used, for example Red Spot type NIT or TIA.

**Equipment operating conditions**

The equipment should be operated within the specified electrical and environmental limits.

**Current transformer circuits**

Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation.

Generally, for safety, the secondary of the line CT must be shorted before opening any connections to it.

For most equipment with ring-terminal connections, the threaded terminal block for current transformer termination has automatic CT shorting on removal of the module. Therefore external shorting of the CTs may not be required, but it is advisable to use external CT shorting as general practice.

**External resistors, including voltage dependent resistors (VDRs)**

Where external resistors, including voltage dependent resistors (VDRs), are fitted to the equipment, these may present a risk of electric shock or burns, if touched.

**Battery replacement**

Where internal batteries are fitted they should be replaced with the recommended type and be installed with the correct polarity to avoid possible damage to the equipment, buildings and persons.

**Insulation and dielectric strength testing**

Insulation testing may leave capacitors charged to a hazardous voltage. After the completion of test, to discharge capacitors the voltage should be gradually reduced to zero before the test leads are disconnected.

**Insertion of modules and PCB cards**

Modules and PCB cards must not be inserted into or withdrawn from the equipment whilst it is energized, since this may result in damage.

**Insertion and withdrawal of extender cards**

Extender cards are available for some equipment. If an extender card is used, this should not be inserted or withdrawn from the equipment whilst it is energized. This is to avoid electric shock or damages. Hazardous live voltages may be accessible on the extender card.

**Fiber optic communication**

Where fiber optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.

**Cleaning**

The equipment may be cleaned using a lint free cloth dampened with clean water, when no connections are energized.

DECOMMISSIONING AND DISPOSAL**Decommissioning**

The supply input (auxiliary) for the equipment may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to

the equipment (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to decommissioning.

Disposal



It is recommended that incineration and disposal to water courses to be avoided. The equipment should be disposed of in a safe manner. Any equipment containing batteries should be removed before disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of batteries.

TECHNICAL SPECIFICATIONS FOR SAFETY

Protective Fuse Rating



The recommended maximum rating of the external protective fuse for equipments is 8A, high rupture capacity (HRC) Red Spot type NIT, or TIA, or equivalent, unless otherwise stated in the technical data section of the equipment documentation. The protective fuse should be located as close to the unit as possible.

DANGER - CTs must NOT be fused since open circuiting them may produce lethal hazardous voltages 7.2 Protective Class

Protective Class

IEC 60255-27: 2005

EN 60255-27: 2005

Class I (unless otherwise specified in the equipment documentation).

This equipment requires a protective conductor (earth) connection to ensure user safety.

Installation Category

IEC 60255-27.2005

Category III

(Overvoltage Category III)

: At 2 KV, 50Hz between all terminals connected together and earth for 1 minute Distribution level, fixed installation.

Equipment in this category is qualification tested at 5KV peak, 1.2/50µs, 500Ω, 0.5J, between all supply circuits and earth and also between independent circuits

Environment

The equipment is intended for indoor installation and use only. If required to be used in an outdoor environment, then it must be mounted in a specific cabinet or housing which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP52 (dust and splashing water protected).

Pollution Degree 2 Compliance is demonstrated by reference to safety standards.

Altitude Operation up to 2000m

IEC 60255-27:2005

EN 60255-27: 2005

CE MARKING



Directives:

Compliance demonstrated by reference to safety standards

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Section 1

Introduction and Specifications

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1 INTRODUCTION AND SPECIFICATIONS

1.1 Overview

ASHIDA has designed economical & reliable Single element over current ADR111A/ ADR211A relay to simply feeder protection wiring. The simple and compact construction of ADITYA series ADR111A/ ADR211A relay provides integrated Protection, Control and Monitoring functions for feeders. This relay is mainly deployed in various electrical utilities at industrial installations for Low voltage/ Medium voltage switchgear control.

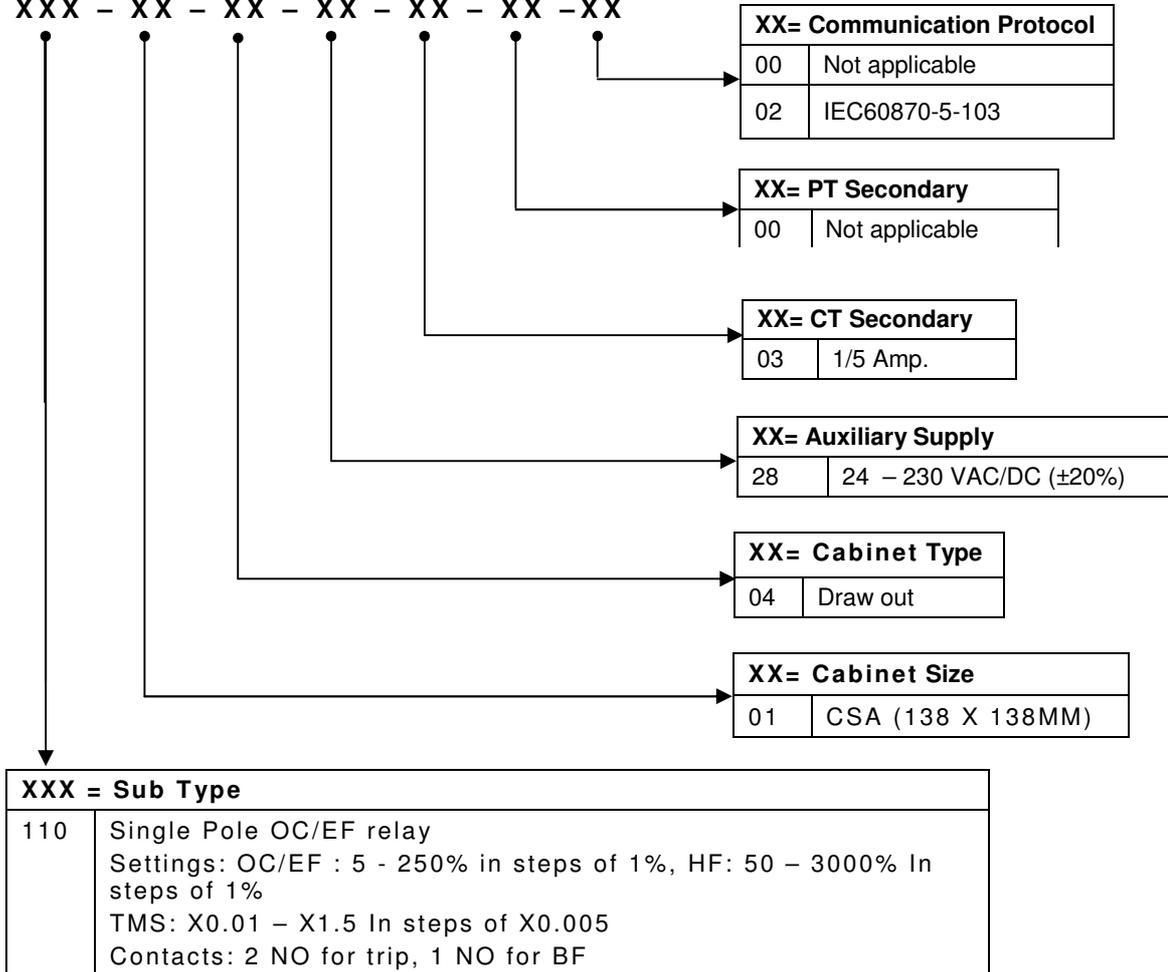
1.2 Features

- Single Element over current IDMT with instant trip.
- Relay can be used for single pole OC or EF or REF application.
- Back - lit LCD display for settings.
- Display of fault current. / Load current.
- Selection of Curve: Seven selectable curves Normal Inverse1 (C1), Normal Inverse2 (C2), Very Inverse (C3), Extremely Inverse (C4), Extremely Inverse (C4A) as per EE Relays, Long Time Inverse (C5) & Definite Time (C6).
- Design using DSP technology.
- Latching of fault current up-to last 5 faults.
- Password protection for setting.
- Site selectable CT secondary i.e. 1A/ 5A.
- Relay can be made either IDMT or Define Time.
- Programmable operating time in instantaneous element.
- Inbuilt Breaker Fail detection.
- USB (at front) and RS422/ RS485 (at rear side) Communication Port for remote SCADA (only for ADR211A i.e. communicable Relay).

Model and Options

Definition of Model No of Aditya Series of Relays

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



Example:

ADR111A-AM-110-01-04-28-03-00-00

ADR211A-AM-110-01-04-28-03-00-02

1.3 Applications

ADR111A/ ADR211A single pole numerical relay designed for Transmission line protection, Underground cable & feeder protection. Relay designed with fast and selective tripping ensures the stability and availability of electrical power system.

ADR111A/ ADR211A relay apply for protection, control & monitoring of feeder to achieve sensitivity and selectivity on phase or ground faults.

1.4 Technical Specifications

AC Measuring Input:		
I.	Measurement Accuracy	Typical $\pm 2\%$ In
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
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

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		

Accuracy of protection function:			
I.	Phase/ Ground Over current:		
	For operating Value	Pick-up	1.05 x Setting \pm 5%
		Drop –off	0.95 x Setting \pm 5%
	For operating Time	IDMT Characteristic shape	As per class5 of 60255-151 cl.5.2** or 55ms whichever is greater
		DT Operation	\pm 5% or 55ms whichever is greater*
Note “ * “ indicates Reference Condition that is Fault current 2 time above set value.			
II.	CB Fail		
	For operating Time	DT Operation	\pm 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%

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

Terminals specification:		
I.	AC current and Voltage Input Terminals	M4 Threaded terminals for ring lug connection. Suitable up to 4 mm ²
II.	Auxiliary & Input/output Terminals	M4 Threaded terminal. Suitable up to 2.5 mm ²
III.	Note on M4 Terminal Torque	Use torque control screw driver with 1.2 N-m torque maximum
IV.	Rear Communication Terminal	Four/Two wire RS422/RS485 signal levels Suitable up to Multi core shielded

Mechanical & Environmental specification:		
I.	Design	Flush mounting case
II.	Weight	2.50 Kg approximate
III.	Pollution Degree	II

Drawing References			
	Drawing References	: For Cabinet Type without IP cover	MAC01974
		: For Cabinet Type with IP cover	MAC01975
		: For Electrical and Back Terminal Connections	APR07409

1.5 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 and 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.

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Section 2

Installation and Procedure

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2 **INSTALLATION AND PROCEDURE**

2.1 **Overview**

The first steps in applying the ADR111A/ ADR211A Single pole Protection Relay is installing and connecting the relay. This section describes common installation features and requirements.

To install and connect the relay safely and effectively, user must be familiar with relay configuration features and options. User should carefully plan relay placement, cable connections, and relay communication.

This section contains drawings of typical ac and dc connections to the ADR111A. Use these drawings as a starting point for planning your particular relay application.

2.2 **Handling**

2.2.1 **Handling the Goods**

Our products are of robust construction but require careful treatment before installation on site. This section discusses the requirements for receiving and unpacking the goods, as well as associated considerations regarding product care and personal safety.



Caution: Before lifting or moving the equipment, user should be familiar with the Safety Guide of this manual.

2.2.2 **Receipt of the Goods**

On receipt, ensure the correct product has been delivered. Unpack the product immediately to ensure there has been no external damage in transit. If the product has been damaged, make a claim to the transport contractor and notify ASHIDA promptly.

For products not intended for immediate installation, repack them in their original delivery packing.

2.2.3 **Unpacking the Goods**

When unpacking and installing the product, take care not to damage any parts and make sure that additional components are not accidentally left in the packing or lost. Do not discard any CDROMs or technical documentation. These should accompany the unit to its designated substation and kept in a dedicated place.

The site should be well lit to aid inspection, clean, dry and reasonably free from dust and excessive vibration. This particularly applies where installation is being carried out at the same time as construction work.

2.2.4 Storing the Goods

If the unit is not installed immediately, store it in a place free from dust and moisture in its original packaging. Keep any de-humidifier bags included in the packing. The de-humidifier crystals lose their efficiency if the bag is exposed to ambient conditions. Restore the crystals before replacing it in the carton. Bags should be placed on flat racks and spaced to allow circulation around them. The time taken for regeneration will depend on the size of the bag. If a ventilating, circulating oven is not available, when using an ordinary oven, open the door on a regular basis to let out the steam given off by the regenerating silica gel. On subsequent unpacking, make sure that dust on the carton does not fall inside. Avoid storing in locations of high humidity, in locations of high humidity the packaging may become impregnated with moisture and the de-humidifier crystals will lose their efficiency.

The device can be stored between -25° to $+65^{\circ}\text{C}$

2.2.5 Dismantling the Goods

If you need to dismantle the device, always observe standard ESD (Electrostatic Discharge) precautions.

The minimum precautions to be followed are as follows:

Use an antistatic wrist band earthed to a suitable earthing point.

Avoid touching the electronic components and PCBs.

2.3 Installation Procedure

2.3.1 Safe Mounting

ADR111A/ ADR211A supports flush panel mounting and can be mounted into panels using fitting clamps with M4 X 12 screws.

The Protective cover and M4 X 25 screws (optional) are supplied along with the relay.

For mounting the relay into the panel follow this procedure

Insert the relay into the panel cut-out as show below.

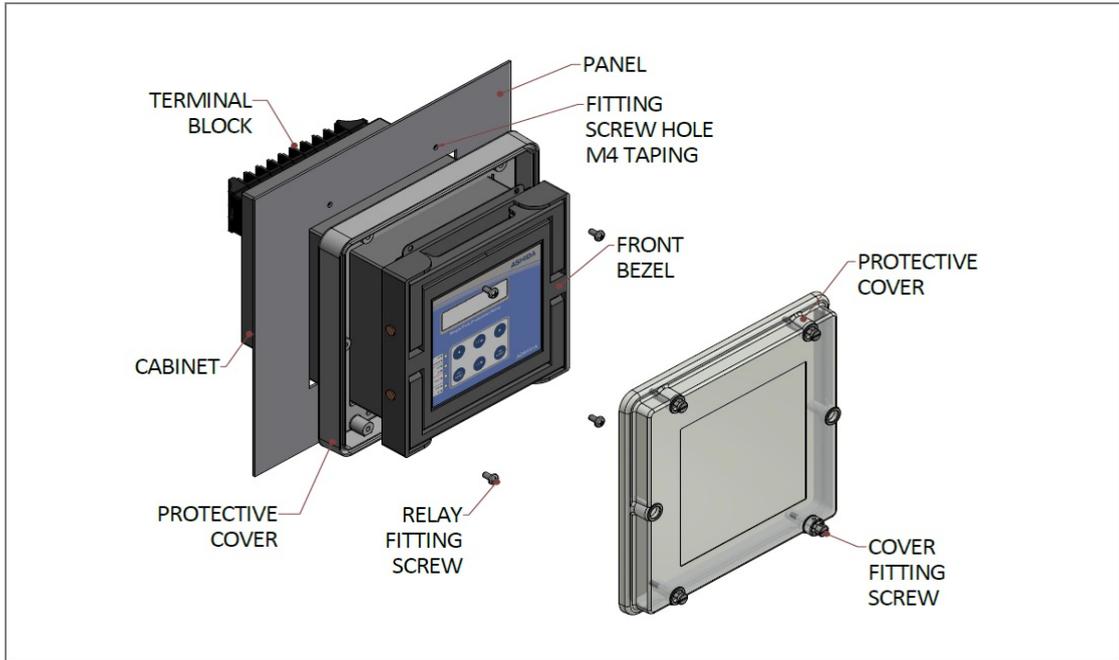


Figure 1: Inserting Relay into the panel cut-out

After inserting the Relay in the Panel fasten the relay to the Panel as shown below.

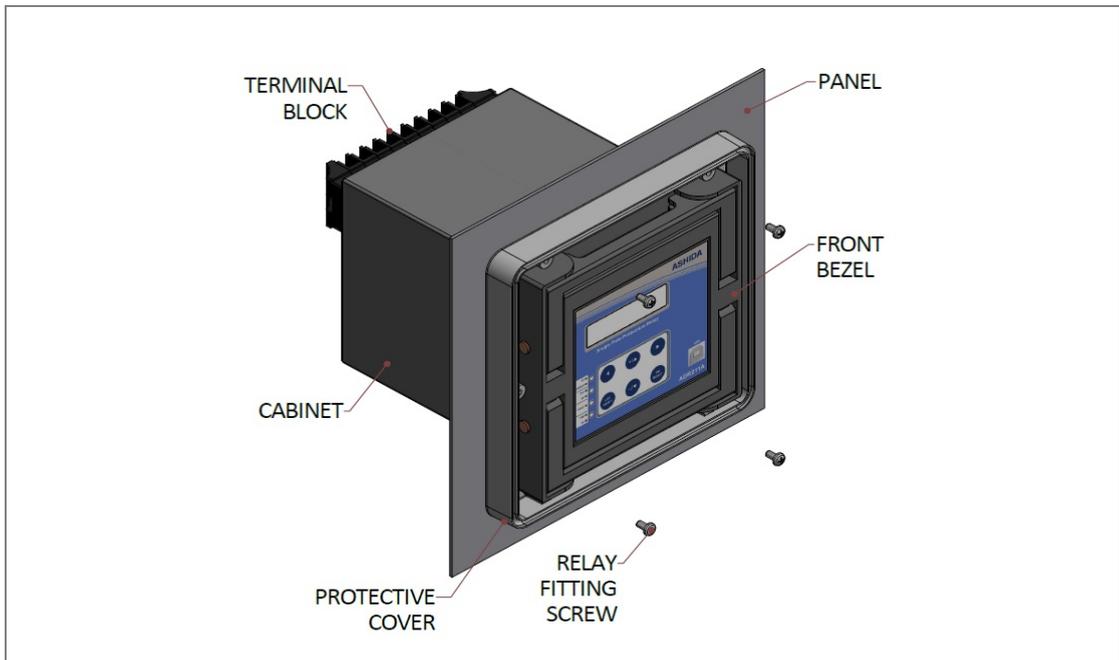


Figure 2: Fastening Relay to the panel



Caution: Always use M4x12 screws for Relay fitting.

After fastening the relay to the Panel, mount the protective cover on the relay front panel as shown below.

