# ADR141A / ADR241A

# Feeder Protection Relay

# Instruction Manual

# Preface

The ADR141A / ADR241A Feeder Management Relay Instruction Manual describe 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 relay 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 everyone who will be associated with the equipment must be familiar with the contents of that Safety Section, or this 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** | **Class I (unless otherwise specified in the equipment documentation).** |
| **EN 60255-27: 2005** | **This equipment requires a protective conductor (earth) connection to ensure user safety.** |

**Installation Category**

| | |
|---|---|
| **IEC 60255-27.2005** | : At 2 KV, 50Hz between all terminals connected together and earth for 1 minute Distribution level, fixed installation. |
| **Category III** | |
| **(Overvoltage Category III)** | **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, with optional cover).

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**

CE

**Directives:**

**Compliance demonstrated by reference to safety standards**

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# Section 1

# Introduction and Specifications

## Contents

# 1 INTRODUCTION AND SPECIFICATIONS

## 1.1 Overview

ASHIDA has designed economical & reliable Multifunction ADR141A/ ADR241A Protection & Control System. The simple and compact construction of ADITYA series ADR141A/ ADR241A relay provides integrated Protection, Control and Monitoring functions for Over head Transmission Lines, Underground cables, and Distributed Feeders.

## 1.2 Features

**Key Protection & Control Functions:**

- 4 Element (3 Phase + EF) over current IDMT with instant trip.
- Back – lit LCD display for settings.
- Display of load current in terms of primary.
- **Separate curve selection for phase and EF.**
- Selection of Curve: Seven selectable curves Normal Inverse1 (C1), Normal Inverse2 (C2), Very Inverse (C3), Extremely Inverse (C4), Extremely Inverse (C4A) EE equivalent, Long Time Inverse (C5) and Definite Time (C6).
- **Design using DSP technology.**
- Latching of fault current up to last 5 faults with time stamping.
- Cold Load Pickup (CLP) for prolong inrush current.
- Inbuilt Trip circuit supervision function (TCS).
- Inbuilt Breaker Failure function (50BF).
- Programmable Annunciation contacts.
- **Site selectable CT secondary i.e. 1A/5A**
- Self Supervision of relay.
- Metering function.
- Fully communicable with IEC standard open protocol IEC60870-5-103.
- **USB (at front) and RS 422/ RS 485 (at rear) communication port for remote SCADA (Only for ADR241A i.e. communicable relay).**
- User friendly local operation with key pad.
- **Password Protection.**

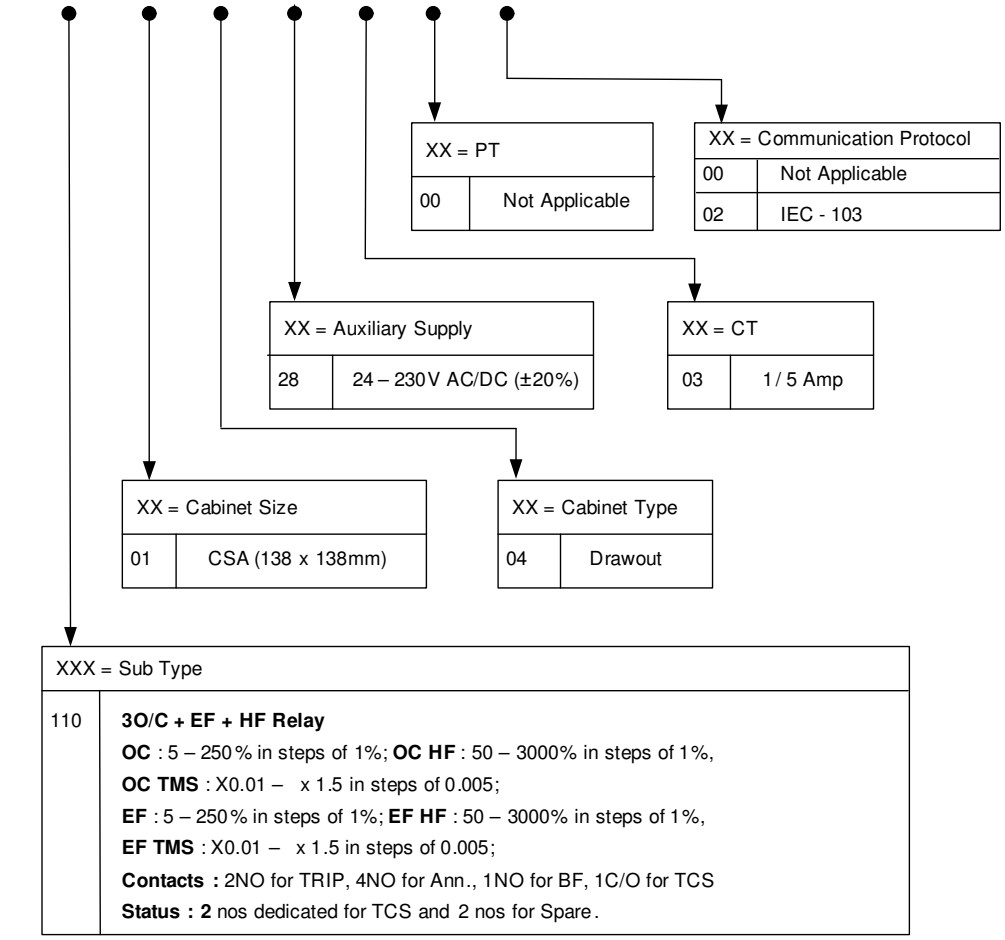
**Software Support**

- Online Setting Editor.
- Online Settings upload / download.
- Online Measurement.

## Model and Options

Definition of Model No For Aditya Series Relays

AM XXX – XX – XX – XX – XX – XX – XX




**Example:**

ADR241A–AM–110–01–04–28–03–00–02

ADR141A–AM–110–01–04–28–03–00–00

## Applications

ADR141A/ ADR241A 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.

ADR141A/ ADR241A relay apply for protection, control & monitoring of radial and ring main feeder to achieve sensitivity and selectivity on phase and ground faults.

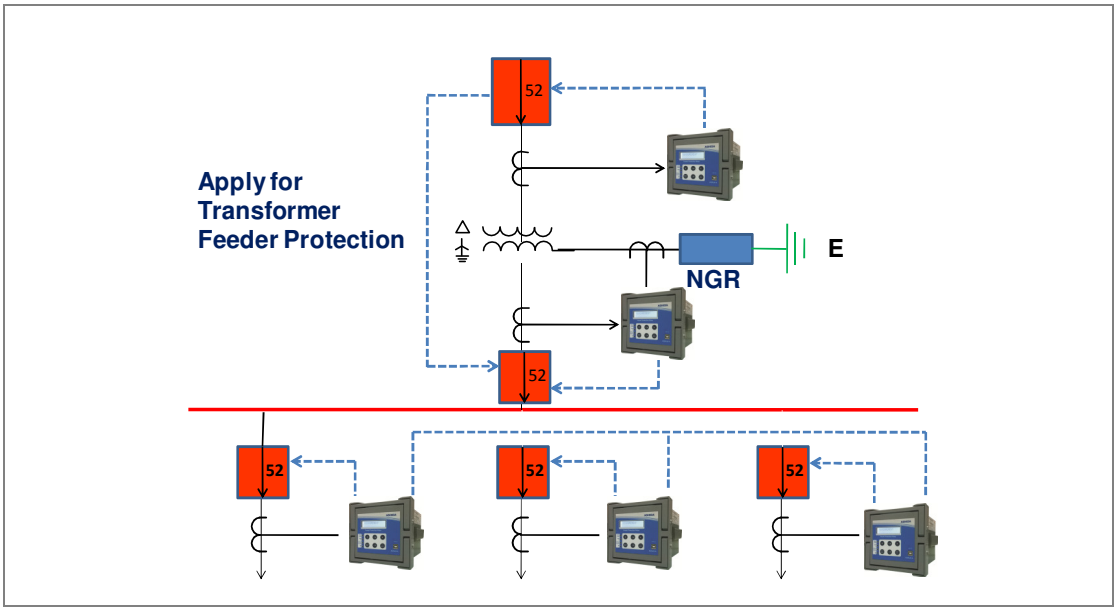



**Fig1: Radial feeder application**

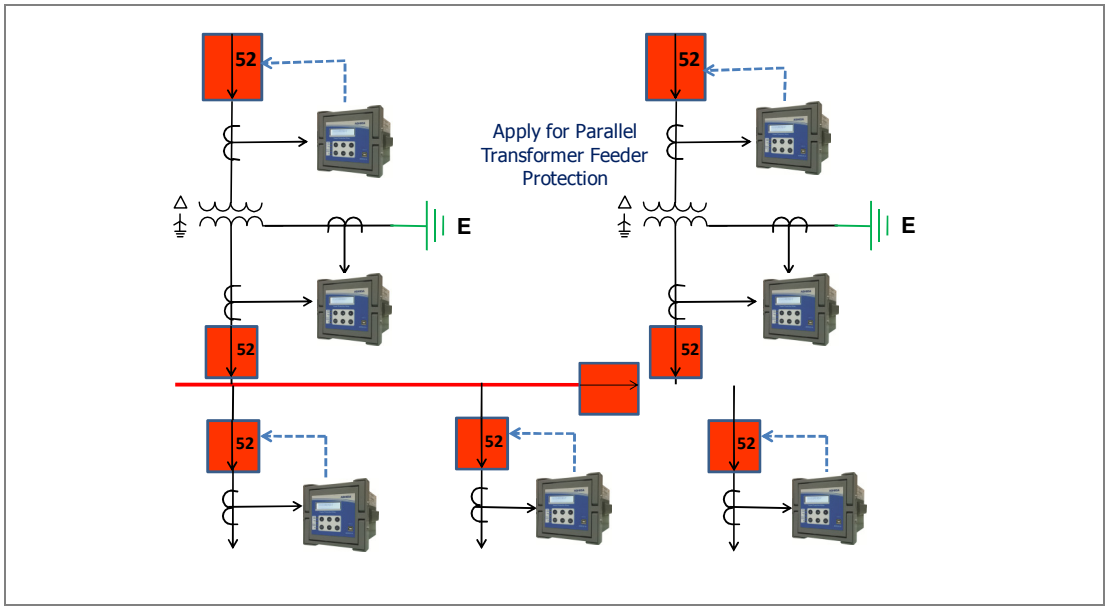



**Fig2: Ring main feeder application**

## 1.3 Technical Specifications

| **AC Measuring Input:** | | |
|---|---|---|
| I. | Measurement Accuracy | Typical ± 2% In for Phase and EF |
| II. | Frequency measurement range | 45 Hz – 55 Hz |

| Current Input: | | |
|---|---|---|
| I. | CT secondary | 1 / 5 Amp. (Selectable) |
| II. | Nominal Burden at In (without tripping condition) | < 0.20 VA at rated current (In) |
| III. | Thermal Withstand Capacity | 40 x rated current (In) for 3sec<br>2 x rated current (In) continuous for Phase and EF CT |
| IV. | Measurement Linearity Range for Non – Offset AC Current | Linear up to 40 In |

| Auxiliary Supply Input: | | | |
|---|---|---|---|
| I. | Nominal operating range | 24 – 230V AC/ DC | |
| II. | Voltage operating range | 80% of lower nominal range and 120% of upper nominal range (For DC Supply)<br>80% of lower nominal range and 110% of upper nominal range (For AC Supply) | |
| III. | Nominal Burden on 24 – 230V Auxiliary Power Supply | 24 – 230 VAC | < 12 VA |
| | | 24 – 230 VDC | < 5 W |
| IV. | Tolerable AC ripple | Up to 15% of highest dc supply, As per IEC 60255-26: 2013 | |
| V. | Relay power up time | < 2.5 Sec | |

| Opto Isolated Input: | | |
|---|---|---|
| I. | Opto Isolated input operating Range | 24 – 230 VDC |
| II. | Threshold Voltage for DC | 18V +/- 3volts |
| | Maximum operating voltage range | 250 VDC |
| III. | Drop out | Within 85% of threshold voltage value |
| IV. | VA Burden of Opto Isolated Status Input | For each status < 1.5 Watt / VA |
| V. | Filtering Time | < 40ms |
| VI. | Logic input recognition time | : For all Status filtering time + 5ms ± 5 ms |

| Output contact: | | | |
|---|---|---|---|
| I. | Output Contacts | Continuous | 5A/250Vac |
| | | Make & carry | 30Amp for 3sec AC /DC |
| | | Short time withstand | 50Amp for 1sec AC /DC |
| | | Breaking capacity | AC- 1250VA max @ 250V(PF 0.4) |
| | | | DC- 100W Resistive max. 5A or 300V |
| | | | 50 Watt Inductive (L/R 45ms) max. 5A or 300V |
| | | Operating Time | <10msec |
| | | Minimum no. of operations | 10,000 operation loaded condition & unloaded 100,000 operations |

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

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

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

| xValue 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 ºC to +65 ºC |
| III. | Storage temperature range | : -25 ºC to +70 ºC |

| **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:** | | | |
|---|---|---|---|
| I. | Drawing References | : For Cabinet Type without IP cover | - MAC01972 |
| | | : For Cabinet Type with IP cover | - MAC01973 |
| | | : For Typical Electrical connection (For 3Phase, 3Wire system) | - APR06828 |
| | | : For Typical Electrical connection (For 3Phase, 4Wire system) | - APR06829 |

## 1.4 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<br>2) 1 kV Differential Mode<br>EUT Condition Energized |
| II. | Electrostatic Discharge Test- Direct Application | IEC60255-22-2, IEC60255-26 (ed3) : 2013 | 1) 8kV air discharge<br>2) 6kV contact discharge<br>Test Mode Direct and Indirect Method<br>EUT Condition Energized |
| III. | Fast Transient Disturbance Test | IEC60255-22-4, IEC60255-26 (ed3) : 2013 | Test Voltage : ±4 KV<br>Repetition rate : 5 KHz and 100 KHz.<br>EUT Condition : Energized |
| IV. | Surge Immunity Test | IEC60255-22-5, IEC60255-26 (ed3) : 2013 | Front time / time to half value : 1.2/50 µS<br>Source impedance : 2Ω<br>Common Mode : ±4 KV<br>Differential Mode : ±2 KV<br>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<br>Frequency Range 80 - 1000 MHz<br>Modulation 80% AM @ 1 KHz<br>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<br>Frequency Range 0.15 – 80 MHz<br>Modulation 80% AM @ 1 KHz<br>EUT Condition Energized<br>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:<br>40%: 200 ms<br>70%: 500ms<br>80%: 5s<br>AC Interruption:<br>10ms. 20ms, 50ms, 100ms, 200ms, 0.5s and 5s<br>DC Voltage dip:<br>40% : 200ms<br>70% : 500ms<br>DC Interruption:<br>10ms, 20ms, 30ms, 50ms, 100ms, 200ms, 0.5s, |

| | | | |
|---|---|---|---|
| | | | 1s and 5s |
| IX. | Conducted & Radiated frequency Emission Test | IEC60255-25, IEC60255-26 (ed3) : 2013 | : Conducted<br>Frequency Range — Limit<br>0.15 – 0.5 MHz — 79 dB/µV (Quasi peak)<br>66 dB/µV (Average)<br>0.5 – 30 MHz — 73 dB/µV (Quasi peak)<br>60 dB/µV (Average)<br>EUT Condition — Energized<br>: Radiated<br>Frequency Range — Limits<br>30 MHz – 230 MHz — 50 dB (µV/m)<br>230 MHz – 1000 MHz — 57 dB (µV/m)<br>EUT Condition — Energized |

| **Insulation Tests:** | | | | |
|---|---|---|---|---|
| I. | Dielectric Test | IEC60255-27 | : At 2kV 50Hz<br>a) between all terminals connected together and case earth for 1 minute<br>b) Between independent circuits with case earth for 1 minute. | |
| II. | Impulse Voltage Test | IEC60255-27 | Test Voltage<br>Energy<br>No. of impulses<br>Polarity<br>EUT Condition | 5kv, 1.2/50 µSec<br>0.5 J<br>3 on each<br>+ve and –ve<br>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<br>IP52 (with optional IP cover)<br>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<br>: Frequency Range = 10Hz – 250Hz, acceleration. = 2gn<br>: Sweep rate 1 octave/min; 20 cycle in 3 orthogonal axis. |
| II. | Vibration Response Test | : IEC 60255-21-1 class 2<br>: Frequency Range = 10Hz – 150Hz , acceleration. = 1gn<br>: Sweep rate 1 octave/min; Displacement =0.075mm, in 3 orthogonal axis. |
| III. | Bump Test | : IEC 60255-21-2 Class-1<br>: 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<br>: 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<br>: 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<br>: 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

## Contents

# 2 INSTALATION AND PROCEDURE

## 2.1 Overview

The first steps in applying the ADR141A/ ADR241A Feeder Protection Relay are 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 ADR141A/ ADR241A. 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 Information chapter 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 –25º to +70ºC

### 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

ADR141A/ ADR241A 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.

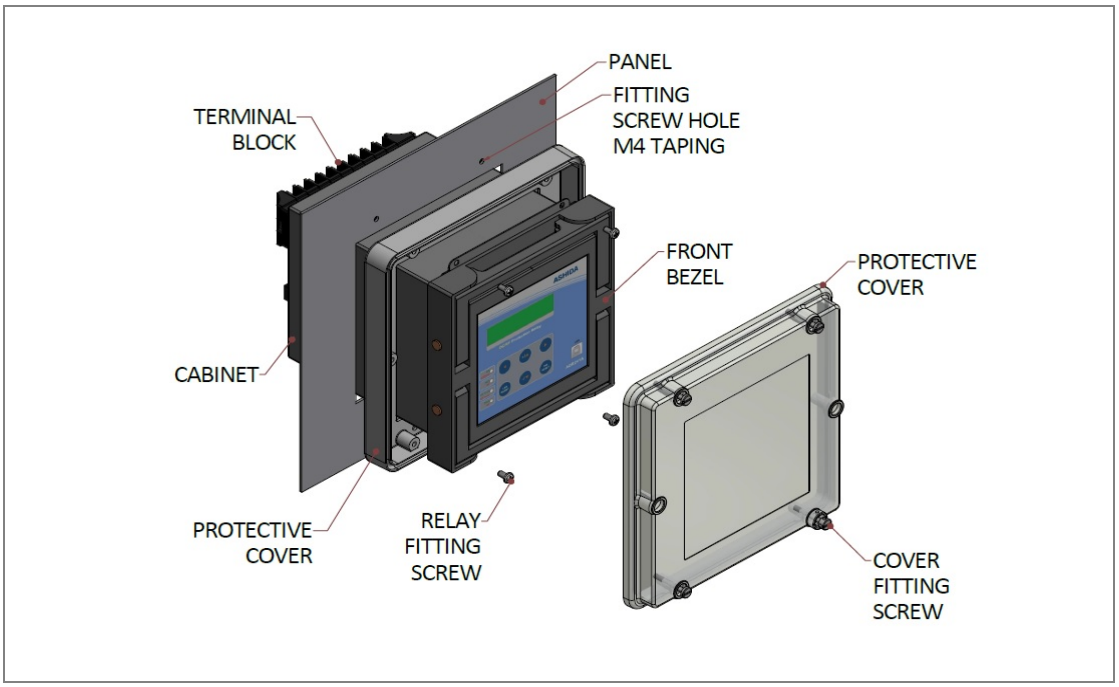


Figure 1: Inserting Relay into the panel cut-out

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

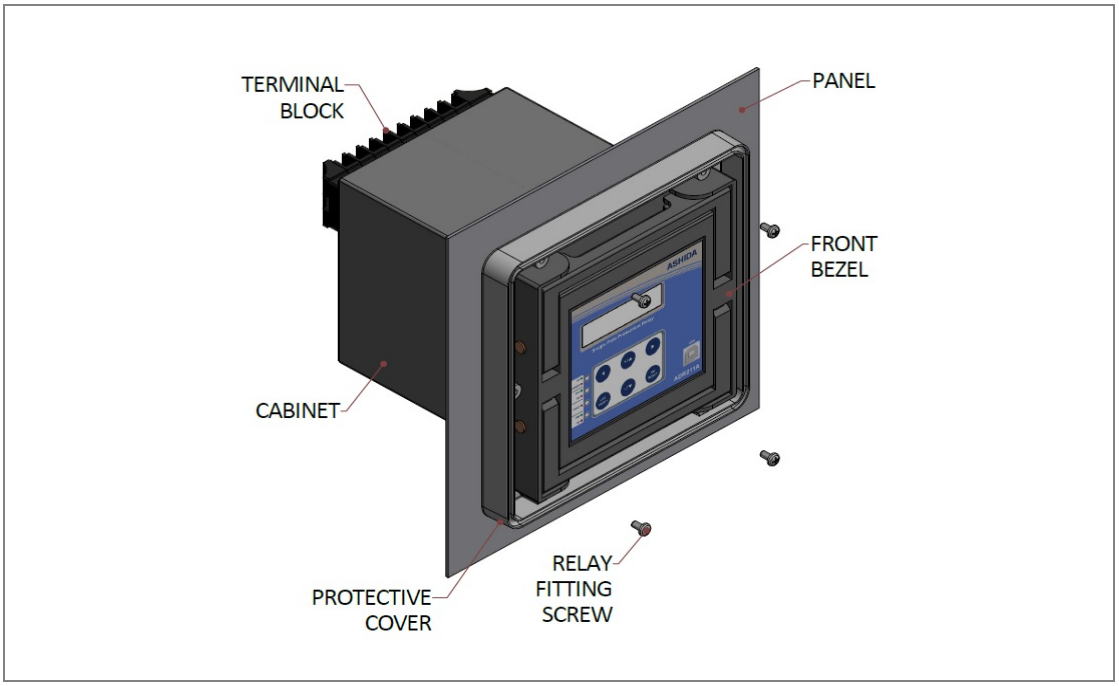


Figure 2: Fastening Relay to the panel

**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.

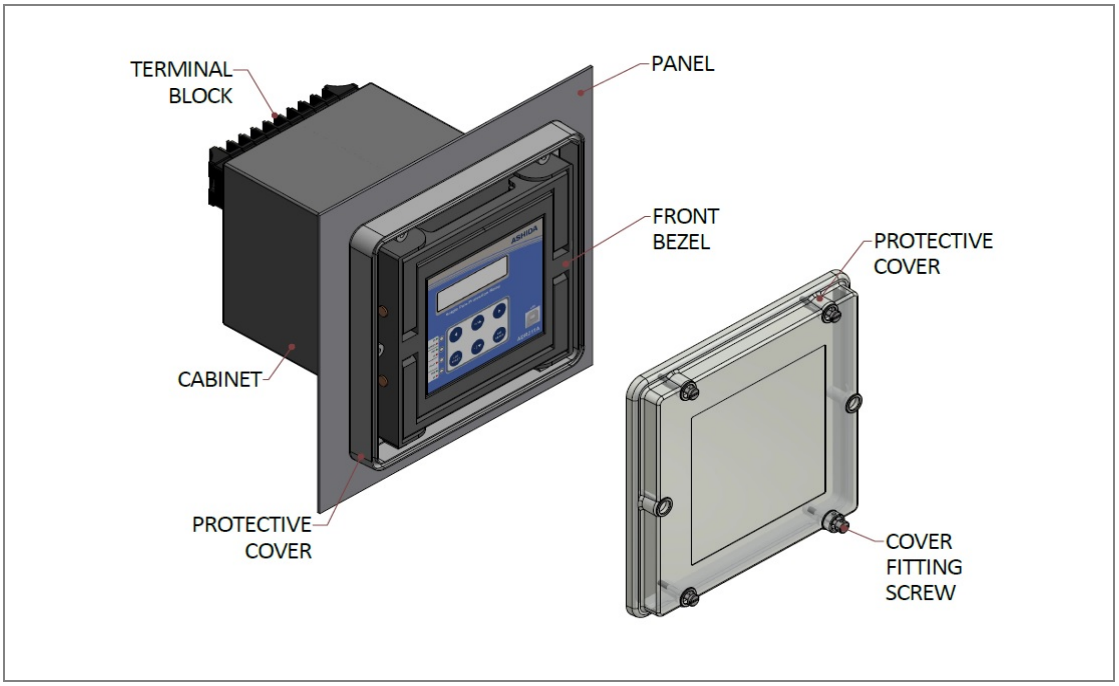


Figure 3: mounting protective cover on relay front panel.

