

Description

AFM-8A multifunction power analyzer provides high-accuracy measurement and is designed for single phase and three phase application. It includes 4 Digital inputs, 4 Relay outputs, and a RS-485 Modbus RTU Communication port. The user can choose one more communication port, and 2 Analog outputs for output expansion.

It provides measure voltage and current of the 2~63 harmonic, and it shows CO₂ emissions, which is suitable for power monitoring, management and analyze power quality. It has TOU (time-of-use) function and 4MB Flash memory capacity, allowing users to record data for a long time. It also has a software line adjustment function to reduce the on-site line adjustment work.

It has the functions of waveform capture and recording, power record, and event record, which can be used for multifunction power analyzer.



Features

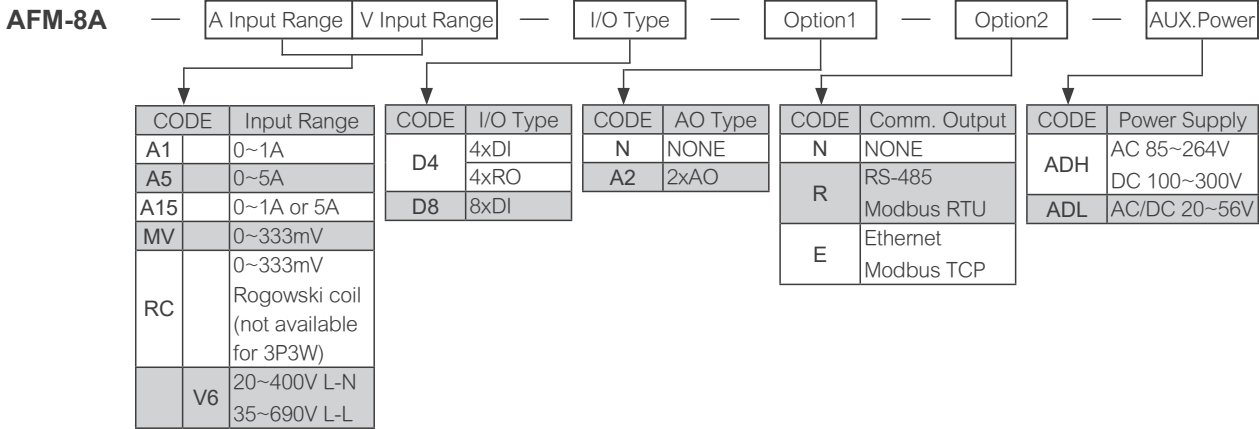
- Measuring 1P2W/1P3W/3P3W/3P4W system and the setting is programmable.
- Measuring balance / unbalance loading system, including power parameters such as voltage, current, frequency, power factor, active power, reactive power, apparent power and energy.
- CT input current can be set 1A or 5A by the user.
- The number of sampling cycles is the number of cycles of the input frequency, and each cycle samples 256 points.
- The large-size, high-brightness LCD is easy and clear to read even under direct sunlight.
- Innovative meter AI calculation can perform automatic line adjustment (See Note).
- Embedded 4MB non-volatile memory(NVM) which is with data and events recording function, can record for a long time.
- Measuring power quality is optional, for recording voltage sag, voltage surge and current swell event which included the time stamp and setting value.
- RS-485 Modbus RTU or Ethernet Modbus TCP is optional for the second communication.
- Measuring voltage and current up to 63th individual harmonic, and can maintain power stability, and moreover, to avoid risk of equipment malfunction.
- Standard with time of use (TOU) function, which can perform power consumption with differential statistics according to the electricity consumption period.
- Standard with 4 sets of DI and 4 sets of relay output, or choose option with 8 sets of DI and 2 sets of AO for the control functions to facilitate on-site monitoring and alarm needs.
- Standard with 1 set of RS-485 Modbus RTU, and it's optional for one more set of RS-485 or Ethernet interface (Modbus TCP).
- CE, and FCC approved.
- Up to 9 parameters with 20Hz (50ms) of data refresh rate.

Note: Auto wiring function is conditional, please refer to operation manual.

Applications

- Voltage swell and sag detection record
- Power abnormal event record
- Waveform capture and recording
- Analysis of energy quality
- Support AFC System

