EPM420

Multi-Function Power Monitor

V.2.0

DAETECH
DAE INSTRU

WE MAKE POWER SMART

Table of Content

COPY RIGHT

INSTALLLATION AND MAINTENANCE

Dae's products are designed for ease of installation and maintenance. As with any product of this nature, however, such installation and maintenance can present electrical hazards and should only be performed by properly trained and qualified personnel.

WARRANTY AND ASSISTANCE

All Dae's Multifunction instruments are warranted for on year against defects in materials and workmanship under normal use and service. Obligation part or parts which Dae's examination should be defective. There are no other warranties, obligations, liabilities for consequential damages, or other defective materials or work workmanship. The warranties of merchantability and fitness for a particular purpose are expressly excluded

NOTICE

Read these instruction carefully and look at the equipment to become familiar with the device before trying to install, operate,or maintain it.The following special message may appear throughout this bulletin to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

DANGER

Used where there is hazard of serious injury of death.Faiture to follow a “DANGER” instruction will result in deeath or serious injury.

-WARNING

Used where there is hazard of serious injury or death.Failure to follow a “WARNING” instruction can result in death or injury.

ntent

CAUTION
Used where there is hazards of equipment damage.Failure to follow a "CAUTION" instruction can result in damage to equipment.

PLEASE NOTICE

Electric equipment should be serviced only by qualified maintenance personnel, and this document should not be viewed as sufficient for those who are not otherwise qualified to operate, service, or maintain the equipment discussed. Although reasonable care has been taken to provide accurate and authoritative information in this document, no responsibility is assumed by DAE INSTRUMENT for any consequence arising out of the use of this material.

1. Introduction

Product overview

Current and voltage, as well as real and reactive power are essential quantities, which must be measured accurately in order to optimize the control and delivery of electric power. The use of state of the Art" microprocessor technology assures digital accuracy and repeatability across a wide range of input signal levels. EPM series are rugged electronic instruments designed for utility and industrial applications requiring standard. The meters are modular in design, with push-button rescaling to display primary values when using any standard current and voltage transformer. Rescaling can be done in the field, in a matter of minutes, without removing the instrument from the panel or the need for any calibration equipment. EPM series also provides the user with the capability to connect directly with Modbus-RTU protocols. This capability allows users to seamlessly integrate the meters into an existing or planned SCADA or PLC .

What is EPM420 Basic Introduction

EPM420 multi-function digital power monitoring meter is one kind of full-function intelligent power monitoring instruments. These devices not only provide all requirements in power measurement but also solving the problem of the complicated traditional wiring and commission. EPM420 greatly simplify the traditional complicated electric power automation wiring and commission and replace the related component such as Transducers and RTUs.EPM420 is basic crucial equipment essential for the modernization of power automation system.

Measuring Function

EPM420 can measure 3-phase voltage and 3 phase current, with kW, Kr, pf, kWh, kvarh simultaneously and updated the measurement reading every 0.4-sec. It can be operated no matter in 3 phase 3wire or 3 phase 4 wire .The users can set the parameter such as PT ratio, CT ratio, wiring form, to fulfill the different requirement through front panel to use different wire forms in different wire mode.

Measuring Accuracy:

This device is calibrated fully by digital system, and there is no variable resistance provided to be adjusted. The calibration factor is storage in EEPROM and needless to readjust in 3 years .To order to increase the accuracy of measurement, adjusting parameter in 3 phase 4wire and 3 phase 3wire are separately measured and storage in their own memory register. The current input minimum great than 0.35A ,threshold value otherwise will cause the PF measurement incorrect.

Operator Interface: In order to provide clear display of measurement reading in long distance , EPM420 adopt LED in large size. So that the users of EPM420 can observe the measurement reading directly.
To be a high-reliable power instrument, there are two key factors to be concerned: being able to operate in high-temperature and owning a long life span. These two factors are what LED advantage. Compared with LED, LCD would like to deteriorate when constantly operating in high-temperature .As a result,Led is adopted.

Simple Installation EPM420 is the installation of DIN144 x 144.The depth of this device is only 7cm,so that it's just needed very shallow space to use. There are some brands limited in this, so the display mode and module must be take apart. This will result extra cost in installation. In proportion to EPM420,the installation of EPM420 is much easier.

Digital communication EPM420 provides Isolated RS-485 communication, and communicational rate up to 19200bps,being able to intensify communication response time between the meter and the computer.
At the same time,EPM420 provide quite great ability of telecommunication response , being able to order the computer send the measuring value back in 125 msec .It is very important to the users who want to have rapid datacommunication response when using many meters.
This device adopts Modbus-Rtu communicational protocol, conscientiously and carefully designed, reliable, linked with most monitoring software easily and needless to design extra interface, reducing cost. This device also can be connecting to PLC, being slave equipment of PLC, via PLC integrating to be a large-scale of automatic system.

Measurement Principles

All the quantities measured by the Meters instrument utilize digital signal processing (DSP) technique. This technique allows the instrument to measure a large number of quantities with a small amount of hardware. It also allows field upgrades, since the signal processing algorithms are in an EPROM, and can be simply updated to provide new features. The following section will give a brief overview of the measurement principles.

Voltage/Current signal processing begins with the low level AC signal supplied from the power board which is about 1 Vac RMS for a full scale input signal. Pure sine wave inputs or complex, distorted, periodic waveforms are handled equally well a major advantage when computing Watts and Vars. As well as true RMS currents and voltages. This design frees the user from concern about errors, which will otherwise occur during the measurement of distorted waveforms. Phases A, B and C are samples in succession, providing the MCU with instantaneous measurements of all voltage and current inputs. Samples are accumulated for 1 seconds, at which time the MCU calculates the Volts and Amps for each phase. Any Zero Offset or drift is compensated every calculation cycle. Once the Volts and Amps have been calculated, the MCU scales the values by the external PT and CT ratios, which have been selected by the user, and displays the values.

Chapter 1--Introduction

Watts/VARs Instantaneous Watt samples are accumulated for 0.4 seconds, at which time the MCU calculates the Watts and Vas for each phase. The VARS quantity for

each phase is derived from a power triangle calculation where the WATTS and Vas are known. This technique provides a true" measure of VARs even with distorted waveforms. Zero offset is slow adjusted for each signal channel every 0.4 seconds by the MCU. These per phase quantities are then summed to form the total three phase WATTS and VARS. Once the WATTS and VARS have been calculated, the MCU scales the values by the external PT and CT ratios, which have been selected by the user, and displays the primary values.