**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

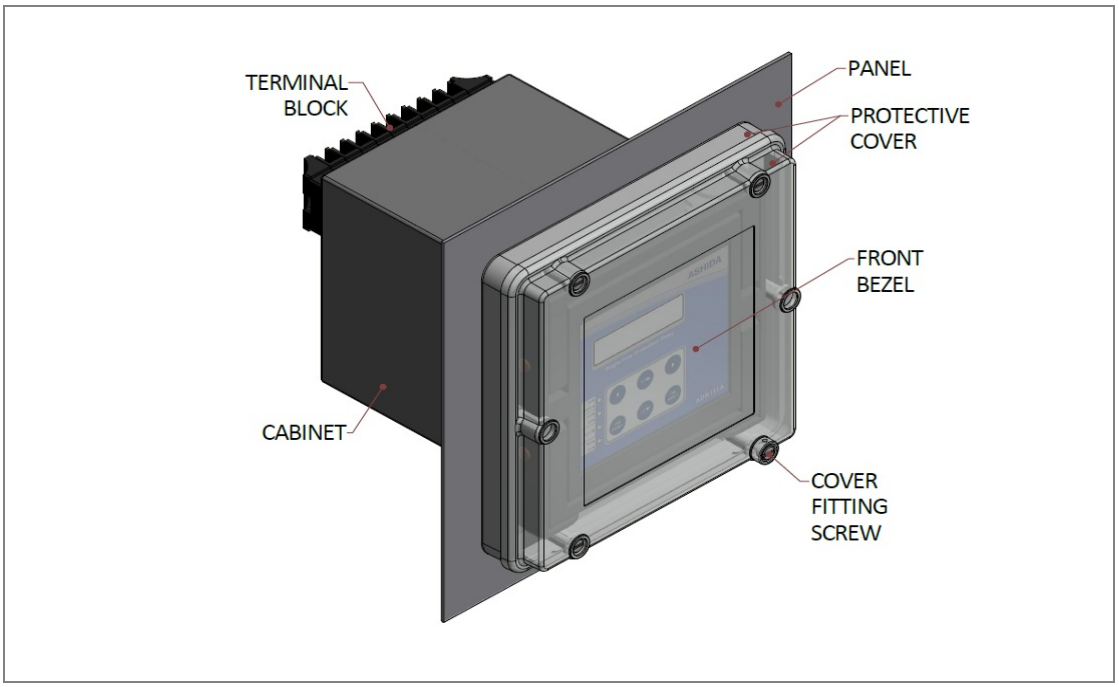


Figure 4: Relay mounted on the panel-front view

### 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.

### 2.3.3 Before energizing the relay following should be checked

1. Voltage rating and polarity.
2. CT circuit rating and integrity of connection.
3. Protective fuse rating.
4. Integrity of the earthing connection.
5. Current rating of external wiring, applicable as per application.

### 2.3.4 Relay Operating Condition

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

### 2.3.5 Current Transformer (CT) Circuit

Do not open the secondary circuit of a live CT as the high voltage produce may be lethal to personnel and could damage insulation. The unit is provided with special with draw able case which automatically short CT connection. But as standard practice and for additional safety it recommended to short the secondary of the line CT connection before removing relay from circuit.

### 2.3.6 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.

### 2.3.7 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.**

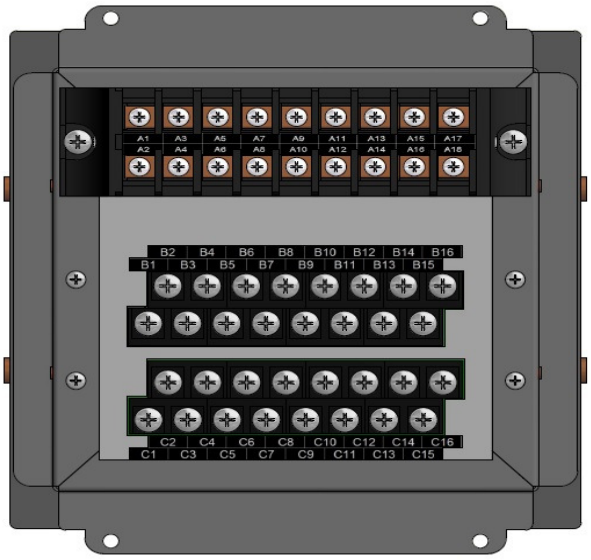


***Figure 5:*** *Rear view-Terminal Connection of ADR141A/ ADR241A*

**CT/Auxiliary power/Input/Output connections**

The use terminal blocks used for ADR141A/ ADR241A devices are as shown below.

The terminal block of ADR141A/ ADR241A consists of up to 50 x M4 screw terminals. M4 terminal blocks are used for CT/ auxiliary power/ input/ output 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.


***Figure 6:*** *Terminal blocks*

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

**Rear Serial Port connection (for ADR241A)**

The rear serial port is intended for use with a permanently wired connection to a remote SCADA system. The physical connectivity is achieved using this terminal for signal connection. The terminal block is located at the rear of the relay as shown below.


***Figure 7:*** *Rear Serial port terminal block*

For connecting the RS422/ RS485, 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 $mm^2$ copper conductors, PVC insulated

Nominal conductor area: 0.5 $mm^2$ 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.

### 2.3.8 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.

### 2.3.9 Earth Connection

Every device must be connected to the earthing terminal. 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 $mm^2$ 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.*

### 2.3.10 Current Transformers

Current transformers would generally be wired with 2.5 $mm^2$ PVC insulated multi-stranded copper wire terminated with M4 ring terminals. The wires should be terminated with rings using 90º 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 $mm^2$ using ring terminals.

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

**Caution: Current transformer circuits must 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 $mm^2$ PVC insulated multi-stranded copper wire.*

### 2.3.11 Output Relay Connections

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

### 2.3.12 USB Connection (for ADR241A)

The IED has a type B USB socket on the front panel. A standard USB printer cable (type A one end, type B at the 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 Dimensions and Electrical Connection

### 2.4.1 Mechanical Dimensions ADR241A without IP cover

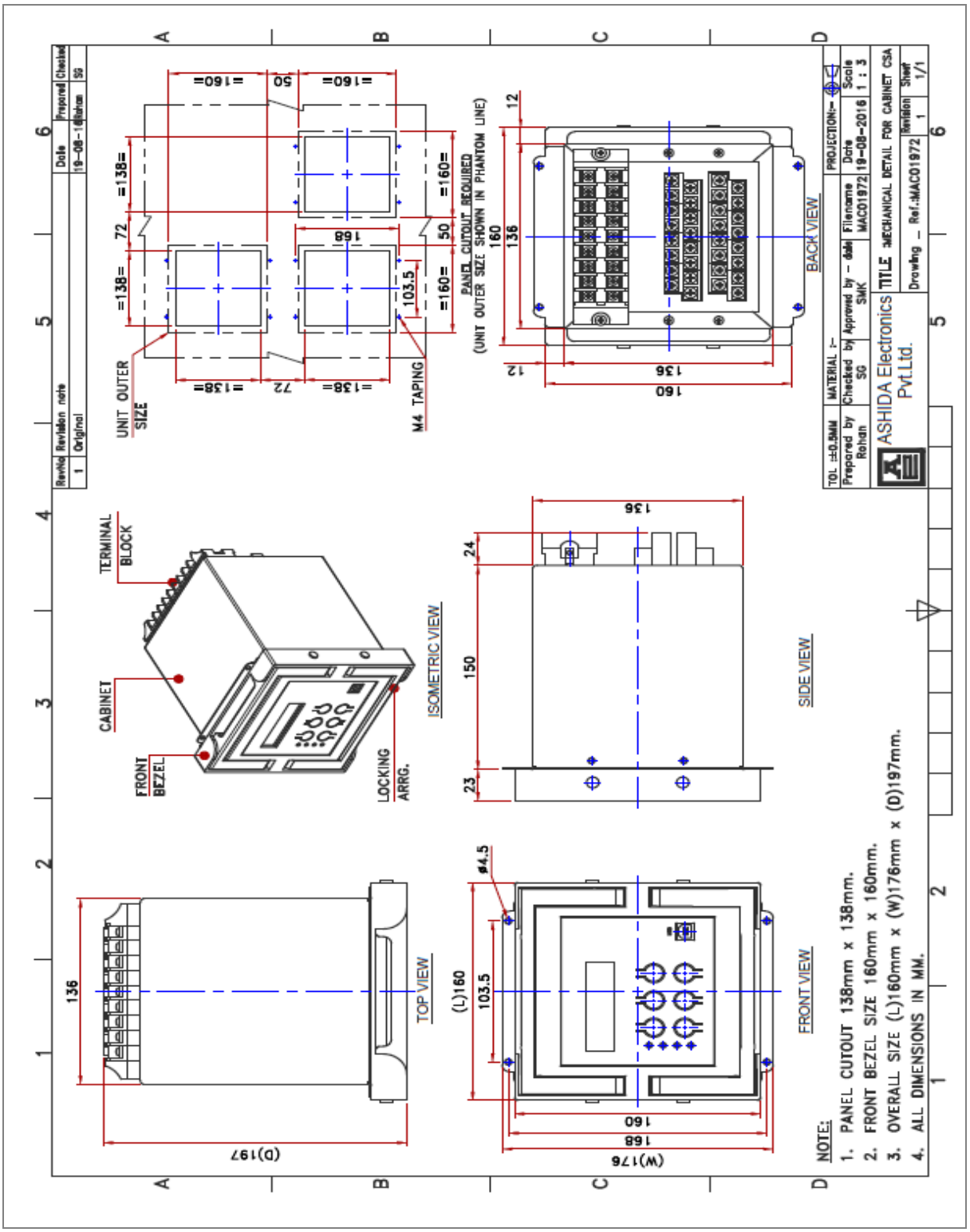


**Figure 8:** Case dimensions for basic version without IP cover

> ***Note:*** *All dimensions in mm.*

### 2.4.2 Mechanical Dimensions ADR241A with IP cover

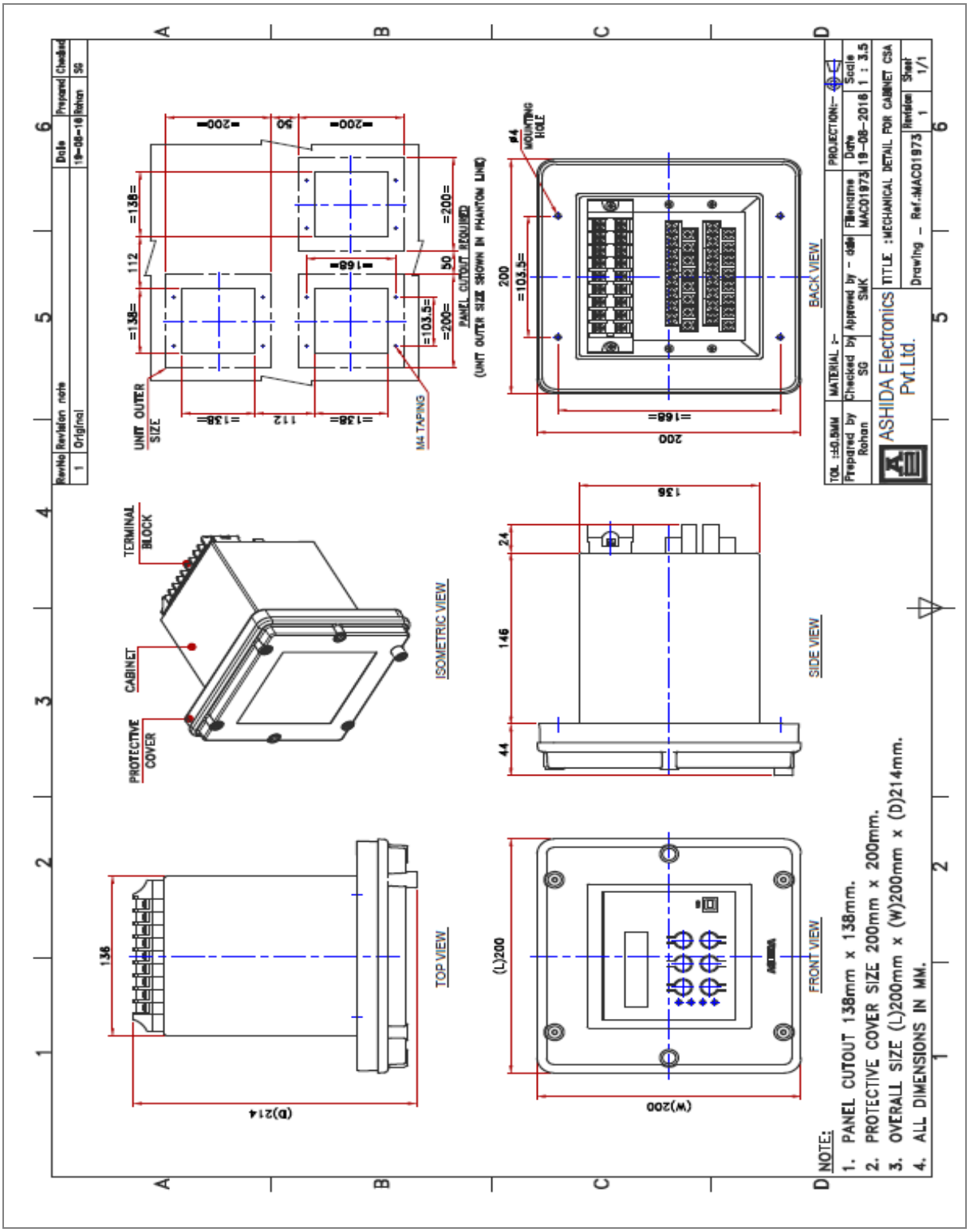


**Figure 9:** Case dimensions for basic version without IP cover

> ***Note:*** *All dimensions in mm.*

### 2.4.3 Electrical Connection diagram for 3Phase, 3Wire system

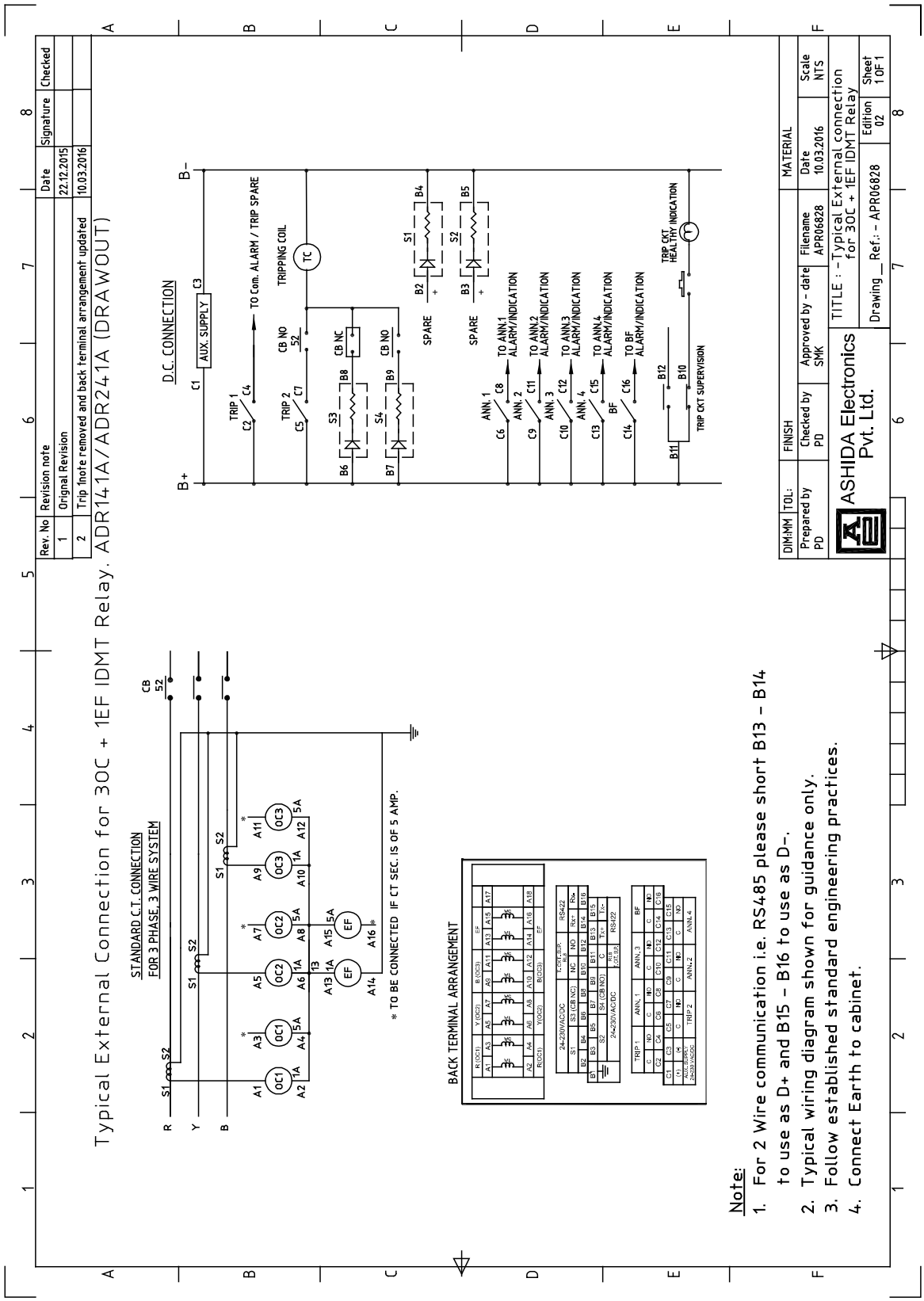


**Figure 10:** Electrical Connection diagram for 3Phase, 3Wire system

### 2.4.4 Electrical Connection diagram for 3Phase, 4Wire system

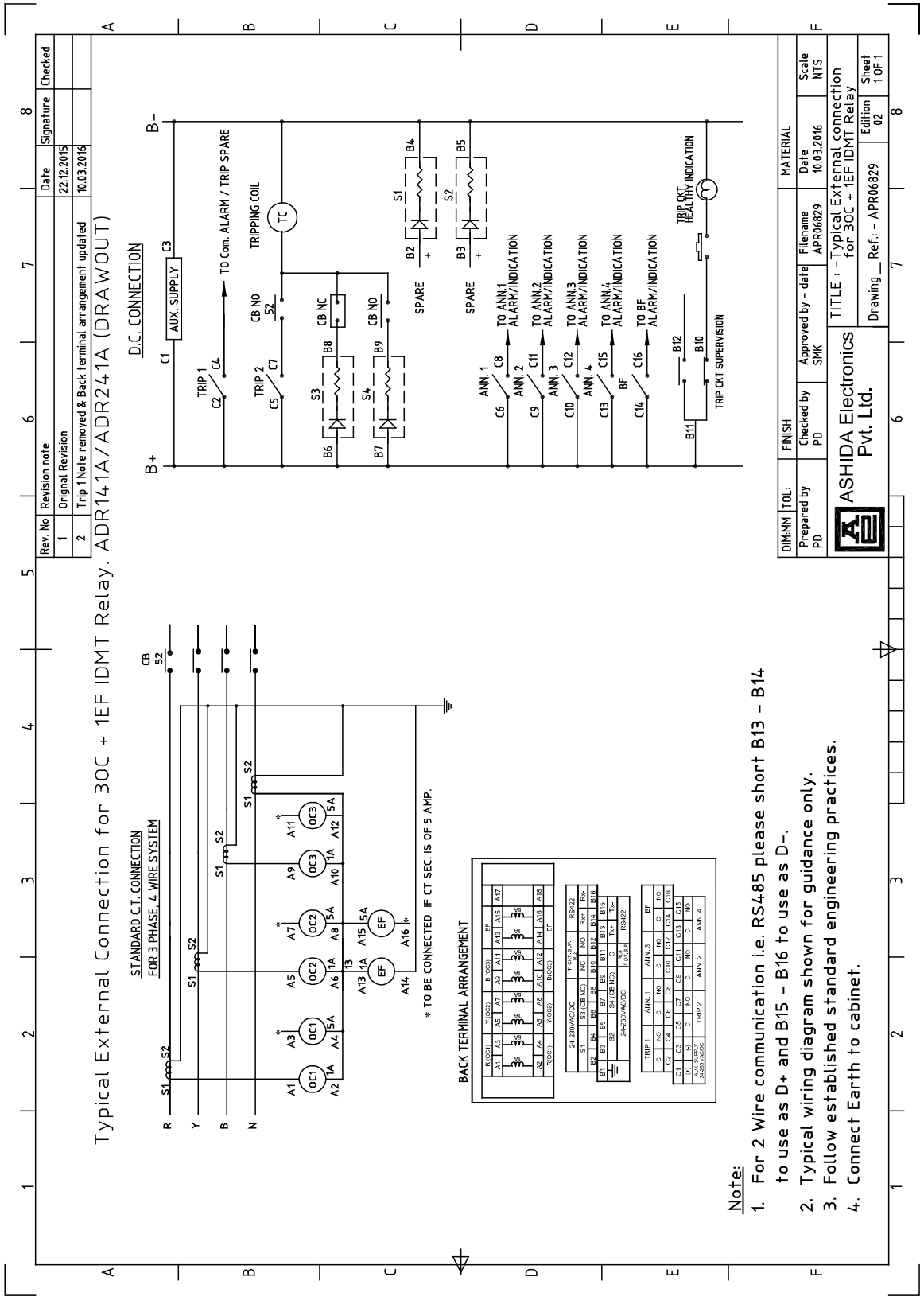


**Figure 11:** Electrical Connection diagram for 3Phase, 4Wire system

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# Section 3

# PC Software Information

## Contents

# 3 PC SOFTWARE INFORMATION

## 3.1 Overview

ASHIDA Provides following Software solution to support the ADR241A Feeder Protection Relay and the other ASHIDA products.

| Sr. No. | Application Software | Description |
|---|---|---|
| 1 | ASHIDA Relay-Talk | Customizes ADR241A Settings and configure communication, view events, history faults, online measurements |
| 2 | DR Analysis | Disturbance Record viewer |

This section describes how to get started with the ADR241A and Relay Talk software. It particularly explains about the software setup and working procedure.

### 3.1.1 Relay Talk Software Features

| | |
|---|---|
| Connections | ADR241A 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 oscillography 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*

### 3.1.2 ASHIDA Relay Talk System

**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.

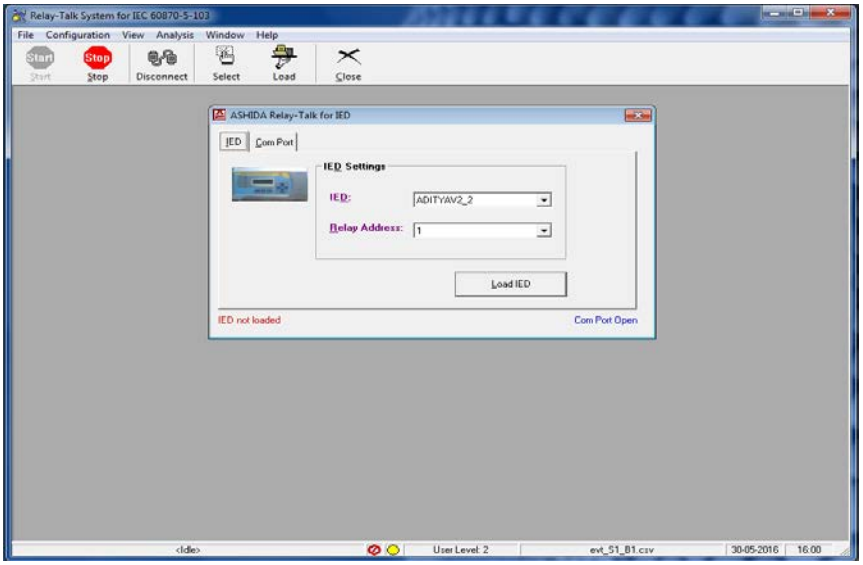



**Figure 1: Main screen of Relay talk system**

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 ADR241A relay

***To check communication setting click Com Port button:***

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

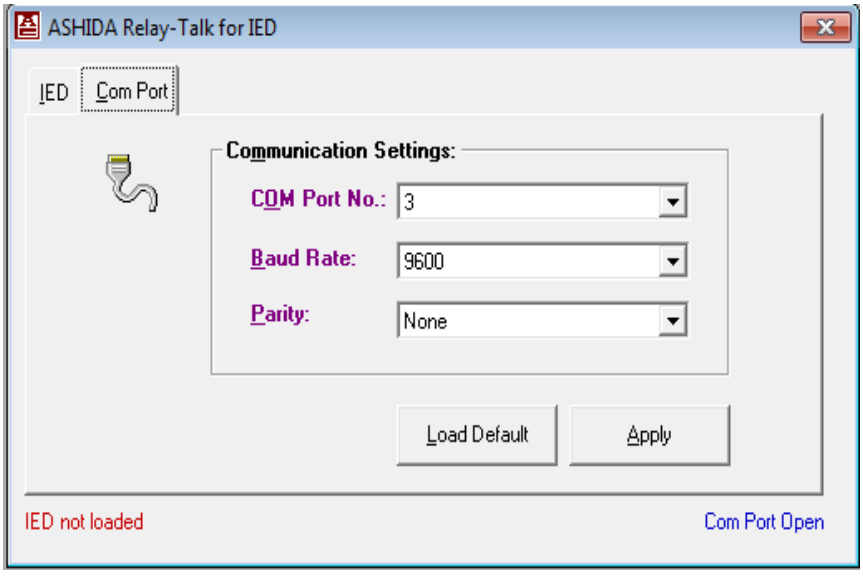



**Figure 2 Communication Setting**

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.