Ordering Information



Meter Guide

| Measurement items and functions | | Data refresh rate 20Hz(50mS) |
|------------------------------------|---|------------------------------|
| Voltage | Total and per phase L-L and L-N | ● |
| Current | Total and per phase and neutral | ● |
| Active Power | Four quadrants/per phase and active power total | ● |
| Reactive Power | Four quadrants/per phase and reactive power total | ● |
| Apparent Power | Total and per phase | ● |
| Power Factor | Total and per phase | ● |
| Frequency | Frequency | ● |
| Active Energy | Import / Export / Total / Net | |
| Reactive Energy | Import / Export / Total / Net | |
| Apparent Energy | Total | |
| THD/Voltage | Total and per phase | ● |
| THD/Current | Total and per phase | ● |
| Individual Harmonic | Current and voltage 2nd~63rd Individual harmonics | |
| Phase Angle | Current and voltage | |
| Unbalance | Current and voltage | |
| Waveform Capture | Current and voltage per phase | |
| Max/Min Demand values | Current, power and time stamp | |
| Max. Demand Value | Current, active, reactive, apparent power and time stamp | |
| Max/Min Values | Parameter values and time stamp | |
| Power Record | Swells voltage, Sags voltage and Over Current include time and setting | |
| Event Recording | Record the following parameter alarm events: frequency, phase voltage, line voltage, current, active/reactive/apparent power, power factor, voltage/current unbalance, voltage THD, current THD, power demand, current demand, voltage swell/sag, current swell | |
| Data Logging | The following parameters can be set to logging: frequency, phase voltage, line voltage, current, active/reactive/apparent power, power factor, active/reactive/apparent energy, voltage/current unbalance, load type, current and voltage phase angle, voltage THD max/min values, current THD max/min values, power demand max/min values, current demand max/min values, AO present values | |
| First Port of Comm. | RS-485 Modbus RTU | |
| Second Port of Comm. | RS-485 Modbus RTU or Ethernet Modbus TCP (Optional) | |
| Digital Input | DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8 (Optional) | |
| Pulse Output | PO1 PO2 | |
| Relay Output | RO1 RO2 RO3 RO4 (Optional) | |
| Analog Output | AO1 AO2 | |
| Digital Input/ Output Expansion | DIO1 DIO2 (Optional) | |
| Time of Use | 4 time zones, 8 periods, 4 tariff | |
| Date and Time | Year, Month, Day, Hour, Minute, Second | |
| Run hour | Operating hours, Running hours | |
| CO ₂ Emission | Total CO ₂ weight of energy(Kg) | |

Accuracy & Resolutions

| Parameter | Accuracy | Resolution | Measurement Range |
|---------------------------------|----------|------------|-----------------------------|
| Voltage | 0.1% | 0.1V | 20~400V L-N / 35~690V L-L |
| Current | 0.1% | 0.001A | 1%~120% CT rating current |
| Neutral Current | 0.5% | 0.001A | 1%~120% CT rating current |
| Active Power | 0.2% | 1W | -999,999,999~999,999,999W |
| Reactive Power | 0.5% | 1Var | -999,999,999~999,999,999Var |
| Apparent Power | 0.5% | 1VA | 0~999,999,999VA |
| Power Factor | 0.5% | 0.001 | -0.020~+1.000~0.020 |
| Frequency | 0.01Hz | 0.01Hz | 45.00~65.00Hz |
| Active Energy | 0.2% | 0.1kWh | 0~99,999,999.9kWh |
| Reactive Energy | 0.5% | 0.1kVarh | 0~99,999,999.9kVarh |
| Apparent Energy | 0.5% | 0.1kVAh | 0~99,999,999.9kVAh |
| THD | 1.0% | 0.1% | 0~100.0% |
| Individual Harmonic | 1.0% | 0.1% | 0~100.0% |
| Unbalance | 0.5% | 0.1% | 0~300.0% |
| Voltage and Current Phase Angle | 1.0% | 0.1° | 0.0° ~359.9° |
| Current demand | 0.2% | 0.001A | 0.000~9,999A |
| Active Power demand | 0.5% | 1W | -999,999,999~999,999,999W |
| Reactive Power demand | 0.5% | 1Var | -999,999,999~999,999,999Var |
| Apparent Power demand | 0.5% | 1VA | 0~999,999,999VA |

Technical Specification

Electrical Characteristics

Measurement: True RMS measurement
 Sampling: 256 point/Cycle
 Display refresh rate: 0.25s
 Power system: 1P2W, 1P3W, 3P3W, (1, 2, 3CT) ; 3P4W(1, 3CT) Balance/Unbalance
 Input range: Voltage: 20~400VLN ; 35~690VLL
 PT Primary ratio: 100~1,200,000V
 PT Secondary ratio: 50~600V
 Current: 5A / 1A / 333mV
 CT Primary ratio: 1~9999A
 CT Secondary ratio: 0~5A / 0~1A / 333mV
 Overload capacity: Current: 2x rated continuous ; 20x rated / 1s
 Input burden: Voltage:<0.2VA ; Current:<0.1VA

Power Quality

THD: Total harmonic distortion for voltage and current
 Individual harmonic: 2nd~63rd individual harmonics for voltage and current
 Unbalance: 3-phase voltage and current
 Swell/Sag detection: It can detect swell/sag from voltage and current per phase, so as to alert for power quality events, and trigger waveforms capture
 Waveform and record: The waveform can be captured manually, DI trigger or sag/swell event, and the captured waveform can be directly obtained from the instrument through the communication address

Relay Output(RO)

Relay capacity: 4 channels SPST(1a), 5A / 250Vac, 5A / 30Vdc
 Relay mode: Hi / Lo / Hi.Hold / Lo.Hold / DO
 Active delay time: 0~599.9s can be set
 Alarm set points: Up to 56 parameters of power and demand for alarm

Analog Output(AO)(Optional)