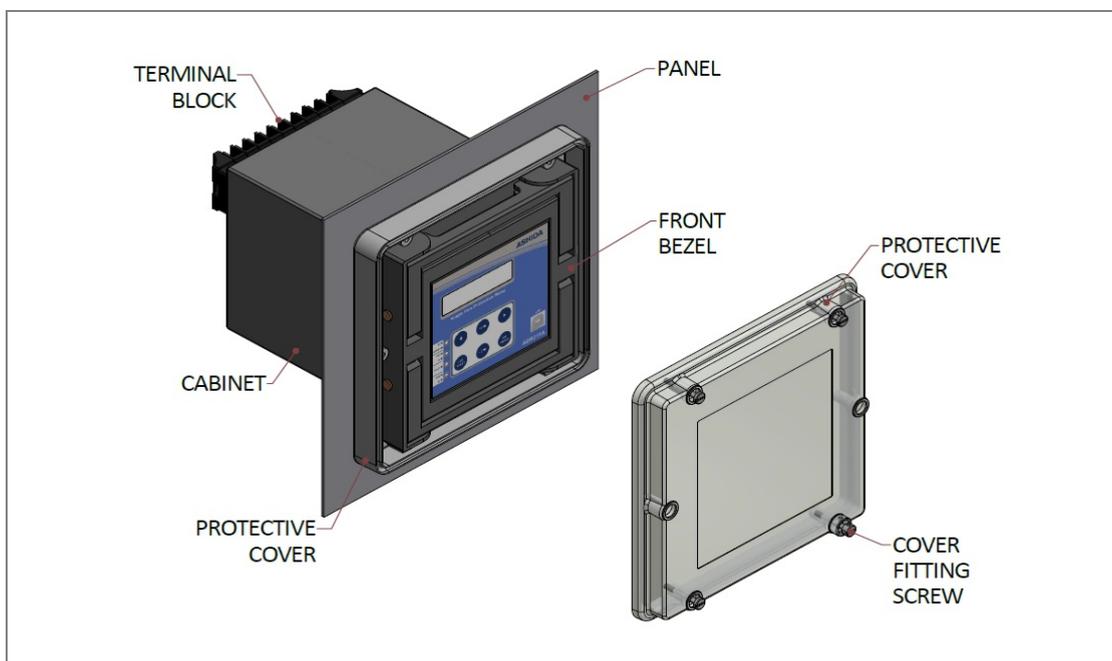


Figure 3: mounting protective cover on relay front panel.



Caution: Always use M4x25 screws for Protective Cover fitting.

After mounting the cover on relay front panel, fasten the cover fitting screw, as shown below

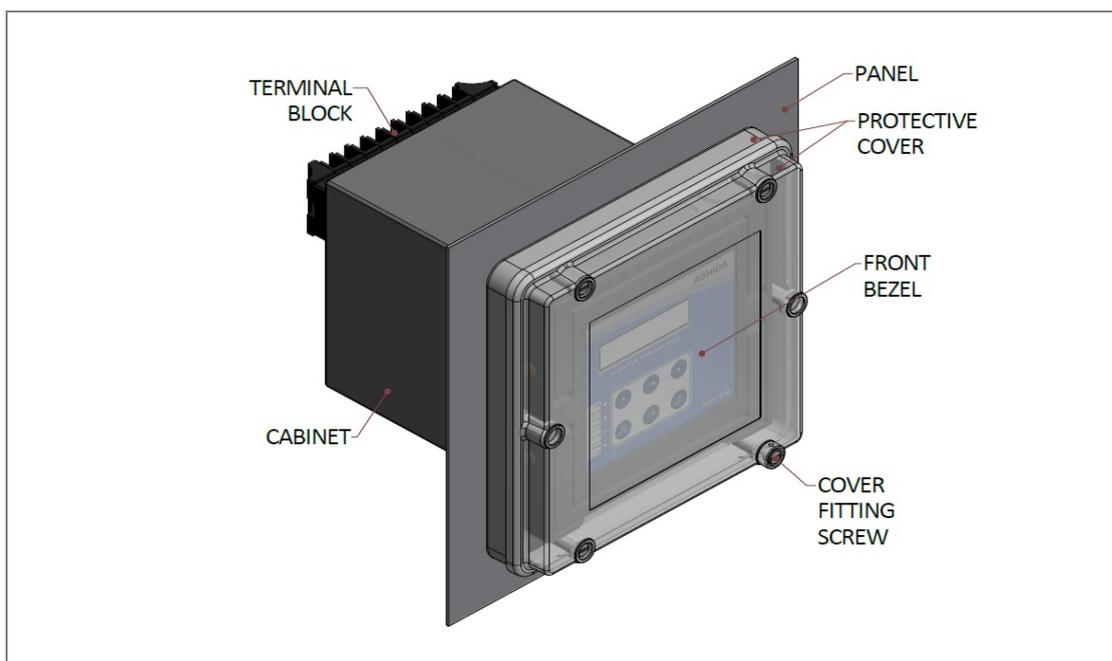


Figure 4: Relay mounted on the panel-front view

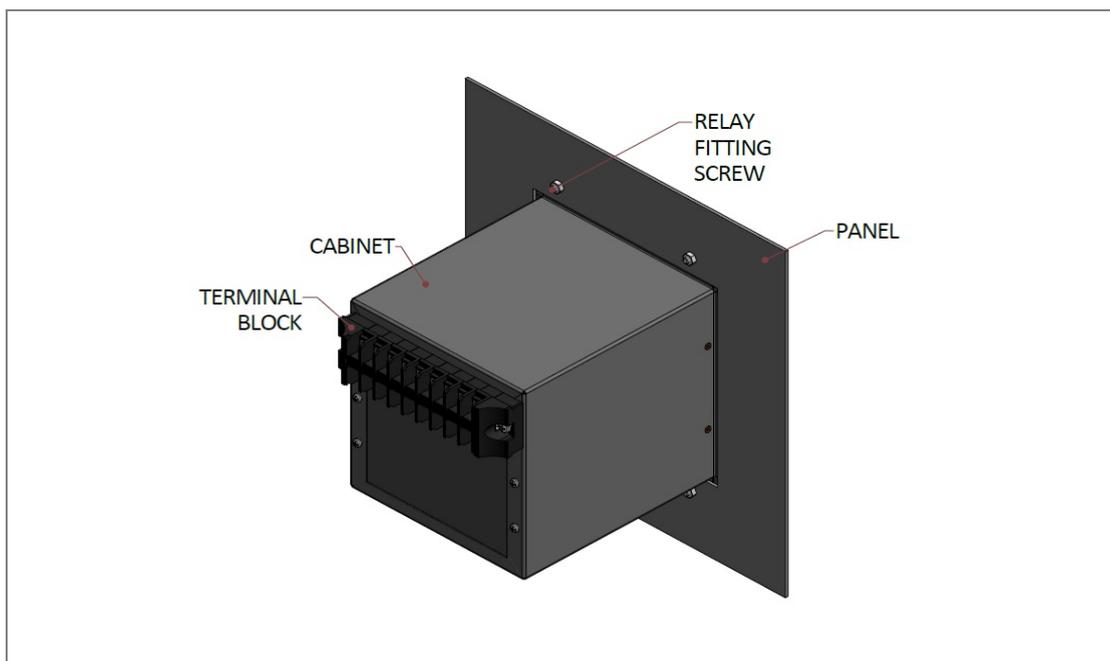


Figure 5: Relay mounted on the panel-rear view

2.3.2 Relay Connection and Diagram

Before installation of the relay check the correct working procedure as to ensure safety. The Terminal exposed during installation may present a hazardous voltage unless the equipment is electrically isolated. Any disassembly of the equipment may expose parts to hazardous voltage. Electronic parts may be damaged if suitable electrostatic discharge (ESD) precautions are not taken. Voltage and current connection should be made using insulated crimp termination to ensure that terminal block insulation requirements are maintained for safety. To ensure that wires are correctly terminated the correct crimp terminal and tool for wire size should be used. The equipment must be connected in accordance with the appropriate connection diagram.

Before Energizing the relay following should be checked

- Voltage rating and polarity.
- CT circuit rating and integrity of connection.
- Protective fuse rating.
- Integrity of the earthing connection.
- Current rating of external wiring, applicable as per application.

2.3.3 Relay Operating Condition

The equipment should be operated within the specified electrical and environmental limits.

2.3.4 Current Transformer (CT) Circuit

Do not open the secondary circuit of a live CT as high voltage produced may be lethal to personnel and could damage insulation. Generally, for safety, the secondary of the line CT must be shorted before opening any connection.

2.3.5 Insulation and dielectric strength testing

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part test, the voltage should be gradually reduced to zero, to discharge capacitors, as this may result in damage.

2.3.6 Cables and Connectors

This section describes the type of wiring and connections that should be used when installing the device. For pin-out details please refer to the wiring diagrams.



Caution: Before carrying out any work on the equipment, user should be familiar with the Safety Section and the ratings on the equipment’s rating label.



Figure 5: Rear view-Terminal Connection of ADR111A/ ADR211A

2.3.7 CT/Auxiliary power/ output/ serial port connections

The terminal blocks used for ADR111A/ ADR211A relay are as shown below.

The terminal block of ADR111A/ ADR211A consists of up to 18 x M4 screw terminals. M4 terminal blocks are used for CT connections, auxiliary power, output contact and rear serial port connections. The wires should be terminated with rings using 90° ring terminals, with no

more than two rings per terminal. The product is supplied with sufficient M4 screws for proper connection.

M4 Terminal block for CT connection, Auxiliary Supply, Output connection

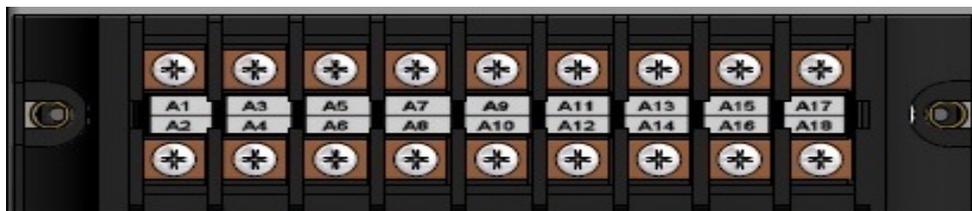


Figure 6: Terminal blocks

Caution: Always fit an insulating sleeve over the ring terminal.

2.3.8 Rear Serial Port connection (For ADR211A only)

The rear serial port is intended for use with a permanently wired connection to a remote SCADA system. The physical connectivity is achieved using four terminals A5-A6-A7-A8 for signal connection shown below.



For connecting the RS422, use screened cable with a maximum total length of 1000 m or 200 nF total cable capacitance.

A typical cable specification would be:

Each core: 16/0.2 mm² copper conductors, PVC insulated

Nominal conductor area: 0.5 mm² per core

Screen: Overall braid, PVC sheathed

There is no electrical connection of the cable screen to the device. The link is provided purely to link together the two cable screens.

2.3.9 Power Supply Connections

These should be wired with 1.5 mm PVC insulated multi-stranded copper wire terminated with M4 ring terminals. The wire should have a minimum voltage rating of 300 V RMS.

As per the application, in case auxiliary supply input of the relay needs to be wired, then adequate care should be taken to wire as per polarity marking on the Terminal sticker at the rear of the relay. The supply range is also mentioned on the Terminal sticker and before energising, care should be taken to confirm that the auxiliary supply being wired is within range.

2.3.10 Earth Connection

Every device must be connected to the cubicle earthing bar. Earthing terminal is provided on back side of the relay. Ensure that the relay earthing is connected to the local earth bar. With several relays present; make sure that the copper earth bar is properly installed for solidity connecting to the earthing terminal of each relay equipment box.

Before energizing the equipment, it must be earthed using the protective conductor terminal, (if provided) or the appropriate termination of the supply plug in the case of plug connected equipment. The protective conductor (earth) connection must not be removed since the protection against electric shock provided by the equipment would be lost. The recommended minimum protective conductor (earth) wire size is 2.5 mm² or as per industries standard practice. The protective conductor (earth) connection must be of low-inductance and as short as possible.



Note: To prevent any possibility of electrolytic action between brass or copper ground conductors and the rear panel of the product, precautions should be taken to isolate them from one another. This could be achieved in several ways, including placing a nickel-plated or insulating washer between the conductor and the product case, or using tinned ring terminals.

2.3.11 Current Transformers

Current transformers would generally be wired with 2.5 mm² PVC insulated multi-stranded copper wire terminated with M4 ring terminals. The wires should be terminated with rings using 90° rings terminals, with no more than two rings per terminal.

Due to the physical limitations of the ring terminal, the maximum wire size user can use is 4.0 mm² using ring terminals.

The wire should have a minimum voltage rating of 300 V RMS.



Caution: Current transformer circuits never be fused.

Note 1: Terminal blocks must not be detached whilst current transformer (CT) circuit is live. CT shorting must be achieved by external means;

Note 2: For 5A CT secondary, we recommend using 2 x 2.5 mm² PVC insulated multi-stranded copper wire.

2.3.12 Output Relay Connections

These should be wired with 1 mm PVC insulated multi-stranded copper wire terminated with M4 ring terminals.

2.3.13 USB Connection (For ADR211A only)

The IED has a type B USB socket on the front panel. A standard USB printer cable (type A one end, type B at other end) can be used to connect a local PC to the IED. This cable is the same as that used for connecting a printer to a PC.

2.4 Mechanical, Back Terminal and Electrical Connection Drawings

2.4.1 Mechanical Dimensions without IP cover

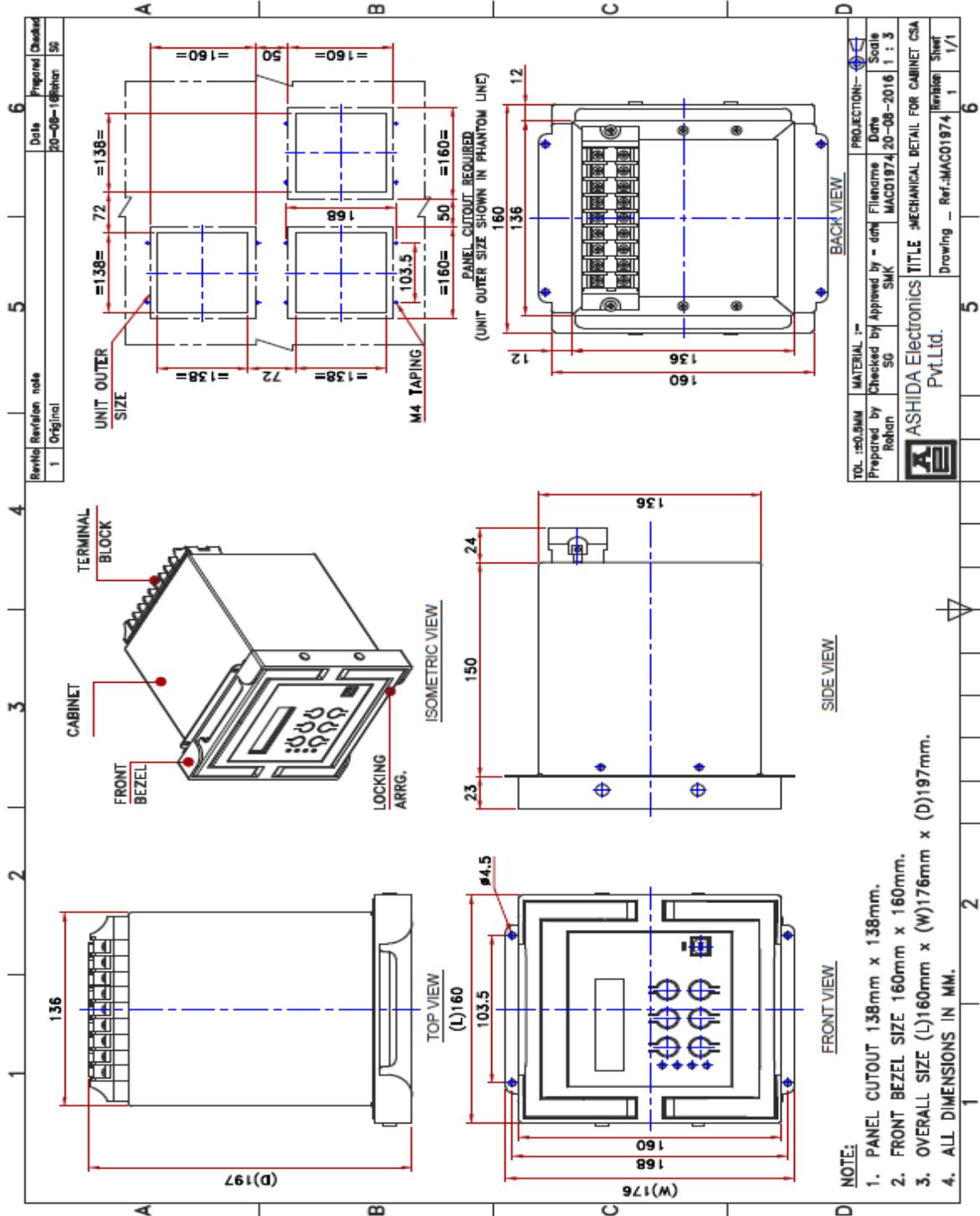


Figure 7: Case dimensions for basic version without IP cover

Note: All dimensions in mm.