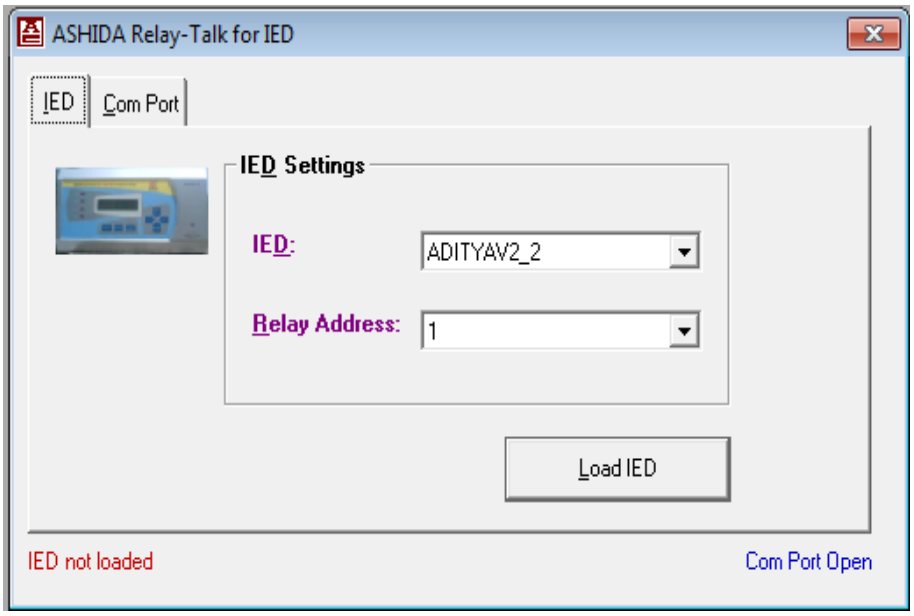



**Figure 3: IED Setting**

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

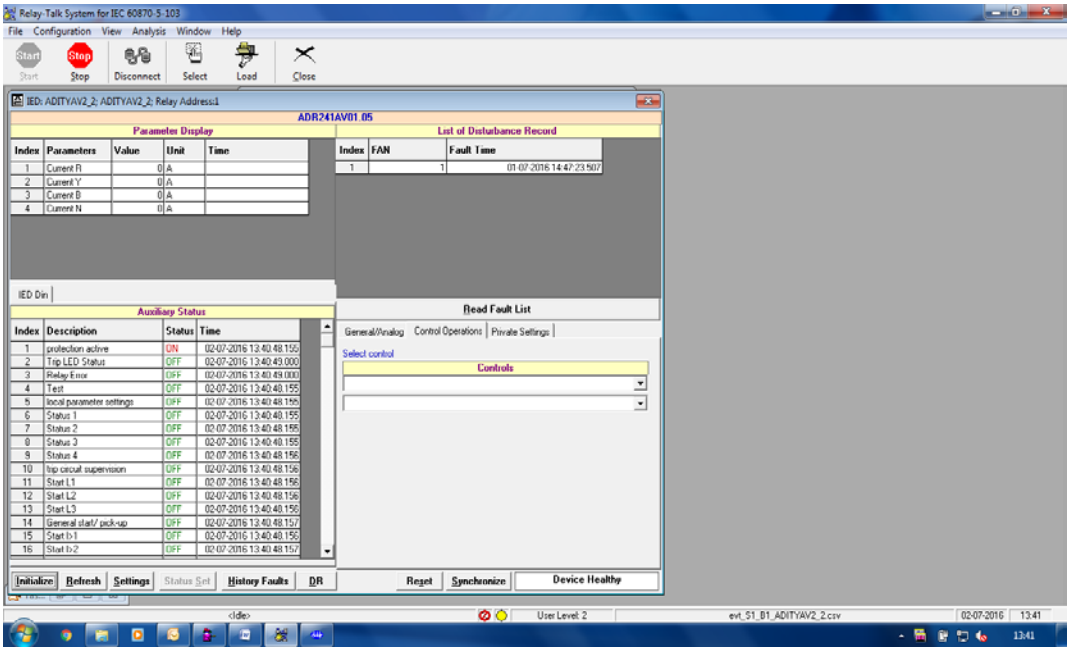



**Figure 4: IED main screen**

## 3.2 ADR241A IED Main Screen

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

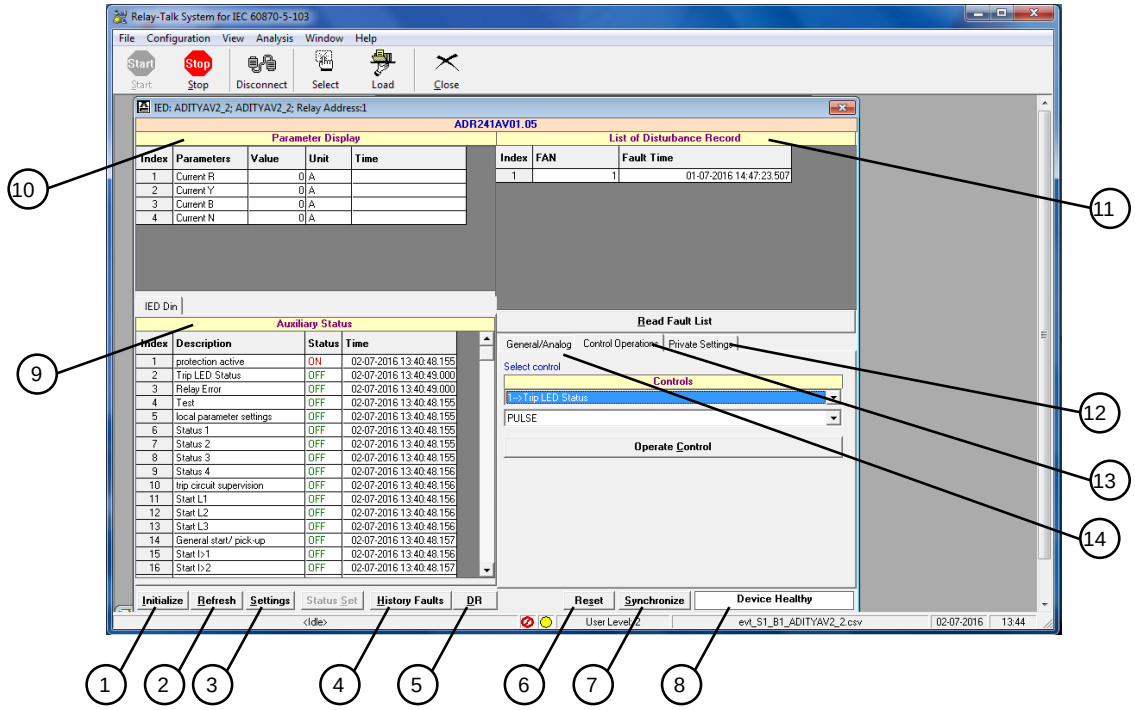



**Figure 5: IED Main screen**

The windows/Buttons functions are as follows

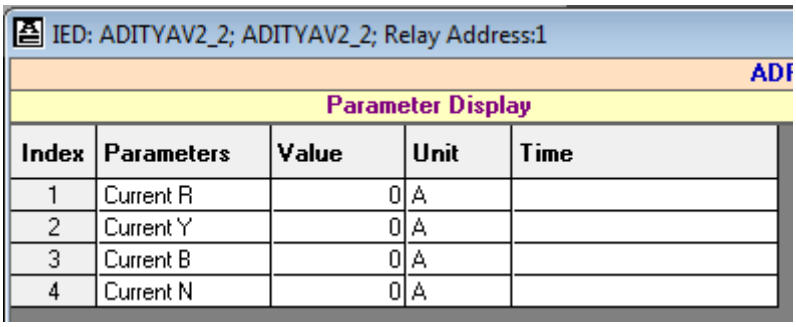
| Sr. No | Name | Description |
|---|---|---|
| 1 | Initialize | This will initialize relay communication. |
| 2 | Refresh | It will refresh all windows and parameters |
| 3 | Settings | This will display the relay Settings |
| 4 | History Faults | It will read all fault data (which is also available 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/Analog | This used to view Relay name, Version, and compatibility. |

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

### 3.2.1 Parameter Display

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

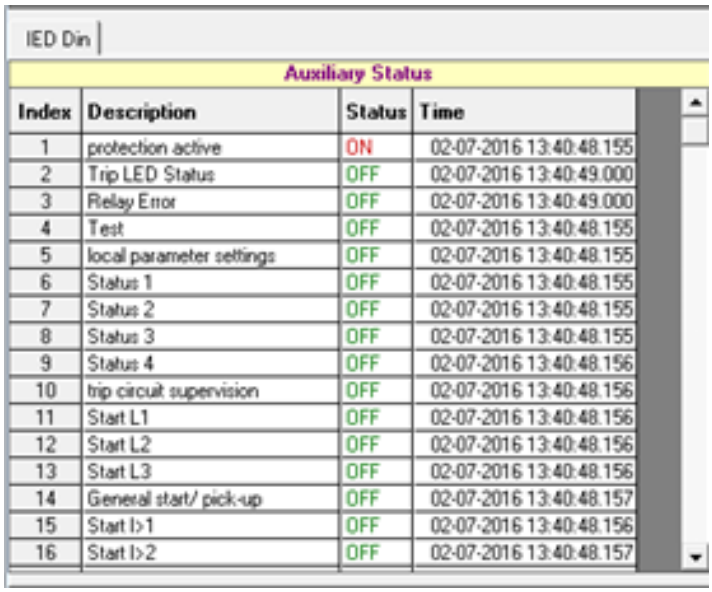



| Index | Parameters | Value | Unit | Time |
|---|---|---|---|---|
| 1 | Current R | 0 | A | |
| 2 | Current Y | 0 | A | |
| 3 | Current B | 0 | A | |
| 4 | Current N | 0 | A | |

**Figure 6: Parameter Display**

### 3.2.2 IEDs Din Display

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




| Index | Description | Status | Time |
|---|---|---|---|
| 1 | protection active | ON | 02-07-2016 13:40:48.155 |
| 2 | Trip LED Status | OFF | 02-07-2016 13:40:49.000 |
| 3 | Relay Error | OFF | 02-07-2016 13:40:49.000 |
| 4 | Test | OFF | 02-07-2016 13:40:48.155 |
| 5 | local parameter settings | OFF | 02-07-2016 13:40:48.155 |
| 6 | Status 1 | OFF | 02-07-2016 13:40:48.155 |
| 7 | Status 2 | OFF | 02-07-2016 13:40:48.155 |
| 8 | Status 3 | OFF | 02-07-2016 13:40:48.155 |
| 9 | Status 4 | OFF | 02-07-2016 13:40:48.156 |
| 10 | trip circuit supervision | OFF | 02-07-2016 13:40:48.156 |
| 11 | Start L1 | OFF | 02-07-2016 13:40:48.156 |
| 12 | Start L2 | OFF | 02-07-2016 13:40:48.156 |
| 13 | Start L3 | OFF | 02-07-2016 13:40:48.156 |
| 14 | General start/ pick-up | OFF | 02-07-2016 13:40:48.157 |
| 15 | Start I>1 | OFF | 02-07-2016 13:40:48.156 |
| 16 | Start I>2 | OFF | 02-07-2016 13:40:48.157 |

**Figure 7: Auxiliary Status**

### 3.2.3 Control Operation

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

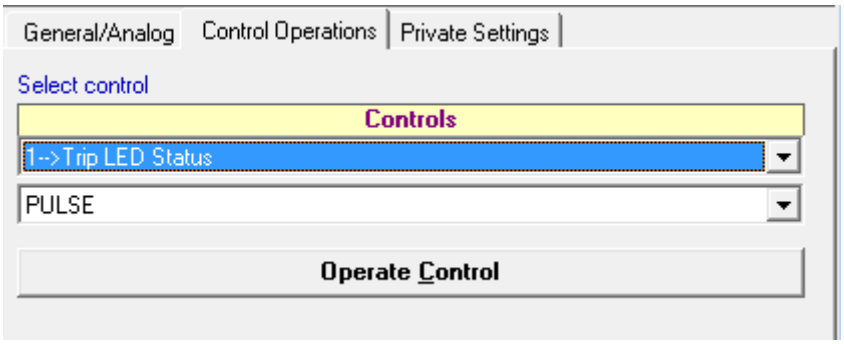
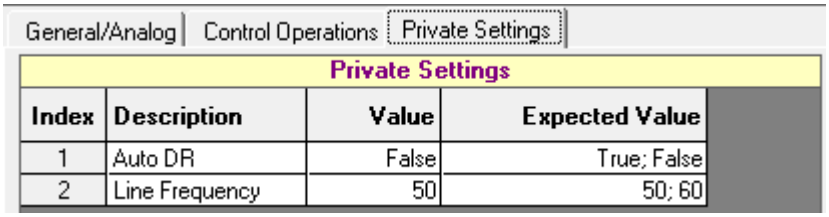



**Figure 8: Control Operation**

### 3.2.4 Private Setting

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




| Index | Description | Value | Expected Value |
|---|---|---|---|
| 1 | Auto DR | False | True; False |
| 2 | Line Frequency | 50 | 50; 60 |

**Fig. 9: Private Setting**

### 3.2.5 Bank Settings

This window is to set/ to read Bank settings.

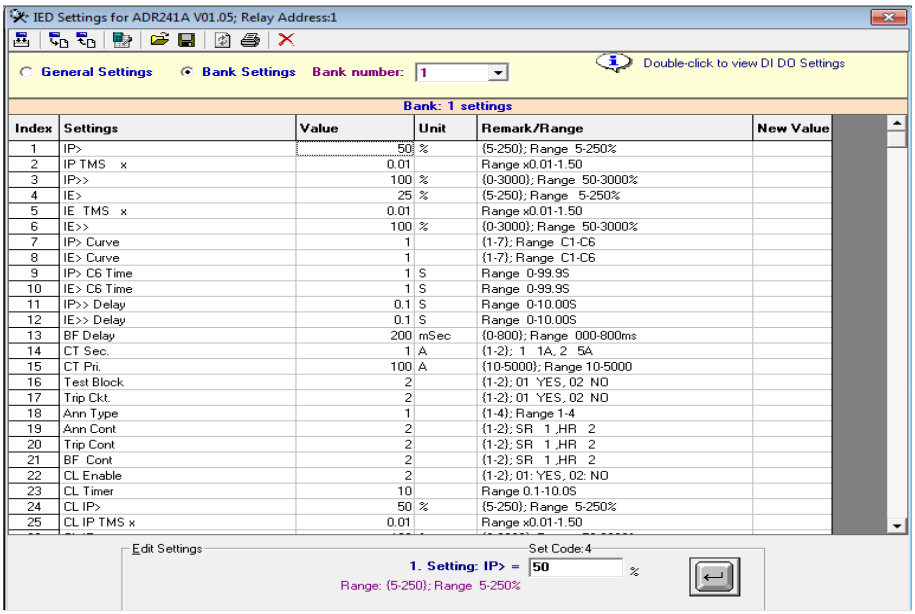



**Figure 10: Bank Setting**

### 3.2.6 History Fault

When the History fault selected, the following window displayed

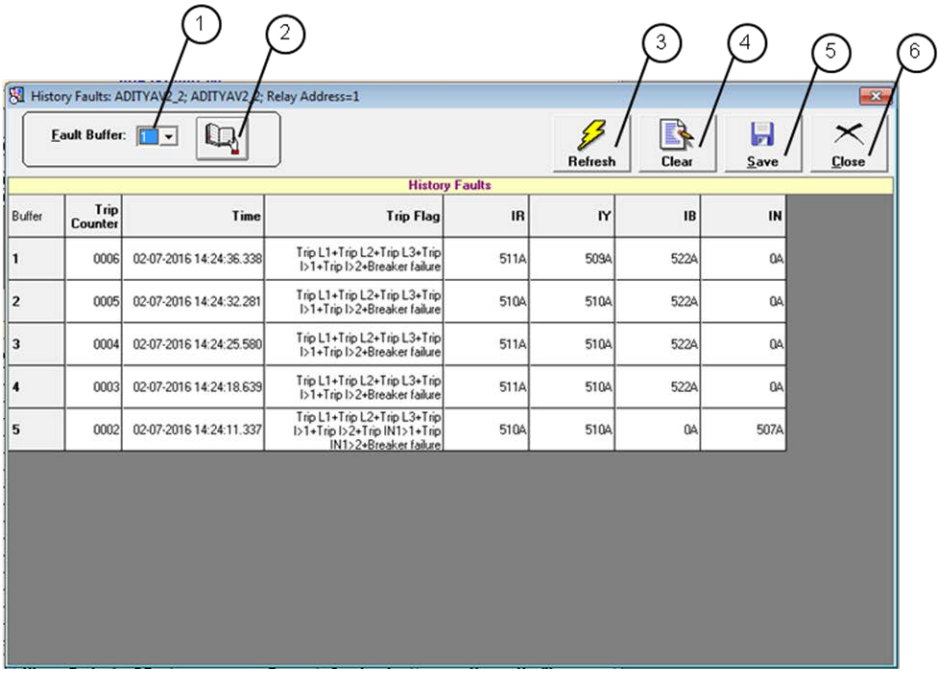



**Figure 11: History Fault**

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

## Contents

# 4 PROTECTION FUNCTION & LOGIC FUNCTIONS

## 4.1 Overview

This section describes the ADR141A/ ADR241A Feeder Management IED settings, including the protection elements and basic functions as well as the settings 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.

**Breaker Failure (LBB).**

Describes the Breaker Failure setting and logic needed for Breaker failure.

**Trip Circuit Supervision.**

Describes the Trip Circuit Supervision setting and logic needed for Trip Circuit Supervision.

**Phase over current.**

Describes all the over current settings and logic needed for protection for the Phase over current fault

**Ground over current (EF).**

Describes all the Ground over current settings and logic needed for protection for the Phase to Ground fault.

**Cold Load.**

Describe all the Cold Load settings and logic needed for protection for Cold Load protection.

## 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 ground and three-phase Faults

## 4.3 General Settings

**Communication setting (for ADR241A only)**

The Communication settings of ADR241A IED is listed below which is necessary for the communication between the IED and Personal computer.

**Table1. The Communication settings**

| Sr. No. | Setting Parameters | Setting ranges |
|---|---|---|
| 1. | Unit ID | 0001 - 0250 |
| 2. | Com Port | USB/ RS485 |
| 3. | Set RP Parity | None/Even/Odd |
| 4. | Set RP Baud rate | 2400/4800/9600/14400/19200/28800/38400/57600 |

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

**CT Primary and Secondary Settings**

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

**Table 2. The CT Primary and Secondary Settings**

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

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

**Test Block Setting**

A Local Control parameter setting is provided with Enable or Disable option. This is used to operate the relay locally by issuing the CB Trip command through the relay HMI when it is enabled.

**Trip Circuit Supervision (TCS)**

The trip circuit supervision is use to monitor healthiness of circuit breaker. The trip circuit extends beyond the relay enclosure and passes through more components, such as fuse, wires, relay contacts, auxiliary switch contact and so on. The failure of any one of component result bypassing the protection. The relay is provide with special trip circuit supervision function which continuously monitor continuity of trip circuit and generate ALARM to take appropriate action.

The figure 1 represents the logic implementation of Trip Circuit Supervision , It monitors the continuity of trip circuit through either normally open (CB NO) or normally close (CB NC) contact of CB connected to dedicated Opto isolator digital inputs CBNO (S4) and CBNC (S3). If any discontinuity is observed, then the L1 red LED (ERROR) will glow.

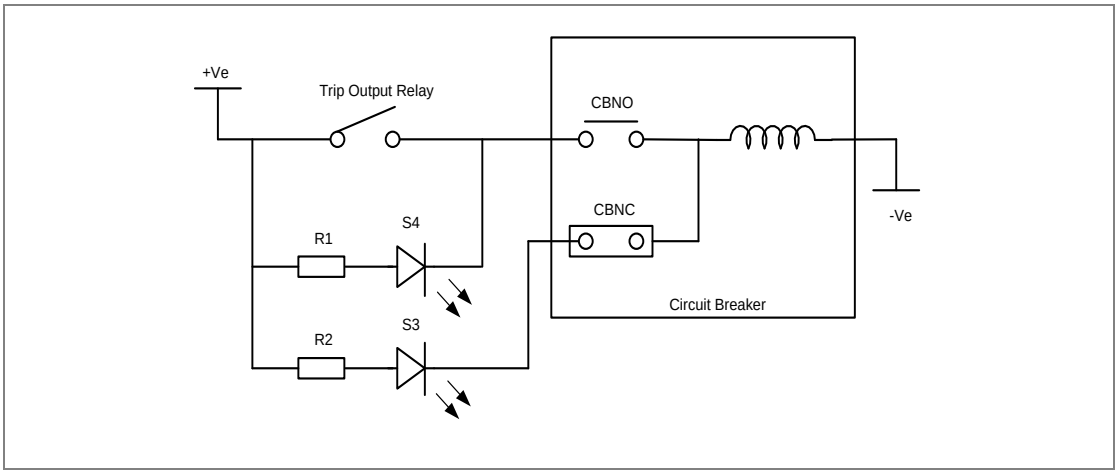



**Figure 1: Logic Diagram for Trip Circuit Supervision**

When the CB is closed, supervision current passes through the Opto-input, into the trip coil via CBNO. When the CB is open, supervision current flows through the Opto-input and into the trip coil via the CBNC auxiliary contact. This means that TCS (Trip Coil healthy) signal is high when the CBNO or CBNC signal is available. Otherwise IED Generates TCS Fail signal which is used to block the protection function.

**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 main 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 use to operate back-trip, upstream circuit breakers to ensure that the fault is isolated correctly.