Output channel: 2 channels
 Signal output: Voltage: 0~5V / 1~5V / 0~10V
 Current: 0~20mA / 4~20mA / 0~10mA
 Output capacity: Voltage: $\geq 1000\Omega$; Current: $\leq 530\Omega$
 Accuracy: $\leq \pm 0.1\%$ of F.S.; 16 bits DA converter
 Ripple rate: $\leq \pm 0.1\%$ of F.S.
 Response time: $\leq 200\text{ms}$ (output: 10~90%)
 Set points: Up to 29 parameters of power

Digital Input (DI)

Input capacity: 4 or 8 channels DI input, mechanical contact or open collector input are available
 Function mode: Can be set to DI / Demand reset / Max. Demand reset / Energy reset / Max. and Min. reset / Relay reset / Screen backlight / Waveform capture enable / Manual TOU start
 Debouncing time: 0~99 (x5ms) programmable

Pulse Output (PO)

Output capacity: 2 open collector(O.C.), 30Vdc, 30mA(max)
 Output frequency: 40Hz (max)
 Pulse divider: 1~9999 (1 Pulse= 0.1kWh, if set 100, 1Pulse= 10.0kWh)
 Pulse width: 0~5000ms, 0 is duty cycle 50%
 Energy assign: Import active energy / Export active energy / Import reactive energy / Export reactive energy / Test pulse
 Test pulse: 3200 Pulse/1kWh, Duty cycle 50%

Digital Output / Input Expansion(DIO)(Via 2nd RS-485)

Expansion groups: 2 groups (2 RS-485 address)
 Protocol: Modbus RTU
 Mode setting: 16xDI / 16xDO / 8xDI + 8xDO
 Features: Same function as relay output (RO) and digital input (DI) of meter
 Polling time: Can be set 10~3000x10ms

Demand

Calculation method: Block / Sliding
 Period: 1~60 min
 Demand record: Records of Max/Min value and time stamp

TOU (Time of Use)

4 time zones: 1~4 zones per year
 8 periods: Each time zone can set 1~8 periods
 The sharp, peak, valley and normal tariff can be specified for each period
 Parameters of TOU: Cumulative value of import and export active energy, import and export reactive energy, total apparent energy for each tariff of previous and current day, and previous and current month; and maximum current and power demand of each tariff for current month

Holiday setting: The date and timetable of holiday for five years can be set individually or set on the same holiday for five years

Enhanced TOU

Calculation: By hour, day, month, custom period, DI trigger and trigger by communication

Custom period: Up to 4 periods

Records capacity: 12 records for month, 31 records for day, 72 records for hour, 144 records for custom period, 8 records for DI trigger, 8 records for communication trigger

Tariff: Same as TOU define

Parameters of TOU: Cumulative value of import and export active energy, import and export reactive energy, total apparent energy, and maximum current and power demand of each tariff for per calculation period

Data Log

Waveform capture: Each phase of voltage and current sampling are 64 points per cycle and continues record 16 cycles

Swell and sag: It can record voltage sag/swell and current swell events, including the time of occurrence, the voltage phase or current phase that occurred, and the current measurement value

Log setting: The specified parameters can be recorded according to the set interval time, the interval time can be set from 1 to 32767, and the interval time unit can be set as day, hour, minute, second

Event recording: The event and time when an exception occurs can be recorded

Memory storage: 4MB Flash ROM, no battery life issue

Rapid Data Refresh

Data capture: From RS-485 or Ethernet

Refresh rate: 20Hz(50mS)

Parameters: Phase voltage, line voltage, current, active/reactive/apparent power, power factor, frequency, voltage THD, current THD

RS-485 Communication (2nd RS-485 is optional)

Port: 2 ports, which can fill the requirements of on-site HMI and central monitoring; the second port of RS-485 by expansion DIO module is available as a master.

Protocol: Modbus RTU mode

Address: 1~247

Baud rate: 1200/2400/4800/9600/19200/38400/57600/115200 bps

Response time: ≤50ms(receive command completion to start transferring data)

Parity: None / Even / Odd

Data bits: 8 bits

Stop bit: 1 or 2

Distance: 1200M max

Ethernet (Optional)

Interface: 10M/100M BASE-TX, RJ45 connector

Protocol: Modbus TCP

Environmental Conditions

Operating Temp: 0~60°C

Humidity rating: 5~95%RH, Non-condensing

Temp. coefficient: ≤100 PPM/°C

Storage Temp: -10~70°C

Degree of protection: Front panel: IEC 529 (IP50) ; Housing: IP20

Operating altitude(maximum): 2000m above sea-level

Power Supply

Range: ADH: AC 85~264V, 50/60Hz; DC 100~300V
ADL: AC/DC 20~56V

Power consumption: AC:≤15VA @ 230V / DC:≤5W

Mechanical Characteristics

Dimensions: 96mm(W)x96mm(H)x98mm(L)

Panel cutout: 91.5mm(W)x91.5mm(H)

Material: ABS, Black (with fire-retardant)

Mounting: Panel mounting

Wire terminal: PA 66 (UL 94V-0)

Voltage input: AWG: 22~12 / 0.5~2.5mm²

Screw Torque Value: M2.5 / 5.202kgf.cm(Max)