Energy

The WATT and VAR values are calculated every 0.4 second. These values are then multiplied by a factor in order to generate Watt-hours and VAR-hours. The sign of the Watt-hours and VAR-hour values are then checked, and the values are then added to the appropriate registers (Positive/Negative WATThours, VARhours). In order to retain the energy values during a power failure, the registers must be stored in the EEPROM in the base of the instrument, The EEPROM has a limited number of write cycles, so the energy are only written every 90 seconds. At this rate, the EEPROM will last in excess of 15 years at rated conditions. The registers are in primary kilowatt-hours and kilo VAR-hours, and the CT and PT ratio are used to calculate the primary units.
The Energy registers count to a maximum of 10000000 kWh before rolling over to zero. It is the responsibility of the user to ensure that these values are read often enough to detect every rollover.

Frequency

The Frequency measurement is generated by timing zero-crossings of the Phase A Voltage (Phase A-B) over a period of 0.6 seconds. Knowing the number of zero-crossings and time between them, the frequency can be calculated. A rolling average of two measurements helps to reduce the fluctuations in the measurement. The input voltage must be greater than 10Vac for the frequency function to determine a value.

Power factor

The Power Factor measurements require a secondary side of CT current of minimum 0.25Aac and a secondary side of PT voltage approximately 50Vac to determine an accurate answer. If the input signals are below these values the power factor ready will be displayed at 1.00 .

2.System Description

Feature

- All measured quantities available over the digital communications channel to SCADA or PLC systems.
- Push-button rescaling in the field accommodates all ANSI CT and PT ratios. displays the primary values.
- Non-volatile memory backup of CT/PT settings energy readings, communication settings. No batteries are needed.
- Separate second microprocessor to off-load the main processor
- Standard Universal power supply works on AC or DC service, (110v or 230V)
- True RMS measurements are standard.
- DIN size 144*144 enclosures
- 4 digits by 3 lines high efficiency LEDs for easy reading
- Watchdog timer maximizes system reliability

EPM SPECIFICATION

Voltage inputs	Rating	120vac, 400vac(L/N)
	Max	600 VAC Max. between L/L 400VAC Max between L/N
	Overload	2 x rating continuous
	Sensing method	True-RMS
Current inputs	Rating:	5 Amps with 20% over range
	Overload	15 Amps continuous 250 Amps for 1 sec. non-recurring
	Sensing method	True-RMS
Frequency	Range	40-100 Hz
		0.2 VA
Low Burden	PT Burden	
	CT Burden	0.2 VA
Power measurement	Line voltage	Per phase
	Phase voltage	Per Phase (3p4w only)
	Current	Per phase
	3 phase total	f, PF, KW, KVAR
	Energy total	Kwh, Kvarh (import and export)
Accuracy	Current and voltage	0.5%,FS; 0.2% FS (optional)
	Other power functions	1%,FS; 0.5%(optional)
	Frequency	0.1Hz
Microprocessor	Microprocessor	16 bit low power MPU 32K-byte non-volatile RAM 4K bit EEPEROM
Display	Data display	3 lines of 4 digits data LED display
	Power parameter	18 LED display
	Update time	0.5 sec
	Auto scaling	Available

User configuration parameters	Setting	Keyboard Saved in EEPROM , no parameters are required to maintain data
	Parameter setting	PT/CT table select ratio, RS 485address, Baud rate
Isolated RS485 communication	Isolation	Photo isolation 2500 Vrms
	Address	Up to 32 EPM420 per line
	Baud rate	up to 19200 bps
	Distance	4000 ft.
	Protocol	Modbus-RTU mod
Seals	Front panel	IP41/UL94
	Termina**l**	IP20
Environment	Operating	-20 ~ 70 deg. C
	Termina**l**	IP20
Dimension & weight	Dimension	144*144*90mm
	Weight	1kg
Standards apply	IEC	IEC870,IEC801-4
	ANSI	ANSI 37.9/IEEE-472 SWC
	UL	UL94
Isolation	Input/output/ground	2500 vac, between any input and output; 2800vac between I/O and ground
Insulation		500M ohm, between any I/O and case
Power supply	Input	115/230 V (20%),AC or DC
	Consumption	3.5 VA

Measuring range

Real-time reading	**Range**
Current per phase	0 to 7500A
Voltage L-L per phase	0 to 35KV
Voltage L-N per phase	0to 230KV
Real power 3 phase total	0to 9999Kw
Reactive power 3 phase total	0 to 9999Kw
Apparent power 3 phase total	0 to 9999Kw
Power factor 3 phase total	-1 to 1
Frequency(50/60Hz)	40 to 70 Hz
KWH 3 phase total	1000000.0Kwh
KVARH 3 phase total	1000000.0Kwh

Table 2-1

3.Product Structure

Modular construction

The EPM Series Meters are composed of three major modules. The analog module and controller module, and power supply module .

The analog module is installed at backside while controller module at the front side; the power module is attached by analog module. The analog Module contains passive parts (transformers, connectors , etc.) and cannot be serviced without removal from the panel. The controller consists of the analog and digital Processing, dual Micro controller, and the LED Displays. This module can easily be removed for maintenance without the need to remove the meter from the panel, or to remove the meter from service.

Analog module

The analog module consists of the input and power connector, the initial current transformer, analog circuit, communication transceiver, input protection circuitry, instrument potential transformer EEPROM.

The meters provide for complete interchangeability among analog module and controller modules. Compensation for normal variations in input circuits is achieved by storing calibration constants in a non-volatile memory (EEPROM) which resides on the PC board. These constants are factory programmed to provide identical signal gain (attenuation) in each of the six isolated signal input paths. The CT and PT settings for scaling the display to the user's CTs and PTs are also stored in this EEPROM. The Energy Registers are also stored in this EEPROM.

Detailed descriptions of each of the boards can be found in the following sections.

Input signal connections

The EPM420 have 10 independent signal input ；6 current and 4voltage for each phase being measured .The signal input of voltage and current are directly connected to the rear panel of the meter in #10-32 AWG .The meter can be connected directly to CTs or PTs and can directly connected if the voltage is lower than 600 volts.

The internal of CT and PT have a feature of low burden rate ,so that it almost no loading effects on the secondary value of PT and CT .It must be paid attention that the polarity and order sequence in PT or CT input .The wiring error will not cause any anxiety in security but there will some problems in reading errors.

And it must be noted that：When connecting PTs or CTs , all kind of protecting and prevent measures must be adopted to stave off the burning out of equipments.

The meter have power of MOV ,confirming ANSI / IEEE C57.13.13-1983.

Chapter 3--Product Structure

Communication connector

The meter have the isolated communicational interface of RS485 in the upper right side of the rear panel .