2.4.2 Mechanical Dimensions with IP cover

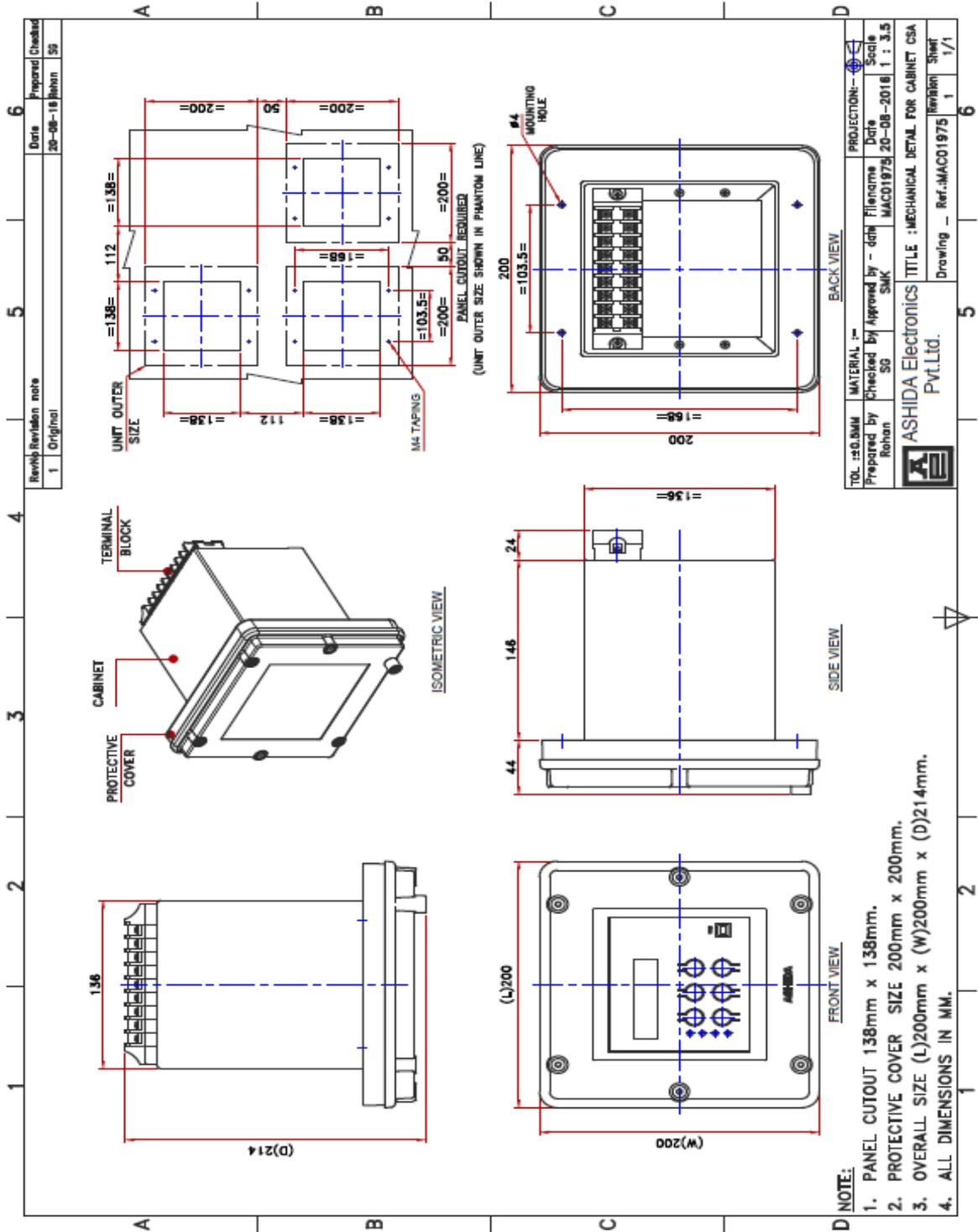


Figure 8: Case dimensions for basic version with IP cover

Note: All dimensions in mm.

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Section 3

PC Software Information

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3 PC SOFTWARE INFORMATION

3.1 Overview

ASHIDA Provides following Software solution to support the ADR211A single pole Protection Relay and the other ASHIDA products.

Sr. No.	Application Software	Description
1	ASHIDA Relay-Talk	Customizes ADR211A Settings and to view events, history faults, online measurements
2	DR Analysis	Disturbance Record viewer

This section describes how to get started with the ADR211A and Relay Talk software. It particularly explains about the software setup and working procedure.

3.1.1 Relay Talk Software Features

Connections	ADR211A connected to the PC through Front port as well as Rear port.
Settings Editor	Provides online utility to interface with ASHIDA Relay series.
*I/O Mask	Allows user to program the inputs, outputs and LEDs
Events	Provides event analysis tool.
History Faults	Provides History fault analysis tool
*Disturbance Record	Provides oscillographic analysis tool.
Time Synchronization	Local clock time synchronized data is available.
Measurements	Provides online power system parameter measurements.
Status	Provides status of the inputs, outputs and protection functions tool.
Control	Provides the control function tool (output, input, LED)

*NOTE: The above features are generally provided with all the ASHIDA Relays but the * marked features are not applicable to this product*

3.2 Relay Talk software

Following is a brief step-by-step instruction to download relay data using ASHIDA Relay Talk software

- **Start Relay Talk program from program menu**

Following is the main screen of Relay talk system.

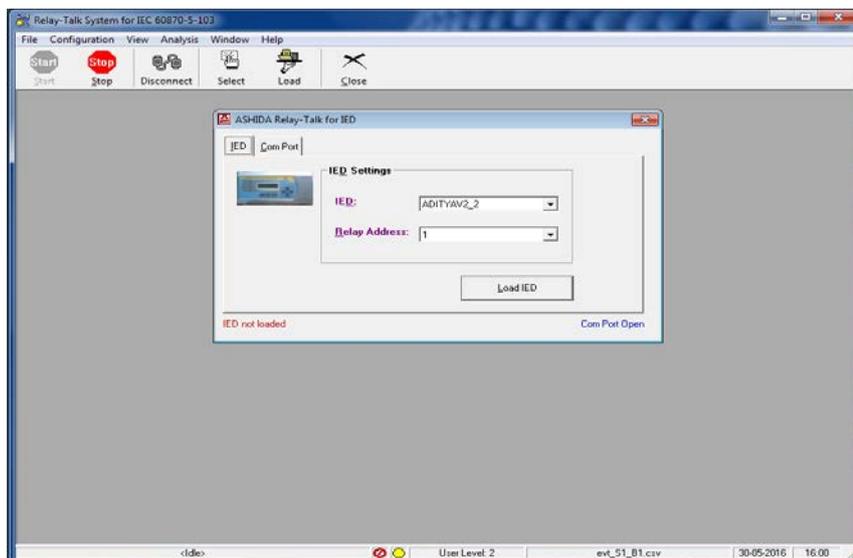


Figure 1: Main screen of Relay talk system

For successful communication, setting of relay should match with software settings. In relay Talk software, there are numbers of settings. Here we had shown only essential for ADR211A relay

To check communication setting click Com Port button:

After pressing Com Port button display will show following screen, and follow steps

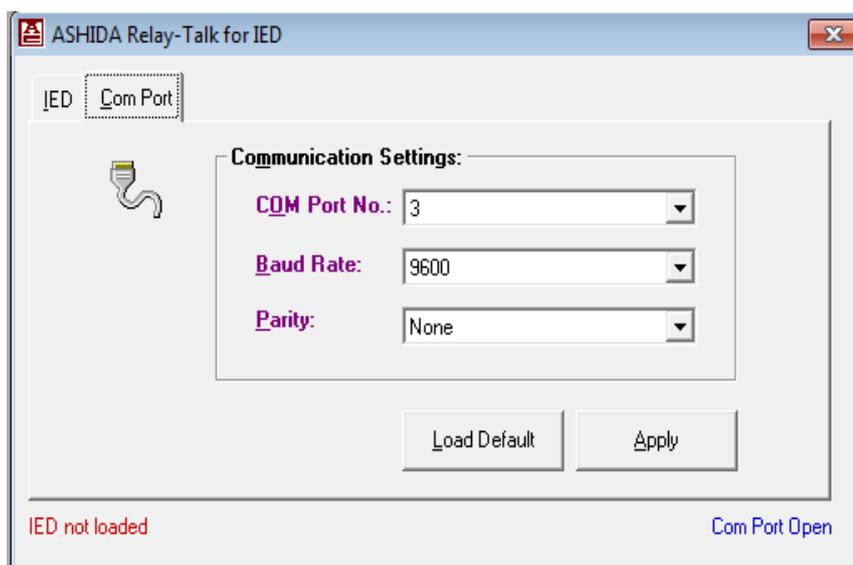


Figure 2 Communication Setting

Now set communication setting it should be match with relay settings.

After selecting the communication setting, click on Apply button.

Now, press the IED button.

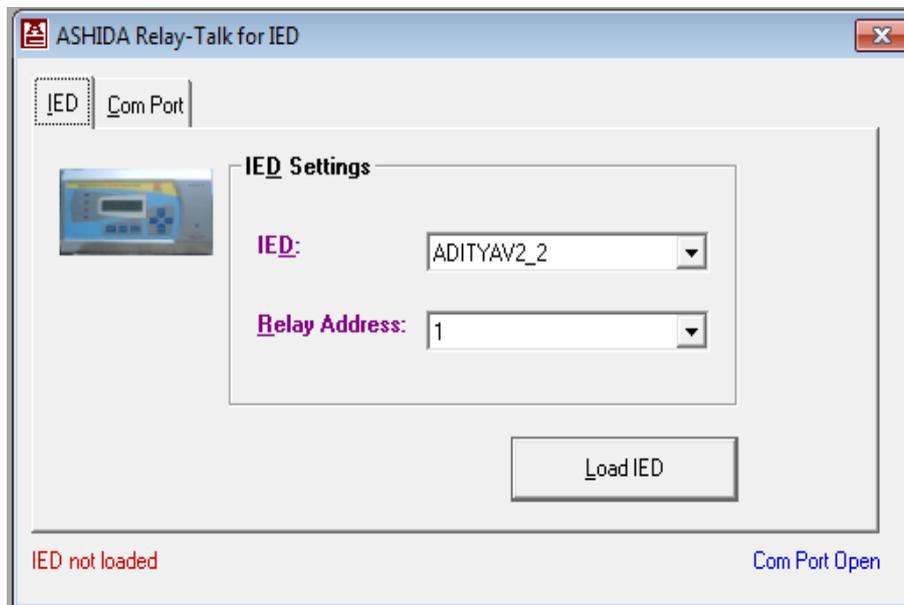


Figure 3: IED Setting

Now press the Load IED button, the display will show following IED Main screen.

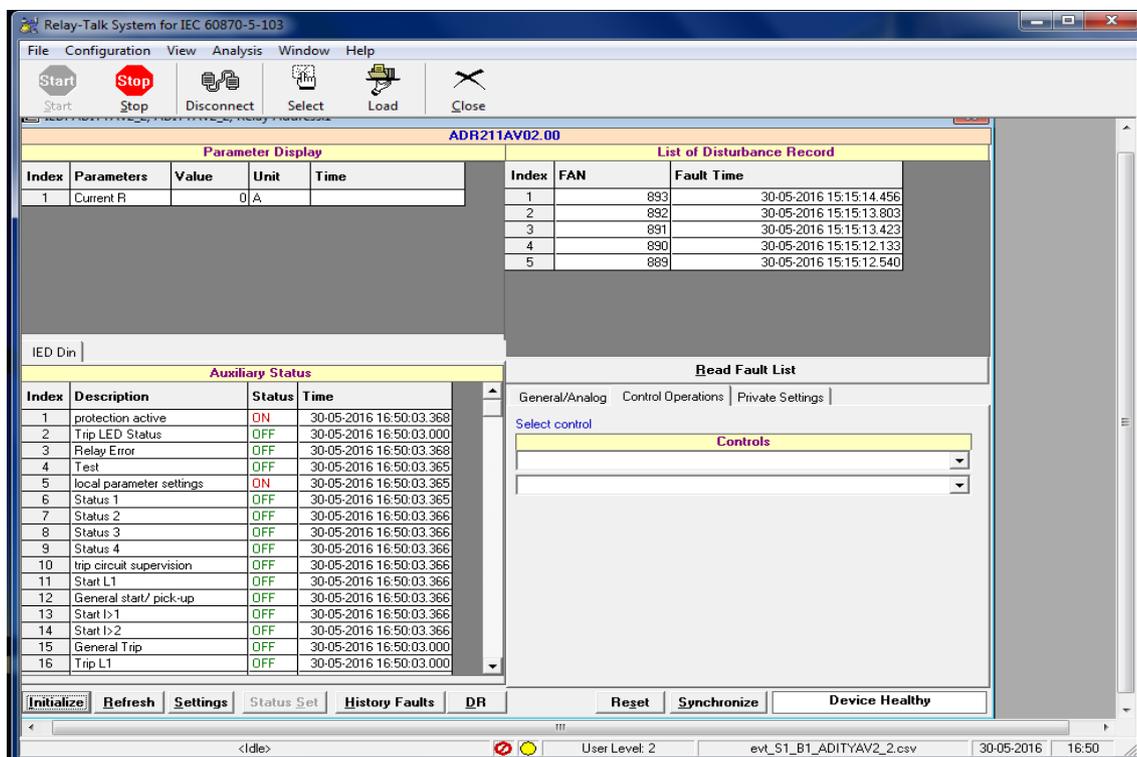


Figure 4: IED main screen

3.3 ADR211A IED Main Screen

After checking all settings and loading the IED the following window will be displayed on the PC screen.

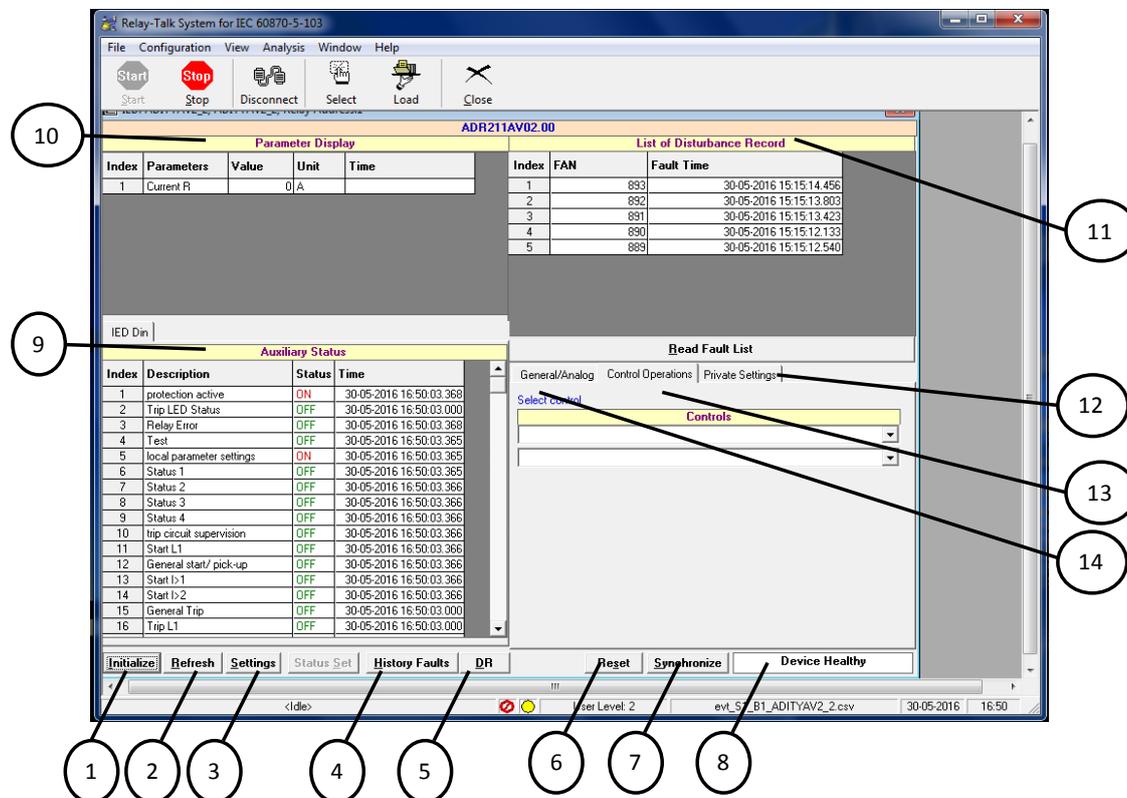


Figure 5: IED Main screen

The windows/Buttons functions are as follows

Sr. No	Name	Description
1	Initialize	This will initialize relay communication.
2	Refresh	It will refresh all windows and parameters
3	Settings	This will display the relay Settings
4	History Faults	It will read all fault data (which is also available on LCD display)
5	*Disturbance Recorder	This is used to view the disturbance with the help of waveform as well as parameters
6	Reset	This is used to reset the relay.
7	Synchronize	This is used to synchronize the relay date and time with PC
8	Device Healthy	This window indicates the healthy condition of the relay with software
9	Auxiliary Status	This is used to view the input status received by the relay
10	Parameter Display	This is used to view the parameters of current.

11	*List of Disturbance Recorder	This is used to view the last 5 faults saved in the relay with fault number.
12	Private settings	This is used to view the current value and the expected value
13	Control Operation	This is used to operate, relay control operation through PC
14	General/Analogue	This is used to view Relay name, Version, and compatibility.

3.3.1 Parameter Display

Online Parameters along with their values & Display Mode units are displayed and refreshed on successful communication.

Parameter Display				
Index	Parameters	Value	Unit	Time
1	Current R	0	A	

Figure 6: Parameter Display

3.3.2 IEDs Din Display

These are IED Din s; these IEDs along with their online status are display.

IED Din				
Auxiliary Status				
Index	Description	Status	Time	
1	protection active	ON	30-05-2016 16:50:03.368	
2	Trip LED Status	OFF	30-05-2016 16:50:03.000	
3	Relay Error	OFF	30-05-2016 16:50:03.368	
4	Test	OFF	30-05-2016 16:50:03.365	
5	local parameter settings	ON	30-05-2016 16:50:03.365	
6	Status 1	OFF	30-05-2016 16:50:03.365	
7	Status 2	OFF	30-05-2016 16:50:03.366	
8	Status 3	OFF	30-05-2016 16:50:03.366	
9	Status 4	OFF	30-05-2016 16:50:03.366	
10	trip circuit supervision	OFF	30-05-2016 16:50:03.366	
11	Start L1	OFF	30-05-2016 16:50:03.366	
12	General start/ pick-up	OFF	30-05-2016 16:50:03.366	
13	Start I>1	OFF	30-05-2016 16:50:03.366	
14	Start I>2	OFF	30-05-2016 16:50:03.366	
15	General Trip	OFF	30-05-2016 16:50:03.000	
16	Trip L1	OFF	30-05-2016 16:50:03.000	

Figure 7: Auxiliary Status

3.3.3 Control Operation

The IEDs Controls are listed in the list and depending on their type either pulse or latch the control operation



Figure 8: Control Operation

3.3.4 Private Setting

These settings for IEDs are display along with their current values and expected values.

Private Settings			
Index	Description	Value	Expected Value
1	Auto DR	False	True; False
2	Line Frequency	50	50; 60

Fig. 9: Private Setting

3.3.5 Bank Settings

This window is to set/ to read Bank settings.