Current input: AWG: 22~12 / 0.5~4.0mm²

Screw Torque Value: M4 / 12.24kgf.cm(Max)

Other input: AWG:22~16 / 0.5~1.5mm²

Screw Torque Value:M2 / 2.04kgf.cm(Max)

Weight: ≤600g

Safety

Isolation: AC 2.5KV,50/60Hz,for 1 min, between Power / Input / Output / Case

Surge immunity: AC±4KV, 1.2 / 50us
Voltage input / Current input / AUX. power

Insulation resistance: ≥100MΩ @ 500Vdc

EMC: EN 61326-1:2013
EN 55011 Class B
EN 61000-3-2:2014
EN 61000-3-3:2013
EN 61326-2-6:2013
IEC 61000-4-2:2008
IEC 61000-4-3:2006+A1:2007+A2:2010
IEC 61000-4-4:2012
IEC 61000-4-5:2014
IEC 61000-4-6:2013/COR1:2015
IEC 61000-4-8:2009
IEC 61000-4-11:2004

LVD: EN 61010-1:2010

FCC: FCC part 15 subpart B Class B

Accuracy of Standard

Active energy: Class 0.2S (IEC62053-22:2003)

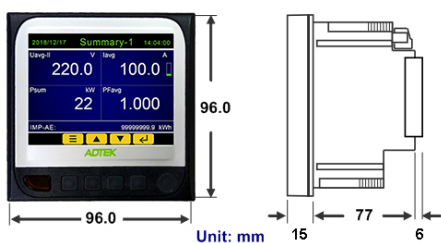
Reactive energy: Class 1.0 (IEC62053-24:2003)

Front Panel

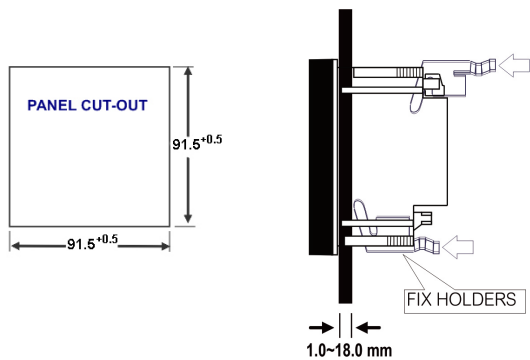


Display: 3.5" TFT color LCD, 70.0(W)x52.5(H)mm
 Refresh rate: 0.5 Sec
 Operation key: The keys function as icons show on display