### 4.4 Phase Over current Element (50/51)

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

### 4.5 Ground Over current Element (50N/51N)

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

### 4.6 IDMT Characteristics

ADR141A/ ADR241A relay provides inverse time over current characteristic for phase over current and ground over current elements. The phase and ground over current elements are independently settable with inverse time or definite time characteristic. The following tripping characteristics curves are available

- Normal Inverse 1 Curve (C1)
- Normal Inverse 2 Curve (C2)
- 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 phase over current and earth fault function are 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

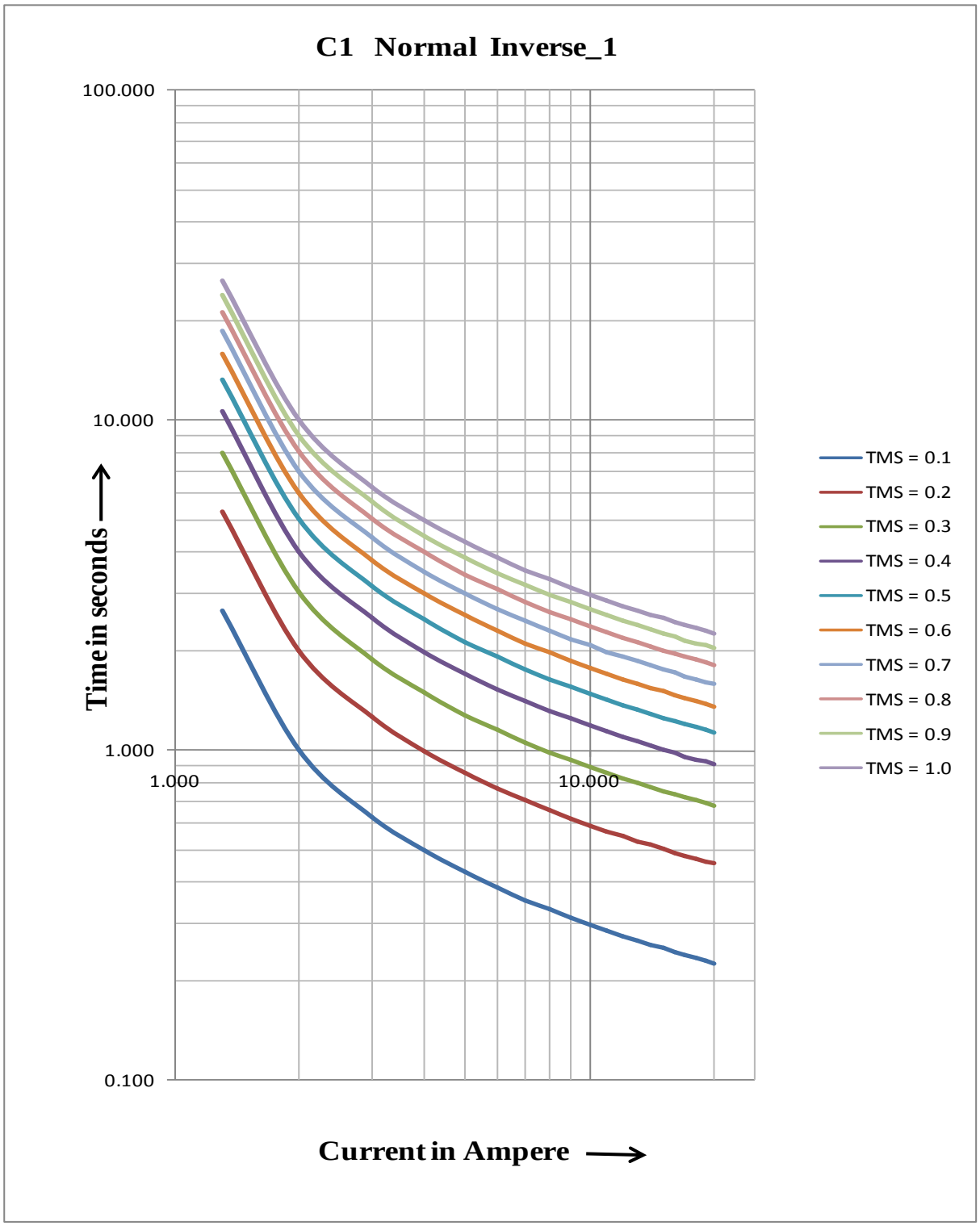
I = Input current

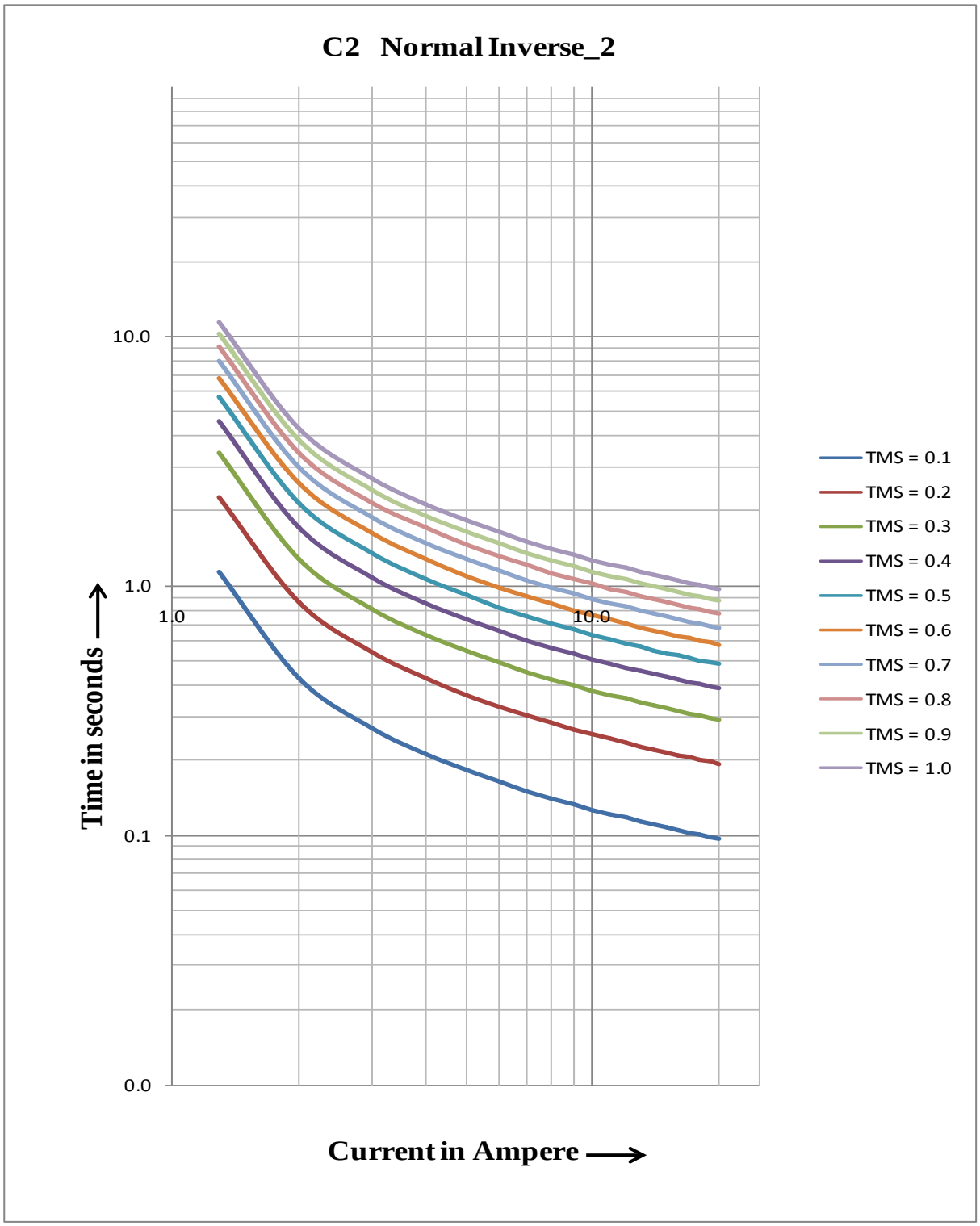
Iref = Current threshold setting

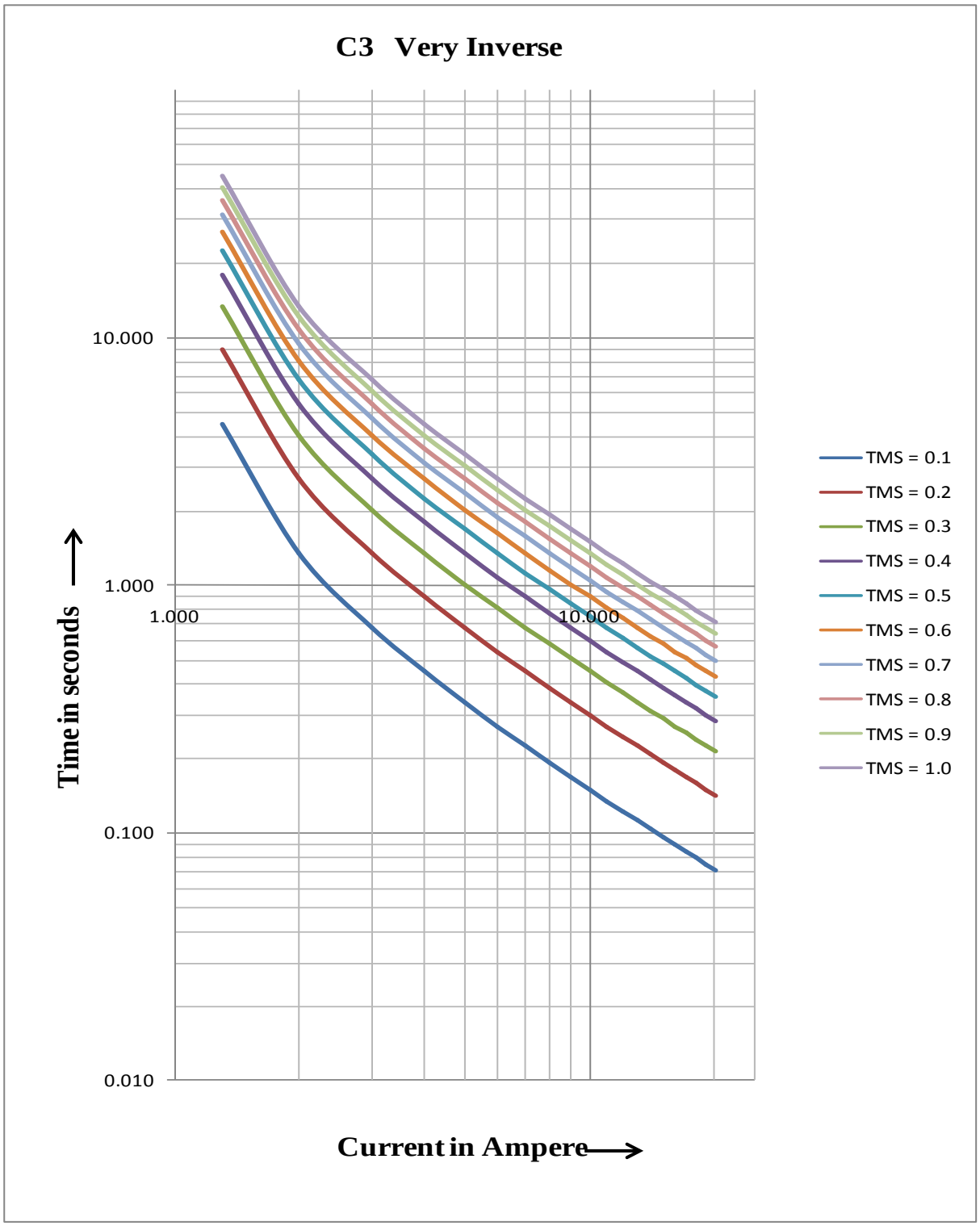
b = Constant

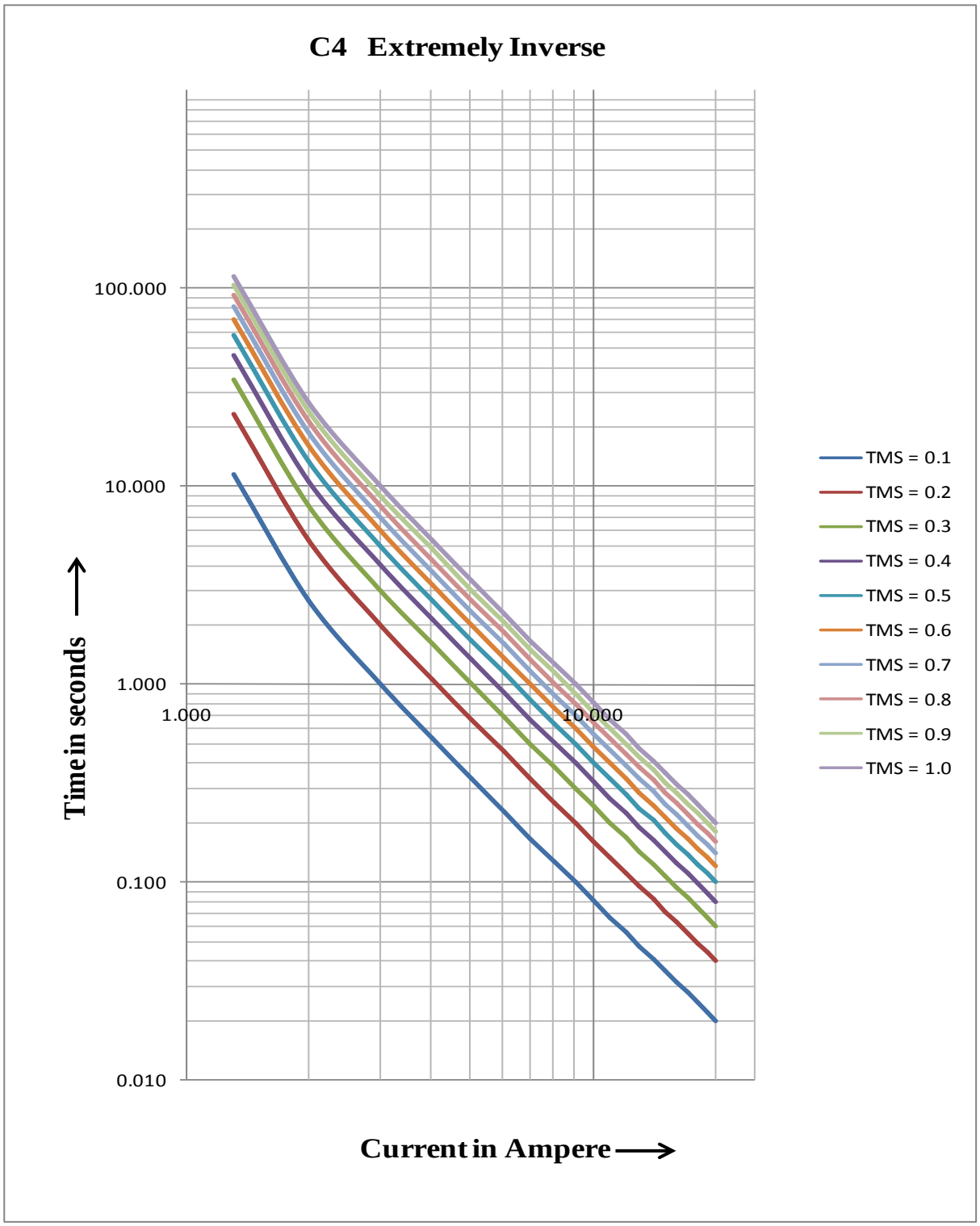
K = Time multiplier setting

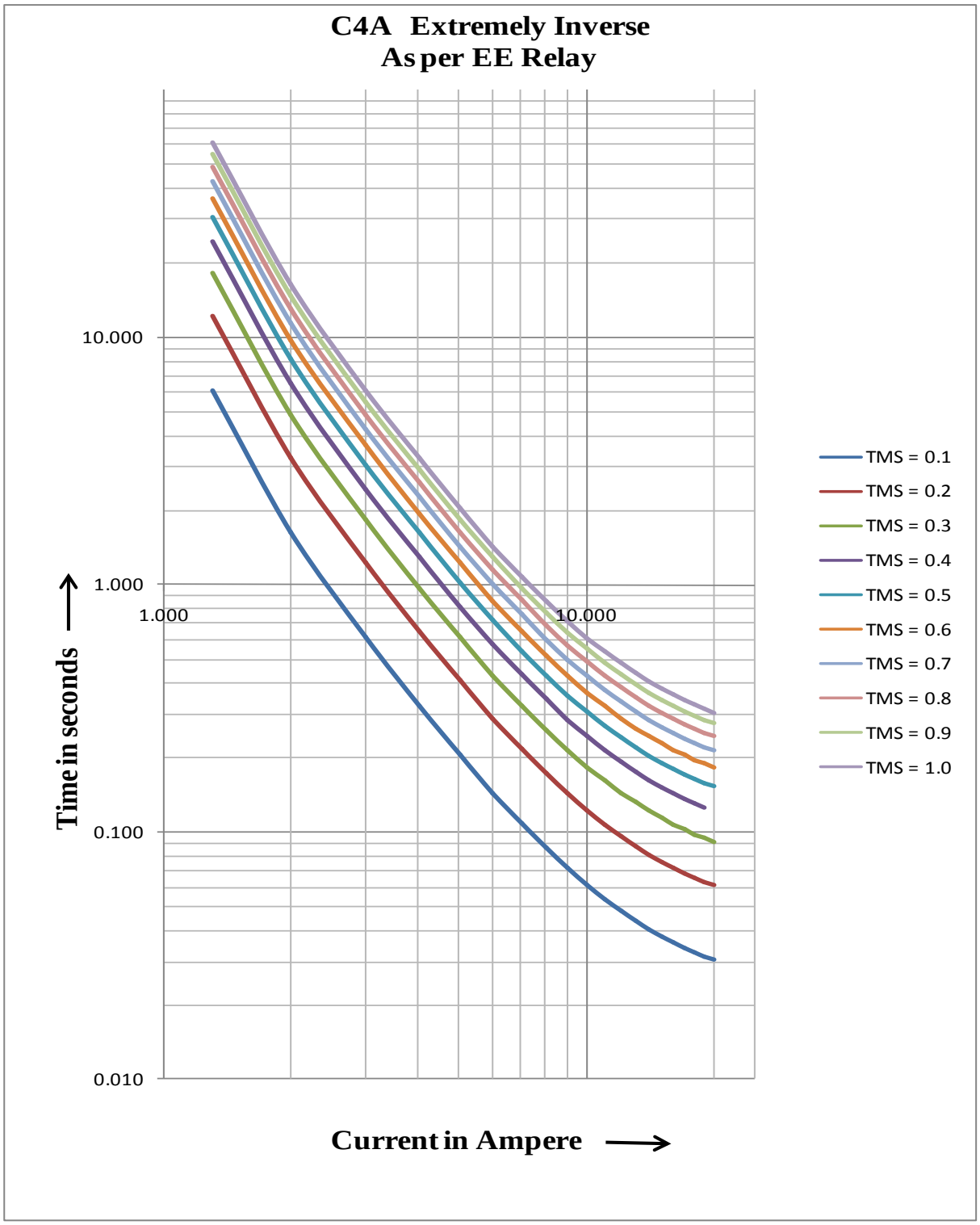
| Curve Type | Description | a | b |
|---|---|---|---|
| C1 | Normal Inverse_1 | 0.14 | 0.02 |
| C2 | Normal Inverse_2 | 0.06 | 0.02 |
| C3 | Very Inverse | 13.5 | 1 |
| C4 | Extremely inverse | 80 | 2 |
| C4A | Extremely Inverse (C4A) as per EE Relays | 80 | 2.2 |
| C5 | Long Time Inverse | 120 | 1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

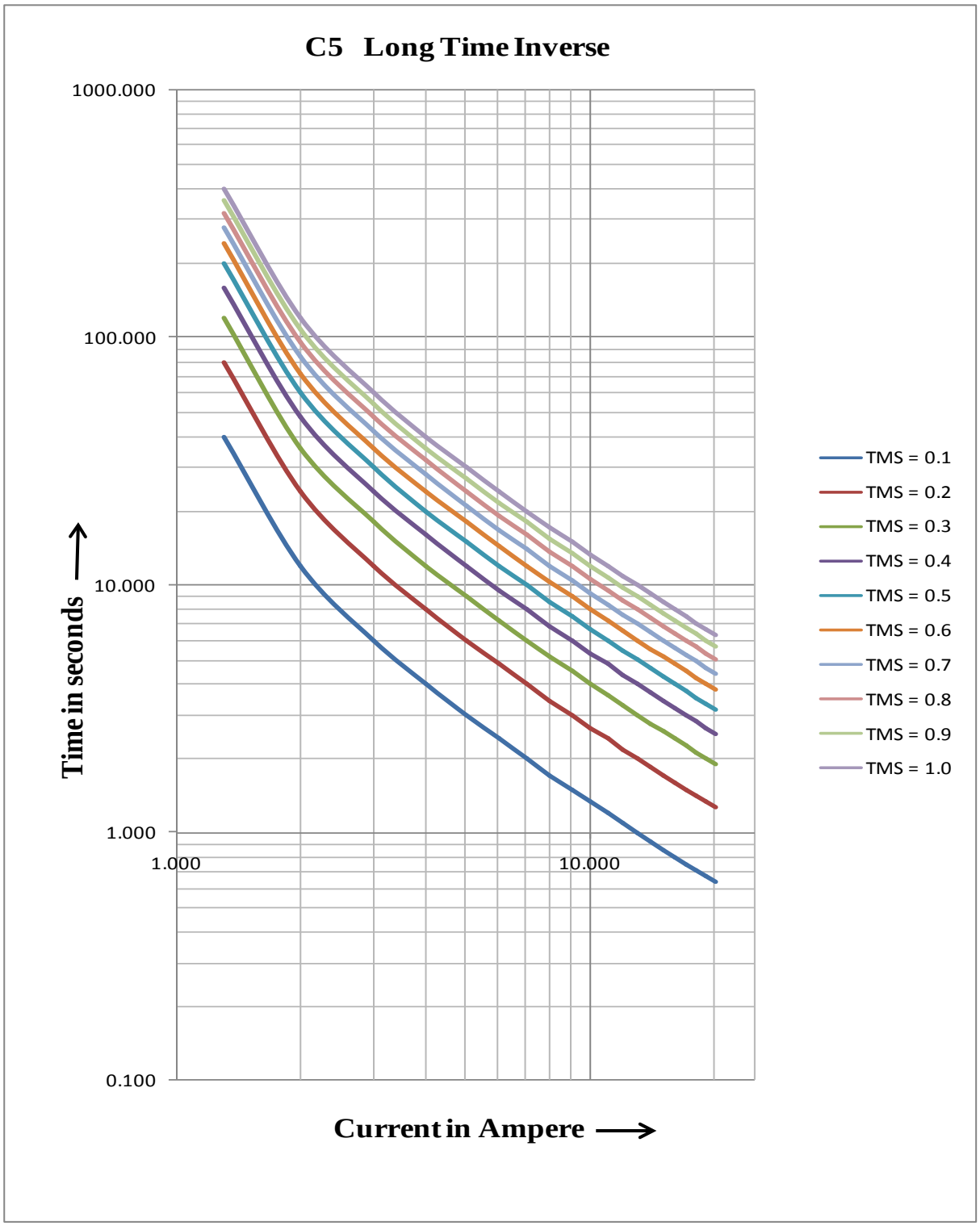

C1 Normal Inverse_1
100.000
10.000
1.000
0.100
1.000
10.000
Time in seconds
Current in Ampere
TMS = 0.1
TMS = 0.2
TMS = 0.3
TMS = 0.4
TMS = 0.5
TMS = 0.6
TMS = 0.7
TMS = 0.8
TMS = 0.9
TMS = 1.0

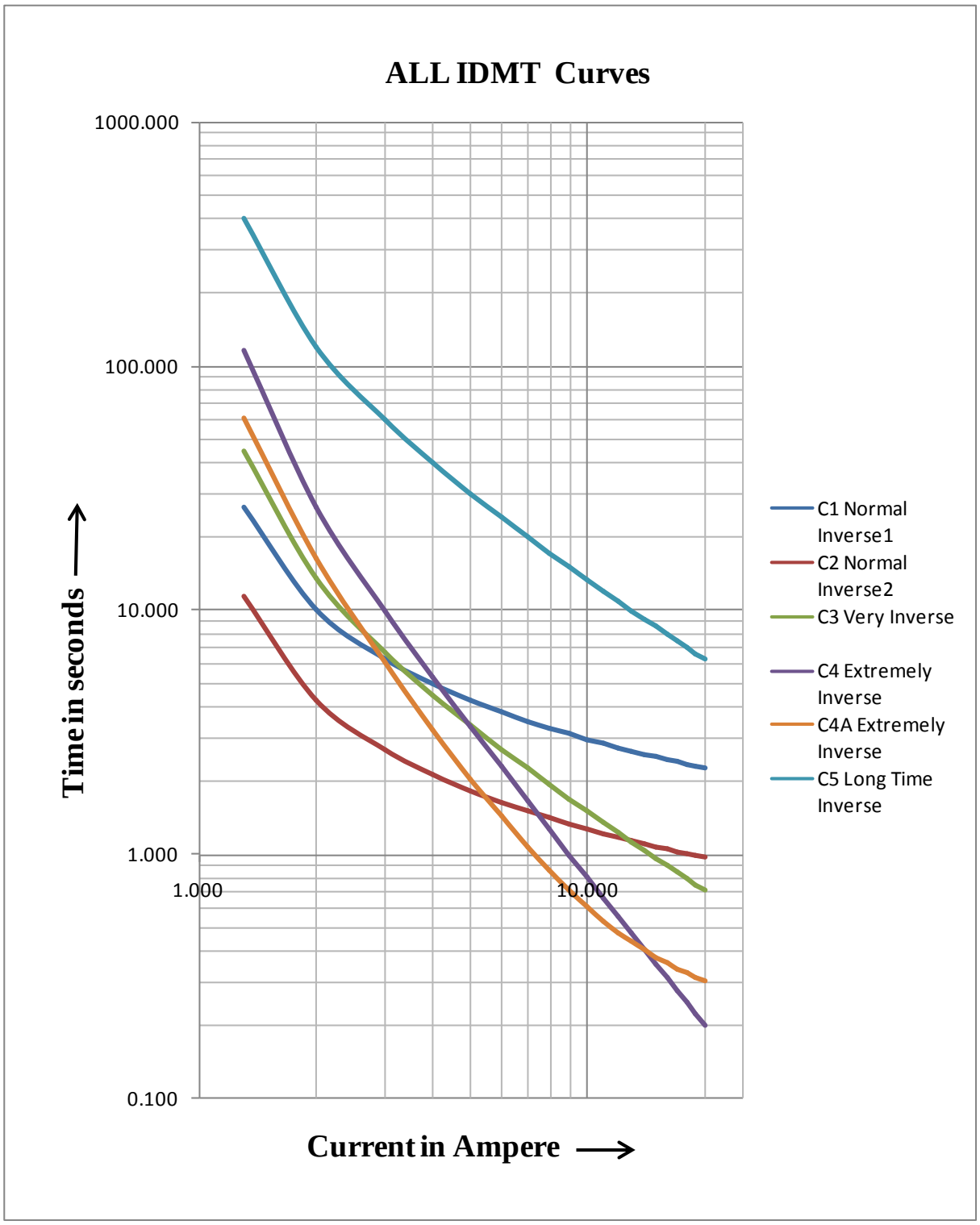

C2 Normal Inverse_2
10.0
1.0
0.1
0.0
1.0
10.0
Time in seconds
Current in Ampere
TMS = 0.1
TMS = 0.2
TMS = 0.3
TMS = 0.4
TMS = 0.5
TMS = 0.6
TMS = 0.7
TMS = 0.8
TMS = 0.9
TMS = 1.0


