

Smart Real Time Power Analyzer User Manual (IPM -3-D)



Safety Instruction:

At the first step, please read this manual carefully and pay full attention to safety before start using our product. The instructions given in this manual are the safety instructions of the Power Module (IPM-3-D). Electrical equipment needs to be installed, operated, serviced and maintained only by qualified person. No responsibility is assumed by CTI system for any consequences arising out of the use of this material. A qualified person is the one who has skills and knowledge related to the operation construction and installation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Please keep this manual in a safe place for future reference.

Before performing any modifications or operation on the module, make sure to read the manual carefully and confirm the safety.

CONDITIONS OF USE FOR THE PRODUCT

The Power module is based on DIN Rail Standard Format. Please follow the wiring diagram for a safe installation. Make sure to shut off any external power supply before wiring. Please check all cables and connection before turning power off. Labels on each port of the module give details of equipment for safe operation. Please examine all labels carefully before installation.

- ⚠ Always use a properly rated voltage sensing device to confirm that all power is off.
- ⚠ Based on the device specification, follow check list after turn module on to confirm right module functionality. (Recall module Id from Master)
- ⚠ Do not touch the terminals while the power is on. It may cause electric shocks or malfunctions.
- ⚠ Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- ⚠ All power meter terminals should be inaccessible after installation.
- ⚠ WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- ⚠ Dispose of this product as an industrial waste

1.0 Product Feature Overview

The smart power analyzer (IPM-3-D) is a measurement device. It measures voltage and current to perform active, reactive and apparent power and energy (RMS and instantaneous values), voltage and current sags, voltage and current swells, and line frequency of single-phase, double-phase or three-phase systems. This 24VDC module provides more flexibility for complex power analyzing. The IPM-3-D has RS485 interface with the benefit of Modbus RTU protocol. The module has optional LCD indicator to illustrate status of inputs and outputs for diagnostic and troubleshooting purposes. Default configuration is presented in Table .The user can change parameters by using the direct Modbus command or via dedicated computer program from CTi Smart Systems introduced as CTi MCONFIG V1.0.

1.1 Applications

Our IPM-3-D provides a simple robust solution for power monitoring, power quality analysis, kWh metering, system integration, controlling power distribution systems & other specialty applications. It is extremely flexible and can be used in a large variety of different applications. Digital inputs and relay outputs can be programmed to interact during various conditions defined by the user. Various third-party devices, such as alarms, pulse meters, trip units and sensors, can be easily integrated to the Power Meter. Analog outputs can be programmed to output meter parameters to PLC systems. Some main application of IPM-3-D includes:

- ✓ Single-phase 2-wire, direct connected energy meter for residential applications.
- ✓ Electric Panel and Power Distribution Automation.
- ✓ Test System (Life Test).
- ✓ Electric Switch Gear Monitoring and Control Panels.
- ✓ Smart Meter.
- ✓ Power Network Analyzer.
- ✓ Energy Management Systems.

1.2 Features and benefits:

- Measures Instantaneous and average power.
- Measures RMS and Instantaneous voltage and current.
- Detects voltage and current sag and swell.
- Detects and monitors Overcurrent.
- Single-phase, Double-phase and Three-phase energy meter.
- Direct measurement up to 100A AC.
- Display of active power, voltage and current.
- Accuracy class B according to EN50470-3.
- 5 digits display.

1.3 Functionality

- High Accuracy: Accuracy of Current, Voltage and Power is 0.5% of true value.
- Easy to Use, Easy to Install and Compact: The Power module is a DIN Rail mounting based on Standard DIN Rail Format, it is easy to install and convenient to use. Mounting clips are used for easy installation and removal.
- High Safety, High Reliability: IPM-3-D is designed according to industrial standards. This power meter has been fully tested for safety and EMC accordance with UL94V0 and IEC standards.
- Remote power monitoring: This power analyzer is designed for measuring power parameters. Since different I/O modules can be connect to the meter, this provides a very flexible platform for using the module for metering, monitoring and remote controlling, all in one unit by using benefit of Modbus RTU.