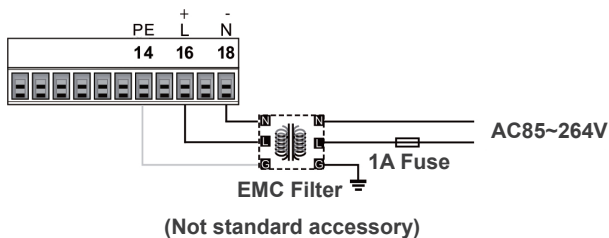
Dimensions



Installation



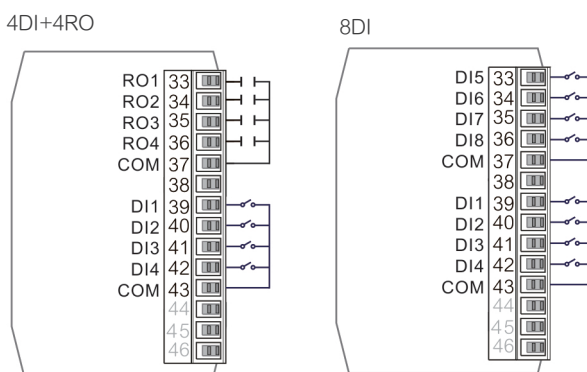
Power Connection



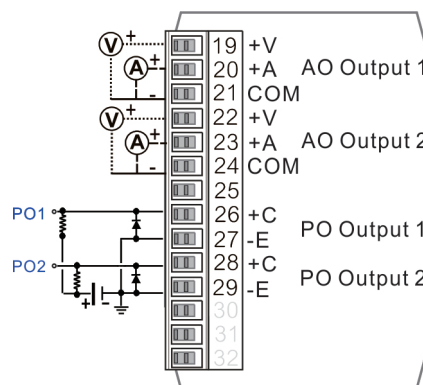
Pin Assignment

| 4DI+4RO | | | | | | | | | | | | | | 8DI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|--|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|----|-----|----|-----|----|-----|----|-----|----|----|--|----|-----|----|-----|----|-----|----|-----|----|----|--|----|--|----|
| 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| V1 | V2 | V3 | Vn | PE | L+ | N- | V1 | V2 | V3 | Vn | PE | L+ | N- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VOLTAGE INPUTS | | | | | | | | | | | | | | VOLTAGE INPUTS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| AUX. POWER | | | | | | | | | | | | | | AUX. POWER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | +V | 20 | +A | 21 | COM | 22 | +V | 23 | +A | 24 | COM | 25 | | 26 | +C | 27 | -E | 28 | +C | 29 | -E | 30 | | 31 | +A | 32 | -B | D15 | 33 | D16 | 34 | D17 | 35 | D18 | 36 | COM | 37 | 38 | | 39 | D11 | 40 | D12 | 41 | D13 | 42 | COM | 43 | 44 | | 45 | | 46 |
| Analog Output 1 Analog Output 2 Pulse Output 1 Pulse Output 2 | | | | | | | | | | | | | | Analog Output 1 Analog Output 2 Pulse Output 1 Pulse Output 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Relay Output Digital Input (ECI) LAN | | | | | | | | | | | | | | Relay Output Digital Input (ECI) LAN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CURRENT INPUTS | | | | | | | | | | | | | | CURRENT INPUTS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| I11 | I12 | I21 | I22 | I31 | I32 | I11 | I12 | I21 | I22 | I31 | I32 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

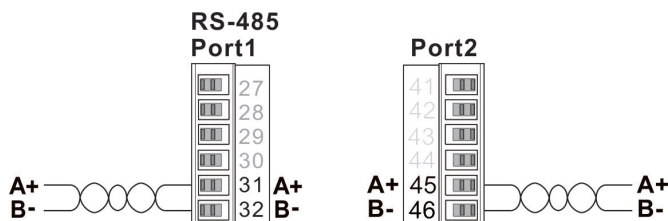
Relay Output (RO) / External Control Input (ECI)



Analog Output(AO) / Pulse Output (PO)

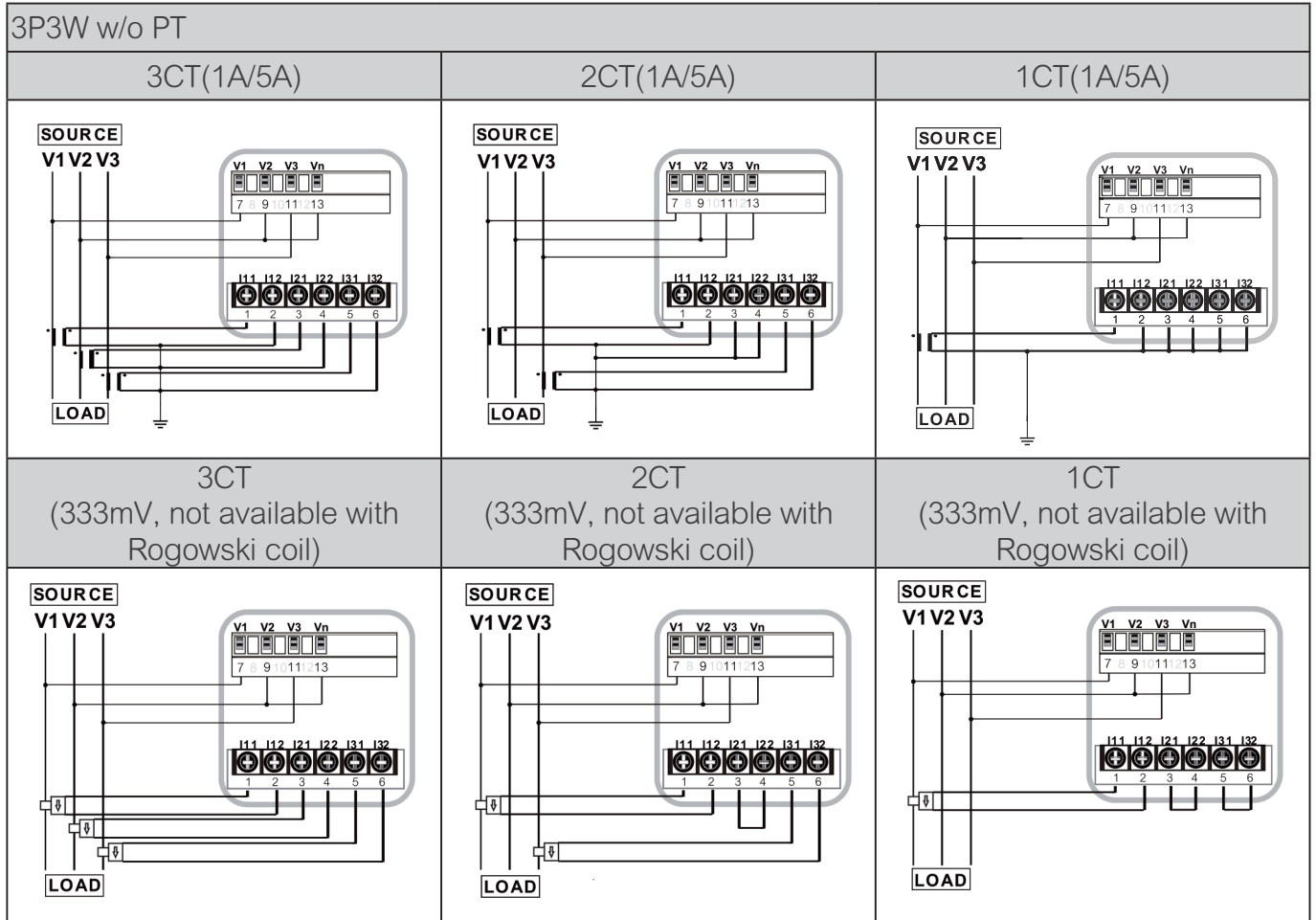
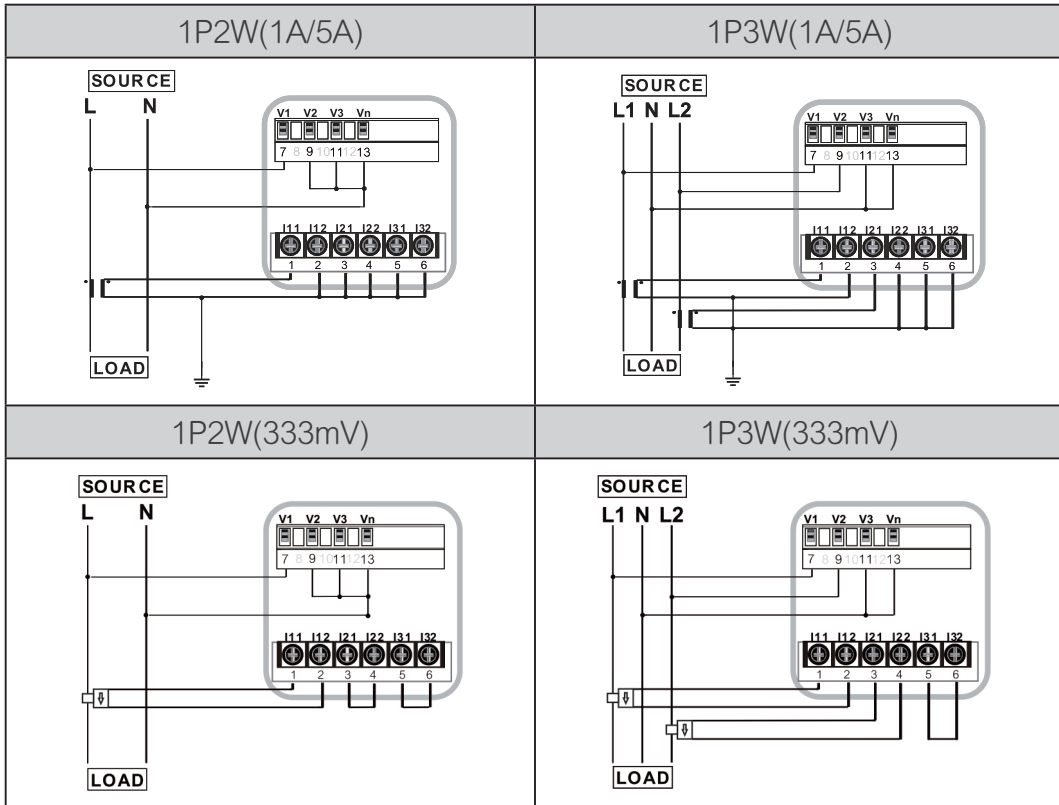


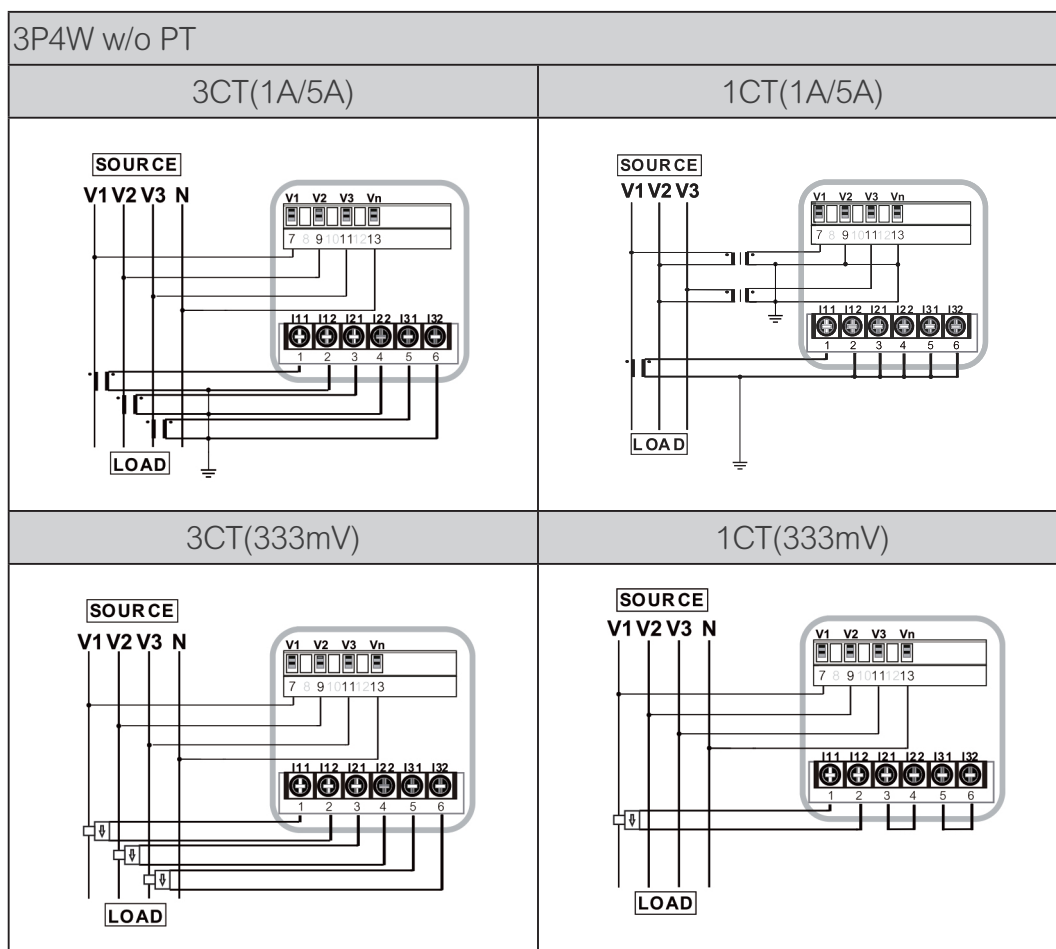
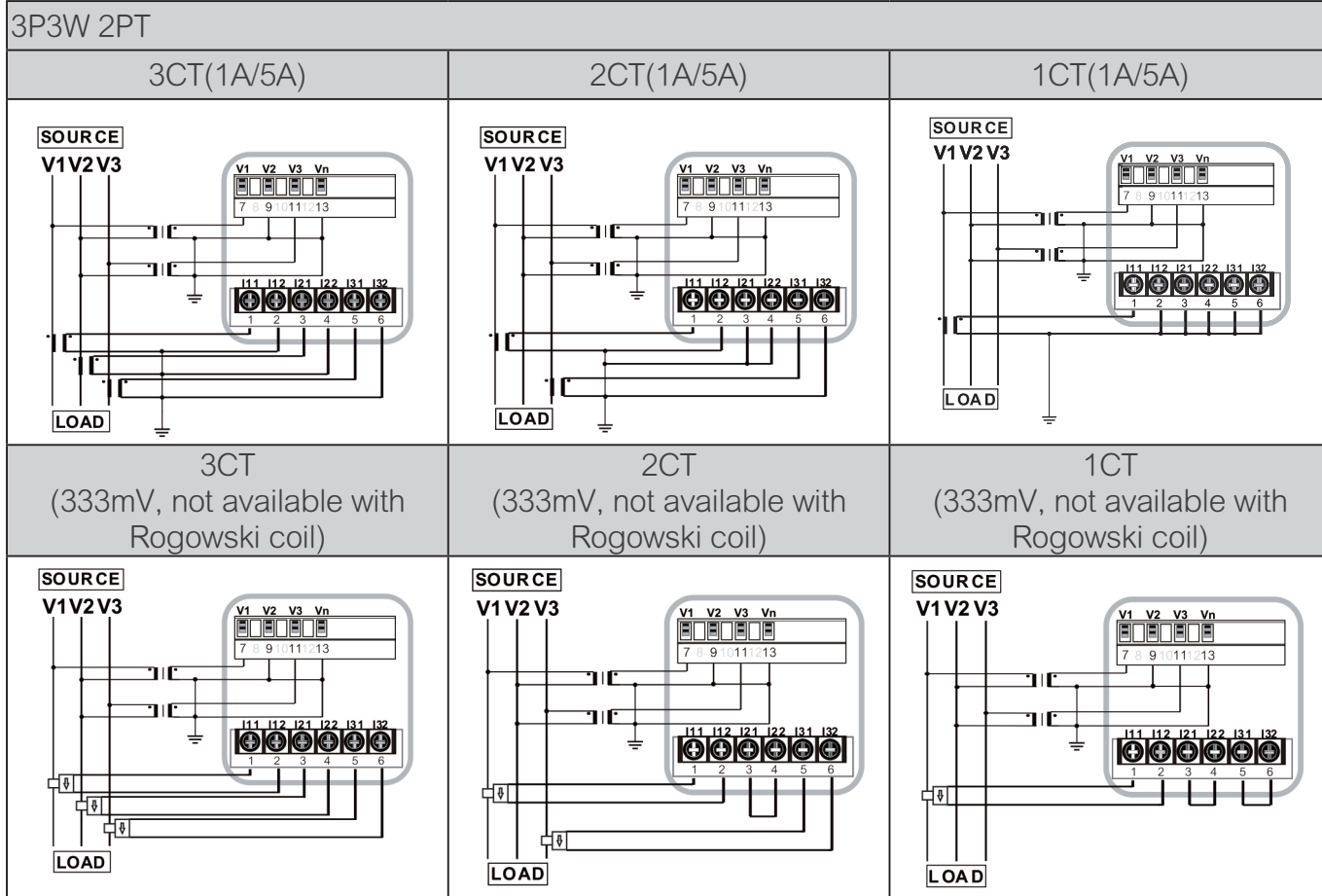
RS-485 Communication Port