C3 Very Inverse
10.000
1.000
0.100
0.010
1.000
10.000
Time in seconds
Current in Ampere
TMS = 0.1
TMS = 0.2
TMS = 0.3
TMS = 0.4
TMS = 0.5
TMS = 0.6
TMS = 0.7
TMS = 0.8
TMS = 0.9
TMS = 1.0


C4 Extremely Inverse
100.000
10.000
1.000
0.100
0.010
1.000
10.000
Time in seconds
Current in Ampere
TMS = 0.1
TMS = 0.2
TMS = 0.3
TMS = 0.4
TMS = 0.5
TMS = 0.6
TMS = 0.7
TMS = 0.8
TMS = 0.9
TMS = 1.0


C4A Extremely Inverse
As per EE Relay
10.000
1.000
0.100
0.010
1.000
10.000
Time in seconds
Current in Ampere
TMS = 0.1
TMS = 0.2
TMS = 0.3
TMS = 0.4
TMS = 0.5
TMS = 0.6
TMS = 0.7
TMS = 0.8
TMS = 0.9
TMS = 1.0


C5 Long Time Inverse
1000.000
100.000
10.000
1.000
0.100
1.000
10.000
Time in seconds
Current in Ampere
TMS = 0.1
TMS = 0.2
TMS = 0.3
TMS = 0.4
TMS = 0.5
TMS = 0.6
TMS = 0.7
TMS = 0.8
TMS = 0.9
TMS = 1.0


ALL IDMT Curves
1000.000
100.000
10.000
1.000
0.100
1.000
10.000
Time in seconds
Current in Ampere
C1 Normal Inverse1
C2 Normal Inverse2
C3 Very Inverse
C4 Extremely Inverse
C4A Extremely Inverse
C5 Long Time Inverse

## 4.7 Cold Load Protection Function

Cold Load Pickup function is provided to avoid mal operation of relay due to high prolong inrush current after the closing of circuit breaker. If Cold Load function is enable, whenever a circuit breaker is turn ON relay sense through CB auxiliary contact (CBNO) and start internal Cold Load timer, during this time period relay will activate separate group of setting specified in cold load settings menu and inhibits all other protection function for a set duration. When the set “Cold Load Timer” is elapsed, all the relevant settings will revert to their normal protection setting values or become unblocked.

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# Section 5

# Metering Section

## Contents

# 5 MEASUREMENT SHEET

## 5.1 Measurement

Measurement window displays the primary and secondary values of phase and ground current based on the power system network.

| Parameter | Unit | Description |
|---|---|---|
| R = 0000 | A | Primary current in phase R |
| Y = 0000 | A | Primary current in phase Y |
| B = 0000 | A | Primary current in phase B |
| N = 0000 | A | Primary current in Neutral CT |
| r = 00.00 | A | Secondary current in phase R |
| y = 00.00 | A | Secondary current in phase Y |
| b = 00.00 | A | Secondary current in phase B |
| n = 00.00 | A | Secondary current in Neutral CT |

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# Section 6

# Setting Sheet

## Contents

# 6 SETTING SHEET

## 6.1 Relay Settings

| Sr. No | Parameter | Defaults setting | Setting / Ranges |
|---|---|---|---|
| 1. | Password | 000 | 000 – 099 |
| This setting specifies to enter the set password | | | |
| 2. | New Password | 000 | 000 – 099 |
| 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. | IP> | 100% | 5% – 250% in step of 1% |
| This setting determines Pick-up setting for first stage over current element. | | | |
| 5. | IP> 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. | IP>> | 100% | 50% – 3000% in step of 1% |
| This setting determines Pick-up setting for second stage over current element. | | | |
| 7. | IE> | 100% | 5% – 250% in step of 1% |
| This setting determines Pick-up setting for first stage ground over current element. | | | |
| 8. | IE> 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. | | | |
| 9. | IE>> | 100% | 50% – 3000% in step of 1% |
| This setting determines Pick-up setting for second stage ground over current element. | | | |
| 10. | IP> Curve | C1 | Normal Inverse1 (C1)/ Normal Inverse2 (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 first stage over current. | | | |
| 11. | IE> Curve | C1 | Normal Inverse1 (C1)/ Normal Inverse2 (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 first stage ground over current element. | | | |
| 12. | IP> C6 Time | 1.0s | 000 – 99.9s in steps of 0.1s |
| This setting is used to set the time-delay for Definite Time (C6) setting if selected for first stage over current. | | | |
| 13. | IE> C6 Time | 1.0s | 000 – 99.9s in steps of 0.1s |

| | | | |
|---|---|---|---|
| This setting is used to set the time-delay for Definite Time (C6) setting if selected for first stage ground over current. | | | |
| 14. | IP>> Delay | 0.05s | 000 – 10.0s in steps of 0.01s |
| This setting is used to set the time-delay for second stage over current. | | | |
| 15. | IE>> Delay | 0.05s | 000 – 10.0s in steps of 0.01s |
| This setting is used to set the time-delay for second stage ground over current. | | | |
| 16. | BF Delay | 50ms | 000 – 800 msec. |
| This setting for the time-delay for the CBF trip. | | | |
| 17. | CT Secondary | 1 A | 1 A/5 A |
| This setting is used to set the CT Secondary | | | |
| 18. | CT Primary | 10 A | 10 – 5000A in step of 1A |
| This setting is used to set the CT Primary. | | | |
| 19. | Test Block | No | 01 – 02 (1= Yes, 2= No) |
| This setting is used to enable (turn on) or disable (turn off) the CB Trip operation through relay HMI. | | | |
| 20. | Trip Circuit | No | 01 – 02 (1= Yes, 2= No) |
| This setting is used to enable (turn on) or disable (turn off) Trip circuit supervision. This is used to monitor trip coil which is used to trip the circuit breaker. | | | |
| 21. | Ann. Type | 1 | 1 – 4 |
| This setting is used select the annunciation type. | | | |
| 22. | Ann. Contact | 1 | 01 –02 (1=SR, 2=HR) |
| This setting specifies to ann. contact can be set to Manual/Hand reset (HR) or Self reset (SR) | | | |
| 23. | Trip Contact | 1 | 01 –02 (1=SR, 2=HR) |
| This setting specifies to Trip1 and Trip2 contact can be set to Manual/Hand reset (HR) or Self reset (SR) | | | |
| 24. | BF Contact | 1 | 01 –02 (1=SR, 2=HR) |
| This setting specifies to BF contact can be set to Manual/Hand reset (HR) or Self reset (SR) | | | |
| 25. | Com Port | USB | USB/RS485 |
| This setting specifies to select communication port for 103 communications. | | | |
| 26. | Set 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. | | | |
| 27. | Baud Rate | 57600 | 2400/ 4800/ 9600/ 14400/ 19200/ 28800/ 38400/ 57600 |
| 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. | | | |

## 6.2 Cold Load

| Sr. No | Parameter | Defaults setting | Setting / Ranges |
|---|---|---|---|
| 1. | Password | 000 | 000 – 099 |
| This setting specifies to enter the set password | | | |
| 2. | CL Enable | Yes | 01 – 02 (1= Yes, 2= No) |
| This setting determine to enable (turn on) or disable (turn off) the Cold load function. | | | |
| 3. | CL Timer | 1.00s | 0.01 – 10.0s in steps of 0.10s |
| This setting controls the period of time for which the relevant over current and ground over current settings are altered or inhibited following circuit breaker closure. | | | |
| 4. | CL IP> | 100% | 5% – 250% in step of 1% |
| This setting determines Pick-up setting for first stage over current element. | | | |
| 5. | CL IP>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. | CL IP>> | 100% | 50% – 3000% in step of 1% |
| This setting determines Pick-up setting for second stage over current element. | | | |
| 7. | CL IE> | 100% | 5% – 250% in step of 1% |
| This setting determines Pick-up setting for first stage Ground over current (Measured) element. | | | |
| 8. | CL IE>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. | | | |
| 9. | CL IE>> | 100% | 50% – 3000% in step of 1% |
| This setting determines Pick-up setting for second stage Ground over current (Measured) element. | | | |
| 10. | CL IP> Curve | C1 | Normal Inverse1 (C1)/ Normal Inverse2 (C2)/ Very Inverse (C3)/ Extremely Inverse (C4)/ Extremely Inverse (C4A)/ Long Time Inverse (C5)/ Definite Time (C6) |
| This setting determines the tripping characteristic for the first stage over current element. | | | |
| 11. | CL IE> Curve | C1 | Normal Inverse1 (C1)/ Normal Inverse2 (C2)/ Very Inverse (C3)/ Extremely Inverse (C4)/ Extremely Inverse (C4A)/ Long Time Inverse (C5)/ Definite Time (C6) |
| This setting determines the tripping characteristic for the first stage Ground over current element. | | | |
| 12. | CL IP> C6 Time | 1.00s | 0.00 – 99.9s in steps of 0.10s |
| This setting is used to set the time-delay for the Definite Time (DT) setting if selected for first stage over current element. | | | |
| 13. | CL IE> C6 Time | 1.00s | 0.00 – 99.9s in steps of 0.10s |

| | | | |
|---|---|---|---|
| This setting is used to set the time-delay for the Definite Time (DT) setting if selected for first stage Ground over current (Measured) element. | | | |
| 14. | CL IP>> Delay | 0.10s | 0.00 – 10.0s in steps of 0.01s |
| This setting for the time-delay for the definite time setting if selected for second stage over current element. | | | |
| 15. | CL IE>> Delay | 0.10s | 0.00 – 10.0s in steps of 0.01s |
| This setting for the time-delay for the definite time setting if selected for second stage ground over current element | | | |

## 6.3 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 ADR241A Only)

## Contents

# 7 COMMUNICATIONS

## 7.1 MODBUS

This section describes how the MODBUS standard is applied to the ADITYAV2 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 front panel menu
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.<br>NOTE: If the start address received is correct but the range includes unsupported address this error is produced. |

| Sr. No. | | Function Code | Register | No. of Regs | Format | Reg. Type | Address Map |
|---|---|---|---|---|---|---|---|
| 1 | 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 |
| | | | Relay Description | 10 | 20-Bytes ASCII | R | 4x00075 – 4x00084 |

| 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 |

| 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 | | | | | |
| | | | Auxiliary input 1 | 1 | 1 bit | R | 1x32769 |
| | | | Auxiliary input 2 | 1 | 1 bit | R | 1x32770 |
| | | | Auxiliary input 3 | 1 | 1 bit | R | 1x32771 |
| | | | Auxiliary input 4 | 1 | 1 bit | R | 1x32772 |
| | | | General pick-up | 1 | 1 bit | R | 1x32773 |
| | | | Start/Pick-up L1 | 1 | 1 bit | R | 1x32774 |
| | | | Start/Pick-up L2 | 1 | 1 bit | R | 1x32775 |
| | | | Start/Pick-up L3 | 1 | 1 bit | R | 1x32776 |
| | | | General Trip | 1 | 1 bit | R | 1x32777 |
| | | | Trip L1 | 1 | 1 bit | R | 1x32778 |
| | | | Trip L2 | 1 | 1 bit | R | 1x32779 |
| | | | Trip L3 | 1 | 1 bit | R | 1x32780 |
| | | | Trip Ip> | 1 | 1 bit | R | 1x32781 |
| | | | Trip Ip>> | 1 | 1 bit | R | 1x32782 |
| | | | Test | 1 | 1 bit | R | 1x32783 |
| | | | Breaker Failure | 1 | 1 bit | R | 1x32784 |
| | | | Ie> Pickup | 1 | 1 bit | R | 1x32785 |
| | | | Ie>> Pickup | 1 | 1 bit | R | 1x32786 |
| | | | Trip Ie> | 1 | 1 bit | R | 1x32787 |
| | | | Trip Ie>> | 1 | 1 bit | R | 1x32788 |
| | | | CLP | 1 | 1 bit | R | 1x32789 |
| | | | Protection active | 1 | 1 bit | R | 1x32790 |
| | | | Relay Error | 1 | 1 bit | R | 1x32791 |
| | | | LED reset | 1 | 1 bit | R | 1x32792 |
| | | | Local para settings | 1 | 1 bit | R | 1x32793 |
| | | | Trip Ckt | 1 | 1 bit | R | 1x32794 |
| | | | Ip> PKP | 1 | 1 bit | R | 1x32795 |
| | | | Ip>> PKP | 1 | 1 bit | R | 1x32796 |

| Sr. No. | | Function Code | Register | No. of Regs | Format | Reg. Type | Address Map |
|---|---|---|---|---|---|---|---|
| 5 | Outputs | 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 | | | | | |
| | | | IR | 2 | 32 bit Float | R | 3x33281– 3x33282 |
| | | | IY | 2 | 32 bit Float | R | 3x33283 – 3x33284 |
| | | | IB | 2 | 32 bit Float | R | 3x33285 – 3x33286 |
| | | | IE | 2 | 32 bit Float | R | 3x33287 – 3x33288 |

## 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 ADR241A 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 front panel menu.

## 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 ASDU 3 and 9. ASDU 3 will be reported with information number 147 and ASDU 9 with information number 148. 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.

The device transmits its measurands at **1.2** times the rated value of the analogue value.

## 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 |

| Sr. No. | INF | Description | GI | TYP | COT | FUN |
|---|---|---|---|---|---|---|
| 2 | Semantics of INFORMATION NUMBER : Status indications in monitor direction | | | | | |
| | 18 | Protection active | X | 1 | 1,7,9,11,12,20,21 | 160 |
| | 19 | LED Reset | - | 1 | 1,7,11 | 160 |
| | 145 | Relay Error | X | 1 | 1,7,9,11,12,20,21 | 127 |
| | 21 | Test | X | 1 | 9,11 | 127 |
| | 22 | Local Parameter setting | X | 1 | 9,11 | 160 |
| | 27 | Auxiliary Status 1 | X | 1 | 1,7,9,11 | 160 |
| | 28 | Auxiliary Status 2 | X | 1 | 1,7,9,11 | 160 |
| | 29 | Auxiliary Status 3 | X | 1 | 1,7,9,11 | 160 |
| | 30 | Auxiliary Status 4 | X | 1 | 1,7,9,11 | 160 |
| | 64 | Start/ Pick-up $L_1$ | X | 2 | 1,7,9 | 160 |
| | 65 | Start/ Pick-up $L_2$ | X | 2 | 1,7,9 | 160 |
| | 66 | Start/ Pick-up $L_3$ | X | 2 | 1,7,9 | 160 |
| | 84 | General Start/ Pick-up | X | 2 | 1,7,9 | 160 |
| | 117 | Ip> PKP | X | 2 | 1,7 | 126 |
| | 103 | Ip>> PKP | X | 2 | 1,7 | 126 |
| | 68 | General Trip | - | 2 | 1,7 | 160 |
| | 69 | Trip $L_1$ | X | 2 | 1,7 | 160 |
| | 70 | Trip $L_2$ | X | 2 | 1,7 | 160 |
| | 71 | Trip $L_3$ | X | 2 | 1,7 | 160 |
| | 85 | Breaker failure | - | 2 | 1,7 | 160 |
| | 90 | Trip Ip> | X | 2 | 1,7 | 160 |
| | 91 | Trip Ip>> | X | 2 | 1,7 | 160 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 123 | Trip Ie> | X | 2 | 1,7 | 126 |
| | 124 | Trip Ie>> | X | 2 | 1,7 | 126 |
| | 143 | Ie> pickup | X | 2 | 1,7,9 | 126 |
| | 144 | Ie>> pickup | X | 2 | 1,7,9 | 126 |
| | 225 | CLP | - | 2 | 1,7 | 126 |

| Sr. No. | INF | Description | GI | TYP | COT | FUN |
|---|---|---|---|---|---|---|
| 3 | Semantics of INFORMATION NUMBER : Supervision indication in monitor direction | | | | | |
| | 36 | trip circuit supervision | X | 1 | 1,7,9 | 160 |

| Sr. No. | INF | Description | GI | TYP | COT | FUN |
|---|---|---|---|---|---|---|
| 4 | Semantics of INFORMATION NUMBER : Fault indication in monitor direction | | | | | |
| | 21 | Test | X | 1 | 9,11 | 127 |
| | 69 | Trip $L_1$ | - | 2 | 1,7 | 160 |
| | 70 | Trip $L_2$ | - | 2 | 1,7 | 160 |
| | 71 | Trip $L_3$ | - | 2 | 1,7 | 160 |
| | 90 | Trip Ip> | - | 2 | 1,7 | 160 |
| | 91 | Trip Ip>> | - | 2 | 1,7 | 160 |
| | 123 | Trip Ie> | - | 2 | 1,7 | 126 |
| | 124 | Trip Ie>> | - | 2 | 1,7 | 126 |
| | 85 | Breaker failure | - | 2 | 1,7 | 160 |
| | 225 | CLP | - | 2 | 1,7 | 126 |

| Sr. No. | INF | Description | GI | TYP | COT | FUN |
|---|---|---|---|---|---|---|
| 5 | Semantics of INFORMATION NUMBER : Measurands in monitor direction | | | | | |
| | 147 | * Measurands $I_N$, $V_{EN}$ | - | 3.4 | 2,7 | 160 |
| | 148 | * Measurands $I_{L1,2,3}$, $V_{L1,2,3}$, P, Q, f | - | 9 | 2,7 | 160 |

*Note: ASDU 3 and 9 are send alternately in response to Class 2 data request, following Measurands $V_{L1,2,3}$, P, Q, f, are set to Invalid.*

| Sr. No. | INF | Description | GI | TYP | COT | FUN |
|---|---|---|---|---|---|---|
| 6 | Semantics of INFORMATION NUMBER : Private Frames in monitor direction | | | | | |
| | 1 | Fault Data | X | 246 | 1, 11 | 127 |

| Sr. No. | INF | Description | TYP | COT | FUN |
|---|---|---|---|---|---|
| 7 | Semantics of INFORMATION NUMBER : Private Frames in monitor direction | | | | |
| | 0 | Fault List Request | 24 | 31 | 160 |
| | 1 | Fault Data Request | 245 | 11 | 127 |

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

| Sr. No. | INF | Description | COM* | TYP | COT | FUN |
|---|---|---|---|---|---|---|
| 9 | Semantics of INFORMATION NUMBER : General Command in control direction | | | | | |
| | 19 | LED Reset | ON | 20 | 20 | 160 |
| | 124 | Trip | ON | 20 | 20 | 127 |

* *Permissible selections of DCO values are specified in COM column (Ref. IEC60870-5-103 Section7.2.6.4)*

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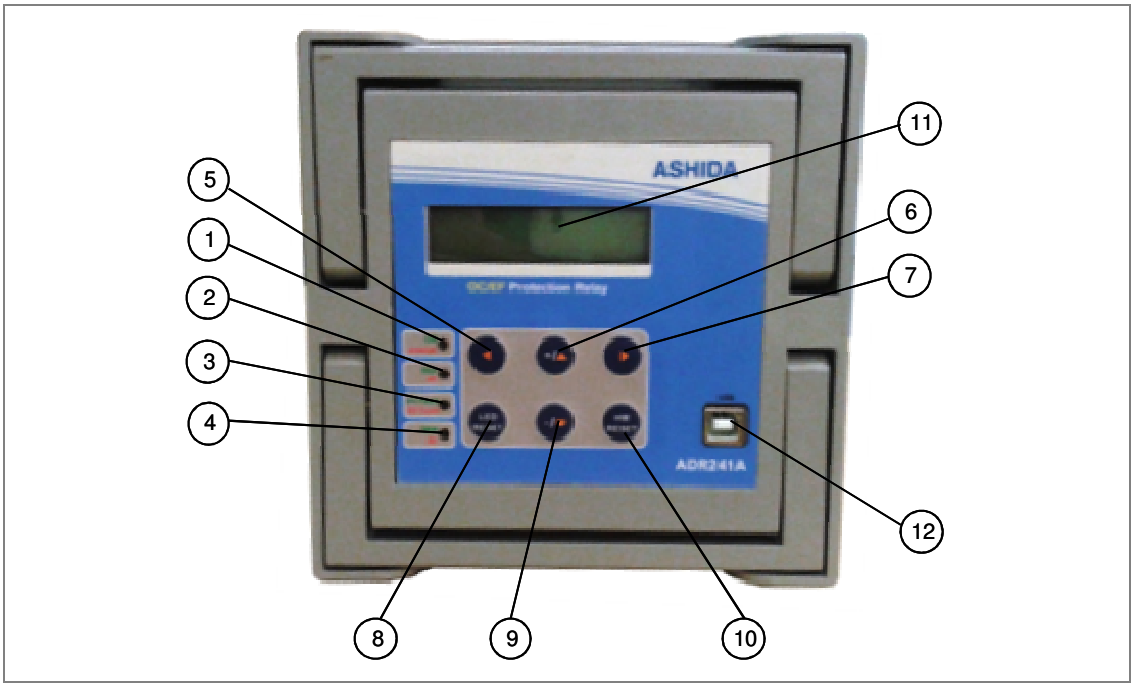
# Section 8

# User Guide

# Contents

# 8 USER GUIDE




| No | Legend | Function |
|---|---|---|
| 1. | ON / ERROR | : Green LED indicates Relay OK.<br>: Red LED indicates problem in Relay hardware. |
| 2. | PKP / HF | : Green LED indicates Pick-up<br>: Red LED indicates relay operated at HF. |
| 3. | OC FAULT / EF FAULT | : Green LED indicates the relay tripped by OC. Hand Reset (HR) Type.<br>: Red LED indicates the relay tripped by EF. Hand Reset (HR) Type. |
| 4. | TRIP / BF | : Green LED Indicates that Trip pulse is being executed. SR type when TRIP contact selected as SR and HR type when TRIP contact selected as HR.<br>: Red LED indicates BF operated. SR type when BF contact selected as SR and HR type when BF contact selected as HR. |
| 5. | ◄ | : Feather Touch Key Left arrow Key [◄] for navigating through the menus and submenus and save settings. |
| 6. | + /▲ | : Feather Touch Key [ + ] Plus to INCREMENT the values &<br>[▲] to SCROLL the Main Menu up. |
| 7. | ► | : Feather Touch Key [►] to VIEW the settings and to navigate through the menus and submenus. |
| 8. | LED RESET | : Feather Touch Key LED RESET to Reset LED and HR Type Output contact |

| No | Legend | Function |
|---|---|---|
| 9. | - /▼ | : Feather Touch Key [ - ] Minus to 'DECREMENT' the values & [▼] to SCROLL the Main Menu down. |
| 10. | HW RESET | : Feather Touch Key for HW RESET is provided for Hardware Reset. This key is interlock with LED RESET key. |
| 11. | LCD Display | : 16 x 2 char. LCD display to observe settings and parameters of the relay. |
| 12. | USB | : USB port for serial communication (for ADR241A). |

## 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: When the Left Arrow key (◂) is used to navigate through the menus and submenus 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 and submenus.