2.0 Technical and Environmental Specifications

Panel technical and environmental specifications are shown in table 1 and table 2

Table 1: Technical Specification of Power Module CTI-IPM-3-X

Power Source Specification	
Power Source Requirement	22 VDC to 26 VDC
Power Supply Current	<20mA
Max Ripple	0.05
Power Consumption	<50mW
Input Specification	
Input Channels	2
Input Type	Isolated with Common Ground
Rated Input Voltage	300VAc
Rated Load	CT
Dielectric Strength	
Input Isolation	Galvanic
	1000 VAC VRMS 1 min Between Contacts
Measurement Specification	
Sampling Frequency	7.812KHZ
RMS Voltage Accuracy	<0.5%
RMS Current Accuracy	<0.5%
Active Power Accuracy	<0.5%
Total Power Accuracy	<0.5%
Network Specification	
Communication Protocol	Modbus RTU
Baud Rate	1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K,115.2K
Connection Interface/Physical Layer	RS-485, Half Duplex, Optical Isolated
Default Slave ID	1

Table 2: Environmental Specification of Power Module CTI-IPM-3-X

Operating Temperature	-40°C to +75°C
Storage Temperature	-40°C to +150°C
Standard	IEC-61000-4, IEC 62053-2 , UI60370, EN50470
Humidity Range	20 - 90% Relative Humidity
Isolation Protection Degree	UL94V0
Weight/Dimension	200g/ 105 x 89 x 60 mm
Bus Expansion End Terminal	Yes
Mounting Option	Din Rail T35
Monitor -Display	LCD

3.0 Installation:

3.1 Safety Instructions

- ⚠ Make sure to shut off the external power supply before start wiring.
- ⚠ Check all labels before turn power on.
- ⚠ Mount the product in appropriate visible place to be able easy monitoring.
- ⚠ Do not open circuit a CT.
- ⚠ Ground yourself and discharge any static charge.
- ⚠ Pay close attention to polarity marks and wiring colors.

3.2 Din Rail Mounting Procedure

The Power analyzer can be mounted on standard T35(35mm) Din rail according to the following steps:

- ❖ By sliding the clips underside of the slot, it will be attached to the housing. Make sure stopping pegs are facing to housing and the outside edge of housing must be flushed with the outside edge of clips.
- ❖ Push the clips into the Din rail. Follow below diagram of the underside of the housing.
- ❖ In order to avoid shifting and moving clips in horizontal direction, use the two ends stop clips.
- ❖ No tools required.

3.3 Wirings Diagram:

This section shows wiring of the power module. diagrams:

Table 3 shows used symbols in the

Table 3 : Wiring Symbols

Symbol	Description
	Load
	SW
	Fuse
	Electric Relay
	Motor
	Buzzer
	Light
	CT
	Capacitor

Start by connecting Twisted, shielded, 2 × 0.5 mm² at the power supply 24 VDC, Ground, A(Data+) and B(Data-), Using chart below indicated in Table 4 for wire- colors.

Table 4: Wiring Color

Wiring Color	Description
Red	24 VDC
Blue	Ground
Orange	A
Purple	B

After installation, in order to make sure the installation is correct, Master should be able to read serial number of this module represented in part.