Internal CT

The internal CT in the meter provides good function of isolation and meter protection and simultaneously avoids that the monitored equipment open-circuit (result in melt and electric accident). The internal I/O capability uppers to 1500 volts.

Internal potential transformer

The potential transformer (PT) contain secondary transformers , which provide electrical isolation for each of the signal-input channels. Voltage from the PT terminal flows though a internal PT to assure that the user's external PT circuit can never open-circuit, even under extreme fault conditions. The use of transformer isolation on all input leads provides excellent isolation (>1500Vac) between the inputs and any output.

Power module

Switching power Supply

The meters have a universal power supply as a standard feature. The universal power supply is a high-efficiency, high frequency switching power supply with integrated over-current protection. Power from the input terminals is conducted to a full-wave bridge rectifier and converts AC power inputs to DC.. The output of the switching supply is then post regulated by a low-drop linear regulator to provide precise supply voltage control under all conditions.

Working power supply

The total load required to operate is only 3.5VA. It is therefore possible to po the EPM Series Meter with AC or DC station power or an auxiliary PT or batte The meter are designed in Aac or Vac in power input(110 or 220volts),and the terminal is designed in the upper left side of rear panel(terminal 1 and 2). In order to assure the operation of meter monitoring ,the power supply of the meter should separately set ,especially in low voltage for the working power should maintain its good electric quality and the monitored power may be harmful electric quality .In applying high voltage, the meter can directly connected to 110 or 220 Aac volts for the working power supply.

Controller module

Analog processing

The function of analog processing is to sample and digitize the micro-controller (MCU) for further processing. Calibration constants stored in the analog module □ EEPROM to provide drift-free calibration, and complete interchangeability of analog processing.

Master micro-controller

The master micro-controller consists of an 16-bit micro-controller, address memory and a watchdog timer. All the data acquisition, signal processing manipulation are controlled by this micro-controller. Communications to n other boards is accomplished via a serial data link consisting of three li common to all the other devices.

Slave micro-controller

The micro-controller consists of an 8-bit micro-controller, address latch, EPR memory, dual port ram. This processor performs all the front panel operation communication functions. Utilized this slave processor can share the load of m processor to enhance the response speed. The dual port RAM for pass messag between master and slave micro controller in order to service operator's I display and data communication function.

EEPROM The meter configuration and data(max. demand,max. current, happen time can be preserved in EEPROM even loss of power.

LED display The LED Display sets consist of three 4-digit displays comprised of high efficiency red LED seven segment common cathode displays. Each 4 digit display is driven in a multiplexed fashion by an seven segment decoder driver chip, which accepts serial data from the slave processor, and decodes the data into seven segment and digit select outputs necessary for the multiplexed display. An driver provides the high current cathode drive for each pair of digits.

Front Panel

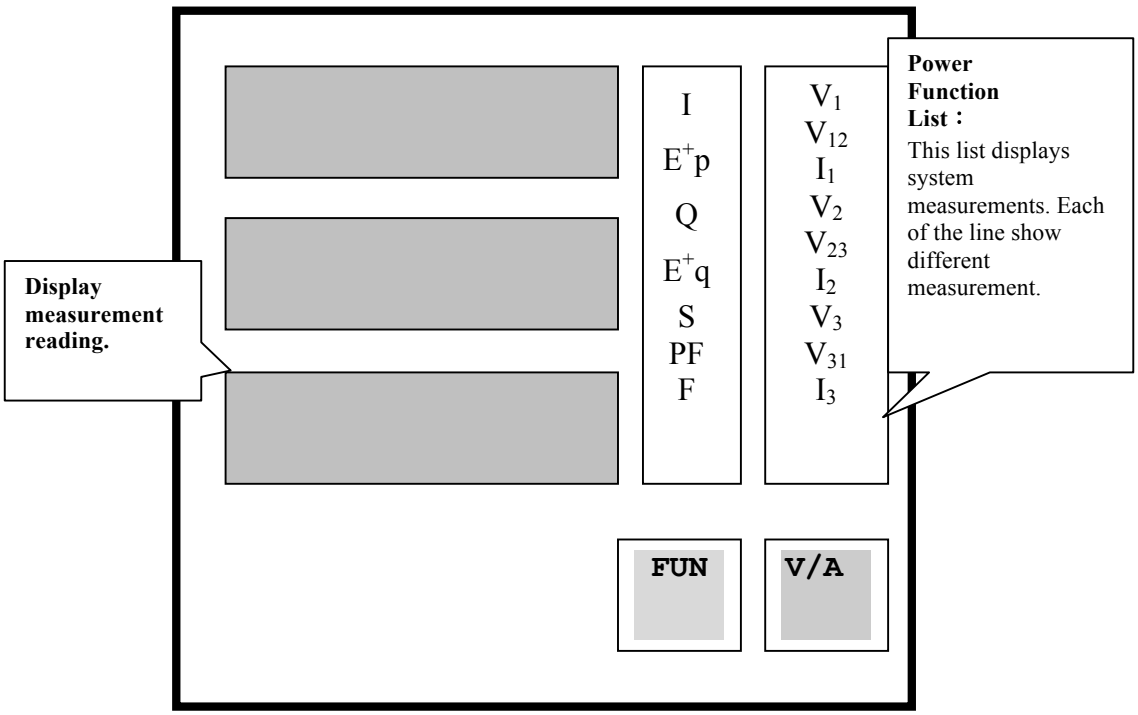
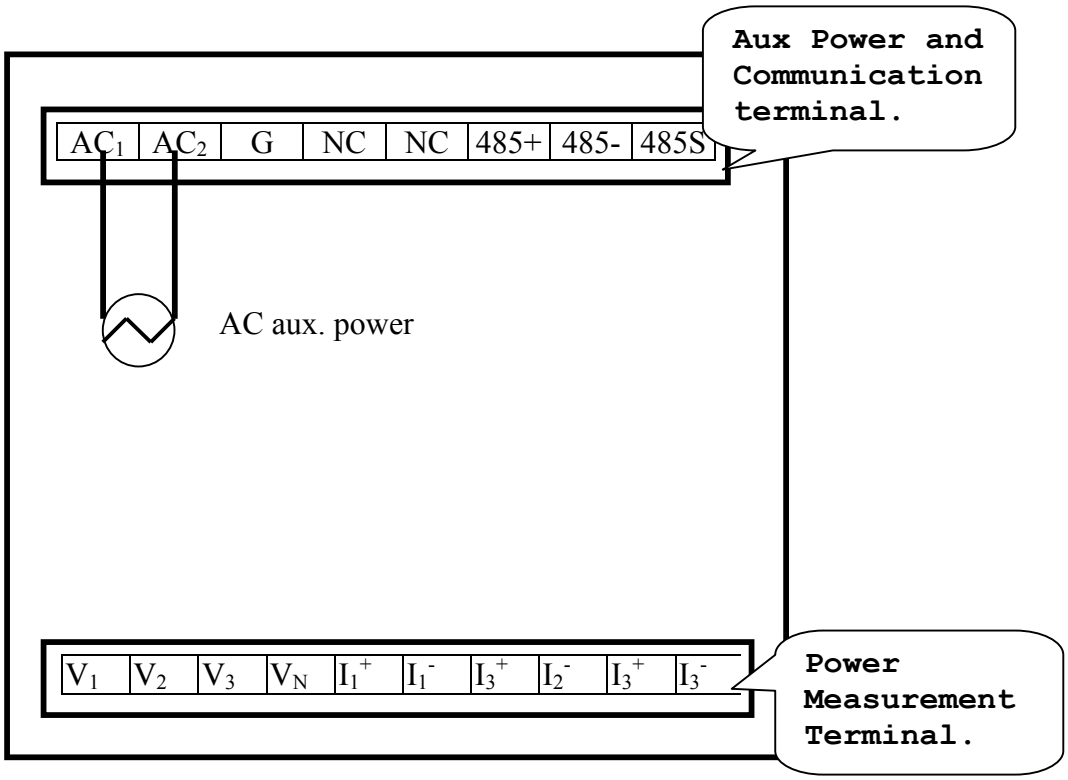