Index	Settings	Value	Unit	Remark/Range	New Value
1	I>		5	(5-250); Range 5-250%	
2	I> TMS x	0.105		Range x0.01-1.50	
3	I>>	0		(0-3000); Range 50-3000%	
4	I> Curve	7		(1-7); Range C1-C6	
5	I>C6 Time	0		Range 00-99.9 S	
6	I>> Delay	0		Range 0-10.00S	
7	BF Delay	0		(0-800); Range 00-800 ms	
8	CT Sec.	1		(1-2); 1 1A, 2 5A	
9	CT Primary	10		(10-5000); Range 10-5000	
10	Trip Cont	1		(1-2); SR 1 HR 2	
11	BF Cont	1		(1-2); SR 1 HR 2	
12	Hrm.Pst.	0		(0-80); Range (00-80)%	

Edit Settings: 1. Setting: I> = 5 Set Code:4
Range: (5-250); Range 5-250%

Figure 10: Bank Setting

3.3.6 History Fault

When the History fault is selected the following window is displayed

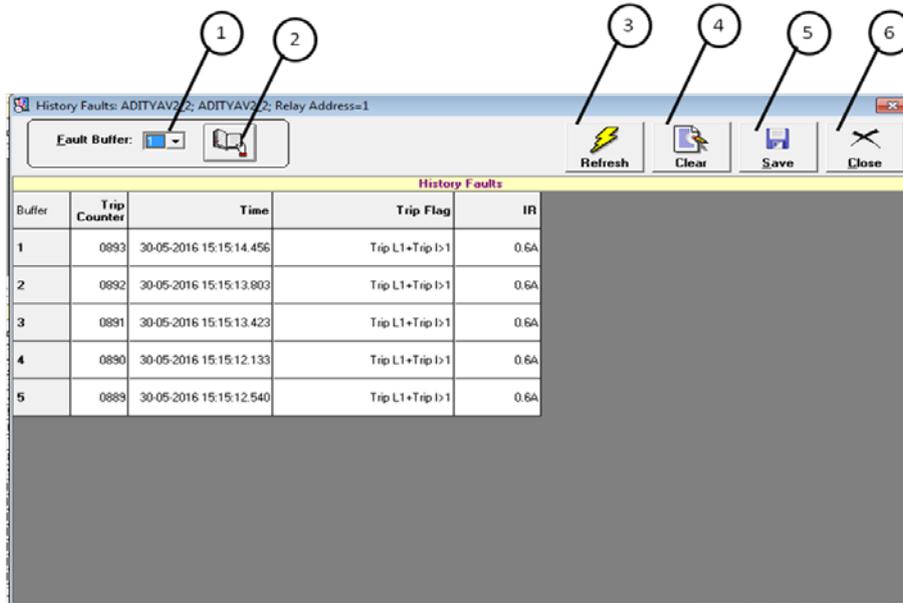


Figure 11: History Fault

The windows/Buttons functions are as follows

Sr. No	Name	Description
1	Fault Buffer	To view the fault buffer number
2	Read Fault	To read the fault selected in the fault buffer
3	Refresh	To refresh all windows and parameters
4	Clear	To clear the screen
5	Save	To save the fault data in history fault
6	Close	To close the History fault window

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Section 4

Protection and Logic Function

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4 PROTECTION FUNCTION & LOGIC FUNCTIONS

4.1 Overview

This section describes the ADR111A/ ADR211A Single Pole IED settings, including the protection elements and basic functions associated with the protection function.

Application data.

Describes the list of information that you will need to know about the protected equipment before calculating the relay settings.

Relay Settings.

- List of settings that configure the IED inputs to accurately measure and interpret the ac current input signals.
- Describes the Breaker Failure settings for Breaker failure on internal protection trip
- Describes all the over current settings and logic needed for protection for the over current fault

4.2 Application Data

It is required to have the field data which is used to calculate the parameter settings which has to be set in the IED. Hence the following inputs are required to calculate the parameter settings in the relay.

- Highest expected load current.
- Current transformer primary and secondary ratings and Connections
- Expected fault current magnitudes for OC Faults

4.3 Relay Settings

Communication setting (for ADR211A)

The Communication settings of ADR211A IED is listed below which is necessary for the communication between the IED and Personal computer.

Sr. No.	Setting Parameters	Setting ranges
1.	Unit ID	0001 - 0250
2.	Com Port	Front/ Rear
3.	Set Parity	None/Even/Odd
4.	Set Baud rate	2400/4800/9600/14400/19200

To establish the proper communication between the IED and Relay Talk software through the Computer, the above settings must be set same in the Relay Talk software as well in the IED.

CT Ratio Settings

The Current transformer setting is required to set for perfect scaling of current measurement. The primary and secondary values of current settings are set in the as given below table.

Sr. No.	Setting Parameters	Setting ranges
1.	CT Secondary	1A/5A
2.	CT Primary	10A to 5000 A

The above settings have to be set based on the Electrical power system parameters to establish the proper measurement of current in the IED.

Breaker Failure Setting (50BF)

If the Circuit Breaker fails to operate within the settable time following the protection trip then relay generates a circuit breaker failure trip signal. Following the inception of a fault, one or more protection functions will operate. Operation of the circuit breaker is essential to isolate the fault, and prevent damage or further damage to the power system.

For transmission and sub-transmission systems, slow fault clearance can also threaten system stability. It is therefore common practice to install circuit breaker failure protection [50BF], which monitors that the circuit breaker has opened within a reasonable time. If the fault current has not been interrupted following a set time delay from circuit breaker trip initiation, breaker failure protection (CBF) will operate. CBF operation can be used to operate back-trip, upstream circuit breakers to ensure that the fault is isolated correctly.

4.4 Phase/Ground Over current Element (50/50N/51/51N)

The ADR111A/ ADR211A has one sensing element. Due to which the same relay can be used for OC/ EF/ REF application.

The Over-current function operates for a set value of current with time delay (IDMT/DT). This function provided with two stages, Where Stage 1 ($I>1$) can be programmed as IDMT or Definite Time (DT) provided with the Range of 5% to 250% in step of 1%. The Stage 2 ($I>2$) can be programmed as Instantaneous or Definite Time (DT) provided with the Range of 50% to 3000% in step of 1%.

The over Current logic checks the current if it exceeds the pickup value ($I>n$) and calculates operating time based on the curve selected in $I>n$ Curve setting and $I>n$ TMS or $I>n$ DT

Delay parameter settings. After all the above condition are satisfied, the IED generates the over current trip.

4.5 IDMT Characteristics

ADR111A/ ADR211A relay provides following inverse time over current characteristics

- Normal Inverse 1 Curve (C1) for 3s
- Normal Inverse 2 Curve (C2) for 1.3s
- Very Inverse Curve (C3)
- Extremely Inverse Curve (C4)
- Extremely Inverse Curve (C4A) as per EE Relays
- Long time Inverse Curve (C5)
- Definite time Over current (C6)

The over current function is programmable as per IDMT characteristic based on IEC standards. The inverse time delay is calculated with the following mathematical formula:

For IEC Inverse Curve

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

For Extremely Inverse C4A Curve as per EE relays

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

Where

t = operation time

a = constant

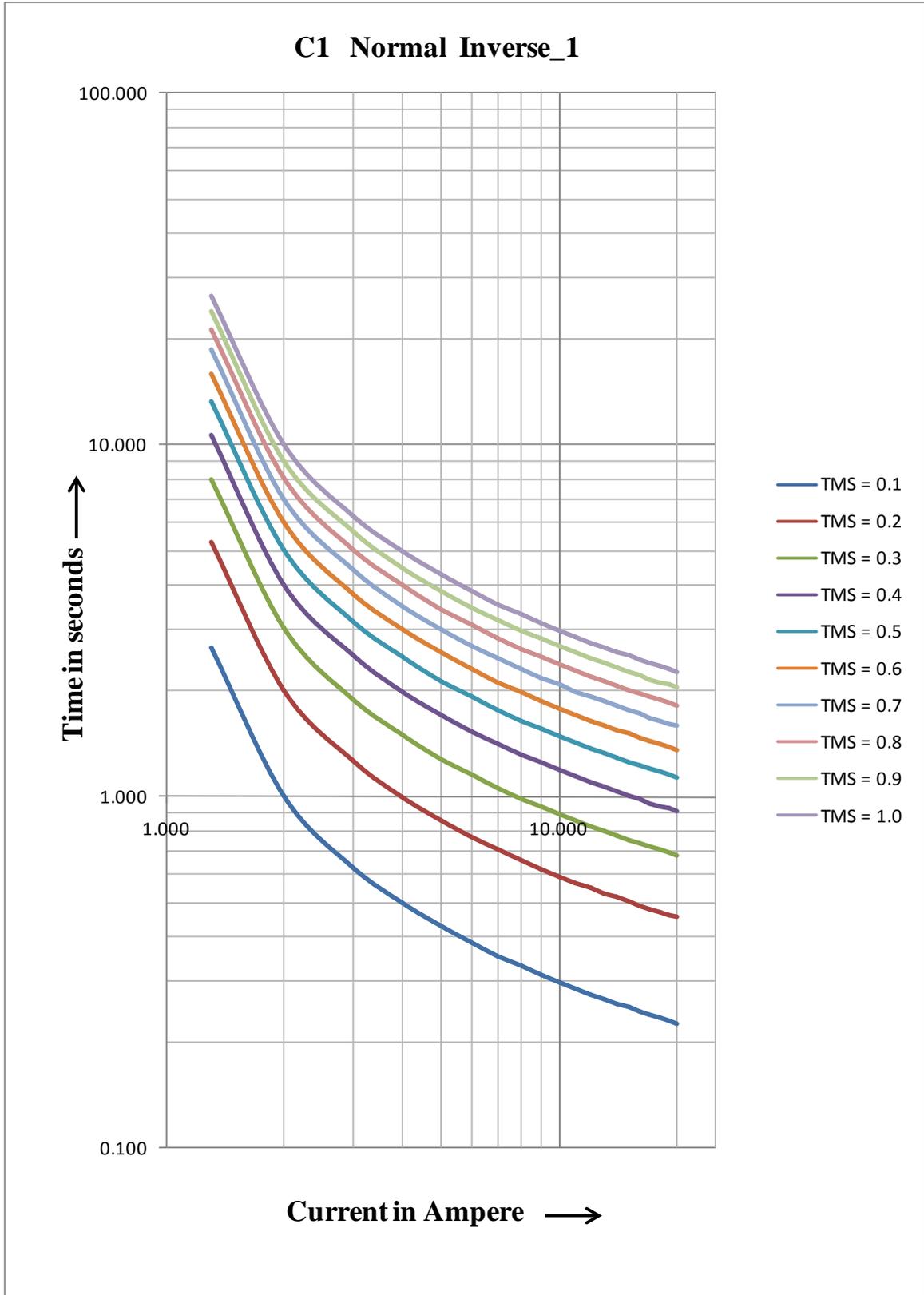
I = Input current

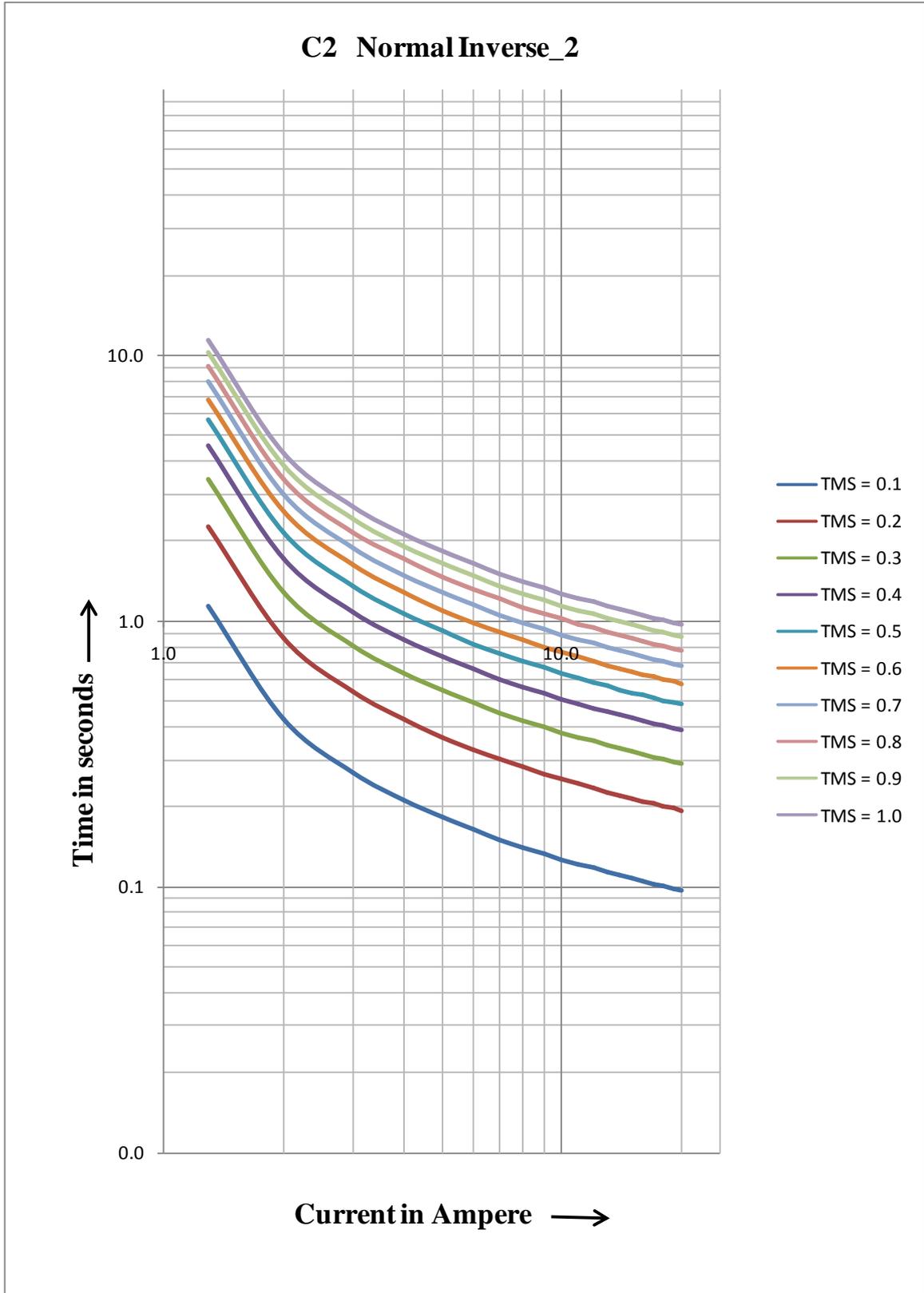
Iref = Current threshold setting

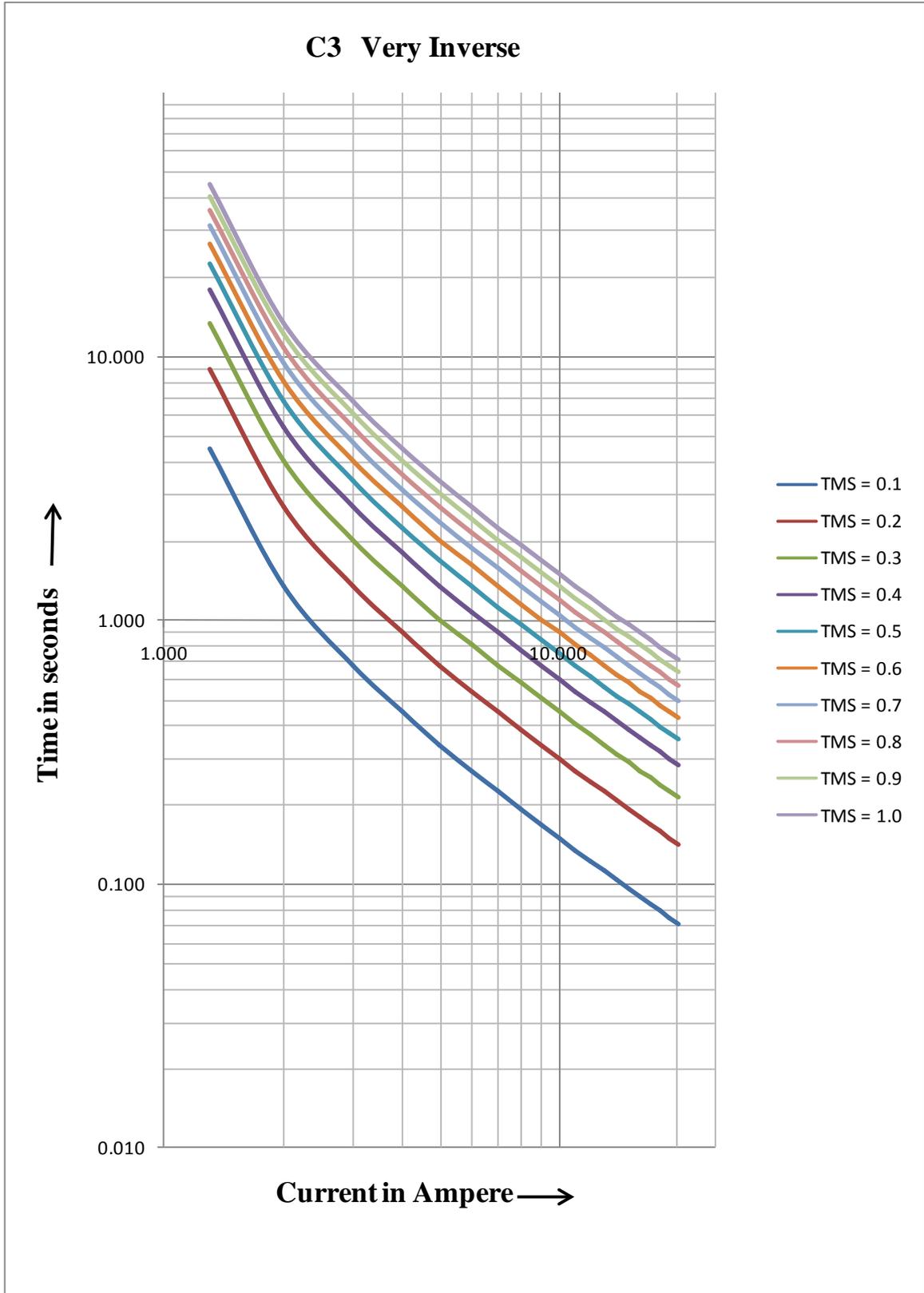
b = Constant

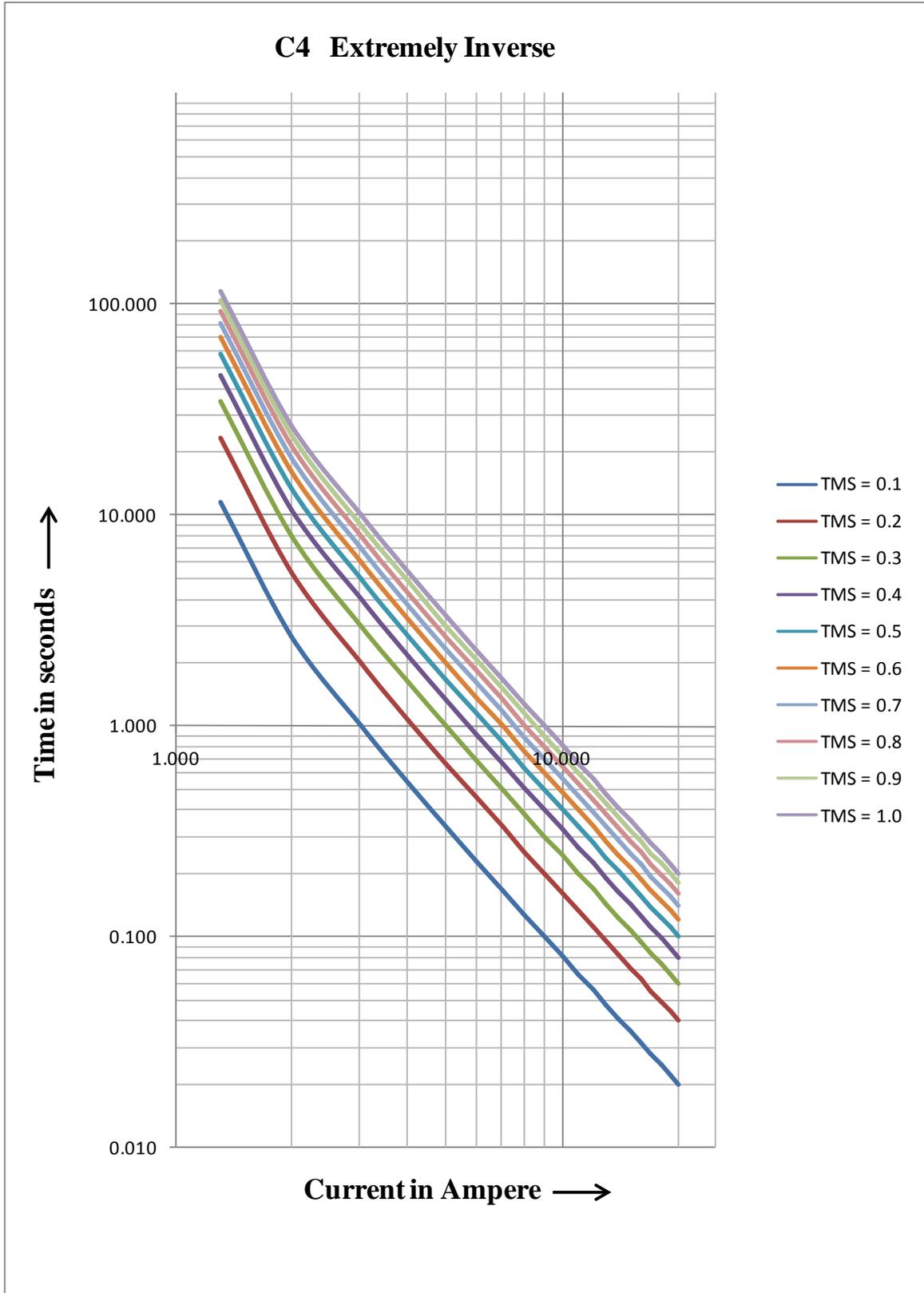
K = Time multiplier setting

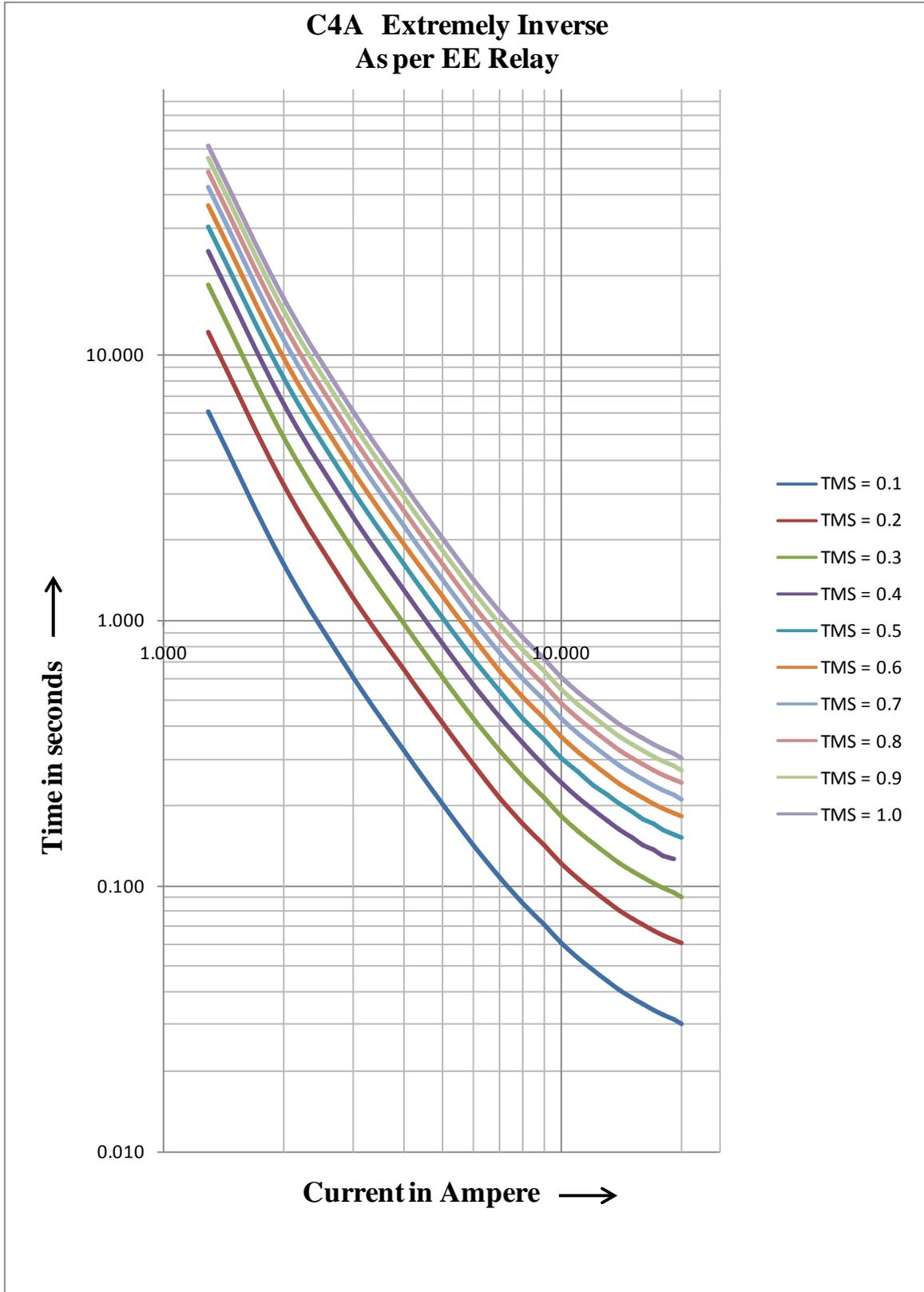
Curve Type	Description	a	b
C1	Normal Inverse 1	0.14	0.02
C2	Normal Inverse 2	0.06	0.02
C3	Very Inverse	13.5	1
C4	Extremely inverse	80	2
C4A	Extremely Inverse (C4A) as per EE Relays	80	2.2
C5	Long Time Inverse	120	1
C6	Definite Time	-	-

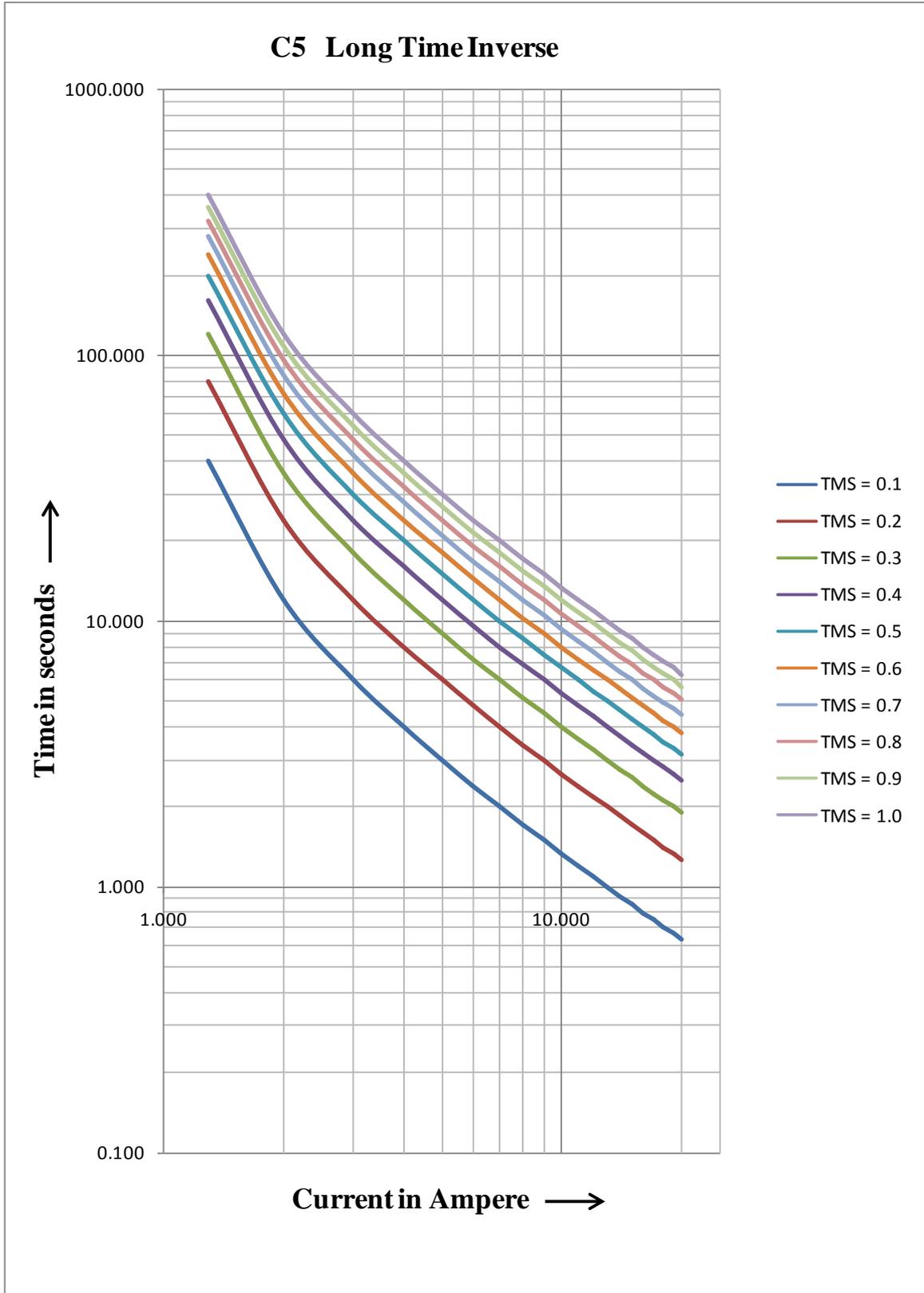












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Section 5

Metering Section

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5 MEASUREMENT SHEET**5.1 Measurement**

Measurement window displays the value of Primary Current and Secondary current based on the power system network.

Parameter	Unit	Description
I =0000.00	A	Primary current
i =0000.00	A	Secondary current

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Section 6

Setting Sheet

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6 SETTING SHEET

6.1 Relay Settings

Sr. No	Parameter	Defaults setting	Setting / Ranges
1.	Password	0000	0000 – 9999
This setting specifies to enter the set password			
2.	New Password	0000	0000 – 9999
This setting specifies to set the new password			
3.	Unit ID	001	001 – 250 in step of 1
This cell sets the unique address for the relay such that only one relay is accessed by master station software.			
4.	I>	100%	5% – 250% in step of 1%
This setting determines Pick-up setting for first stage (IDMT/DT) over current element.			
5.	I> TMS	1.00	0.01 – 1.50 in steps of 0.005
This setting for the time multiplier setting to adjust the operating time of the IDMT characteristic.			
6.	I>>	100%	50% – 3000% in step of 1%
This setting determines Pick-up setting for second stage (Inst/DT) over current element.			
7.	I> Curve	C1	Normal Inverse 1 (C1)/ Normal Inverse 2 (C2)/ Very Inverse (C3)/ Extremely Inverse (C4)/ Extremely Inverse (C4A)/ Long Time Inverse (C5)/ Definite Time (C6)
This setting is used to select the IDMT curves for the various applications.			
8.	C6 Time	0 s	0 – 99.9 s in step of 0.1 s
This setting is used to set the time-delay for the Definite Time (DT) setting if selected for first stage over current element.			
9.	I>> Delay	1.00 s	0.00 – 10s in steps of 0.01s
This setting is used to set the time-delay for the setting for second stage over current element.			
10.	BF Delay	050	000 – 800 ms in step of 50 ms
This setting is used to set the time-delay for the CBF trip.			
11.	CT Secondary	1 A	1 A/5 A
This setting is used to set the CT Secondary			
12.	CT Primary	10 A	10 – 5000A in step of 1A
This setting is used to set the CT Primary.			
13.	Trip Cont	1	001 – 002 (1=SR, 2=HR)
This setting specifies to Trip contact can be set to Manual/Hand reset (HR) or Self reset (SR)			
14.	BF Cont	1	001 – 002 (1=SR, 2=HR)
This setting specifies to BF contact can be set to Manual/Hand reset (HR) or Self reset (SR)			
15.	Com Port	FRONT	FRONT/REAR
This setting specifies to select communication port for 103 communications.			
16.	Parity	None	None/Even/Odd

This setting is used to set parity. It is important that both relay and master station are set with the same parity setting.			
17.	Baud Rate	9600	2400/ 4800/ 9600/ 14400/ 19200
This setting is used to set Baud rate. It is important that both relay and master station are set with the same Baud rate setting.			
18.	Hrm. Rst.	10	00 – 80% in step of 5%
This setting is specify the 2nd Harm Threshold value, if the level of 2nd harmonic exceeds the setting, the over current protection will be blocked.			

6.2 Date and Time setting

Sr. No	Parameter	Defaults setting	Settings / Ranges
1.	SET Hours	00	00 – 23 Hrs in step 1.
Hour setting needed when relay is not connected to SCADA system			
2.	SET Minutes	00	00 – 59 Mins in step 1.
Minutes setting needed when relay is not connected to SCADA system			
3.	SET Seconds	00	00 – 59 Sec. in step 1.
Seconds setting needed when relay is not connected to SCADA system			
4.	SET Date	01	01 – 31 Days in step of 1.
Date needed when relay is not connected to SCADA system			
5.	SET Month	01	01 – 12 Months in step of 1.
Month needed when relay is not connected to SCADA system			
6.	SET Year	01	00 – 99 Years in step of 1.
Year needed when relay is not connected to SCADA system			

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Section 7

Communication

(Applicable to ADR211A Only)

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7 SCADA COMMUNICATIONS

7.1 MODBUS

This section describes how the MODBUS standard is applied to the RT platform. It is not a description of the standard itself. The level at which this section is written assumes that the reader is already familiar with the MODBUS standard.

The MODBUS protocol is a master/slave protocol, defined and administered by the MODBUS Organization. For further information on MODBUS and the protocol specifications please see the Modbus web site (www.modbus.org).

Overview: Physical Connection and Link Layer

For connecting on MODBUS use:

Rear serial port - for permanent SCADA connection via RS422/ RS485

The MODBUS interface uses 'RTU' mode communication rather than 'ASCII' mode as this provides more efficient use of the communication bandwidth. This mode of communication is defined by the MODBUS standard.

The IED address and baud rate can be selected using the relay front panel.

When using a serial interface, the data format is: 1 start bit, 8 data bits, 1 stop bit (a total of 10 bits per character).

7.1.1 MODBUS Protocol Map

7.1.1.1 Function Codes supported:

Code	Function Name	Addresses starts with
02	Read Input Status	1x addresses
03	Read Holding Registers	4x addresses
04	Read Input Registers	3x addresses
05	Force Single Coil	0x addresses
16	Preset Multiple Registers	4x addresses

7.1.1.2 Exception Codes generated in case of an error:

Code	MODBUS Response Name	Product interpretation
01	Illegal Function Code	The function code received in query is not supported by the IED.
02	Illegal Data Address	The start address received in the query is not an allowable value. NOTE: If the start address received is correct but the range includes unsupported address this error is produced.

NOTE: The addresses of the MODBUS registers start from 1 and the user may have to subtract 1 from the addresses, depending upon the configuration of the Master station configuration.

Sr. No.		Function Code	Register	No. of Regs	Format	Reg. Type	Address Map
	Product Information	03					
			Manufacturer Name	10	20-Bytes ASCII	R	4x00001 – 4x00010
			Relay Name	10	20-Bytes ASCII	R	4x00011 – 4x00020
			Model	10	20-Bytes ASCII	R	4x00021 – 4x00030
			Version	10	20-Bytes ASCII	R	4x00031 – 4x00040

Sr. No.		Function Code	Register	No. of Regs	Format	Reg. Type	Address Map
2	Relay Configuration	03					
			Num Status (s)	1	16 bit	R	4x00258
			Num Controls (c)	1	16 bit	R	4x00259
			Num Parameters (p)	1	16 bit	R	4x00260
			Num Faults (f)	1	16 bit	R	4x00261

Inverted IEC 870-5-4 CP56Time2a Format

Time Synchronization – For ASHIDA RTV2 IEDs on Modbus, time synchronization is possible via a broad cast command to 800H (4x02049 through 4x02052). The format is Inverted IEC 870-5-4 CP56Time2a.

Words	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	
1	0	0	0	0	0	0	0	0	Year								00....99
2	0	0	0	0	Month				Day of Week	Day of Month							1...12 1...7 1...31
3					Hours				lv0	Minutes							0...23 0...59
4	Milliseconds Hi								Milliseconds Lo								0.....59999 (second + mill seconds)
Su	(=0 standard, =1 Summer Time)																
iv	(=0 valid, =1 nonvalid or nonsynchronized system case)																
	First Day of week is Monday																

Sr. No.		Function Code	Register	No. of Regs	Format	Reg. Type	Address Map
3	Time Synchronization (Unicast/Broadcast)	03/16					
			Year	1	16 bit	R/W	4x02049
			Month- Day	1	16 bit	R/W	4x02050
			Hour, Min	1	16 bit	R/W	4x02051
			Milliseconds	1	16 bit	R/W	4x02052

Sr. No.		Function Code	Register	No. of Regs	Format	Reg. Type	Address Map
4	Status and Logical Status	02					
			Relay Error	1	1 bit	R	1x32773
			Test	1	1 bit	R	1x32774
			General Start	1	1 bit	R	1x32777
			Start l>	1	1 bit	R	1x32778
			Start l>>	1	1 bit	R	1x32779
			General Trip	1	1 bit	R	1x32780

		Breaker Fail	1	1 bit	R	1x32782
		Trip I>	1	1 bit	R	1x32783
		Trip I>>	1	1 bit	R	1x32784

Sr. No.		Function Code	Register	No. of Regs	Format	Reg. Type	Address Map
5	Status and Logical Status	05					
			Trip	1	16 bit	W	0x33025
			LED Reset	1	16 bit	W	0x33026

Sr. No.		Function Code	Register	No. of Regs	Format	Reg. Type	Address Map
6	Parameters	04					
			I	2	32 bit Float	R	3x33281-3x33282

7.2 IEC60-870-5-103

The specification IEC 60870-5-103 (Tele control Equipment and Systems Part 5 Section 103: Transmission Protocols), defines the use of standards IEC 60870-5-1 to IEC 60870-5-5, which were designed for communication with protection equipment.