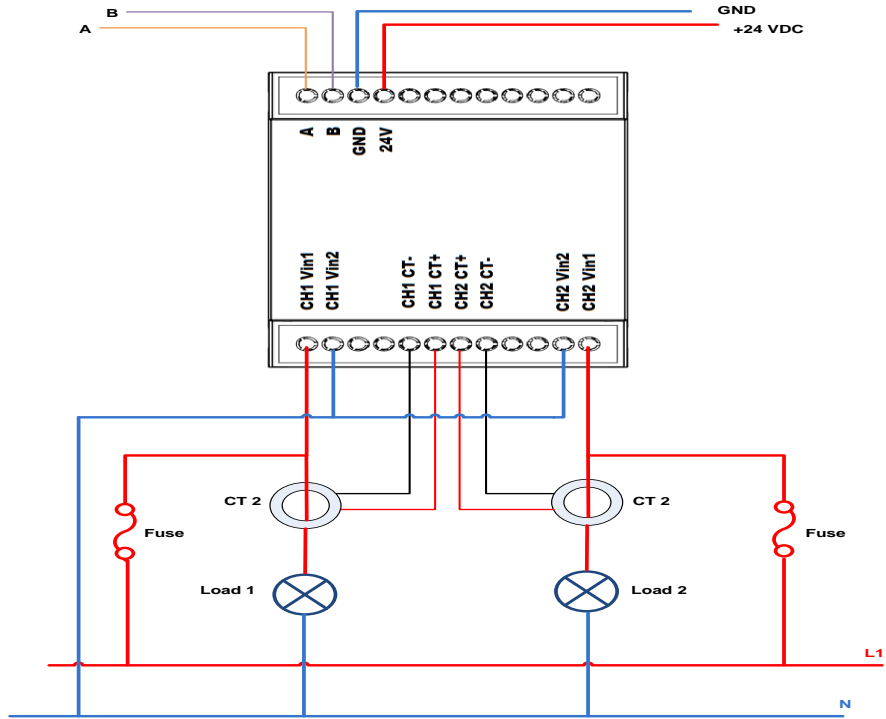


Figure 1: One Phase Wiring Diagram

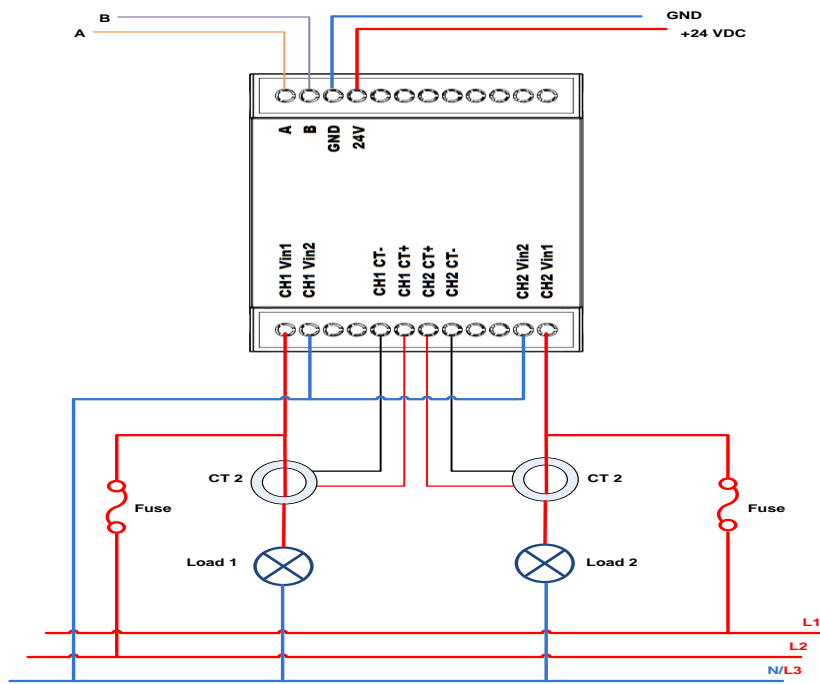


Figure 2: Two or Three Phase Wiring Diagram

3.4 Dimension and Mechanical Reference of the Power Module:

Dimension of the module is shown below. This module will be mounted to the Din standard rail (Standard DIN Rail Format). Also labels are shown for each connector. LCD indicator is in front panel and each connector has a label for external wiring.

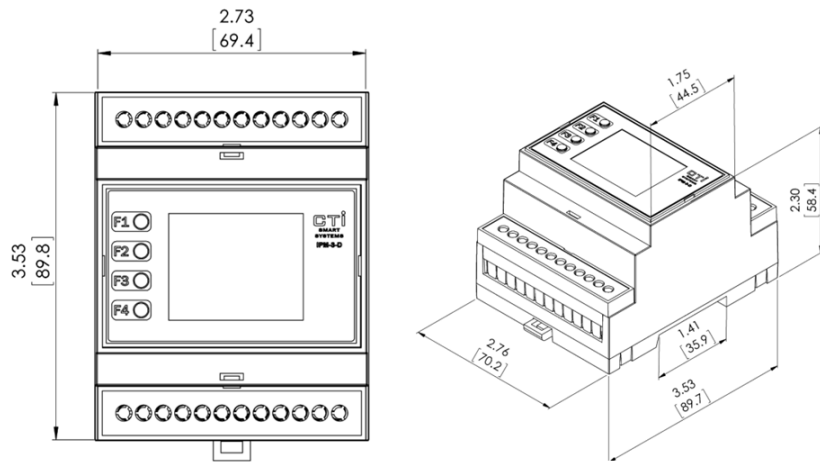


Figure 4: IPM-3-D Display Front View /Side View

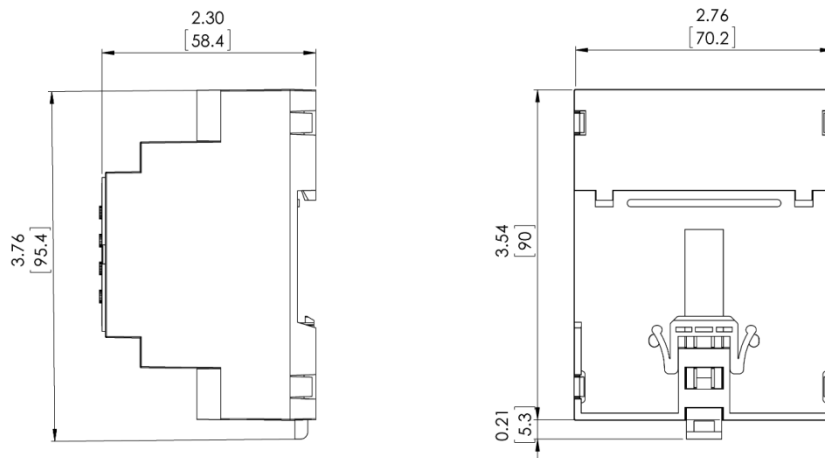


Figure 5: IPM-3-D Meter Side / Rear View

4.0 Operation:

4.1 Display Panel and Buttons:

The front view of the IPM-3-D meter consists of an LCD screen and four control buttons F1 to F4. All the display segments are illustrated in **Error! Reference source not found.**. Users should note that each of the segments will display in a single page under pushing related key.