Table 3-1 Power Function List

SYMBOL	DEFINITION	UNIT	ANNOTATIONS
V1	Phase R voltage	Kv or V	PT ratio = 1(low voltage),the uint is "V" PT ratio = other value(mideum or high voltage),the unit is "Kv". V1,V2,V3 are uesd when in 3 phase 3 wire.
V2	Phase S voltage	Kv or V	
V3	Phase T voltage	Kv or V	
V12	Line RS voltage.	Kv or V	
V23	Line ST voltage.	Kv or V	
V31	Line TR voltage.	Kv or V	
I1	Phase R current	Amp	
I2	Phase S current	Amp	
I3	Phase T current	Amp	
P	Real power	Kw or Mw	PT ratio >1000,the unit is Mw
Q	Kvar	Kw or Mw	
S	Apparent power	Kw or Mw	
PF	Power factor		
F	Frequency	Hz	Base on voltage Phase A
E_P^+	Kwh(import)	0.1Kwh	
E_Q^+	Kvarh(import)	0.1Kwh	

Rear Connection



Button function

Button	Display Mode	Setting Mode
FUN	Choose the power function	Increase the setting parameter.
V/A	Change the measurement of current or voltage	Confirm the setting
FUN + V/A	Press the two button at the same time to enter into setting mode	

4.Programming your meter

The Meters can display several per-phase and total quantities for the circuit being monitored. This allows the simultaneous display of all phases for a given quantity such as AMP. The parameter ITEM LED display at the right side of the instrument prompts the user as to what quantity is being displayed. While this chapter will construct you step by step to learn how to operate meters. Please refer the attachment table of PT/CT ratio index while in set-up mode.

Table 4-1

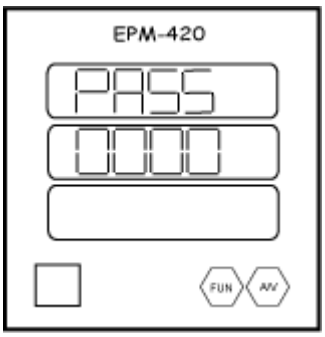
Parameter	Allowed Values	Defaults
CT ratio	1200	1
PT1	35000*	100
PT2	220	100
Device Address	0-31	00
Baud Rate	0-5	4
Password	0-9998	0

Button function

Button	Setting Mode
FUN	Increase the setting parameter.
V/A	Confirm the setting
FUN + V/A	Press the two button at the same time to enter into setting mode

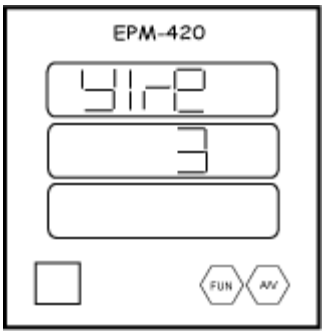
EPM420 set-up

Setting mod*e:*
User can follow procedures, step by step to set scaling factor, communication ID number, and Baud rate selection (9600 or 19200bps)



Step 1: **Enter into set-up, select wiring mode**
a. Press BOTH of **FUN** and **V/A** key simultaneously, enter into set-up mode.
b. Press **FUN** key to select the password value.

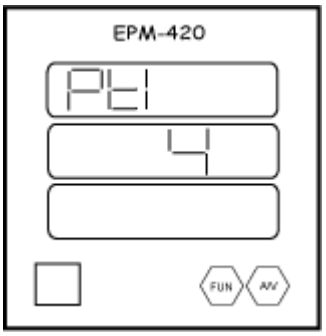
Note:"Press **V/A** key to confirm the password if the password is correct, the screen will change to step 2 otherwise ,the screen will stay at step 1."



Step 2: Select 3p3 or 3p4
The LED screen shows: "**y i r e**" and select 3 or 4. where
"**3**":means wiring mode is 3p3w
"**4**"; means wiring mode 3p4w.

a. press **FUN** key to toggle change 3p3 or 3p4.
b. press **V/A** key to go to step 2.

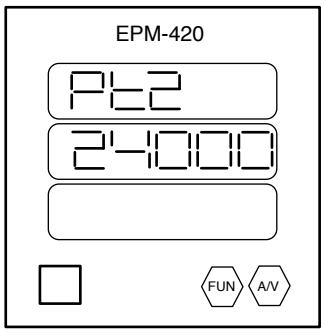
(ex: 3 means.3p4w)



step 3: **PT 1 value setting**
(Pt1=primary value ; Pt2=secondary value)
The LED screen shows:" **p t 1** "and "**24000**" (
a. press **FUN** key to increase no.(refer attachment index) till correct.
b. press **V/A** key to go to step 3.
(ex. PT 4 : PT ratio = 110)
c. press **V/A** key to shift to set **pt 2** and construction to increase pt index is same as above.