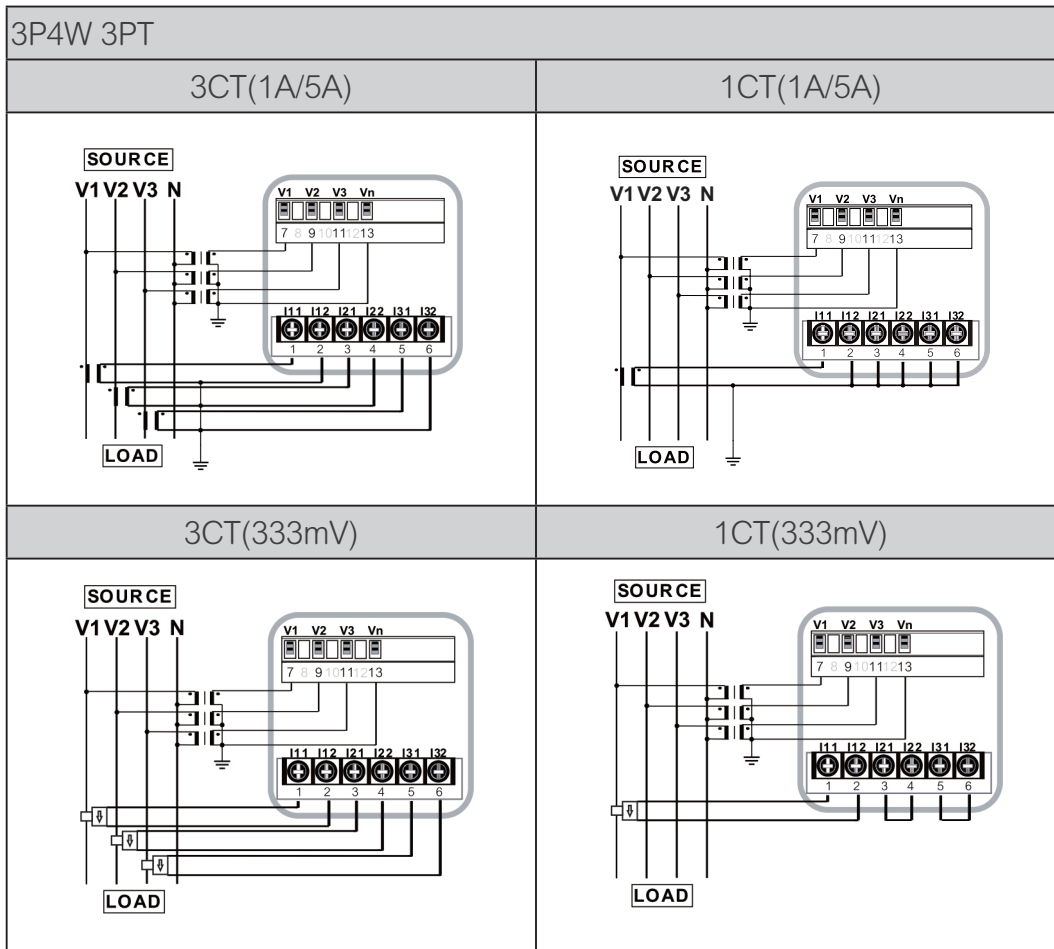


Voltage and Current Connection

CT secondary side distinguishes 1A/5A and 333mV. The mV of CT signal needs to be wired independently, and cannot be grounded or connected together with each other.







Split Core CT Ordering Information

(The output line of mV on the secondary side of the CT needs to be wired independently, and cannot be connected together or grounded for protection purposes.)

US – CTV — Hole — Primary Current — 2 — Cable Option

| CODE | Diameter(mm) | CODE | Rated Current |
|------|--------------|------|---------------|
| 10 | Φ10 | 005 | 5A |
| | | 060 | 60A |
| 16 | Φ16 | 100 | 100A |
| | | 150 | 150A |
| | | 200 | 200A |
| 35 | Φ35 | 300 | 300A |
| | | 400 | 400A |
| | | 600 | 600A |
| 50 | Φ50 | 800 | 800A |

| CODE | Cable Spec. |
|------|------------------------|
| LSFH | Low smoke zero halogen |

This code is not filled when there is no optional function

| Type | Current of primary (A) | Voltage of secondary (mV) | Accuracy %F.S. | Weight |
|---------------|------------------------|---------------------------|----------------|--------|
| US-CTV-10-005 | 5A | 333 | 1.0 | 60g |
| US-CTV-16-060 | 60A | 333 | 0.5 | 100g |
| US-CTV-16-100 | 100A | 333 | 0.5 | 100g |
| US-CTV-16-150 | 150A | 333 | 0.5 | 100g |
| US-CTV-24-200 | 200A | 333 | 0.5 | 205g |
| US-CTV-35-300 | 300A | 333 | 0.5 | 375g |
| US-CTV-35-400 | 400A | 333 | 0.5 | 375g |
| US-CTV-35-600 | 600A | 333 | 0.5 | 375g |
| US-CTV-50-800 | 800A | 333 | 0.5 | 655g |