This section describes how the IEC 60870-5-103 standard is applied to the ADR211A Relay. It is not a description of the standard itself. The level at which this section is written assumes that the reader is already familiar with the IEC 60870-5-103 standard.

This section should provide sufficient detail to enable understanding of the standard at a level required by most users.

The IEC 60870-5-103 interface is a master/slave interface with the device as the slave device. The device conforms to compatibility level 2, as defined in the IEC 60870-5-103 standard.

The following IEC 60870-5-103 facilities are supported by this interface:

- Initialization (reset)
- Time synchronisation
- Event record extraction
- General interrogation
- Cyclic measurements
- General commands

7.3 Physical Connection and Link Layer

For connecting on IEC 60870-5-103 there are two options:

- Front USB Port.
- Rear serial port - for permanent SCADA connection via RS422/ RS485.

The IED address, Parity and Baud rate can be selected using the relay front panel.

7.4 Initialisation

Whenever the device has been powered up, or if the communication parameters have been changed, a reset command is required to initialize the communications. The device will respond to either of the two reset commands; Reset CU or Reset FCB (Communication Unit or Frame Count Bit). The difference between the two commands is that the Reset CU command will clear any unsent messages in the transmit buffer, whereas the Reset FCB command does not delete any messages.

The device will respond to the reset command with an identification message ASDU 5. The Cause of Transmission (COT) of this response will be either Reset CU or Reset FCB depending on the nature of the reset command.

The relay will also produce a power up event, when the relay is powered up.

7.5 Time Synchronisation

The time and date can be set using the time synchronisation feature of the IEC 60870-5-103 protocol. The device will correct the transmission delay depending on communication speed. For this, transmission time, required for the time synchronization frame from the Master to IED, considering current baud rate is added in the received time.

The device will correct the transmission delay depending on baud rate. If the time synchronisation message is sent as a send/confirm message then the device will respond with a confirm message. A time synchronisation Class 1 event will be generated/produced whether the time-synchronisation message is sent as a send confirm or a broadcast (send/no reply) message.

7.6 Spontaneous Events

Events are categorized using the following information:

Function type

Information Number

The IEC 60870-5-103 profile in the Menu Database contains a complete listing of all events produced by the device.

7.7 General Interrogation (GI)

The GI request can be used to read the status of the device, the function numbers, and information numbers that will be returned during the GI cycle. These are shown in the IEC 60870-5-103 profile in the Menu Database.

7.8 Cyclic Measurements

The device will produce measured values using ASDU244. ASDU244 will be reported with information number 0. These frames are reported alternately. This can be read from the device using a Class 2 poll. For every query the current online data is reported.

7.9 Commands

A list of the supported commands is contained in the Menu database. The device will respond to other commands with ASDU 1, with a cause of transmission (COT) indicating 'negative acknowledgement'.

7.10 Configuration

To configure the IED for this protocol, please see the Configuration chapter.

7.11 IEC-103 Protocol Mapping

Sr. No.	INF	Description	GI	TYP	COT	FUN
1	Semantics of INFORMATION NUMBER : System Functions in monitor direction					
	0	End of general interrogation	-	8	10	255
	0	Time synchronization	-	6	8	255
	2	Reset FCB	-	5	3	160
	3	Reset CU	-	5	4	160
	4	Start/Restart	-	5	5	160
	5	Power on	-	5	6	160

Note: **X** under **GI** heading means DI Status is included in General Interrogation response.

Sr. No.	INF	Description	GI	TYP	COT	FUN
2	Semantics of INFORMATION NUMBER : Status & Fault indications in monitor direction					
	19	Trip LED	X	1	1,7,9,11,12,20,21	160
	22	Local parameter setting	X	1	9,11,12	160
	84	General Start	X	2	1,7,9	160
	117	Start I>	X	2	1,7,9	126
	103	Start I>>	X	2	1,7,9	126
	68	General Trip	-	2	1,7	160
	90	Trip I>	-	2	1,7	160
	91	Trip I>>	-	2	1,7	160
	85	50 BF	x	2	1,7	160
	21	Test Trip	-	2	1,7	127

Sr. No.	INF	Description	GI	TYP	COT	FUN
3	Semantics of INFORMATION NUMBER : Measurands in monitor direction					
	148	I in MEA format	-	9	2, 7	160

NOTE: The measurands transmitted by the relay are sent as a proportion of 1.2 times of the rated value

Sr. No.	INF	Description	GI	TYP	COT	FUN
4	Semantics of INFORMATION NUMBER : System Functions in control direction					
	0	Initialization of general interrogation	-	7	9	255
	0	Time synchronization	-	6	8	255

Sr. No.	INF	Description	GI	TYP	COT	FUN
5	Semantics of INFORMATION NUMBER : General commands in control direction					
	19	LED Reset	ON	20	20	160
	124	Trip relay	ON	20	20	127

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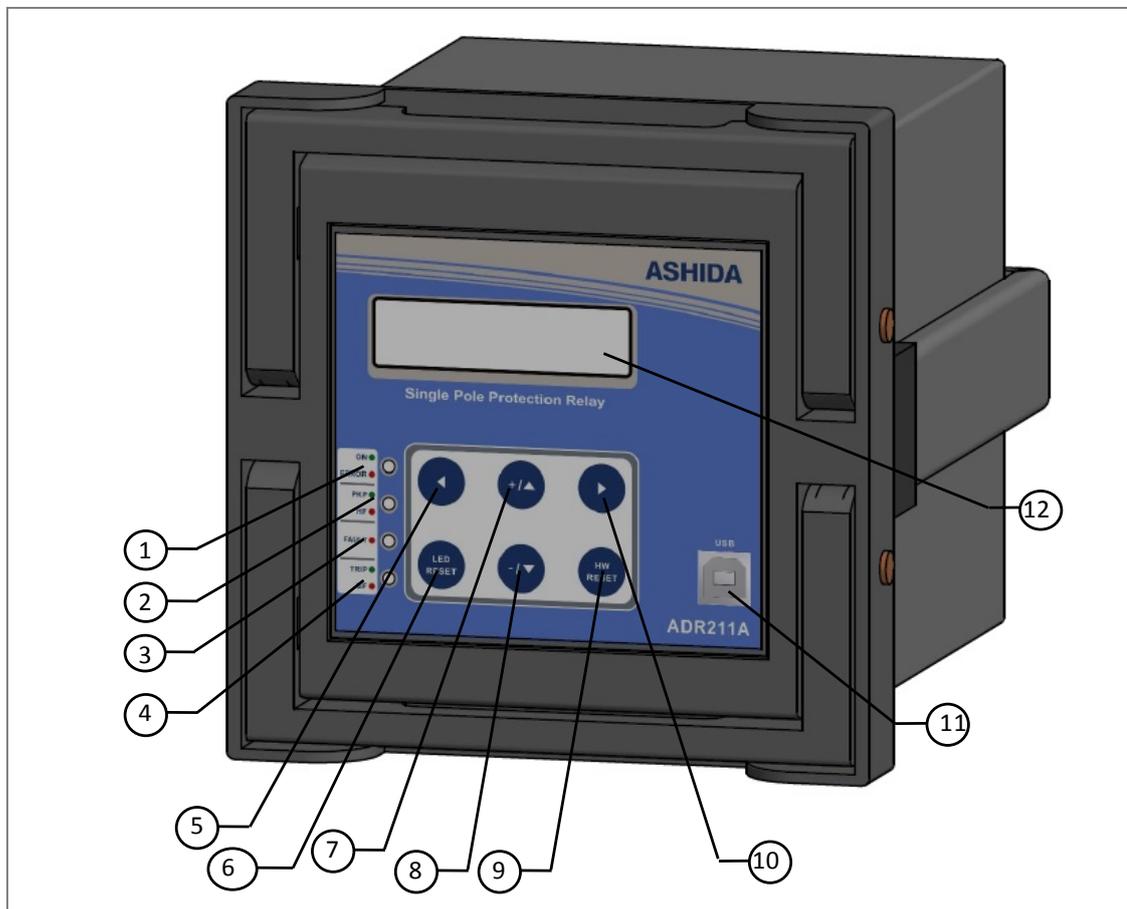
Section 8

User Guide

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8 USER GUIDE



No	Legend	Function
1.	ON / ERROR	: Green LED indicates Relay OK. : Red LED indicates internal error.
2.	PKP / HF	: Green LED indicates Relay pickup. : Red LED indicates instantaneous trip.
3.	FAULT	: Red LED indicates FAULT, Hand Reset (HR) Type.
4.	TRIP / BF	: Green LED indicates Trip command is being executed. SR type when TRIP contact selected as SR and HR type when TRIP contact selected as HR : Red LED indicates Breaker Failure. SR type when TRIP contact selected as SR and HR type when TRIP contact selected as HR
5.	◀	: Feather Touch Key Left arrow Key [◀] for navigating through the menus and submenus and save settings.

No	Legend	Function
6.	LED RESET	: Feather Touch Key LED RESET to Reset LED and HR Type Output contact
7.	+ / ▲	: Feather Touch Key [+] Plus to INCREMENT the values & [▲] to SCROLL the Main Menu up.
8.	- / ▼	: Feather Touch Key [-] Minus to 'DECREMENT' the values & [▼] to SCROLL the Main Menu down.
9.	HW RESET	: Feather Touch Key for HW RESET is provided for Hardware Reset. This key is interlock with LED RESET key.
10.	▶	: Feather Touch Key [▶] to VIEW the settings and to navigate through the menus and submenus.
11.	USB	: USB port for serial communication. (For ADR211A only)
12.	LCD Display	: 16 x 2 char. LCD display to observe settings and parameters of the relay.

8.1 USER INTERFACE

8.1.1 LCD Display

Back-lit LCD display 16 x 2 characters is provided for the parameter and setting display, and for easy viewing of measurement, setting, fault records, date & time and error message. Back-lit will automatically switch OFF if any key is not pressed for more than 100sec. Back-lit is also automatically turned ON when any tripping occurs.

8.1.2 Touch Keys

The function of relay is controlled by the following keys provided on the Front Plate:

(◀) Left Arrow: Left Arrow key (◀) is used to navigate through the menus and SAVE settings.

(+ / ▲) Plus / Up Arrow: (+) Plus is used to increment the setting value in the display. The

(▲) Up Arrow is used to scroll the menu in UP direction.

(▶) Right Arrow: The Right Arrow key is used to VIEW the settings and to navigate through the menus.

LED RESET: The Key for Reset LED and HR type Output contact

(- / ▼) Minus / Down Arrow: (-) Minus is used to decrement the setting value in the display. The (▼) Down Arrow is used to scroll the menu in DOWN direction.

HW RESET: The 'HW RESET' key is not required in normal operation but it is used to reset total hardware of relay. This key is interlocked with LED RESET key. This is normally required during firmware update of relay.

NOTE: At the time of setting if changes are not carried within 100s then the display will reset itself and return to the main menu.

8.1.3 LEDs

The ADR111A/ ADR211A Relay is having 4 dual colour LED's of high intensity for easy identification of type of fault for easy user interface.

No	LED	Function
1.	ON / ERROR	: Green LED indicates Relay OK. : Red LED indicates internal error.
2.	PKP / HF	: Green LED indicates Relay pickup. : Red LED indicates instantaneous trip.
3.	FAULT	: Red LED indicates FAULT, Hand Reset (HR) Type.
4.	TRIP / BF	: Green LED indicates Trip command is being executed. : Red LED indicates Breaker Failure.

8.1.4 RS422 / RS485 Port (For ADR211A)

RS422 / RS485 Port is provided at the rear side of relay for permanent SCADA connectivity. Using RS422 / RS485 port the Fault data, Auxiliary Status and online measurement can be viewed.

Note: The RS422 4 wire (Tx+, Tx-, Rx+, Rx-) communication port can be used as RS485 2 wire (D+, D-) by shorting terminal A5 & A7 used as D+ and A6 & A8 used as D-.

8.1.5 USB Port (For ADR211A)

The USB port includes a USB full-speed function controller, USB transceiver, oscillator, EEPROM, and asynchronous serial data bus (UART). No other external USB components are required.

The USB Communication port is provided on front panel of relay. This is very useful for downloading relay data and analysis it.

For proper operation the user must select the proper communication port in the Relay Setting.

8.2 MENUS

8.2.1 Default Display

After the Power ON or when the H/W. RESET + LED RESET key is pressed, the relay will display the following message.

<p>Ashida Digital Relay</p>	<p>This window will flash momentarily showing the following. Relay Name : Ashida Digital Relay Then the control will automatically move to next option.</p>
<p>ADR211A V-02.00 Unit ID = 001</p>	<p>This window will flash momentarily showing the following. Relay Type: ADR211A_V – 02.00; Unit ID 001 Then the control will automatically move to next option.</p>
<p>I = 0000A</p>	<p>This window shows actual Primary load current as per the CT Primary selection.</p>

8.2.2 Main Menu Details

<p>I = 0000A</p>	<p>This window shows actual Primary load current as per the CT Primary selection. Press the Right arrow key (▶) to move to the next option.</p>
<p>i = 000.00</p>	<p>This window shows actual Secondary load current as per the CT Secondary selection. Press the Right arrow key (▶) to move to the next option.</p>
<p>Measurement</p>	<p>The relay will display “Measurement” in Main Menu. Press the Plus / up arrow key (+ / ▲) to move to the next option.</p>
<p>Relay Settings</p>	<p>Password protected window for “Relay Settings” setting i.e. New Password, Unit ID, I>, I> TMS, I>>, I> Curve, I>C6 Time, I>> Delay, CT Sec., CT Primary, Trip Cont, BF Cont., BF Delay, Com Port, Parity, Baud Rate and Hrm Rst.</p>

	Press the Plus / up arrow key (+ / ▲) to move to the next option.
Trip Test	To apply " Trip Test " Press the Plus / Up arrow key (+ / ▲) to move to the next option.
Fault 1	To view " Fault 1 " Press the Plus / Up arrow key (+ / ▲) to move to the next option.
Fault 2	To view " Fault 2 " Press the Plus / Up arrow key (+ / ▲) to move to the next option.
Fault 3	To view " Fault 3 " Press the Plus / Up arrow key (+ / ▲) to move to the next option.
Fault 4	To view " Fault 4 " Press the Plus / Up arrow key (+ / ▲) to move to the next option.
Fault 5	To view " Fault 5 " Press the Plus / Up arrow key (+ / ▲) to move to the next option.
Error Log	To view " Error Log " Press the Plus / Up arrow key (+ / ▲) to move to the next option.
Status	To view " Status " Press the Plus / Up arrow key (+ / ▲) to move to the next option.

<p>DATE / TIME</p>	<p>Password protected window for “DATE / TIME” setting i.e. Set Hour, Set Minute, Set Second, Set Date, Set Month and Set Year.</p> <p>Press the Plus / Up arrow key (+ / ▲) to move to the next option.</p>
<p>MEASUREMENT</p>	<p>This window shows the first window of Main Menu.</p>

8.2.3 MEASUREMENT

8.2.3.1 To View – MEASUREMENT

<p>MEASUREMENT</p>	<p>This menu is to view CT Primary and Secondary current as per selection,</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
<p>I = 0000A</p>	<p>This window shows actual Primary load current as per the CT Primary selection.</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
<p>i = 000.00</p>	<p>This window shows actual Secondary load current as per the CT Secondary selection.</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
<p>MEASUREMENTS</p>	

8.2.4 Relay Settings

8.2.4.1 To Set – Relay Settings

<p>Relay Settings</p>	<p>Password protected window for “Relay Settings” setting i.e. New Password, Unit ID, I>, I> TMS, I>>, I> Curve, I>C6 Time, I>> Delay, BF Delay, CT Sec., CT Primary, Trip Cont, BF Cont., Com Port, Parity, Baud Rate and Hrm Rst.</p> <p>Press the left arrow Key (◀) to move to the next option..</p>
<p>Password = 0000 Use Inr / Dec</p>	<p>Editable setting</p> <p>Enter the previously set password, by using the up arrow key (+ / ▲) or the down arrow key (- / ▼).</p> <p>The setting range is from 0000 to 9999 in steps of 1.</p> <p>Note: Default password setting is ‘0000’</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>Password = 000 New Password</p>	<p>Editable setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired New Password can be set.</p> <p>The setting range is from 0000 to 9999 in steps of 1.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>Unit ID = 001</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired Unit ID can be set.</p> <p>The unit address will vary from 001 to 250, which means total 249 devices can be connected to single computer. The 250 address is reserved for special command. These settings are required to communicate with the SCADA computer.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>I> = 100 Range 5 – 250%</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired I> can be set.</p>

	<p>The setting range is 5 to 250% in steps of 1%.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>I> TMS = x1.000 Range x0.01 – 1.50</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired I> TMS (Time Multiplier Settings) can be set.</p> <p>The setting range is x0.01 to 1.50 in steps of 0.005</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>I>> = 0100 Range 50 – 3000%</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired I>> can be set.</p> <p>The setting range is 50% to 3000% in steps of 1%</p> <p>Press the left arrow key (◀) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>I> Curve = C1 Range C1 – C6</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired I> Curve (IDMT Curve) can be selected.</p> <p>Seven different types of curves are provided C1 to C6. When the given value is C1 curve 1 is selected and when the given value is C2 curve 2 is selected. In similar manner any desired curve can be selected as C1 to C6 corresponds</p> <p>C1 = Normal Inverse 1 (10 Times 3.0 sec) C2 = Normal Inverse 2 (10 Times 1.3 sec) C3 = Very Inverse (10 Times 1.5 sec) C4 = Extremely Inverse (10 Times 0.8 sec) C4A = Extremely Inverse (10 Times 0.6 sec) C5 = Long Time Inverse (10 Times 13.3 sec) C6 = Definite Time (Inst. to 99.9 sec)</p> <p>Press the left arrow Key (◀) to move to the next option.</p>