Note: if PT primary side is 24000v ,secondary side is 120v, the PT1 should Enter into 24000v , the PT2 should enter Into 120V

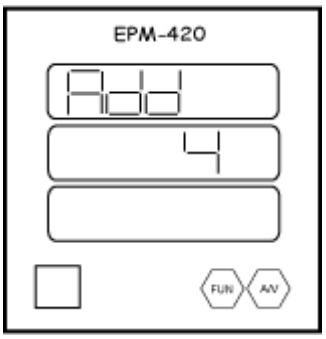
The FUN key increments the value. Short presses increase the value step by step. Holding and not releasing increases the value continuously and the incrementing rate accelerates over time.



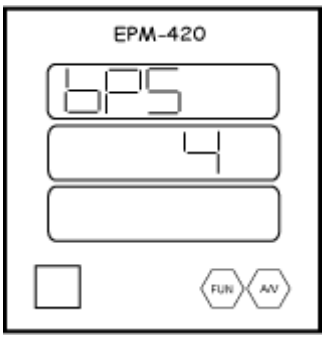
step 4: **PT 2 ratio setting**
(Pt1=primary value; Pt2=secondary value)
The LED screen shows:" **p t 2** "and "**120**" (
a. press **FUN** key to increase no.(refer attachment index) till correct.
b. press **V/A** key to go to step 3.
(ex. PT 4 : PT ratio = 110)
c. press **V/A** key to shift to set **pt 2** and construction to increase pt index is same as above.

Note: if PT primary side is 24000v ,secondary side is 120v, the PT1 should Enter into 24000v , the PT2 should enter Into 120V

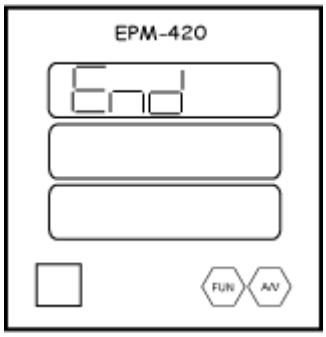
The FUN key increments the value. Short presses increase the value step by step. Holding and not releasing increases the value continuously and the incrementing rate accelerates over time.



Step 6: **Address ID no. setting** (RS485 address setting)
The LED screen shows : "**4**" (ex. ADDRESS ID no.4, the ADDRESS ID no. could be 0-31)
a. press **FUN** key to increase id no. till correct;
b. press **V/A** key to go to step 5
(RS485 address = 4)



step 7: Baud rate setting
The LED screen shows : "**4**" (ex. Baud rate ID no.4)
a. press **FUN** key to increase baud rate ID no. till correct,
(ex .bps = 4 : baud rate = 19200 bps)



step 8: Return to step1 or exit
The LED screen shows : "**End**".
a. press **V/A** key to return to to step 1-b **or**
b. press BOTH of **FUN** and **V/A** key simultaneously to exit set-up mode, and return into display mode

Table 4-4 Baud Rate Setting Table

No:	0	1	2	3	4
Value	1200	2400	4800	9600	19200

Operation

3p4W

Voltage ,current and total harmonic

SYMBOL	DEFINITION	LED DISPLAY
Press the V/A button		
V1	Phase R voltage	
V2	Phase S voltage	
V3	Phase T voltage	
Press the V/A button		
V12	Line RS voltage.	
V23	Line ST voltage.	
V31	Line TR voltage.	
Press the V/A button		
I1	Phase R current	
I2	Phase S current	
I3	Phase T current	

Other Power Function

SYMBOL	DEFINITION	LED DISPLAY
Press the FUN button		
P	Real power	
Q	Kvar	
S	Apparent power	
Press the FUN button		
PF	Power factor	
F	Frequency	
Press the FUN button		
E_P^+	Kwh	
Press the FUN button		
E_Q^+	Kvarh	

3p3W

Voltage ,current and total harmonic

SYMBOL	DEFINITION	LED DISPLAY
Press the V/A button		
V12	Line RS voltage.	
V23	Line ST voltage.	
V31	Line TR voltage.	
I1	Phase R current	
I2	Phase S current	
I3	Phase T current	

Other Power Function

SYMBOL	DEFINITION	LED DISPLAY
P	Active power	
Q	Reactive power	
S	Apparent power	
Press the FUN button		
PF	Power factor	
F	Frequency	
Press the FUN button		
E_P^+	Kwh(import)	
Press the FUN button		
E_Q^+	Kvarh(import)	

5. Installation

Initial

Initial inspection Instruments are carefully checked and turned in" at the factory before shipment. Damages can occur, however, so please check the instrument for shipping damage as it is unpacked. Notify Dae instrument immediately if any damage has occurred, and save any damaged shipping containers.

Power requirements EPM series Meter are normally equipped with universal (AC/DC) power supplier. After power are connected to 110 or 220 volts ,the monitor will light up for operation.

Over current protection A UL listed 0.5 Ampere non-time delay (M) fuse is to be series connected in the ungrounded (hot) side of mains input as part of installation of this product.

Mains disconnect The Disconnect shall be UL Recognized and acceptable for the application.

Instrument mounting Instrument mount in DIN 144 x 144 ,see figure 7-1,7-2

Surge protection It is recommended that a metal oxide varistor (MOV) be placed across the power supply input to protect the meter in the event of high voltage surges or lightning strikes. EPM Meters are shipped with a transient suppression network already attached as a standard design. An MOV provides an added measure of protection against heavy switching transients occasionally experienced in the field. The MOV is designed to clamp applied power voltages above 270 V ac RMS. A single MOV protects the meter Line to Line, and two high voltage capacitors are provided to protect each Line to Ground. To avoid damaging the MOV protector, maintain continuously applied power voltages within the ratings of the instrument.

Setting instrument address The Meters require an address to be set within the instrument before any communications can begin. Address could be set by front panel keyboard a display. Refer to the appropriate protocol option manual for address setup instructions.

setting 3p3w or 3p4w mode The meters combined 3p3w or 3p4w configuration in the same unit, user must set the right configuration correspondence with it's wiring.

Wiring the PT and CT input CT connections:
The polarity of wiring and sequence of correspondence is very important .The mis-wiring with PT will result in that the reading of power and power factor is not correct.

Field adjustments

-WARNING

PROPERLY TRAINED OR QUALIFIED PERSONNEL SHOULD ONLY PERFORM WARNING-INSTALLATION & MAINTENANCE.

Calibration

Routine recalibration is not recommended, or required. However some drift or aging may cause slight errors after years of use.

Field Service Consideration

If the mater requires servicing or field upgrading,you may need to disconnect and remove the meter from its mounting .The initial installation should be done in a way that makes this as convenient as possible:

- All phase voltage sense leads should be protected by breakers or fuses at their source so that the meter can be safely disconnected.
- A CT shorting block should be provided so that the meter current inputs can be safely disconnected without open circuiting the CTs. The shorting block should be wired so that protective replaying is not affected.
- All wiring should be routed to allow easy removal of all connections to the meter terminal strips and the meter itself.