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

(- / ▼) 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 ADR141A/ ADR241A 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.<br>: Red LED indicates problem in Relay hardware. |
| 2. | PKP / HF | : Green LED indicates Pick-up<br>: Red LED indicates relay operated at HF. |
| 3. | OC FAULT / EF FAULT | : Green LED indicates the relay tripped by OC. Hand Reset (HR) Type.<br>: Red LED indicates the relay tripped by EF. Hand Reset (HR) Type. |
| 4. | TRIP / BF | : Green LED Indicates that Trip pulse is being executed. SR type when TRIP contact selected as SR and HR type when TRIP contact selected as HR.<br>: Red LED indicates BF operated. SR type when BF contact selected as SR and HR type when BF contact selected as HR. |

### 8.1.4 RS422/ RS485 Port (for ADR241A)

RS422/ RS485 Port is provided at the rear side of relay for permanent SCADA connectivity. Using RS422/RS485 port the Fault data and Live Events can be downloaded.

***Note**: The RS422 4 wire (Tx+, Tx-, Rx+, Rx-) communication port can be used as RS485 2 wire (D+, D-) by shorting terminal B13 & B14 used as D+ and B15 & B16 used as D-.*

### 8.1.5 USB Port (for ADR241A)

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 General Setting.

## 8.2 Password

### 8.2.1 Editing Password and saving the settings.

**To enter password in ADR141A/ ADR241A refer following steps**

In ADR141A/ ADR241A all the Protection setting windows are password protected. Procedure to enter the password is same for all windows to enter the password follow these steps.

| | |
|---|---|
| **R=0000 Y=0000**<br>**B= 0000 N=0000 A** | This window shows actual Primary load current as per the CT Primary selection.<br><br>Press the Left arrow key ( ◂ ) to go to the Main Menu. |
| | |
| **Measurement** | The relay will display **Measurement** in Main Menu.<br><br>Press the Plus / up arrow key (+ / ▴ ) to move to the next option. |
| | |
| **Relay Setting** | Password protected window for **"Relay Setting"** setting i.e. New Password, Unit ID, IP>, IP>TMS, IP>>, IE>, IE>TMS, IE>>, IP> Curve, IE>Curve, IP> C6 Time, IE> C6 Time, IP>> Delay, IE>> Delay, BF Delay, CT Sec, CT Pri, Test Block, Trip Ckt., Ann Type, Ann Cont, Trip Cont, BF Cont, Com Port, Set Parity and Baud Rate<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Password = 000**<br>**Use Inr/Dec** | Editable setting<br>Enter the previously set password, by using the Plus / up arrow key (+ / ▴ ) or the minus / down arrow key (- / ▾ ).<br>Note: Default password setting is '000'<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **New Password = 000**<br>**Use Inr/Dec** | Editable setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired New Password can be set. The setting range is from 000 to 099.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |

| | |
|---|---|
| **Save Setting?**<br>**Mode ( ◂ )for SAVE** | Now continue to press the Left arrow key ( ◂ ) till the window show SAVE Settings / MODE ( ◂ ) for SAVE<br><br>Press the Left arrow key ( ◂ ) i.e. MODE to SAVE the changes and move to the Main Menu. |
| | |
| **RELAY SETTING** | |

### 8.2.2 Clear Password & Loading of Default Values.

There are unliking event when user forgot the password, in such case password can be cleared by pressing following sequences

1 Press 'HW RESET' + 'LED RESET + Left arrow keys ( ◂ ) simultaneously.

2 Release 'HW RESET' and 'LED RESET keys while keeping the Left arrow key ( ◂ ) in press condition.

| | |
|---|---|
| **Password & Fault**<br>**Memory Clear** | This message will be displayed |

3 Then release Left arrow key ( ◂ ).

| | |
|---|---|
| **Ashida Digital**<br>**OC/EF Relay** | This window will flash momentarily showing the following.<br>Relay Type: Ashida Digital O/C EF Relay<br><br>Then the control will automatically move to next option. |
| | |
| **ADR241A V01.05**<br>**Unit ID = 0001** | This window shows Software version and the Unit ID |
| | |
| **R=0000 Y=0000**<br>**B= 0000 N=0000 A** | This window shows actual Primary load current as per the CT Primary selection. |

***NOTE:*** *This will also clear all fault memory.*

## 8.3 MENUS

### 8.3.1 Default Display

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

| | |
|---|---|
| **Ashida Digital**<br>**OC/EF Relay** | This window will flash momentarily showing the following.<br>Relay Type: Ashida Digital O/C EF Relay<br><br>Then the control will automatically move to next option. |
| | |
| **ADR241A V01.05**<br>**Unit ID = 0001** | This window shows Software version and the Unit ID |
| | |
| **R=0000 Y=0000**<br>**B= 0000 N=0000 A** | This window shows actual Primary load current as per the CT Primary selection. |

### 8.3.2 Main Menu Details

| | |
|---|---|
| **R=0000 Y=0000**<br>**B= 0000 N=0000 A** | Default window, shows actual Primary load current as per the CT Primary selection.<br><br>Press the Left arrow key ( ◄ ) to move to the Main Menu |
| | |
| **Measurement** | This menu is to view the current as per CT Primary and Secondary selection.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Relay Setting** | Password protected window for **"Relay Setting"** setting i.e. New Password, Unit ID, IP>, IP>TMS, IP>>, IE>, IE>TMS, IE>>, IP> Curve, IE>Curve, IP> C6 Time, IE> C6 Time, IP>> Delay, IE>> Delay, BF Delay, CT Sec, CT Pri, Test Block, Trip Ckt., Ann Type, Ann Cont, Trip Cont, BF Cont, Com Port, Set Parity and Baud Rate<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |

| | |
|---|---|
| **Cold Load** | Password protected window for **"COLD LOAD"** setting i.e. CL Enable, CL Timer, CL IP>, CL IP>TMS, CL IP>>. CL IE>, CL IE>TMS, CL IE>>, CL IP> Curve, CL IE> Curve, CL IP> C6 Time, CL IE> C6 Time, CL IP>> Delay and CL IE>> Delay<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **TRIP TEST** | This window is to view the **TRIP TEST**.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Fault 1** | This window is to view the **Fault 1**.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Fault 2** | This window is to view the **Fault 2**.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Fault 3** | This window is to view the **Fault 3**.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Fault 4** | This window is to view the **Fault 4**.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Fault 5** | This window is to view the **Fault 5**.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Error Log** | This window is to view the **Error Log.**<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Status** | This window is to view the **Status.**<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |

| | |
|---|---|
| | |
| **Date / Time** | Password protected window for **"DATE / TIME"** setting i.e. Set Hour, Set Minute, Set Second, Set Date, Set Month and Set Year.<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Measurement** | This window shows the first window of Main Menu. |

### 8.3.3 Measurement

#### 8.3.3.1 To View – Measurement

| | |
|---|---|
| **Measurement** | This menu is to view actual load current as per CT Primary and Secondary current selection.<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |
| | |
| **R=0000 Y=0000**<br>**B=0000 N=0000** | This window shows actual Primary load current as per the CT Primary selection.<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |
| | |
| **r=00.00 y=00.00**<br>**b=00.00 n=00.00** | This window shows actual Secondary load current as per the CT Secondary selection.<br><br>Press the Right arrow key ( ▸ ) to move to the Main Menu. |
| | |
| **Measurement** | |

### 8.3.4 Relay Settings

#### 8.3.4.1 To Set – Relay Settings

| | |
|---|---|
| **Relay Setting** | Password protected window for **"Relay Setting"** setting i.e. New Password, Unit ID, IP>, IP>TMS, IP>>, IE>, IE>TMS, IE>>, IP> Curve, IE>Curve, IP> C6 Time, IE> C6 Time, IP>> Delay, IE>> Delay, BF Delay, CT Sec, CT Pri, Test Block, Trip Ckt., Ann Type, Ann Cont, Trip Cont, BF Cont, Com Port, Set Parity and Baud Rate<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Password = 000**<br>**Use Inr/Dec** | Editable setting<br>Enter the previously set password, by using the up arrow key (+ /▲) or the down arrow key (- /▼).<br>Note: Default password setting is '000'<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **New Password = 000**<br>**Use Inr/Dec** | Editable setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **New Password** can be set.<br>The setting range is from 000 to 099 in steps of 1.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Unit ID = 001** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Unit ID** can be set.<br>The setting range is 001 to 255 in steps of 1. i.e. The unit address will vary from 01 to 255, which means total 254 devices can be connected to single computer. The 255 address, reserved for special command. These settings are required to communicate with the SCADA computer.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IP> = 050**<br>**Range 5 – 250%** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **IP> (*OC Trip)*** can be set.<br>The setting range for OC Trip will be from 5% to 250% in steps |

| | |
|---|---|
| | of 1%. This setting is common to all three phases.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IP> TMS = x0.010**<br>**Range x0.010 to x1.50** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **IP> TMS (*OC TMS)*** can be set**.**<br>The setting range for IP> (OC TMS) will be from x0.01 – x1.50 in steps of x0.005. This setting is common to all three phases<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IP>> = 0100**<br>**Range 50 – 3000%** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **IP>> *(OC HF)*** can be set**.**<br>The setting range for OC HF will be from 00 / 50% to 3000% in steps of 1%. **Setting the HF value to 00 will bypass the instantaneous element.**<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IE> = 025**<br>**Range 5% – 250%** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **IE> (*EF Trip)*** can be set**.**<br>The setting range of EF trip is from 5% to 250% in steps of 1%.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IE> TMS = x0.010**<br>**Range x0.010 to x1.50** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **IE> TMS (EF TMS)** can be set**.**<br>The setting range for EF TMS will be from x0.01 – x1.50 in steps of x0.005.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IE>> = 0100**<br>**Range 50 – 3000%** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **IE>> (*EF HF)*** can be set**.**<br>The setting range for EF HF will be from 00 / 50% to 3000% in |

| | |
|---|---|
| | steps of 1%. **Setting the HF value to 00 will bypass the instantaneous element.**<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IP> Curve = C1**<br>**Range C1 – C6** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **IP> Curve** can be selected. **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 C2 curve 2 is selected.**<br><br>**Curve** / **Description**<br>**C1** – Normal Inverse 1 (10 Times 3.0 sec)<br>**C2** – Normal Inverse 2 (10 Times 1.3 sec)<br>**C3** – Very Inverse (10 Times 1.5 sec)<br>**C4** – Extremely Inverse (10 Times 0.8 sec)<br>**C4A** – Extremely Inverse (10 Times 0.6 sec)<br>**C5** – Long Time Inverse (10 Times 13.3 sec)<br>**C6** – Definite Time (Inst. to 99.9 sec)<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **IE> Curve = C1**<br>**Range C1 – C6** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **IE> Curve** can be selected. **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 C2 curve 2 is selected.**<br><br>**Curve** / **Description**<br>**C1** – Normal Inverse 1 (10 Times 3.0 sec)<br>**C2** – Normal Inverse 2 (10 Times 1.3 sec)<br>**C3** – Very Inverse (10 Times 1.5 sec)<br>**C4** – Extremely Inverse (10 Times 0.8 sec)<br>**C4A** – Extremely Inverse (10 Times 0.6 sec)<br>**C5** – Long Time Inverse (10 Times 13.3 sec)<br>**C6** – Definite Time (Inst. to 99.9 sec) |

| | |
|---|---|
| | Press the Left arrow key ( ◄ ) to move to the next option. |
| | |
| **IP> C6 Time = 01.0**<br>**Range 0-99.9S** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **IP> C6 Time *(OC Definite Time Delay)*** can be selected.<br>The setting range for definite time is from inst. (00.0) to 99.9secs in steps of 0.1secs. This setting is effective only when C6 curve is selected for phase.<br><br>Press the Left arrow key ( ◄ ) to move to the next option. |
| | |
| **IE> C6 Time = 01.0**<br>**Range 0-99.9S** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **IE> C6 Time *(EF Definite Time Delay)*** can be selected.<br>The setting range for definite time is from inst. (00.0) to 99.9secs in steps of 0.1secs. This setting is effective only when C6 curve is selected for EF.<br><br>Press the Left arrow key ( ◄ ) to move to the next option. |
| | |
| **IP>> Delay = 00.10**<br>**Range 0 – 10.00S** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **IP>> Delay *(HF Operating Delay)*** for Phase can be selected.<br>The setting Range for Phase HF operating time is from inst. (0) to 10.00 secs in steps of 00.01 secs.<br><br>Press the Left arrow key ( ◄ ) to move to the next option. |
| | |
| **IE>> Delay = 00.10**<br>**Range 0 – 10.00S** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **IE>> Delay *(HF Operating Delay)*** for EF can be selected.<br>The setting Range for EF HF operating time is from inst (0) to 10.00 secs in steps of 00.01 secs.<br><br>Press the Left arrow key ( ◄ ) to move to the next option. |
| | |

| | |
|---|---|
| **BF Delay = 200**<br>**Range 000 – 800ms** | Editable Setting<br>After tripping operation relay start this timing, if current does not become zero during this time, relay declare as breaker failure.<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **BF Delay** can be set.<br>The range is from 000 to 800 ms in step of 50ms. **The 000 means bypass this feature.**<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **CT Sec. = 001**<br>**1 = 1A, 2 = 5A** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **CT Secondary** can be set i.e. 1A / 5A. I.e.1 or 2. In which, 1 corresponds with 1 Amp. and 2 correspond with 5 Amp respectively.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **CT Primary = 0100**<br>**Range 10 – 5000** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **CT Primary** can be set.<br>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 CT Pri =500 so that when 1A current flows into relay circuit, in measurement window it will show you 500A).<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **Test Block = 02**<br>**01= Yes, 02 = No** | Editable Setting<br>This setting is use to Test block function. Normally Trip Test is required during pre commission testing to check operation of relay and panel wiring.<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Test Block** can be disable or enable, i.e. 1 or 2. When the given set value is 2 then it will enable Trip Test function, but when the given set value is 1 then Trip Test function will be blocked.<br><br>Press the Left arrow key (◄) to move to the next option. |

| | |
|---|---|
| | |
| **Trip Ckt = 02**<br>**01= Yes, 02 = No** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Test Ckt.** functions can be enable or disable, i.e. 1 or 2.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **Ann Type = 001**<br>**Range 1 – 4** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **ANN. Type** can be set. The setting Range is 1 to 4. |

| | **ANN – Type 1** | **ANN – Type 2** | **ANN – Type 3** | **ANN – Type 4** |
|---|---|---|---|---|
| **RELAY 1** | OC1 | OC – HF | HF | COM ALARM |
| **RELAY 2** | OC2 | OC – IDMT | IDMT | PROTH. |
| **RELAY 3** | OC3 | EF – HF | PHASE | PHASE |
| **RELAY 4** | EF | EF – IDMT | EF | EF |

Press the Left arrow key (◄) to move to the next option.

| | |
|---|---|
| | |
| **Ann Cont. = 001**<br>**SR = 1 HR = 2** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Annunciation Contact** can be set, i.e. 1 or 2. In which, 1 corresponds with SR (Self-Reset) and 2 correspond with HR (Hand-Reset) respectively.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **Trip Cont. = 001**<br>**SR = 1 HR = 2** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Trip Cont.** can be set, i.e. 1 or 2. In which, 1 corresponds with SR (Self-Reset) and 2 correspond with HR (Hand-Reset) respectively.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **BF Cont. = 001**<br>**SR = 1 HR = 2** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **BF Cont.** can be set, i.e. 1 or 2. In which, 1 corresponds with SR (Self-Reset) and 2 correspond |

| | |
|---|---|
| | with HR (Hand-Reset) respectively.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Com Port = USB**<br>**USB/RS485** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Com Port** can be set, i.e. USB or RS485.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Set Parity = None**<br>**None/Even/Odd** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Parity** can be set, i.e. None, Even or Odd.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Baud Rate = 008**<br>**Range 1 – 8** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **Baud Rate** can be set. The range is from 1 to 8. |

| Set value | Baud Rate |
|---|---|
| 1 | *2400* |
| 2 | *4800* |
| 3 | *9600* |
| 4 | *14400* |
| 5 | *19200* |
| 6 | *28800* |
| 7 | *38400* |
| 8 | *57600* |

| | |
|---|---|
| | Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Save setting?**<br>**Mode ( ◂ ) For Save** | Press the Left arrow key ( ◂ ) to SAVE the changes and move to the next option. |
| | |

| | |
|---|---|
| **OK** | This window will flash for a moment and it will move to the Main Menu. |
| | |
| **Relay Setting** | |

### 8.3.4.2 To View – Relay Settings

| | |
|---|---|
| **Relay Setting** | Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| **Unit ID = 001** | This window shows the set **Unit ID**.<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| **Ip>050% t>0.010**<br>**Ip>>0100%** | This window shows the set values of **OC Trip, OC TMS and OC High Fault**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| **IE>050% t>0.010**<br>**IE>>0100%** | This window shows the set values of **EF Trip, EF TMS and EF High Fault.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| **Ip>Normal Inv.1**<br>**IE>Normal Inv.1** | This window shows the set values of **OC Curve, and EF Curve selection.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| **Ip> C6 Time = 01.0**<br>**IE> C6 Time = 01.0** | This window shows the set values of **OC C6 Time, and EF C6 Time selection.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |

| | |
|---|---|
| IP>> Delay = 00.10<br>IE>> Delay = 00.10 | This window shows the set values of **OC HF Delay, and EF HF Delay selection.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| CT Sec : 01 A<br>CT Pri : 0100 A | This window shows the set **CT Secondary** and **PT Secondary** Selection.<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| Test Block = NO<br>Trip Ckt. = NO | This window shows the set **Test Block** and **Trip Ckt** selection.<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| Ann Type = 001<br>Ann Cont = HR | This window shows the set **Ann Type** and **Ann Cont.**. Selection.<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| Trip Cont = HR<br>BF Cont = HR | This window shows the set **Trip Cont and BF Cont.** Selection.<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| BF Delay = 200<br>Com Port = USB | This window shows the set **BF Delay** and **Com Port**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| Set Parity = None<br>Baud Rate = 57600 | This window shows the **Set Parity** and **Baud Rate**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| Relay Setting | |

### 8.3.5 Cold Load Settings

#### 8.3.5.1 To Set – Cold Load Settings

| | |
|---|---|
| **COLD LOAD** | Password protected window for **"Cold Load"** setting i.e. CL Enable, CL Timer, CL IP>, CL IP>TMS, CL IP>>. CL IE>, CL IE>TMS, CL IE>>, CL IP> Curve, CL IE> Curve, CL IP> C6 Time, CL IE> C6 Time, CL IP>> Delay and CL IE>> Delay<br><br>Press the Plus / Up arrow key (+ / ▲) to move to the next option. |
| | |
| **Password**<br>**0001** | Editable setting<br>Enter the set password, by using the up arrow key (+ / ▲) or the down arrow key (- / ▼).<br><br>Press the Left arrow key ( ◀ ) to move to the next option. |
| | |
| **CL Enable = 002**<br>**01: YES, 02: NO** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired **Cold Load Enable** function can be set i.e. Yes / No.<br><br>Press the Left arrow key ( ◀ ) to move to the next option. |
| | |
| **CL Timer = 10.0**<br>**Range 0.1 – 10.0S** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired **CL Timer** can be set**.**<br>The setting range is from 0.10 to 10.0s in steps of 0.1s.<br><br>Press the Left arrow key ( ◀ ) to move to the next option. |
| | |
| **CL IP> = 050**<br>**Range 5 – 250%** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired **CL IP>** can be set**.**<br>The setting range is from 5% to 250% in steps of 1%.<br><br>Press the Left arrow key ( ◀ ) to move to the next option. |
| | |
| **CL IP> TMS = x0.010**<br>**Range X0.01 – 1.50** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▲) or the Minus / Down arrow key (- / ▼) the desired **CL IP> TMS** can be set**.** |

| | |
|---|---|
| | The setting range is from 0.01 to 1.50 in steps of 0.005.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **CL IP>> = 0100%**<br>**Range 50 – 3000%** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **CL IP>>** can be set**.**<br>The setting range is from 00 / 50% to 3000% in steps of 1%. **Setting the HF value to 00 will bypass the instantaneous element.**<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **CL IE> = 025**<br>**Range 5 – 250%** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **CL IE>** can be set**.**<br>The setting range is from 5% to 250% in steps of 1%.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **CL IE> TMS = x0.010**<br>**Range X0.01 – 1.50** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **CL IE> TMS** can be set**.**<br>The setting range is from 0.01 to 1.50 in steps of 0.005.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **CL IE>> = 0100%**<br>**Range 50 – 3000%** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **CL IE>>** can be set**.**<br>The setting range is from 00 / 50% to 3000% in steps of 1%. **Setting the HF value to 00 will bypass the instantaneous element.**<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **CL IP>Curve =C1**<br>**Range C1 – C6** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **CL IP>Curve** can be selected. **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 C2 curve 2 is selected.**<br><br>**Curve** / **Description**<br>**C1** – Normal Inverse 1 (10 Times 3.0 sec)<br>**C2** – Normal Inverse 2 (10 Times 1.3 sec)<br>**C3** – Very Inverse (10 Times 1.5 sec)<br>**C4** – Extremely Inverse (10 Times 0.8 sec)<br>**C4A** – Extremely Inverse (10 Times 0.6 sec)<br>**C5** – Long Time Inverse (10 Times 13.3 sec)<br>**C6** – Definite Time (Inst. to 99.9 sec)<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **CL IE>Curve =C1**<br>**Range C1 – C6** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴) or the Minus / Down arrow key (- / ▾) the desired **CL IE>Curve** can be selected. **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 C2 curve 2 is selected.**<br><br>**Curve** / **Description**<br>**C1** – Normal Inverse 1 (10 Times 3.0 sec)<br>**C2** – Normal Inverse 2 (10 Times 1.3 sec)<br>**C3** – Very Inverse (10 Times 1.5 sec)<br>**C4** – Extremely Inverse (10 Times 0.8 sec)<br>**C4A** – Extremely Inverse (10 Times 0.6 sec)<br>**C5** – Long Time Inverse (10 Times 13.3 sec)<br>**C6** – Definite Time (Inst. to 99.9 sec)<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **CL IP> C6 Time = 01.0**<br>**Range 0 – 99.9S** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴) or the Minus / Down arrow key (- / ▾) the desired **CL IP> C6 Time** can be set.<br>The setting range is from 0.00 to 99.9s in steps of 0.1s.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |

| | |
|---|---|
| **CL IE> C6 Time = 01.0**<br>**Range 0 – 99.9S** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **CL IE> C6 Time** can be set**.**<br>The setting range is from 0.00 to 99.9s in steps of 0.1s.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **CL IP>>Delay = 00.10**<br>**Range 0 – 10.00S** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **CL IP>>Delay** can be set**.**<br>The setting range is from 0.00 to 10.00s in steps of 0.10s.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **CL IE>>Delay = 00.10**<br>**Range 0 – 10.00S** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **CL IE>>Delay** can be set**.**<br>The setting range is from 0.00 to 10.00s in steps of 0.10s.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **Save setting?**<br>**Mode (◄) For Save** | Press the Left arrow key (◄) to SAVE the changes and move to the next option. |
| | |
| **Cold Load** | This window will flash for a moment and it will move to the Main Menu. |

### 8.3.5.2 To View – Cold Load Settings

| | |
|---|---|
| **COLD LOAD** | Press the Right arrow key (►) to move to the next option. |
| | |
| **CL Enable = NO**<br>**CL Timer = 10.0S** | This window shows the set **Cold Load Enable** function and set **CL Timer**.<br><br>Press the Right arrow key (►) to move to the next option. |

| | |
|---|---|
| | |
| Ip>050% t>0.010<br>Ip>>0100% | This window shows the set values of **CL OC Trip, OC TMS and OC High Fault**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| IE>025% t>0.010<br>IE>>0100% | This window shows the set values of **CL EF Trip, EF TMS and EF High Fault.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| Ip>Normal Inv.1<br>IE>Normal Inv.1 | This window shows the set values of **CL OC Curve, and CL EF Curve selection.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| IP> C6 Time = 01.0<br>IE> C6 Time = 01.0 | This window shows the set values of **CL OC C6 Time, and CL EF C6 Time selection.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| IP>> Delay = 00.10<br>IE>> Delay = 00.10 | This window shows the set values of **CL OC Delay, and CL EF Delay selection.**<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| Cold Load | |

### 8.3.6 TRIP TEST

| | |
|---|---|
| TRIP TEST | Press the Right arrow key ( ▸ ) to operate the CB. |
| | |
| I>>: TC:0007<br>I> : T | This window shows the set values of HF, IDMT Fault and Trip Counter<br><br>Press the right arrow key ( ▸ ) to move to the next option. |

| | |
|---|---|
| | |
| R=0000A Y=0000A<br>B=0000A N=0000A | This window shows the Primary values of Fault current.<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| 30/06/16<br>11:51:44.546 | This window shows the Date and Time of Fault.<br><br>Press the right arrow key ( ▸ ) to move to the main menu. |
| | |
| Fault 1 | |

### 8.3.7 Fault 1

#### 8.3.7.1 To View – Fault 1

| | |
|---|---|
| Fault 1 | This menu is to view **"Fault 1"**<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |
| | |
| I>>: TC:0007<br>I> : T | This window shows the set values of HF, IDMT Fault and Trip Counter<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| R=0000A Y=0000A<br>B=0000A N=0000A | This window shows the Primary values of Fault current.<br><br>Press the right arrow key ( ▸ ) to move to the next option. |
| | |
| 30/06/16<br>11:51:44.546 | This window shows the Date and Time of Fault.<br><br>Press the right arrow key ( ▸ ) to move to the main menu. |
| | |
| Fault 1 | |

*To View FAULT 2, FAULT 3, FAULT 4 and FAULT 5 follow the above steps*

### 8.3.8 Error Log

#### 8.3.8.1 To View – Error Log

| | |
|---|---|
| **Error Log** | This menu is to view **"Error Log"**<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |
| | |
| **Error Code : 0000** | This window will show **Error Code** dedicated by self supervision function of Relay.<br><br>NOTE: The Error Code description is given in table below.<br>Press the Right arrow key ( ▸ ) to return to the main menu. |
| | |
| **Error Log** | |

| Sr. No. | Error Code | Description | Proposed Action |
|---|---|---|---|
| 1. | 01 | Setting Error | Press LED RESET + H/W RESET |
| 2. | 02 | EEPROM Error | Press LED RESET + H/W RESET |
| 3. | 04 | RTC Error | Set Date & Time or Contact Factory |
| 4. | 04 | Timer Error | Set Date & Time or Contact Factory |
| 5. | 16 | ADC Error | Contact Factory |
| 6. | 32 | FRAM Error1 | Press LED RESET + H/W RESET |
| 7. | 64 | FRAM Error2 | Press LED RESET + H/W RESET |
| 8. | 128 | TRIP_STS Error | Press LED RESET + H/W RESET |

### 8.3.9 Status

#### 8.3.9.1 To View – Status

| | |
|---|---|
| **Status** | This menu is to view **"Status"** i.e. Input Status, Trip Circuit Healthy/Faulty, Software Version, Hardware Version and Relay Serial Number<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |
| | |
| **S1: OFF S2: OFF**<br>**S3: OFF S4: OFF** | This window will show **Status Input.**<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |

| | |
|---|---|
| | |
| **Trip Ckt : Healthy**<br>**Ckt Brkr : ?** | This window will show **Trip Circuit Healthy** / **Faulty.**<br><br>Press Right arrow key ( ▸ ) to move to the next option. |
| | |
| **SWV : 01.05**<br>**HWV: 03.01** | This window will show Relay **Software & Hardware Version.**<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |
| | |
| **SR. No :**<br>**15A241A0001** | This window will show **Relay Serial Number.**<br><br>Press the Right arrow key ( ▸ ) to move to the Main Menu. |
| | |
| **STATUS** | |

### 8.3.10 Date / Time Settings

#### 8.3.10.1 To Set – Date / Time Settings

| | |
|---|---|
| **Date / Time** | Password protected window for **"Date / Time"** setting i.e. Set Hour, Set Minute, Set Second, Set Date, Set Month, and Set Year.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **Password = 000**<br>**Use Inr/Dec** | Editable setting<br>Enter the set password, by using the up arrow key (+ / ▴ ) or the down arrow key (- / ▾ ).<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |
| **SET Hrs = 012**<br>**Range 0 – 23** | Editable Setting<br>By using the Plus / Up arrow key (+ / ▴ ) or the Minus / Down arrow key (- / ▾ ) the desired **SET Hour** can be set.<br>The setting range is from 00 to 23 in steps of 1.<br><br>Press the Left arrow key ( ◂ ) to move to the next option. |
| | |

| | |
|---|---|
| **SET Mins = 10**<br>**Range 0 – 59** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **SET Minute** can be set.<br>The setting range is from 00 to 59 in steps of 1.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **SET Secs = 020**<br>**Range 0 – 59** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **SET Second** can be set.<br>The setting range is from 00 to 59 in steps of 1.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **SET Date = 030**<br>**Range 1 – 31** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **SET Date** can be set. The setting range is from 1 to 31 in steps of 1.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **SET Month = 008**<br>**Range 1 – 12** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **SET Month** can be set.<br>The setting range is from 1 to 12 in steps of 1.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **SET Year = 016**<br>**Range 00 – 99** | Editable Setting<br>By using the Plus / Up arrow key (+ /▲) or the Minus / Down arrow key (- /▼) the desired **SET Year** can be set.<br>The setting range is from 00 to 99 in steps of 1.<br><br>Press the Left arrow key (◄) to move to the next option. |
| | |
| **Save setting?**<br>**Mode (◄) For Save** | Press the Left arrow key (◄) to SAVE the changes and move to the next option. |
| | |

| | |
|---|---|
| **OK** | This window will flash for a moment and it will move to the Main Menu. |
| | |
| **DATE AND TIME** | |

### 8.3.10.2 To View – Date / Time Settings

| | |
|---|---|
| **Date / Time** | This menu is to view **"Date / Time"**<br><br>Press the Right arrow key ( ▸ ) to move to the next option. |
| | |
| **Time : 11:12:30**<br>**Date : 06/08/2015** | Press the Right arrow key ( ▸ ) to return to the main menu. |
| | |
| **DATE AND TIME** | |

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# Section 9

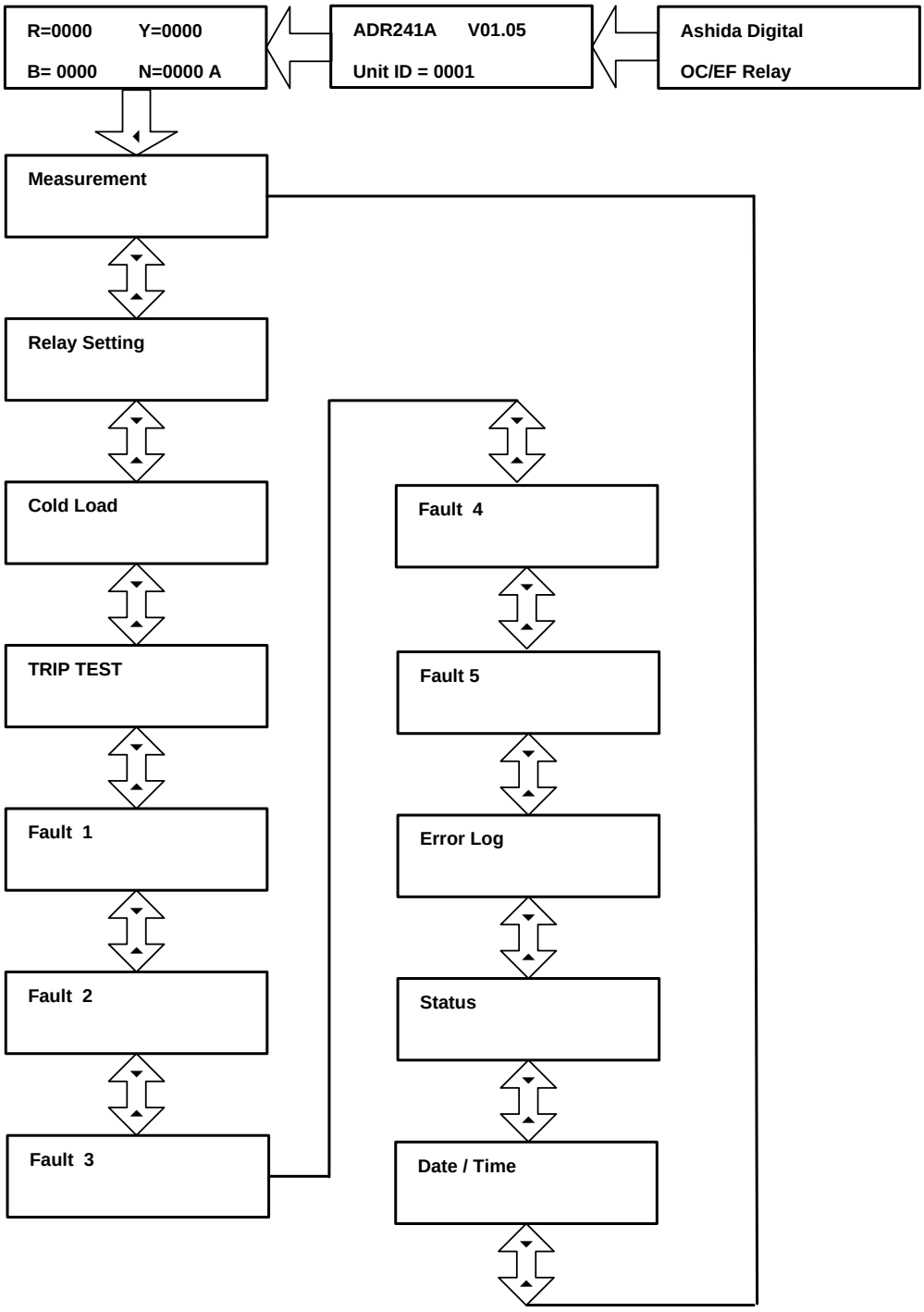
# Flow Chart

## Contents

# 9 FLOW CHART OVERVIEW

## 9.1 Main Menu

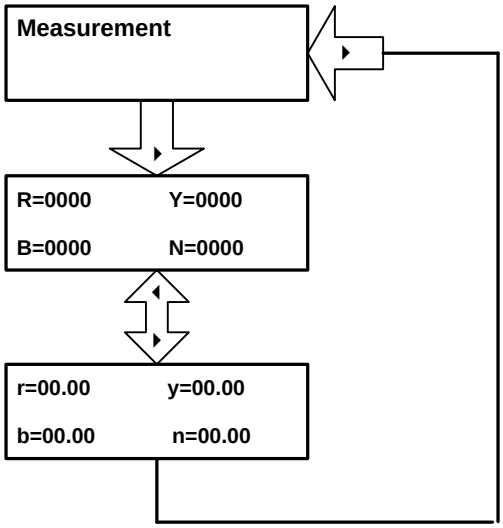
After the Power ON or when LED RESET + HW RESET keys pressed the following windows will be displayed and the user can scroll the main menu as given below




*Note: By using the Up arrow key ( ▲ ) and the down arrow key ( ▼ ) the Main Menu settings can be scrolled.*

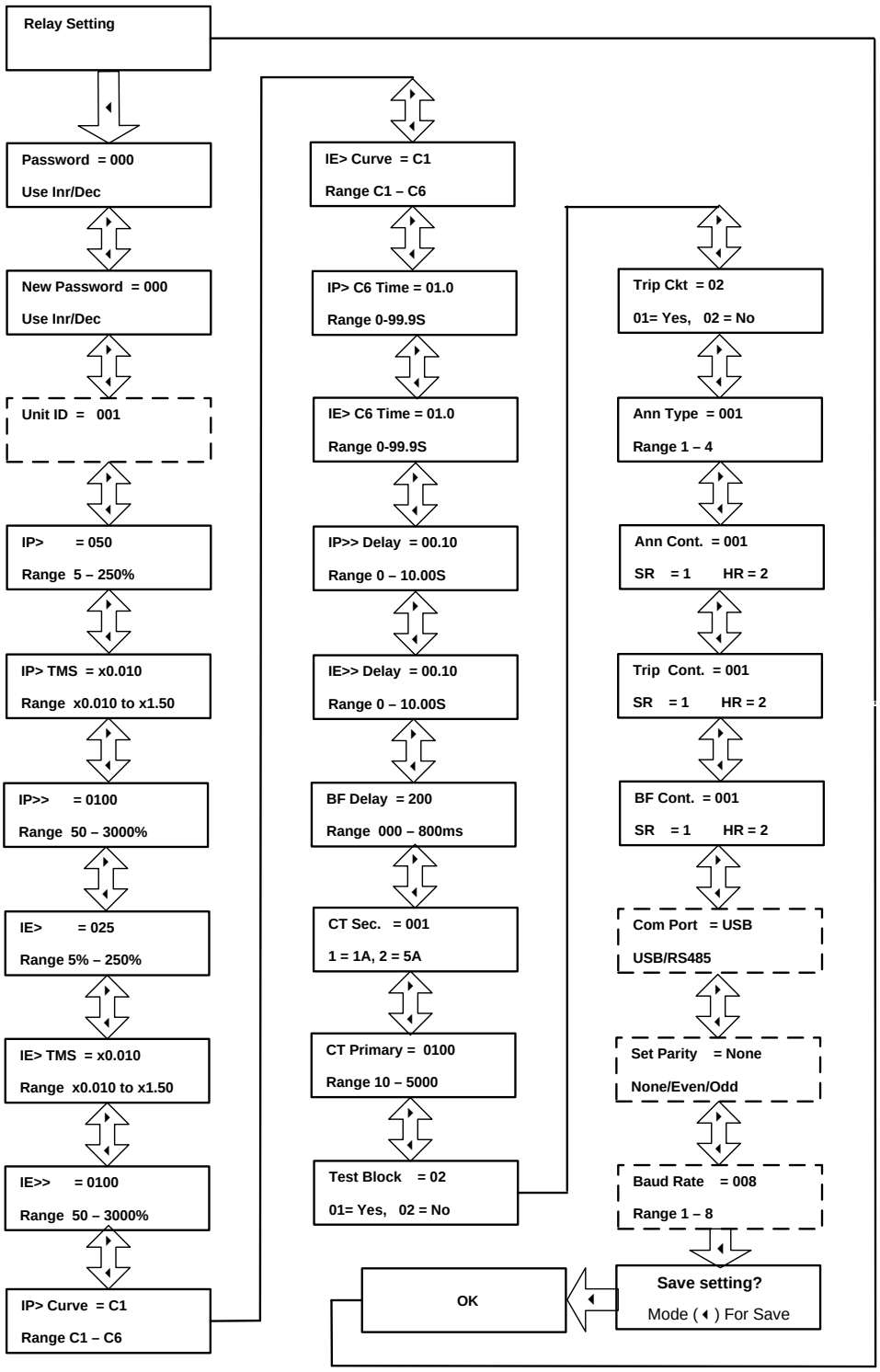
## 9.2 Flow Chart – Measurement

### 9.2.1 To View – Measurement



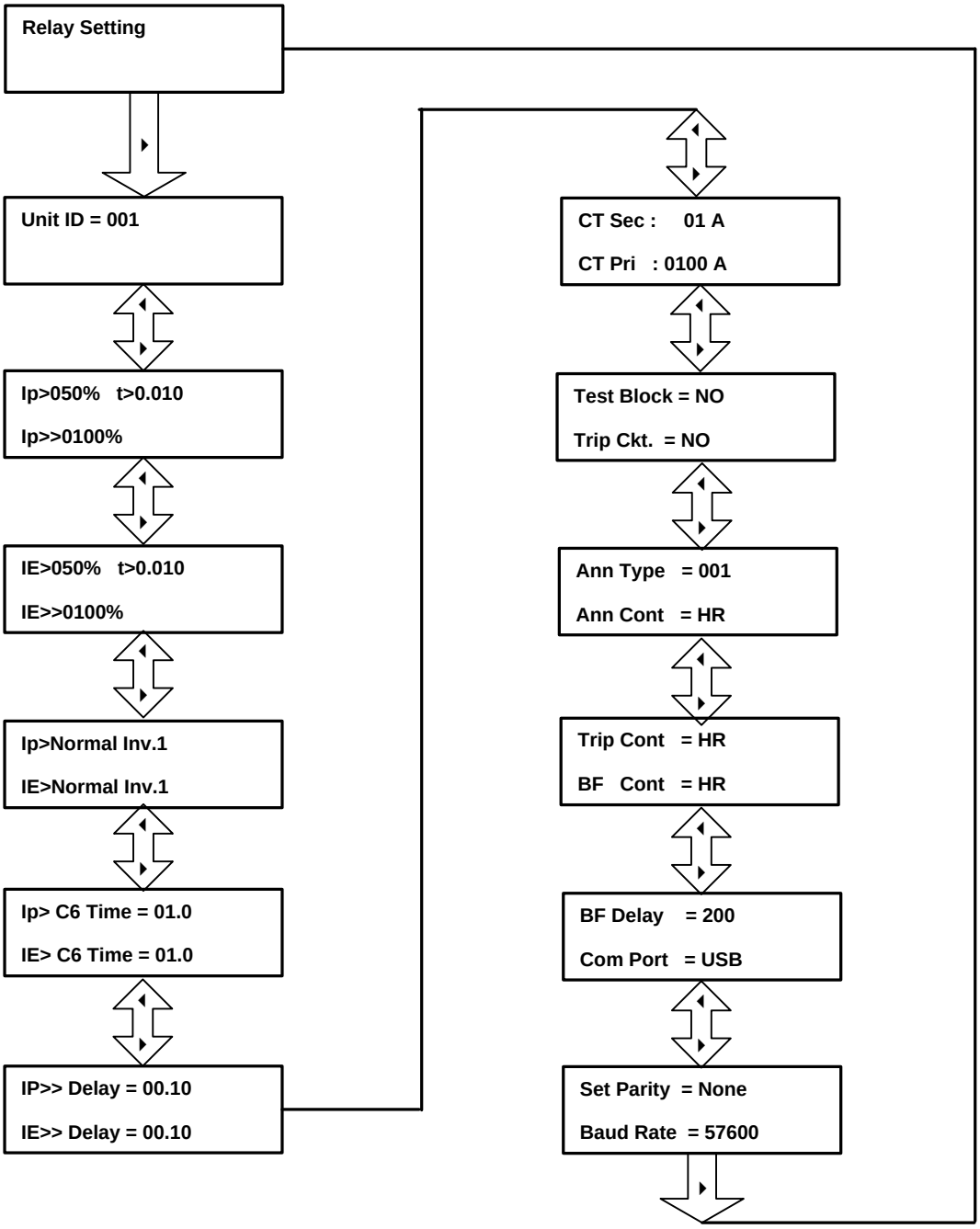
## 9.3 Flow Chart – Relay Setting

### 9.3.1 To Set – Relay Setting



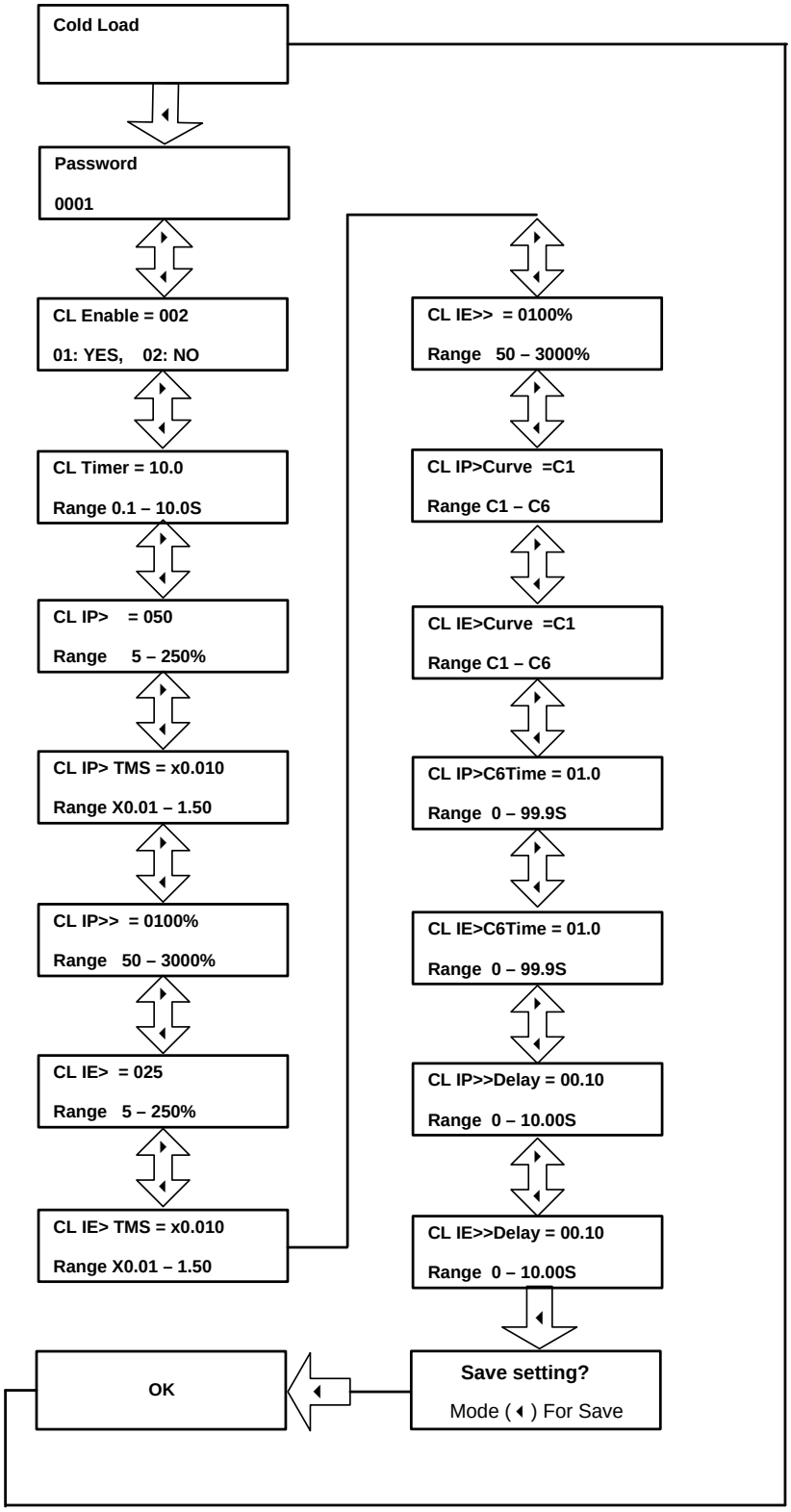

***Note: The display pages shown in dashed lines are only for ADR241A Relay.***

### 9.3.2 To View – Relay Setting

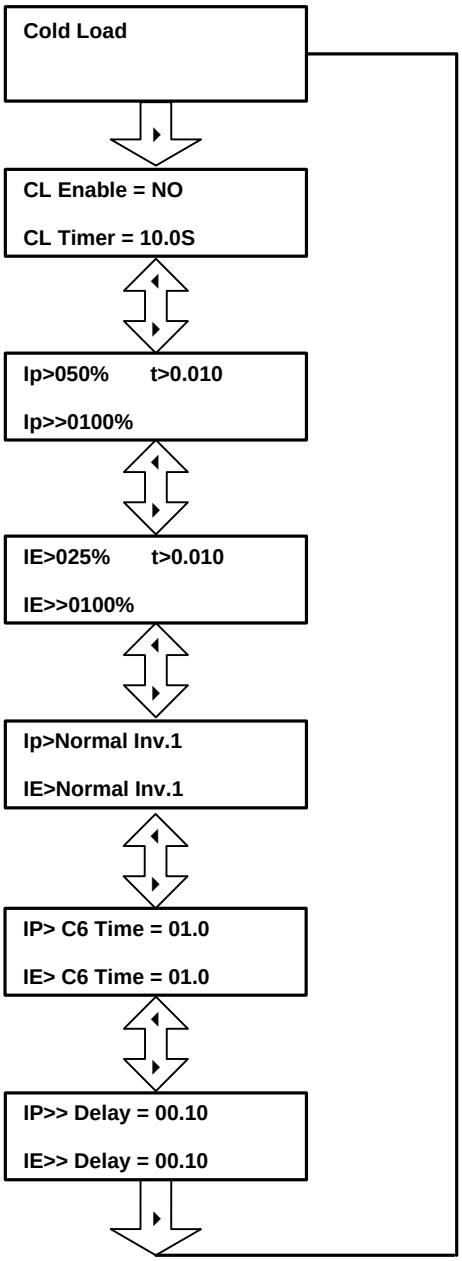


## 9.4 Flow Chart – Cold Load

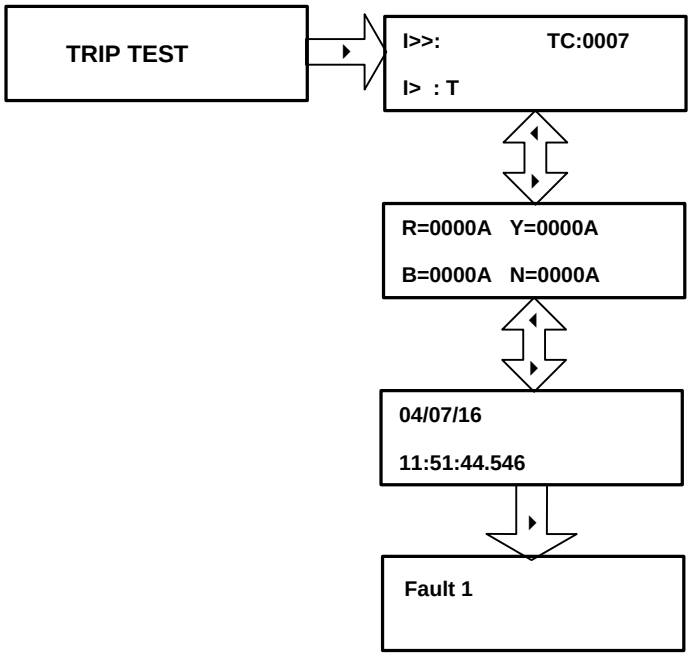
### 9.4.1 To Set – Cold Load



### 9.4.2 To View – Cold Load

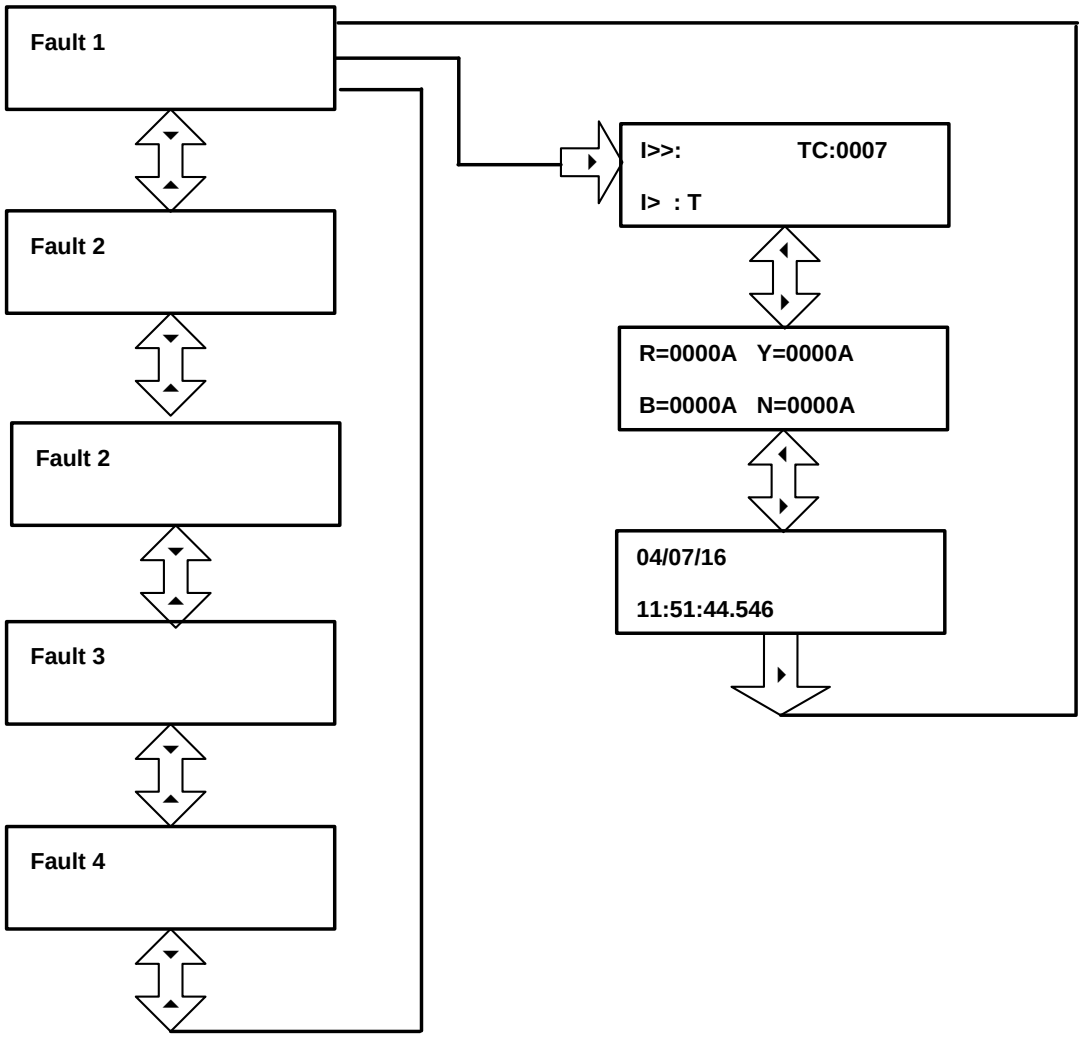


## 9.5 Flow Chart – TRIP TEST



## 9.6 Flow Chart – Fault 1

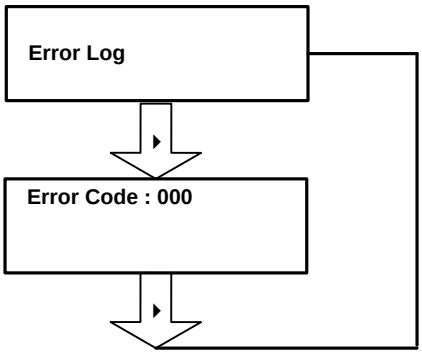
### 9.6.1 To View – Fault 1




***Note: Fault 2, Fault 3, Fault 4 and Fault 5 can be viewed in similar manner.***

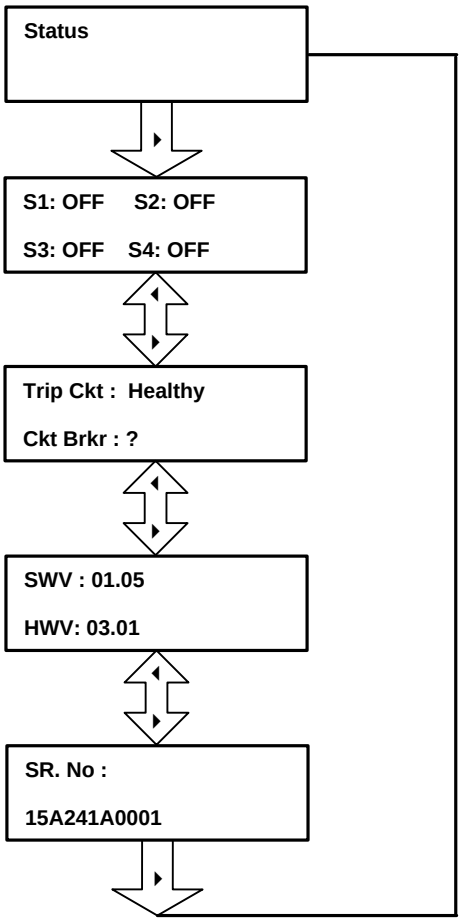
## 9.7 Flow Chart – Error Log

### 9.7.1 To View – Error Log



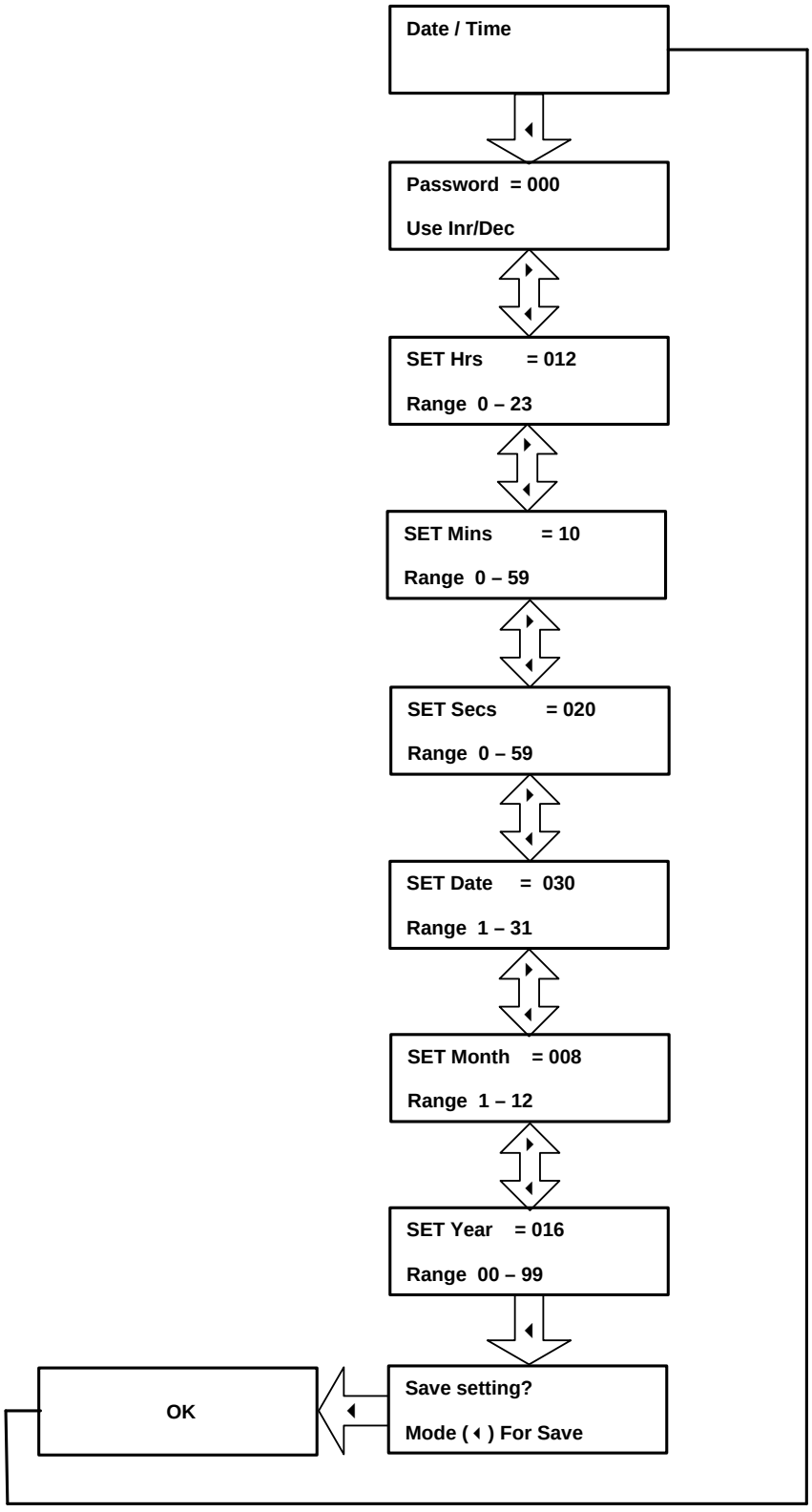

## 9.8 Flow Chart – Status

### 9.8.1 To View – Status

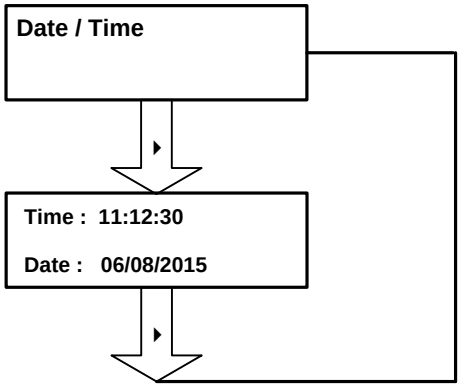


## 9.9 Flow Chart – Date / Time

### 9.9.1 To Set – Date / Time



### 9.9.2 To View – Date / Time



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# Section 10

# Analyzing Event and Fault Record

## (Applicable to ADR241A Only)

## Contents

# 10 ANALYZING EVENT AND FAULT RECORD

## 10.1 Overview

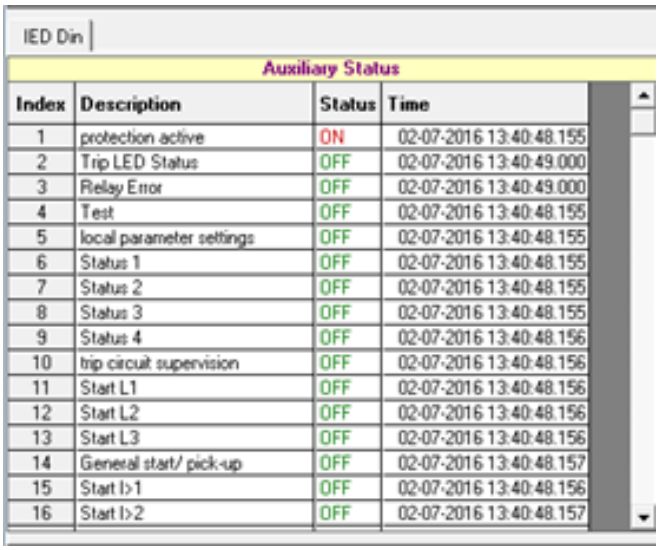
The ADR241A Feeder Protection Relay provides several tools (listed below) to analyze the cause of relay operations. Use these tools to help diagnose the cause of the relay operation and more quickly restore the protected equipment to service.

1. Event Recording
2. History Faults Recoding

All reports are stored in non-volatile memory, ensuring that a loss of power to the ADR241A will not result in lost data.

## 10.2 Event recording

ADR241A relay is providing feature to record and events in non-volatile memory and can be extracted using communication port. The event shall be trigger on time stamp through time synchronization or internal clock setting.



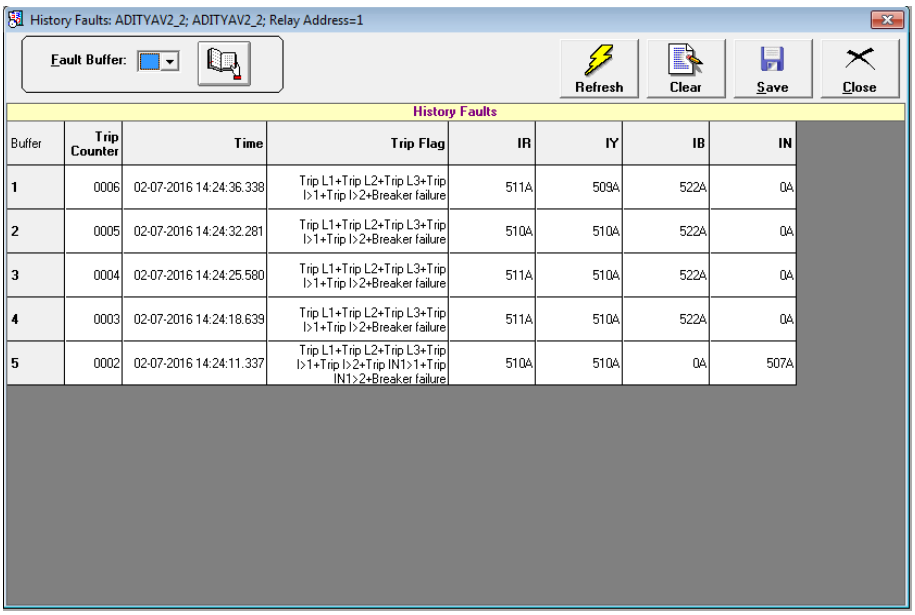
IED Din

Auxiliary Status

| Index | Description | Status | Time |
|---|---|---|---|
| 1 | protection active | ON | 02-07-2016 13:40:48.155 |
| 2 | Trip LED Status | OFF | 02-07-2016 13:40:49.000 |
| 3 | Relay Error | OFF | 02-07-2016 13:40:49.000 |
| 4 | Test | OFF | 02-07-2016 13:40:48.155 |
| 5 | local parameter settings | OFF | 02-07-2016 13:40:48.155 |
| 6 | Status 1 | OFF | 02-07-2016 13:40:48.155 |
| 7 | Status 2 | OFF | 02-07-2016 13:40:48.155 |
| 8 | Status 3 | OFF | 02-07-2016 13:40:48.155 |
| 9 | Status 4 | OFF | 02-07-2016 13:40:48.156 |
| 10 | trip circuit supervision | OFF | 02-07-2016 13:40:48.156 |
| 11 | Start L1 | OFF | 02-07-2016 13:40:48.156 |
| 12 | Start L2 | OFF | 02-07-2016 13:40:48.156 |
| 13 | Start L3 | OFF | 02-07-2016 13:40:48.156 |
| 14 | General start/ pick-up | OFF | 02-07-2016 13:40:48.157 |
| 15 | Start I>1 | OFF | 02-07-2016 13:40:48.156 |
| 16 | Start I>2 | OFF | 02-07-2016 13:40:48.157 |

## 10.3 History Fault recording

ADR241A relay is provides built in history fault recording facility for recoding the fault with the current and date & time. Relay records history fault and stored in to non-volatile memory.




History Faults

| Buffer | Trip Counter | Time | Trip Flag | IR | IY | IB | IN |
|---|---|---|---|---|---|---|---|
| 1 | 0006 | 02-07-2016 14:24:36.338 | Trip L1+Trip L2+Trip L3+Trip I>1+Trip I>2+Breaker failure | 511A | 509A | 522A | 0A |
| 2 | 0005 | 02-07-2016 14:24:32.281 | Trip L1+Trip L2+Trip L3+Trip I>1+Trip I>2+Breaker failure | 510A | 510A | 522A | 0A |
| 3 | 0004 | 02-07-2016 14:24:25.580 | Trip L1+Trip L2+Trip L3+Trip I>1+Trip I>2+Breaker failure | 511A | 510A | 522A | 0A |
| 4 | 0003 | 02-07-2016 14:24:18.639 | Trip L1+Trip L2+Trip L3+Trip I>1+Trip I>2+Breaker failure | 511A | 510A | 522A | 0A |
| 5 | 0002 | 02-07-2016 14:24:11.337 | Trip L1+Trip L2+Trip L3+Trip I>1+Trip I>2+Trip IN1>1+Trip IN1>2+Breaker failure | 510A | 510A | 0A | 507A |

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# Section 11

# Testing and Commissioning

## Contents

# 11 TESTING AND COMMISSIONING

## 11.1 Commissioning Test, Equipment Required

The following connection tests help you to enter settings into the ADR141A/ ADR241A 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; you should not need to repeat it unless major changes are made to the relay electrical connections.

a. The ADR141A/ ADR241A installed and connected according to your protection design.

b. Digital Multi meter - True RMS

c. Timer with precision 1ms.

d. Required Auxiliary supply

e. 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:

- Minimum: single-phase current source with phase angle control
- Preferred: three-phase current source with phase angle control

f. A PC with serial port, terminal emulation software, and serial communications cable with the following software (minimum configuration)

- For IEC 60870-5-103 communication check: Ashida Relay Talk software.
- Ashida Relay Assist software (Electrical Parameter Calculator) to verify Measured value of normal and sequence current.

## 11.2 Checking of External Circuitry

Connection Tests

Step 1: Remove control ac signals from the ADR141A/ ADR241A by opening the appropriate breaker(s) or removing fuses

Step 2: Isolate the relay contact assigned to be the TRIP output

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).

Step 11: If the relay is equipped with voltage inputs, apply rated voltage for your application.

## 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:

a. Ensure over current and earth fault trip setting.

b. Ensure TMS setting of over current and Earth Fault are entered correctly as per required time grading between feeder and incomer.

c. Ensure instantaneous HF setting done correctly and its definite time delay is applied properly as per required time grading between feeder and incomer.

d. Ensure selection of extra annunciation duty contacts is as per required function.

e. 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 & Annunciation contacts, trip contacts has been reset before leaving relay.

If relay ADR141A/ ADR241A 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 applying Load Default Setting (refer chapter number 8 User Guide to load default setting in relay).

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

**Post instillation / Commissioning observation**

After successful installation confirm amount of existing load current in each phase (R, Y and B) and Earth Fault (EF). 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

**Relay Calibration & Measurement**

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

- Connect ADR141A/ ADR241A relay to current injector and timer.
- Following chart shows terminal numbers of connections.

| Source Terminal | Relay Terminal | Relay Connection |
|---|---|---|
| Current Source | A1 – A2 | Current R-CT _1A |
| | A3 – A4 | Current R-CT _5A |
| | A5 – A6 | Current Y-CT _1A |
| | A7 – A8 | Current Y-CT _5A |
| | A9 – A10 | Current B-CT _1A |
| | A11 – A12 | Current B-CT _5A |
| | A13 – A14 | Current EF-CT _1A |
| | A15 – A16 | Current EF-CT _5A |
| Power Supply (+ / -) | C1 – C3 | Power Supply (+ / -) |
| Logic Input | B2 – B4 | Status 1 |
| | B3 – B5 | Status 2 |
| | B6 – B8 | Status 3 |
| | B7 – B9 | Status 4 |
| Logic Output | C2 – C4 | TRIP 1 |
| | C5 – C7 | TRIP 2 |
| | C6 – C8 | ANN. 1 |
| | C9 – C11 | ANN. 2 |
| | C10 – C12 | ANN. 3 |
| | C13 – C15 | ANN. 4 |
| | C14 – C16 | BF |
| | B10 – B11 – B12 | TCS |

**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.

**Step3.** Repeat the same procedure for other element.

## 11.5 Pick up and Trip Test

- Connect current source at R phase CT terminals 1A/5A current input terminal.
- Set current setting value to 100% i.e. 1A/5A, TMS at Minimum (x0.01) value.
- Start current injector to & 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.
- Select the Curve Normal Inverse 1 and Set the TMS at 1.00.
- Connect the assigned trip contact to Timer.
- Set and apply 2 times current value and measure the timing on timer.
- The measured timing should be ±5% of actual timing (10.029 Sec).
- Repeat the above procedure for remaining phases and Earth Fault.

**Phase Protection Test: -**

Setting IP>: _____ IP> TMS =: _____

| Threshold | Theoretical Value | Relay Value |
|---|---|---|
| IP> Threshold | _____A | _____A |
| IP> 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 IP> setting | _____ms | _____ms |
| Time Delay at 10 times of IP> setting | _____ms | _____ms |

**Earth Protection Test: -**

Setting IE>: _____ IE> TMS = :_____

| Threshold | Theoretical Value | Relay Value |
|---|---|---|
| IE> Threshold | _____A | _____A |
| IE> Drop Threshold | _____A | _____A |

Time Delay Setting = _____

IDMT Characteristics = _____ 10 Times _____Sec.

| | Threshold | Relay |
|---|---|---|
| Time Delay at 2 times of IE> setting | _____ms | _____ms |
| Time Delay at 10 times of IE> setting | _____ms | _____ms |

**Testing of Binary Input:**

- The Binary inputs can be tested by applying 24-230V DC voltage to respective binary input terminals.
- Observed binary input status in Status menu on LCD display
- Following are the binary inputs terminals

| Binary Input Terminals | Binary Input |
|---|---|
| B2 – B4 | Status 1 |
| B3 – B5 | Status 2 |
| B6 – B8 | Status 3 |
| B7 – B9 | Status 4 |

## 11.6 Testing of Binary Output

**Output Contact Test:**

- Enable the OC, EF and BF setting in Relay setting menu
- Set the annunciation Type 1 in relay setting menu.
- Set TRIP, ANN., and BF contact as hand reset (HR) type.
- Operate the relay by applying current in all three phases and EF.
- Now, check the continuity in between NO and C terminals of all output contact.
- Reset the contact by using LED reset key.
- Again check the continuity in between NO and C terminals of all output contact.
- For TCS contact, enable the TCS setting in relay setting menu.
- Check the continuity in between NO, NC and C of TCS output contact terminal.
- Now, apply voltage to S3 or S4 status input,
- Again, check the continuity in between NO, NC and C TCS output contact terminal.

| Binary Output Terminals | Binary Output |
|---|---|
| C2 – C4 | TRIP 1 |
| C5 – C7 | TRIP 2 |
| C6 – C8 | ANN. 1 |
| C9 – C11 | ANN. 2 |
| C10 – C12 | ANN. 3 |
| C13 – C15 | ANN. 4 |
| C14 – C16 | BF |
| B10 – B11 – B12 | TCS |

## 11.7 LED Test

1. Apply the auxiliary supply voltage to auxiliary supply terminals, the ON LED (green) will be ON.
2. Enable the OC, EF instantaneous function and BF function.
3. Operate the relay by applying the current to all three phases and EF.
4. Check all the respective LED.

## REVISION CONTROL SHEET

| Issue | Date | Brief description of Revision |
|---|---|---|
| 01 | 30.06.2016 | Original Version |
| 02 | 26.10.2016 | Mechanical Drawing with IP Drawing added. |

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