<p>I>C6 Time = 00.1 Range 00 – 99.9 S</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired I>C6 Time (Definite Time Delay) can be set.</p> <p>The setting range is 00 to 99.9 S in steps of 0.1 S. This setting is effective only when C6 curve is selected.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>I>> Delay = 00.05 Range 0 – 10.00 S</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired I>> Delay can be set.</p> <p>The setting range is 0 to 10.00 S in steps of 0.01 S.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>BF Delay = 100 Range 00 – 800 ms</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired BF Delay (Breaker Fail) can be set.</p> <p>The setting range is 00 to 800 ms in steps of 50 ms. The 000 means bypass this feature.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>CT Sec. = 001 1 = 1A, 2 = 5A</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired CT Secondary can be selected. i.e. 1 or 2. In which, 1 corresponds with 1 Amp. and 2 correspond with 5 Amp respectively.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>CT Primary = 0010 Range 10 – 5000</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired CT Primary can be set.</p> <p>The Setting Range is from 10 to 5000A in steps of 1A. (For example suppose CT Ratio is 500/1A then you have to select</p>

	<p>CT Pri =500 so that when 1A current flows into relay circuit, in measurement window it will show you 500A).</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>Trip Cont = 002 SR = 1 HR = 2</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired Trip Contact can be selected. i.e. 1 or 2. In which, 1 corresponds with SR (Self-Reset) and 2 correspond with HR (Hand-Reset) respectively.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>BF Cont = 002 SR = 1 HR = 2</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired BF Contact can be selected. i.e. 1 or 2. In which, 1 corresponds with SR (Self-Reset) and 2 correspond with HR (Hand-Reset) respectively.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>Com Port = FRONT FRONT/REAR</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired Com Port can be set i.e. FRONT / REAR</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>Parity = None None/Even/Odd</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired Parity can be set i.e. None / Even / Odd</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>Baud Rate = 003 Range 1 – 5</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired Baud Rate can be set.</p>

	<p>The setting range is 2400 – 19200. (i.e. 2400, 4800, 9600,14400, 19200)</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Hrm. Rst. = 080 Range (00 – 80) %</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired Hrm. Rst. can be set</p> <p>The setting range is 00 to 80% in steps of 5%.. The 000 means bypass this feature.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>SAVE Settings? ◀ for Save</p> </div>	<p>Press the left arrow Key (◀) to SAVE the changes.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>OK</p> </div>	<p>This window will flash for a moment and it will move to the Main Menu.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>RELAY SETTING</p> </div>	

8.2.4.2 To View – Relay Settings

<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Relay Settings</p> </div>	<p>Press the right arrow key (▶) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>Unit ID = 001</p> </div>	<p>This window shows the set Unit ID.</p> <p>Press the right arrow key (▶) to move to the next option.</p>

<p>I>100% t>1.000 I>>0100%</p>	<p>This window shows the set Current values.</p> <p>Press the right arrow key (▶) to move to the next option.</p>
<p>I>Normal Inv.1</p>	<p>This window shows the set Curve.</p> <p>Press the right arrow key (▶) to move to the next option.</p>
<p>I>C6 Time = 00.1 I>> Delay = 00.05</p>	<p>This window shows the set I> C6 Time and I>> Delay</p> <p>Press the right arrow key (▶) to move to the next option.</p>
<p>CT Sec. = 01A CT Pri. = 0010A</p>	<p>This window shows the set CT Secondary and CT Primary.</p> <p>Press the right arrow key (▶) to move to the next option.</p>
<p>Trip Cont = HR BF Cont = HR</p>	<p>This window shows the set Trip Cont and BF Cont.</p> <p>Press the right arrow key (▶) to move to the next option.</p>
<p>BF Delay = 100 Com Port = FRONT</p>	<p>This window shows the set BF Delay & Com Port.</p> <p>Press the right arrow key (▶) to move to the next option.</p>
<p>Parity = None Baud Rate = 09600</p>	<p>This window shows the set Parity and Baud Rate</p> <p>Press the right arrow key (▶) to move to the next option.</p>
<p>Hrm. Rst. = 000%</p>	<p>This window shows the set Harmonic Restrain Function.</p> <p>Press the right arrow key (▶) to move to the Main Menu.</p>
<p>Relay Settings</p>	

8.2.5 Trip Test

<p>Trip Test</p>	<p>The password protected window for Trip Test.</p> <p>Press the left arrow key (◀) to move to the next option</p>
<p>Password = 0000 Use Inr / Dec</p>	<p>Editable setting</p> <p>Enter the previously set password, by using the up arrow key (+ / ▲) or the down arrow key (- / ▼).</p> <p>Note: Default password setting is '0000'</p> <p>Press the left arrow Key (◀) to apply the Trip Test.</p>
<p>I>> : TC:0000 I> : T</p>	<p>This window will show High Fault, Trip Counter, IDMT Fault and Test Trip Flag.</p> <p>Press the left arrow key (◀) to move to the next option</p>
<p>FAULT 1</p>	

8.2.6 Fault 1

8.2.6.1 To View – Fault 1

<p>FAULT 1</p>	<p>This menu is to view "Fault 1"</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
<p>I>> : I TC:0000 I> : I BFT</p>	<p>This window will show High Fault, Trip Counter, IDMT Fault and Breaker Fail or Test Trip indication.</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
<p>I = 1000 A i = 000.00A</p>	<p>This window will show Primary & Secondary Current measured at the time of the fault.</p> <p>Please note: If Fault current is ≤ 9999 then display will show the current in Ampere i.e. 9999A and If Fault current is ≥ 10000 then display will show the current in Kilo Ampere i.e. 10.00K</p>

	Press the Right arrow key (▶) to move to the next option.
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> 02/06/16 14:32:51:085 </div>	<p>This window will show Date & Time of Fault.</p> <p>Press the Right arrow key (▶) to move to the Main Menu.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Fault 1 </div>	

Note : Fault 2, Fault 3, Fault 4 and Fault 5 can be viewed in simillar manner

8.2.7 To View Error Log

<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Error Log </div>	<p>This menu is to view “Error Log”</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Error Code : 0000 </div>	<p>This window will show Error Code.</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Error Log </div>	

The relay continuously keeps track on its internal hardware and the moment it detects any failure of component, a message is displayed on LCD display. The type of error can be checked by “Error Log” menu. This feature is very useful for giving pre information to avoid mal operation.

Following are some of Error codes: -

Error Code	Description
01	Setting Error
02	EEPROM Error
04	RTC Error
08	Crystal Error

16	ADC Error
32	FRAM Error1
64	FRAM Error2

In case of ADC error relay will not work at all and will show directly ADC Error and relay function will be locked.

8.2.8 STATUS

8.2.8.1 To View – STATUS

STATUS	<p>This menu is to view “STATUS” i.e. Software Version and Hardware Version.</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
SWV : 02.00 HWV : 02.00	<p>This window will show Relay Software & Hardware Version.</p> <p>Press the Right arrow key (▶) to move to the next option.</p>
STATUS	

8.2.9 DATE AND TIME SETTINGS

8.2.9.1 To Set – DATE AND TIME Settings

DATE / TIME	<p>Password protected window for “DATE / TIME” setting i.e. Set Hour, Set Minute, Set Second, Set Date, Set Month, and Set Year.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
Password = 0000 Use Inr / Dec	<p>Editable setting</p> <p>Enter the previously set password, by using the up arrow key (+ / ▲) or the down arrow key (- / ▼).</p> <p>Note: Default password setting is ‘0000’</p> <p>Press the left arrow Key (◀) to move to the next option.</p>

<div style="border: 2px solid black; padding: 5px; width: fit-content;"> <p>SET Hour = 017 Range 0 – 23</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired SET Hour can be set.</p> <p>The setting range is from 00 to 23 in steps of 1.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 2px solid black; padding: 5px; width: fit-content;"> <p>SET Minute = 039 Range 0 – 59</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired SET Minute can be set.</p> <p>The setting range is from 00 to 59 in steps of 1.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 2px solid black; padding: 5px; width: fit-content;"> <p>SET Second = 040 Range 0 – 59</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired SET Second can be set.</p> <p>The setting range is from 00 to 59 in steps of 1.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 2px solid black; padding: 5px; width: fit-content;"> <p>SET Date = 002 Range 1 – 31</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired SET Date can be set.</p> <p>The setting range is from 1 to 31 in steps of 1.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<div style="border: 2px solid black; padding: 5px; width: fit-content;"> <p>SET Month = 006 Range 1 – 12</p> </div>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired SET Month can be set.</p> <p>The setting range is from 1 to 12 in steps of 1.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>

<p>SET Year = 016 Range 00 – 99</p>	<p>Editable Setting</p> <p>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired SET Year can be set.</p> <p>The setting range is from 00 to 99 in steps of 1.</p> <p>Press the left arrow Key (◀) to move to the next option.</p>
<p>SAVE Settings? Mode for Save</p>	<p>Press the left arrow Key (◀) to move to the next option.</p>
<p>OK</p>	<p>This window will flash for a moment and it will move to the Main Menu.</p>
<p>DATE / TIME</p>	

8.2.9.2 To View – DATE AND TIME Settings

<p>DATE AND TIME</p>	<p>Press the Right arrow key (▶) to move to the next option.</p>
<p>Time : 15:20:25 Date : 02/06/16</p>	<p>Press the Right arrow key (▶) to return to the Main Menu.</p>
<p>DATE AND TIME</p>	

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Section 9

Flow Chart

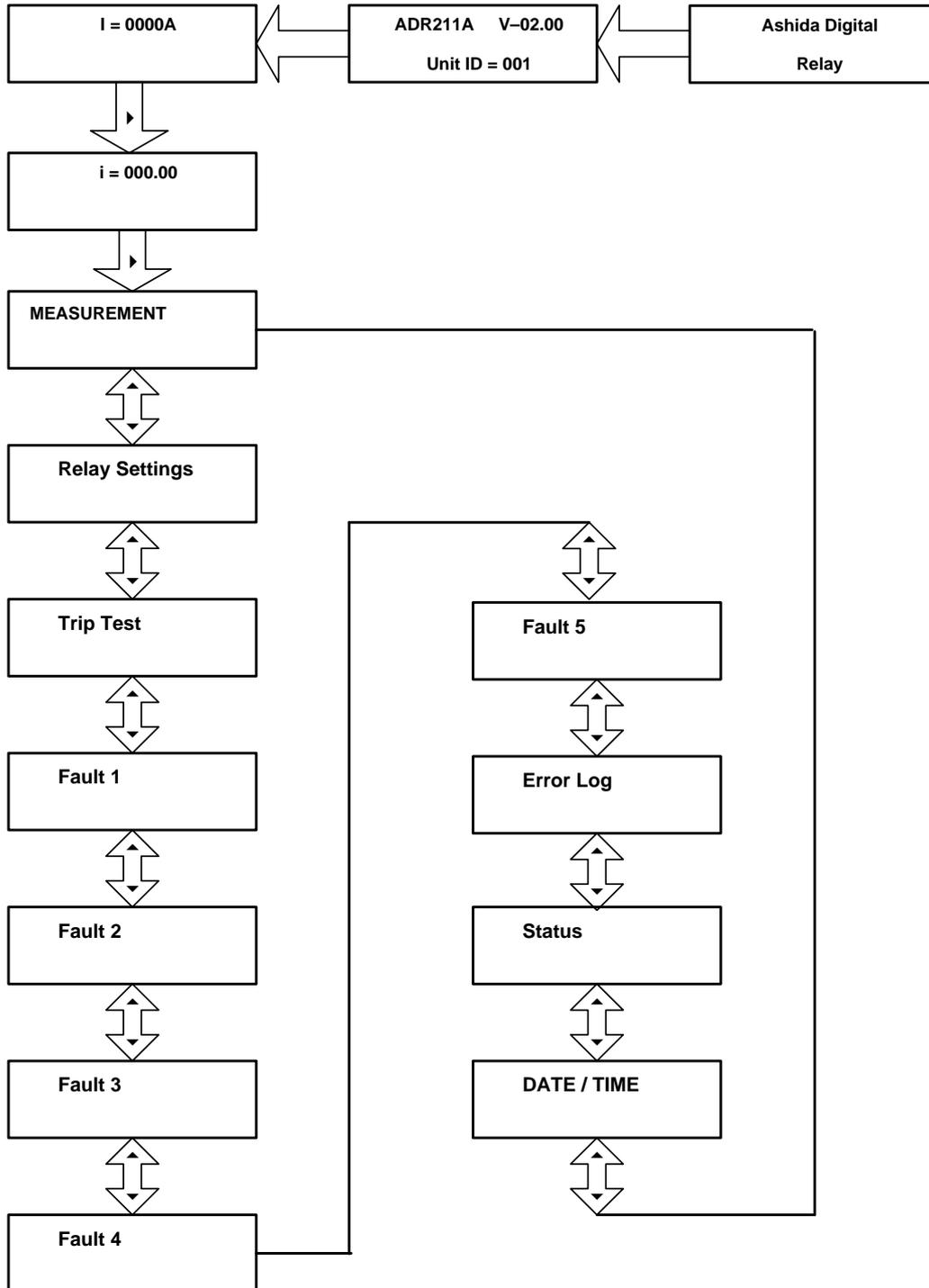
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9 FLOW CHART OVERVIEW

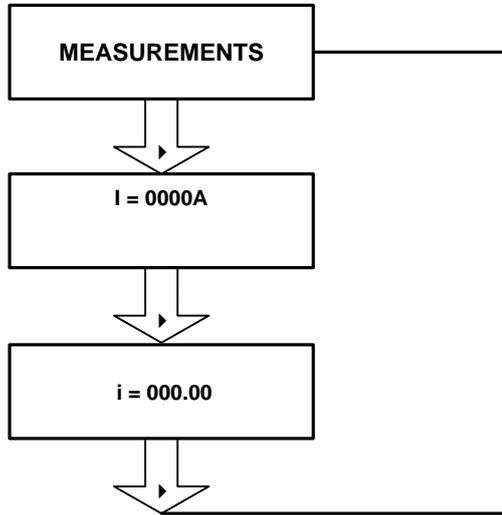
9.1 Main Menu

After the Power ON or when LED RESET + HW RESET keys are pressed the following windows will be displayed and the user can scroll the main menu as given below



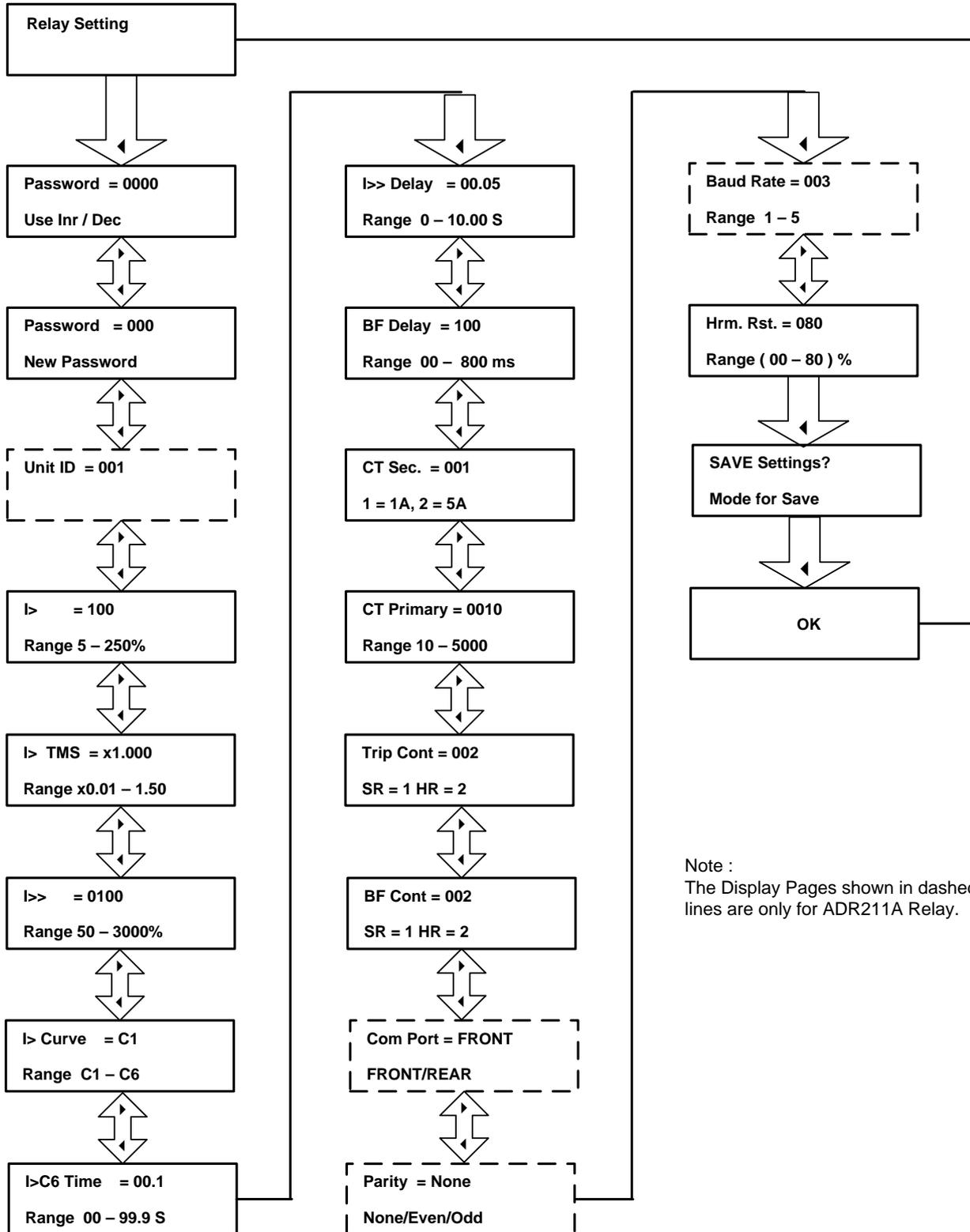
9.2 Flow Chart – Measurement

9.2.1 To View – Measurement

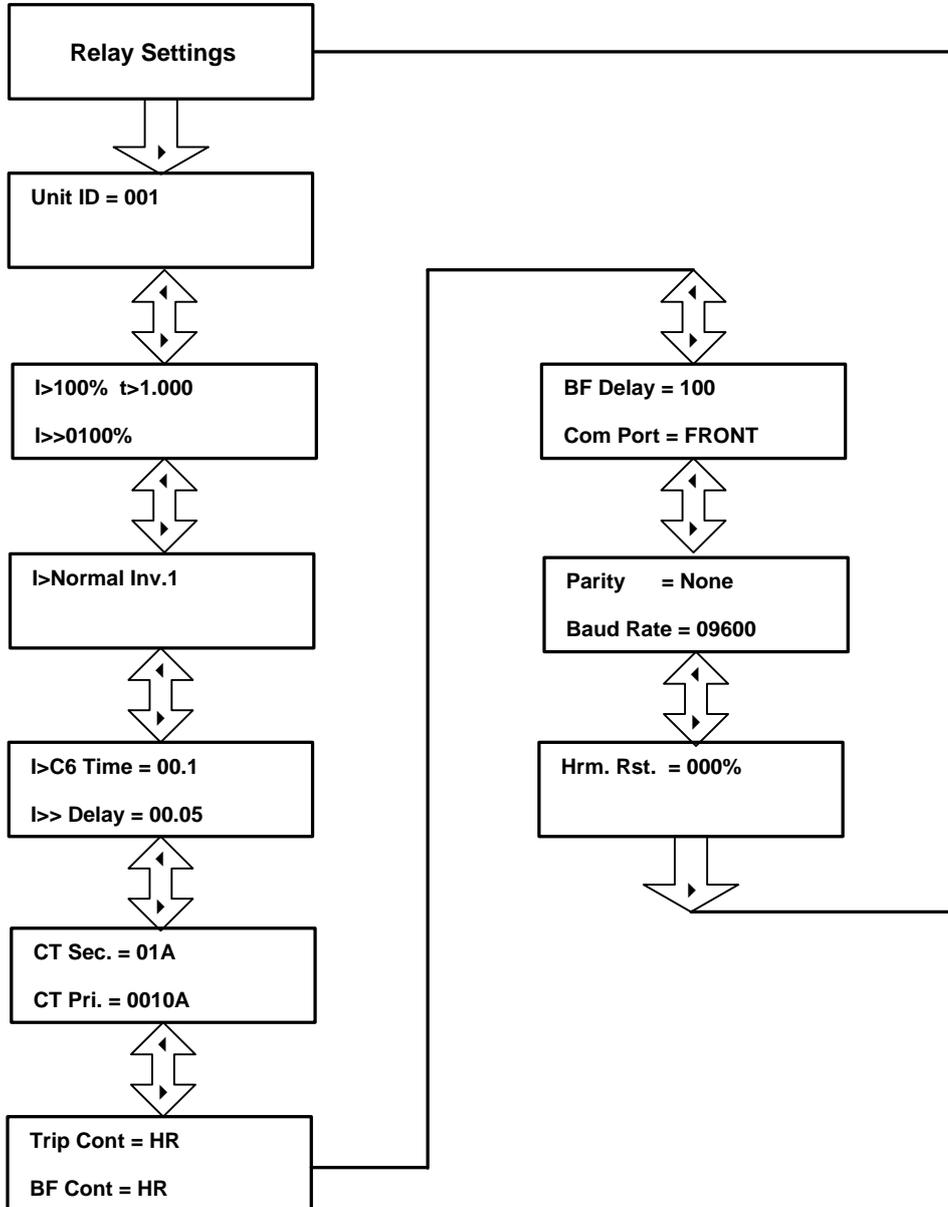


9.3 Flow Chart – Relay Setting

9.3.1 To Set – Relay Setting

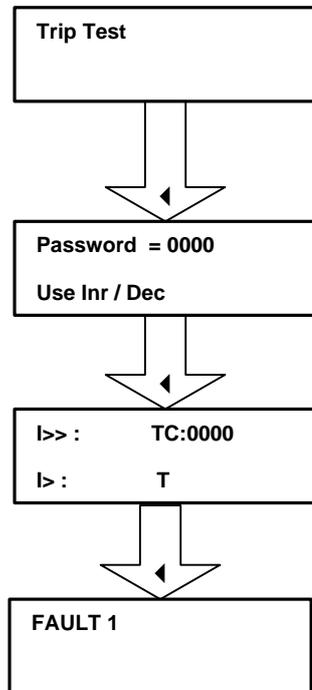


9.3.2 To View – Relay Setting



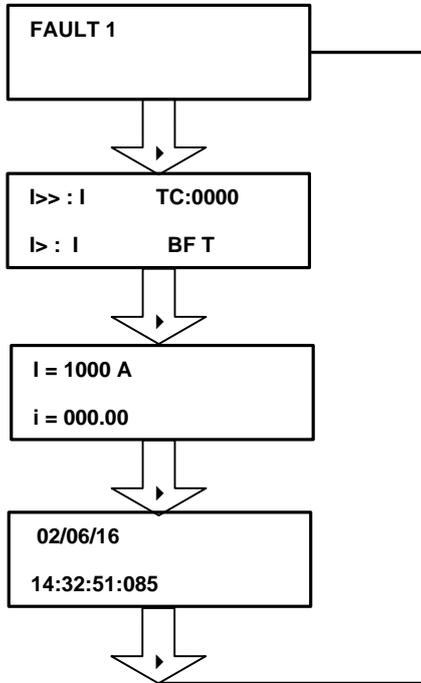
9.4 Flow Chart – Trip Test

9.4.1 To Set – Trip Test



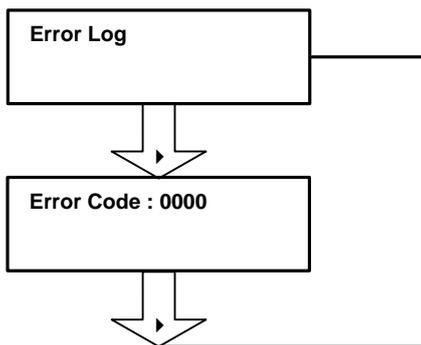
9.5 Flow Chart – Fault 1

9.5.1 To View – Fault 1



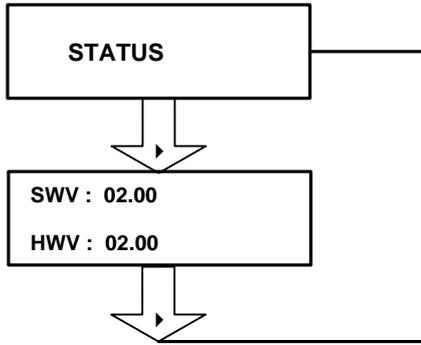
9.6 Flow Chart – Error Log

9.6.1 To View – Error Log



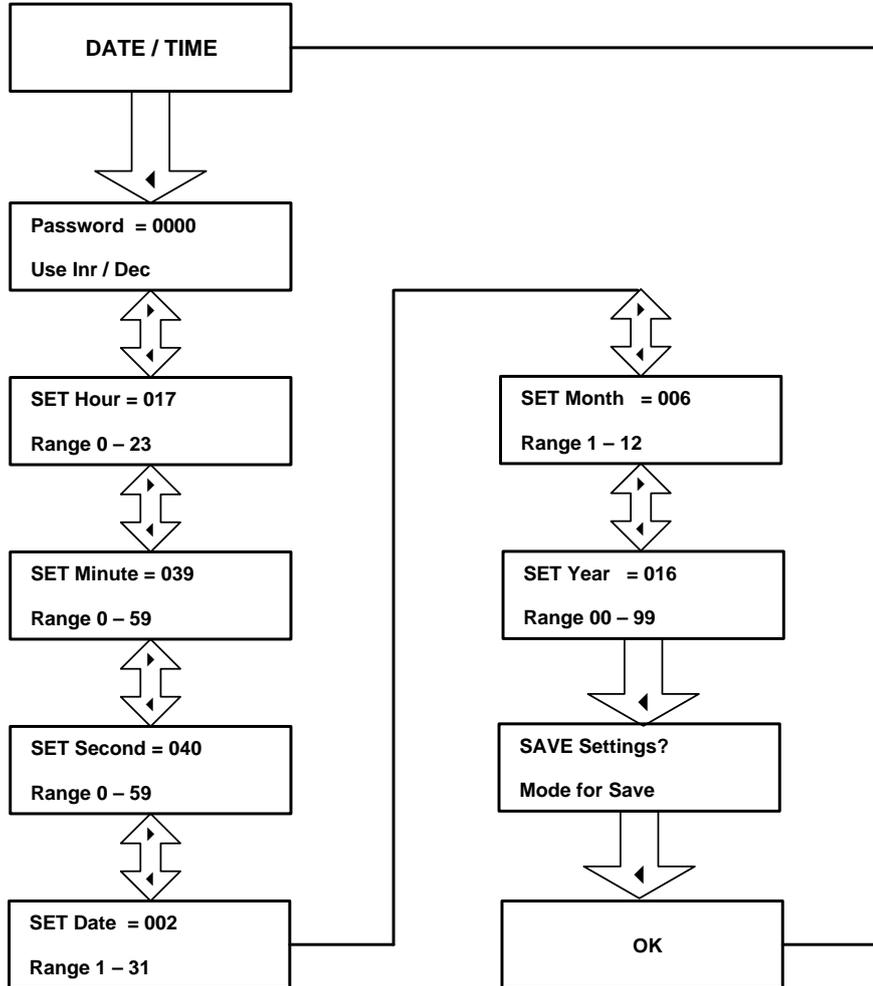
9.7 Flow Chart – Status

9.7.1 To View – Status

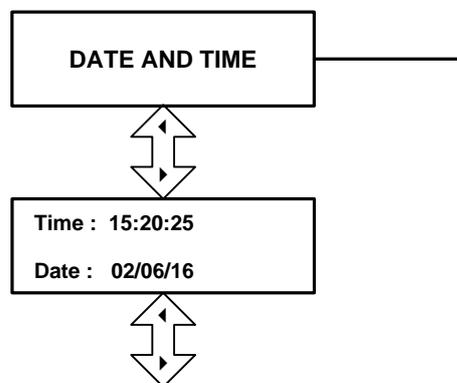


9.8 Flow Chart – Date and Time

9.8.1 To Set – Date and Time



9.8.2 To View – Date and Time



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Section 10

Analyzing Events and Fault Record

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10 ANALYZING EVENT AND FAULT RECORD

10.1 Overview

The ADR211A Single Pole Relay provides several tools (listed below) to analyze the cause of relay operations. Use these tools to help diagnose the cause of the relay operation and more quickly restore the protected equipment to service.

1. Event Recording
2. History Faults Recoding

All reports are stored in non-volatile memory, ensuring that a loss of power to the ADR211A will not result in lost data.

10.2 Event recording

ADR211A relay is providing feature to record and store events in non-volatile memory through internally by protection and control functions and can be extracted using communication port. The event shall be trigger on time stamp through time synchronization or internal clock setting.

Auxiliary Status			
Index	Description	Status	Time
1	protection active	ON	30-05-2016 16:50:03.368
2	Trip LED Status	OFF	30-05-2016 16:50:03.000
3	Relay Error	OFF	30-05-2016 16:50:03.368
4	Test	OFF	30-05-2016 16:50:03.365
5	local parameter settings	ON	30-05-2016 16:50:03.365
6	Status 1	OFF	30-05-2016 16:50:03.365
7	Status 2	OFF	30-05-2016 16:50:03.366
8	Status 3	OFF	30-05-2016 16:50:03.366
9	Status 4	OFF	30-05-2016 16:50:03.366
10	trip circuit supervision	OFF	30-05-2016 16:50:03.366
11	Start L1	OFF	30-05-2016 16:50:03.366
12	General start/ pick-up	OFF	30-05-2016 16:50:03.366
13	Start I>1	OFF	30-05-2016 16:50:03.366
14	Start I>2	OFF	30-05-2016 16:50:03.366
15	General Trip	OFF	30-05-2016 16:50:03.000
16	Trip L1	OFF	30-05-2016 16:50:03.000

10.3 History Fault recording

ADR211A relay is provides built in history fault recording facility for recoding the fault with the current, symmetrical components parameter value. Relay records history fault and stored in to non-volatile memory.

History Faults: ADITYAV2_2; ADITYAV2_2; Relay Address=1

Fault Buffer:

Refresh Clear Save Close

Buffer	Trip Counter	Time	Trip Flag	IR
1	0893	30-05-2016 15:15:14.456	Trip L1+Trip I>1	0.6A
2	0892	30-05-2016 15:15:13.803	Trip L1+Trip I>1	0.6A
3	0891	30-05-2016 15:15:13.423	Trip L1+Trip I>1	0.6A
4	0890	30-05-2016 15:15:12.133	Trip L1+Trip I>1	0.6A
5	0889	30-05-2016 15:15:12.540	Trip L1+Trip I>1	0.6A

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Section 11

Testing and Commissioning

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11 TESTING AND COMMISSIONING**11.1 Commissioning Test, Equipment Required**

The following connection tests help you enter settings into the ADR111A/ ADR211A and verify that the relay is properly connected.

Brief functional tests ensure that the relay settings are correct. It is unnecessary to test every element, timer, and function in these tests. Modify the procedure as necessary to conform to your standard practices. Use the procedure at initial relay installation; the user need not repeat it, unless major changes are made to the relay electrical connections.

The ADR111A/ ADR211A installed and connected according to your protection design.

- Digital Multimeter True RMS
- Timer with precision 1ms.
- Required Auxiliary supply
- For Calibration and measurement check & Pick up test, time test, logic operation test use Power system Simulator DOBEL make F6150 or any Protective relay ac test source:
- single-phase current source.
- A PC with serial port, terminal emulation software, and serial communications cable with the following software (for ADR211A)
- For IEC 60870-5-103 communication check: Ashida Relay Talk software.

11.2 Checking of External Circuitry**Connection Tests**

- Step 1: Remove control ac signals from the ADR211A by opening the appropriate breaker(s) or removing fuses
- Step 2: Isolate the relay TRIP output contact
- Step 3: Verify correct ac and dc connections by performing point-to-point continuity checks on the associated circuits.
- Step 4: Apply ac or dc control voltage to the relay. After the relay is energized, the front-panel green ON LED should illuminate.
- Step 5: Use the appropriate serial cable (USB to serial Cable or equivalent) to connect a PC to the relay.
- Step 6: Start the PC terminal emulation software and establish communication with the relay.
- Step 7: Set the correct relay time and date by using either the front panel or serial port commands
- Step 8: Verify the relay ac connections.

Step 9: Connect the ac test source current to the appropriate relay terminals. Disconnect the current transformer secondary from the relay prior to applying test source quantities.

Step 10: Apply rated current (1 A or 5 A).

11.3 Check Relay Setting

The relay setting check ensures that all of application specific relay setting for the particular installation have been correctly applied to the relay. Enter all setting manually via the relay front panel interface.

The commissioning of following points:

- Ensure over current trip setting.
- Ensure TMS setting of over current function is entered correctly as per required time grading.
- Ensure instantaneous HF setting done correctly and its definite time delay is applied properly as per required time grading.
- Ensure measure of applied current is same as the current measure in CT secondary

Final Check

After completion of all relay functionality testing and relay setting check. Remove all temporary shorting leads etc. if it is necessary to disconnect any of the external wiring from the relay in order to perform the wiring verification test. It should be ensured with the CT connection are replaced in accordance with the relevant external connection or schemes diagram. Ensure all fault & trip contacts have been reset before leaving relay.

If relay ADR111A/ ADR211A is a newly installed or the CB has been just maintained the trip counter of Relay should be zero. This counter can be reset by loading Default Setting.

Note: This will also clear all fault memory and the set password.

Post installation / Commissioning observation

After successful installation confirm amount of existing load current. This can be confirmed with Analogue/ Digital current meter available on panel with relay primary and secondary current measurement window. In normal balanced load condition, the i.e. current should be very low.

11.4 Relay Testing

11.4.1. Relay Calibration & Measurement

Before conducting actual test, confirm relay calibration by following method.

Connect ADR111A/ ADR211A relay to current injector and timer.

Following chart shows terminal numbers of connections.

Source Terminal	Relay Terminal	Relay Connection
Current Source	A1 – A2	Current CT _1A
	A3 – A4	Current CT _5A
Power Supply (+ / -)	A15 – A16	Power Supply (+ / -)
Logic Output	A9 – A10	TRIP contact
	A11 – A12	Alarm contact
	A13 – A14	BF contact

Step1. Connect all terminals as per the chart.

Step2. Adjust rated CT Secondary Current 1A/5A. Observe the current value from measurement menu. The actual current should match with relay display.

11.4.2. Pick up and Trip Test

1. Connect current source at CT terminals 1A/5A current input terminal.
2. Set current setting value to 100% i.e. 1A/5A, TMS at Minimum (x0.01) value.
3. Start current injector & increase current value till relay get pick up and trip. The operating value should be within 1 to 1.1 times of set pickup value.
4. Select the Curve Normal Inverse 1 and Set the TMS at 1.00.
5. Connect the Trip contact to Timer.
6. Set and apply 2 times current value and measure the timing on timer.
7. The measured timing should be $\pm 5\%$ of actual timing (10.029 Sec).

Setting I>: _____ I> TMS =: _____

Threshold	Theoretical Value	Relay Value
I> Threshold	_____ A	_____ A
I> Drop Threshold	_____ A	_____ A

Time Delay Setting = _____

IDMT Characteristics = _____ 10 Times _____ Sec. (take value from selected curve)

	Threshold	Relay
Time Delay at 2 times of I> setting	_____ ms	_____ ms
Time Delay at 10 times of I> setting	_____ ms	_____ ms

11.4.3. Testing of Binary Output (Output Contact Test)

1. Set the $I > = 50\%$, TMS=0.01, Curve Normal Inverse1.
2. Enable the BF function from the Relay Setting menu.
3. Set the Trip contact & BF contact to hand reset (HR) type from the Relay Setting menu.
4. Apply the 1A current & operate the relay in OC & BF, so the TRIP, Alarm & BF relay is operates.
5. After tripping, check continuity in between NO and C output contact terminal.
6. Now, press the LED Reset key to reset the contact.
7. Again check the continuity in between NO and C output contact terminal.

Binary Output Terminals	Binary Output
A9 – A10	TRIP
A11 – A12	ALARM
A13 – A14	BF

REVISION CONTROL SHEET

Issue	Date	Brief description of Revision
01	09.06.2016	Original Version
02	17.06.2017	<ul style="list-style-type: none">• C4A curve is added – Sec 4• Typo mistake in “Relay Setting “ corrected – Sec 6• Note Applicable only for ADR211A is added – Sec 7
03	27.06.2016	<ul style="list-style-type: none">• C4A curve Graph is added – Sec 4
04	25.11.2016	Mechanical Drawing for IP cover added



ASHIDA Electronics Pvt. Ltd.
ASHIDA House, Plot No. A-308, Road No. 21,
Wagle Industrial Estate, Thane - 400604, INDIA
Tel : +91 - 22 - 2582 7524/6129 9100
Fax : +91 - 22 - 2580 4262
Email : sales@ashidaelectronics.com
Web : www.ashidaelectronics.com