Feature Pack Requirements

A minimum of 63.5 mm(2.5") above and below the meter should be left free from cables,wiring,and other devices.

Terminal Strips

All connections to meter are made to terminal strips at the back of the unit.The terminal strips for phase voltage and current are barrier-type ,for which ring or spade terminals, or bare wire ,may be used.
The terminal strips for the communications port, and the supply power inputs are all captured-wire type; they accept stripped wire ends.

Connecting the Base Unit Safely Ground

The ⏚ terminal of the meter provides the safety ground connection .This terminal must be connected to earth ground. A good ,low impedance, safely ground connected is essential for the meter surge and transient protection circuitry to function effectively. It should be made to the switchgear each ground using a dedicated AWG 14(2.1mm^2) or larger wire .

Connecting the Power Supply

The meter requires a constant power supply to maintain monitoring, analysis, control, and communications operations. Powering the meter from the voltage source it is monitoring is not suitable for applications where these operations must be maintained in envent of a power outage.
If an AC power supply is being used, connect the line supply wire to the AC+ terminal and the neutral supply wire to the AC- terminal. If a DC power supply is being used, connect the positive supply wire to the L+ terminal and the negative supply wire to the N- terminal.

External PT

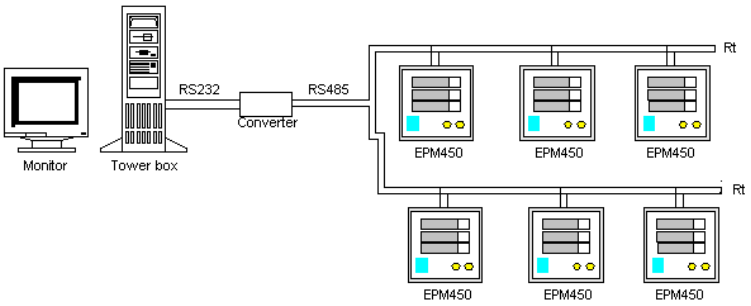
PTs are required for all systems with voltage levels greater than those indicated in Voltage Input specification.

Time to adopt the external PT	When the voltage exceeds the range , it needs external PT.
The Security of External PT	. It's recommended that PTs comply with the requirements in IEC 61010-1,Pollution Degree 2, Category Ⅲ .
Voltage Input Connection	The meter uses the V1 input as the reference for frequency measurements. For any system configuration, the V1 input must be connected to ensure accurate readings and correct operation of the meter.If the voltage on V1 falls below 50V, the meter's accuracy could be affected.
Voltage Reference(Vref) Input Connection	The meter voltage reference terminal ,Vn, serves as the zero voltage reference for the voltage reading. A good , low impedance Vref connection is essential for accurate measurements. It should be made using a dedicated AWG 14 to 12 wire(2.1 to 3.3 mm)to the point where there will no voltage error due to distribution voltage drops.
Connecting External CT	AWG 14 to 12 wire(2.1 to 3.3 mm)is recommended for all current connections. .It's recommended that CTs comply with the requirements in IEC 61010-1,Pollution Degree 2,Overtage Category Ⅲ.
The Choice of External CT	The CT primary rating is normally selected to equal to the current rating of the power feed protection device. However ,if the peak anticipated load is much less than the related system capacity, you can improve accuracy and resolution by selecting a lower related CT. In this case, the CT size should be the maximum expected peak current, rounded up to the nearest standard CT size. The Ct secondary should have burden capacity greater than 3VA.The length of the CT cabling should be minimized , because long cabling contributes to the burden on the CT secondary. Also, the CT burden rating must exceed the combined burden of the meter plus cabling plus any other connected devices(burden is the amount of load being fed by the CT, measured in Volt-Amps.)
RS-485 Communication Connection	1.RS-485 connections are made via the captured-wire connectors on the meter .Up to 32 devices can be connected on a single RS-485 cable. 2.The Rs485 cable should be adopted AWG62 (0.33mm) or larger twisted pair with shidded wire. 3.The RS485 cable should be adopt twisted pair with shidded wire to avoid electric noise. 4.The overall length of the RS485 cable connecting all devices cannot exceed 1200m. 5.The polarity of RS485 connecting link must be correct or any error in any element of this link will occur the system confusing . 6.The setting of all elements must be the same.(ie：baud rate 8/n/1) 7.The address of RS485 must not be repeated. 8.All the element in RS485 must adopt the same communication protocols. 9.It should be set proper rolling interval and time out in central computer software 10. After system wiring ,prepare to test .It should adopt the testing

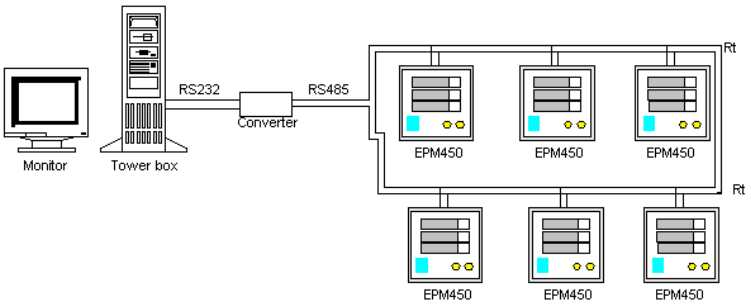
software of DAE Instrument for simplifying the complexity of troubleshooting.

Topology

Loop Topology

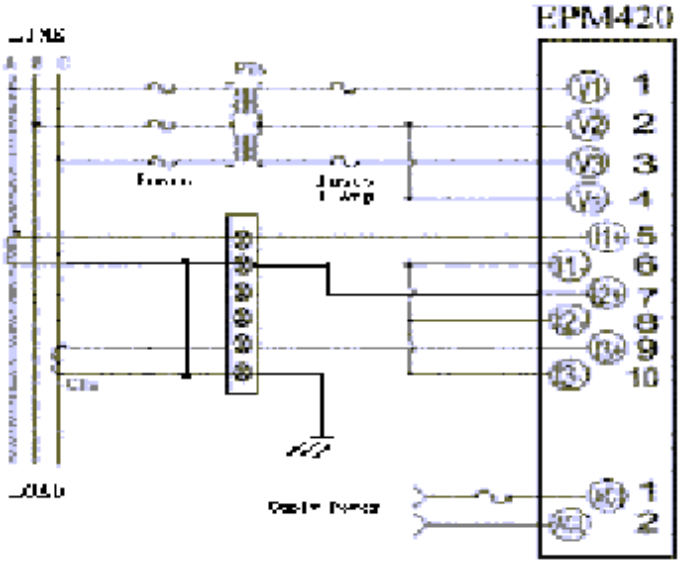


Straight Line Topology

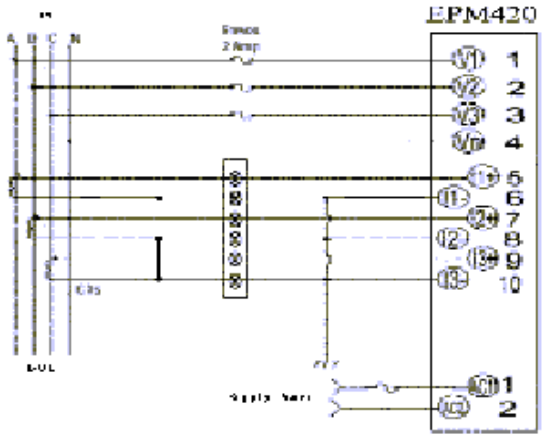


Wiring Diagram

3 wire 2 Delta
(2PT,2CT)

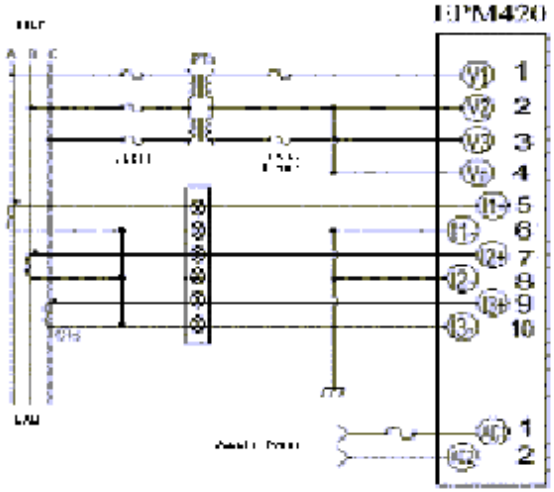


3W Direction



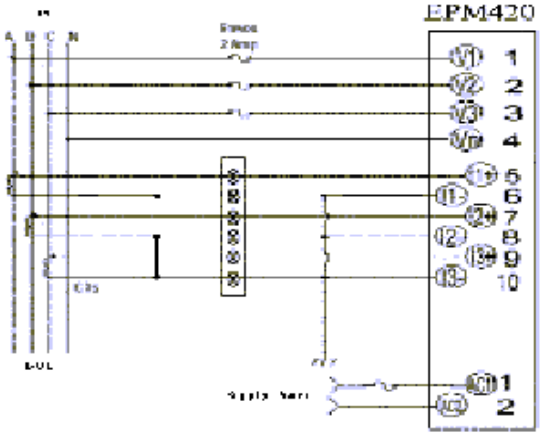
3P3W

3-Wire Delta (2 PTs and 3 CTs)



3P4W

4-Wire Wye (Direct Connect)



6. Maintenance/Troubleshooting

Preventive maintenance

Cleaning the exterior of the instrument shall be limited to the wiping of the instrument using a soft damp cloth applicator with cleaning agents that are not alcohol based, and are nonflammable, non-explosive.

Troubleshooting

In this section, we bring up some poentail problems that you would like to meet, and provide the check .or cure for these prblems.If,after completing the listed checks,you still can't solve the problem,connect the DAE INSTRUMNET for assistance.

Problem :
After applying control power to the EPM420 ,the display is still black.

Possible Cause :
The EPM420 is not receiving the necessary power.
Check or Cure :
Verify that EPM420 AC1 and AC2 terminal (terminal 25and 27)are receiving the necessary power.

Problem:
The data displayde is inaccurate or not what you expected.

Possible Cause:
Incorrect setup values.
Check or Cure:
Check to see that the correct value have been entered for EPM420 setup parameter.(CT and PT rating,Wiring Type ,and so on.)See *Programming your meter in Chapter 4.*

Possible Cause:
EPM420 is wired improperly.
Check or Cure:
Check the CTs and PTs are connceted correctly (proper polarity observed.)and energized.Check shorting terminals.

Possible Cause:
Incorrect voltage input.
Check or Cure:
Check EPM420 voltage input terminals (terminals Va,Vb,Vc,Vn)to verify that adequate voltage is present.

Problem:
Cannot communicte with EPM420 from a remote personal computer.

Possible Cause:
EPM420 address is incorrect.
Check or Cure:
Check to see that EPM420 is correctly addressed.

Possible Cause:
EPM420 baud rate is incorrect.
Check or Cure:
Verify that the baud rate of EPM420 match the baud rate of all other devides on it's communications link.

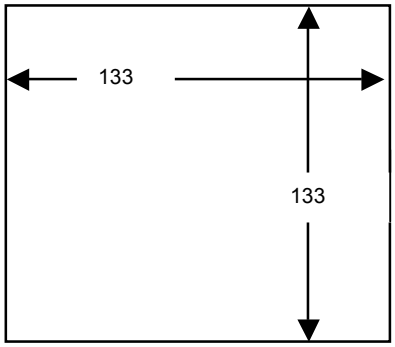
Possible Cause:

Communicating lines are improperly biased.
Check or Cure:
Check to see that a multipoint communications link terminator is properly installed.

7. Appendix

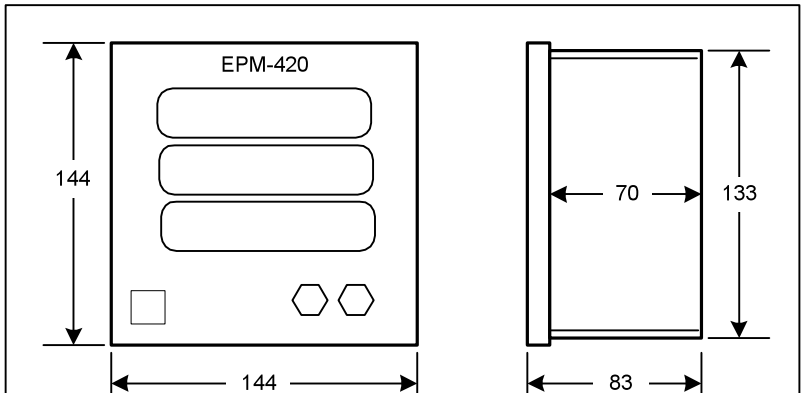
Drawings

Figure 7-1
Panel cutting



Unit : mm

Figure 7-2
Appearance



Unit : mm

B. Communication protocol: (Modbus RTU protocol)

**EPM420 communication can has two 485 ports (optional, contact the factory)

B.1 Transmission mode

The mode of transmission is the structure of the individual units of information within a message, and the numbering system used to transmit the data. The mode is defined in the following, which is compatible with Modbus RTU Mode*.

Table 7-1

Coding System	8-bit binary
Start bit	1
Data bits	8
Parity	no parity
Stop bit	1
Error checking	CRC check

B.2 Framing

Table 7-2

Address	Function	Data	Check
8-Bits	8-Bits	N x 8-Bits	16-Bits

Message Frame Format Function Field

B.3 Function field

B.3.1 Function Codes

Table 7-3

Code	Meaning	Action
01	Read DO Status	Obtain current status of Digital Output
02	Read DI Status	Obtain current status of Digital Input
03	Read Data	Obtain current binary value in one or more registers
05	Control DO	Force DO to a state of on or off
06	Preset Single-Register	Place a specific binary value into a Single-Register
16	Preset Multiple-Registers	Place specific binary values into a series of consecutive Multiple-Registers

B.3.2 Read Data (Function Code 03)

Query

This function allows the user to obtain the measurements of EPM. TABLE 3-2 is an example to read the 3 measured data (U1, U2 and U3) from slave device number 17, the data address of U1 is 0000H, U2 is 0001H. And U3 is 0002H

Table 7-4

Address	11H
Function code	03H
Data start address high	00H
Data start address low	00H
Data register high	00H
Data register low	03H
CRC high	07H
CRC low	5BH

Table 3-2 Read UU1, U2, and U3 Query Message

Response

The EPM response includes the slave address, function code, quantity of data characters, the data characters, and error checking. An example response to read U1, U2 and U3 (U1=03E8H, U2=03E7H,U3=03E9H) is shown as Table3-3

Table 7-5.

Address	11H
Function code	03H
Byte count	06H
Data register high	03H
Data register low	E8H
Data register high	03H
Data register low	E7H
Data register high	03H
Data register low	E9H
CRC high	FDH
CRC low	9CH

Table 3-3 Read U1, U2 andU3 Message

B.3.3 Preset / Reset Multi-Register (Function Code 16)

Query

Function 16 allows the user to modify the contents of a Multi-Register. Any Multi Register that exists within the DPM can have its contents changed by this message.
The example below is a request to slave number 17 to Preset Ep+(178077833KWH), data address=0040H
Table 7-6

Address	11H
Function	10H
Data start register high	00H
Data start register low	40H
Data register high	00H
Data register low	02H
Byte count	04H
Value high	40H
Value low	89H
Value high	0AH
Value low	9DH
CRC high	A0H
CRC low	7CH

Table 3-4 Reset KWH Query Message

Response

The normal response to a preset Multi-Register request includes the slave address, function code, data start reg, the number of regs, and error checking.
Table 7-7

Address	11H
Function code	10H
Data start address high	00H
Data start address low	40H
Data register high	00H
Data register low	02H
CRC high	42H
CRC low	8CH

Table 3-5 Reset KWH+ Response Message

Energy Measurement
Table 7-8
Format: unsigned 16 bit
Funtion Code:03H
Base Address:40001

ADDRESS	NAME	DESCRIPIOTION	LENGTH	FORMAT	MIN	MAX	DEFAULT	UNIT
0040H	Ep+	Kwh total (import)L	4 bytes	F11	0	100000000		0.1Kwh
0041H		Kwh total (import)H						
0044H	Eq+	Kvarh total (import) L	4 bytes	F11	0	100000000		0.1Kwh
0045H		Kvarh total (import) H						

Parameter Setting :
Table 7-9
Function code :16 ,

ADDRESS	NAME	DESCRIPIOTION	LENGTH	FORMAT	MIN	MAX	DEFAULT	UNIT
0080H	wiring	3P3W or 3P4W	2 bytes	F6	0	1	0	
0083H	Address	RS485 address	2 bytes	F1	0	31	0	
0084H	Baud rate	Baud rate	2 bytes	F1	0	4	4	Bps
0085H	PT	PTratio.	2 bytes	F7	0	31	0	
0086H	CT	CTratio.	2 bytes	F8	0	31	0	

Analog Measurement
Table 7-10
Funtion Code:03

ADDRESS	NAME	DESCRIPIOTION	LENGTH	FORMAT	MIN	MAX	DEFAULT	UNIT
0000H	V1	Phase R volt	2 bytes	F6	0	65535	0	V
0001H	V2	Phase S volt	2 bytes	F6	0	65535	0	V
0002H	V3	Phase T volt	2 bytes	F6	0	65535	0	V
0003H	V12	Line R-S volt	2 bytes	F6	0	65535	0	V
0004H	V23	Line R-T volt	2 bytes	F6	0	65535	0	V
0005H	V31	Line T-R volt	2 bytes	F6	0	65535	0	V
0006H	I1	Phase R amp	2 bytes	F7	0	65535	0	A
0007H	I2	Phase S amp	2 bytes	F7	0	65535	0	A
0008H	I3	Phase T amp	2 bytes	F6	0	65535	0	A
0009H	P	KW total	2 bytes	F8	0	65535	0	KW
000AH	Q	KVAR total	2 bytes	F8	0	65535	0	KW
000BH	S	KVA total	2 bytes	F8	0	65535	0	KW
000CH	f	Hz	2 bytes	F10	0	65535	0	
000DH	PF	PF	2 bytes	F9	0	65535	100	%

Parameter reading
Table 7-11
Function Code:03

ADDRESS	NAME	DESCRIPIOTION	LENGTH	FORMAT	MIN	MAX	DEFAULT	UNIT
0080H	wiring	3P3W or 3P4W	2 bytes	F1	0	1	0	
0081H	PT	PT index NO.	2 bytes	F2	0	32	0	
0082H	CT	CT index NO.	2 bytes	F3	0	32	0	
0083H	Address	RS485 address	2 bytes	F4	0	31	0	
0084H	Baud rate	Baud rate	2 bytes	F5	0	4	4	Bps

Format Table

Table 7-12

Format NO.	Format Type	Format Definition
F1	Wiring table	1:for 3P3W ; 0: for 3P4W
F4	RS485 address	
F5	Baud rate index NO.	0 :1200,1:2400,2:4800,3:9600,4:19200
F6	Voltage	Data/10 x PT ratio
F7	Current	Data/1000 x CT ratio
F8	Power(P,Q,S demand)	p= data x PT ratio x CT ratio(w)
F9	PF	positive:Data/100 negative: (Data - 65535) / 100
F10	Hz	Data/10
F11	Energy	{Word(h) x 65536 + word(L) } /10