Table shows the functions of F1 to F4 buttons. F1 contains all measured data of CH1; F2 contains all data of CH2; F3 provides the contact information for maintenance; and F4 provides the details of default setting for slave module; all these 4 keys are available on the screen of the meter. By pushing and selecting each key user can observe related information on the screen menu.

Table 5: Display Panel Keys Information

Key Indicator	Description	
F1	Indicate Power (W)& Current(A)& Voltage(V) of CH1	
F2	Indicate Power (W)& Current(A)& Voltage(V) of CH2	
F3	Maintenance Contact Information	
F4	Slave Address & Data Format & Reset to Defaults	

5.0 Troubleshooting

The information in Table discusses most potential problems and their possible reasons. It also illustrates how you can perform or find possible solutions for each. After referring to the Table , if you cannot resolve the issue, contact our CTi support team for assistance. Do not open meter box to get support from warranty.

Table 6: Most Popular Problem and Solution

Problem	Cause	Solution
Module is disconnected and cannot communicate with User interface.	<ul style="list-style-type: none"> ▪ Inappropriate communication line ▪ Incorrect Baud rate/parity/word length ▪ Incorrect address for power analyzer 	<ul style="list-style-type: none"> ✓ Check all connection line and make sure all units are connected to ground. ✓ Verify baud rate, parity and message length based on Table Verify address of power module
The data displayed is inaccurate	<ul style="list-style-type: none"> ▪ Incorrect voltage for inputs ▪ Incorrect wiring or lose connection for power module ▪ Incorrect setup parameter. 	<ul style="list-style-type: none"> ✓ Verify inputs voltage based on setup information ✓ Based on wiring diagram check all wires and verify correct connectivity ✓ By using Table Verify all parameters are appropriately set up
High temperature alarm- Over heat problem	<ul style="list-style-type: none"> ▪ Tight the meter in small space without air circulation 	<ul style="list-style-type: none"> ✓ Install meter in open area to have enough air circulation.

6.0 Abbreviations

Table 7: Abbreviation

Item	Description
LSB	Least significant bit
MSB	Most significant bit
PF	Power factor
CT	Current transformer
AVG	Average
IP	Ingress protection
RMS	Root mean square
NFC	Near field communication
GUI	Graphical user interface

Appendix

Communication Configuration

Table 8: Default Setting of Communication Configuration

Name	Value
Parity	None
Baud Rate	9600*
Data Bit MSB	8
Stop Bit LSB	1
Modbus ID	1
Protocol	Modbus RTU

*Note: Baud rate range are 1200, 2400,4800,9600,19200,38400 which can be configured by user.

Configuration of Registers

Table 9: Default Setting of Modbus Registers

Modbus Registers	
CH1 RMS Voltage	1
CH1 RMS Current	2
CH1 Active Power	3
CH1 Total Power	4
CH1 Power Factor	5
CH2 RMS Voltage	6
CH2 RMS Current	7
CH2 Active Power	8
CH2 Total Power	9
CH2 Power Factor	10
Serial Number	11
Modbus Slave ID	12
Baud Rate	13

Communication Test

Modbus Point Map

Table 10: Modbus Point Map Description

Name	Read/Write	Unit	Scale	Range
Current	R	Amp	I×100	0-100.00
Voltage	R	Volt	V×100	0-600.00
Power	R	Watt	W	0-400.00
Power Factor	R	Ratio

Module Series - N (NFC Indicators)

CTI Smart System utilizes Near Field Communication (NFC) technologies to reveal short and fast real time status of the electrical equipment. CTI intelligent modules are capable upgrading firmware over the RS-485 protocol that permits user to set/change the required parameters, enable flexible configuration and apply firmware updates remotely from monitoring station under either windows or Linux OS.

Supported Modbus Commands

Table 5: Supported Modbus Commands

Command	Description
0x03	Read Holding Register
0x06	Preset Single Register
0x10	Preset Multiple Register
0x11	Report ID Return String: Byte0: Address Byte1: 0x11 Byte2: #bytes following w/out CRC Byte3: ID byte =247 Byte4: Status = 0xFF if the operating system is used; Status= 0x00 if the reset system is used. Byte5+: ID string
0x2B	Read Device Identification Objective Values: 0x01: 0x02: 0x03: