AC POWER MONITOR
(SD Memory Card Type)

DATA SHEET

PPMC-3

The AC power monitor calculates and indicates active power, reactive power, integrated power, integrated reactive power, frequency and power factor through measurement of single or three-phase AC voltage and current, and stores the measured data.

Voltage is input directly or via a step-down transformer, and current is measured with a general-purpose current sensor (CT) of secondary-side current of 5A or 1A.

FEATURES

1. Readily connectable to existing wiring
   Because this monitor is compact (48 × 96 × 100) and lightweight, it can be readily installed in individual facilities, equipment, and distribution board with limited installation space. Since a CT of secondary-side current of 5A/1A that is generally used in the field of power measurement can be used and its secondary-side current can be directly input, a relay CT is not required and wiring can be facilitated.
2. Easy data recording and acquisition
   For saving and recording measured data, an SD memory card is usable. Data in a long time can be saved. The saved data can be loaded and edited with the card inserted in the card slot of a personal computer. Thus data acquisition by SD memory card does not involve placement of communication cables.
3. Collective monitor possible via network
   Centralized monitoring and control of distributed measurement points can be implemented via an RS-485 communication interface. There are two methods selectable; real-time acquisition of measured data with a personal computer and loading of data recorded on an SD memory card into a personal computer.

SPECIFICATIONS

Input specification

1. **Measurement method:**
   1-phase 2-wire, 1-phase 3-wire and 3-phase 3-wire

2. **Input voltage:**
   - Rated input voltage: 200V AC
   - Measurement input voltage: 20V to 240V AC
   - Effective input voltage (accuracy-guaranteed voltage): 20 to 240V AC
   - Allowable input voltage: 1.2 times the rated voltage (continuous), 1.5 times (for 10 sec)
   (Note 1) In a 440V, 3300V or 6600V system, step-down is required with a transformer installed externally.
   (Note 2) Voltage is isolated with the internal transformer.
   (Note 3) For without voltage measurement, the value of the voltage and power factor should be set by the operation key.

3. **Input current**
   - Rated input current: 5A AC (secondary current of current sensor)
   - Measurement input current: 0A to 5.5A AC (secondary current of current sensor)
   - Accuracy-guaranteed range: 0.1 to 5.5A AC
4. **Allowable input current:** 1.5 times the rated current (for 10 sec)
5. **Frequency:** 45 to 65 Hz
6. **Power factor:** 0.0 to 1.0 (no distinction between lead and lag)
7. **Input protection:**
   - Excessive line voltage: Surge absorber
   - Common mode voltage: Transformer
   - Overvoltage at current input terminal: Antiparallel diode

Fuji Electric Co., Ltd.

Indication unit specification

1. Numerical indication:
     4 digits, 7-segment LED, red
2. Selected item indication:
     2-color LED, red, green
Contents and range of data indication

Data	Contents of indication	Indication range	Remarks
Voltage	Instantaneous and mean effective values	20V to 9999V	– – – – (horizontal bar) is indicated in case of 20 V or less.
Current	Instantaneous and mean effective values	0.01A to 9999A	– – – – (horizontal bar) is indicated in case of about 0.01A or less.
Power	Instantaneous and mean value	-999kW to 9999kW	
Reactive power	Instantaneous and mean value	-999kvar to 9999kvar	Reactive power calculation method is used.
Integrated power	Integrated power value	0 to 9999 × 100kWh	
Integrated reactive power	Integrated reactive power value	0 to 9999 × 100kvarh	
Frequency	Instantaneous and mean value	10.0Hz to 99.9Hz	
Power factor	Instantaneous and mean value	0.00 to 1.00	

(Note 1) When integrated power or integrated reactive power value exceeds 999999, it returns to 0 and integration restarts.
(Note 2) When current, power or reactive power rises beyond 9999, "ovr" is indicated. And when power, integrated power, reactive power or integrated reactive power falls below -999, "-ovr" is indicated.
(Note 3) If the input signal has much distortion, the error of measurement accuracy is large.
(Note4) It takes a second for PPMC to respond to the master's command.

Indication accuracy

(With voltage measurement)

1. Voltage: ±1% FS
     (Note) FS (Full Span) = 200 V
2. Current: ±1% FS
     (Note) FS: 5A × CT ratio (in case of 5A (secondary) CT)
          1A × CT ratio (in case of 1A (secondary) CT)
3. Power: ±1.5% FS
     (Note 1) FS: 1.73kW × CT ratio
          (5A (secondary) CT, 3-phase 3-wire system)
          2kW × CT ratio
          (5A (secondary) CT, 1-phase 3-wire system)
          1kW × CT ratio
          (5A (secondary) CT, 1-phase 2-wire system)
          0.35kW × CT ratio
          (1A (secondary) CT, 3-phase 3-wire system)
          0.4kW × CT ratio
          (1A (secondary) CT, 1-phase 3-wire system)
          0.2kW × CT ratio
          (1A (secondary) CT, 1-phase 2-wire system)
     (Note 2) At power factor 0.67 to 1
4. Reactive power: ±3% FS
     (Note 1) FS: 1.73kvar × CT ratio
          (5A (secondary) CT, 3-phase 3-wire system)
          2kvar × CT ratio
          (5A (secondary) CT, 1-phase 3-wire system)
          1kvar × CT ratio
          (5A (secondary) CT, 1-phase 2-wire system)
          0.35kvar × CT ratio
          (1A (secondary) CT, 3-phase 3-wire system)
          0.4kvar × CT ratio
          (1A (secondary) CT, 1-phase 3-wire system)
          0.2kvar × CT ratio
          (1A (secondary) CT, 1-phase 2-wire system)
     (Note 2) At power factor 0.67 to 1
5. Integrated power: ±1.5% FS
6. Integrated reactive power: ±3% FS

7. Frequency: ±0.5%
8. Power factor: ±10% FS (Note) FS; 1.0

Specification of operation unit

1. Operation key: 4 keys, pushbutton type
2. Operation key function:
     • Indication data changeover:
          Voltage, current, power, reactive power, integrated power, integrated reactive power, frequency, power factor
     • Measurement condition setting - 1:
       • Selection of the number of phases:
          1-phase 2-wire, 1-phase 3-wire or 3-phase 3-wire, factory-set to "3-phase 3-wire"
       • Setting of current sensor (CT) ratio:
          0 to 9999, factory-set to "1"
       • Selection of primary voltage of externally installed transformer:
          non (none), 220V, 440V, 3300V or 6600V, factory-set to "non (none)"
       • Setting of power alarm value:
          0 to 9999 kW, factory-set to "9999"
       • Selection of measurement mode:
          Usual measurement mode/energy saving mode, factory-set to "usual measurement mode"
          (Note) Energy saving mode is a function scheduled to be added in future.
       • Setting of data saving interval:
          (Common for internal system of this monitor and SD memory card) 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 30, 40, 45, 50, 60 or 120 min, factory-set to "5 min"
       • Integrated power pulse output unit:
          non (none), -3 (= 0.001kWh), -2 (= 0.01kWh), -1 (= 0.1kWh), 0 (= 1kWh), 1 (= 10kWh), 2 (= 100kWh) Factory-set to "non"
     • Measurement condition setting - 2:
       • Setting of LED indication ON time:
          Always ON or time period till OFF after end of operation is to be set. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 30, 40, 45, 50 or 60 min, factory-set to "usually ON"
          (Note) For turning ON the LED indication after OFF, press any key.
       • Setting of monitor ID No.:
          Factory-set in 6 alphanumeric characters (This number is the same as the serial No. of this monitor. The serial No. is marked on the nameplate of this monitor.)
       • Selection of communication protocol:
          nor (our company's system) or Modbus RTU mode, factory-set to "nor"
       • Calendar setting:
          Display and setting of the date in the equipment
       • Setting of time:
          Display and setting of the internal clock of this instrument

• Setting of fixed voltage value:

    0 to 9999 V, factory-set to "0V"

    (Note) When the fifth digit of the code symbol is specified as "E" (without voltage measurement), the instrument operates at this voltage setting.

• Setting of fixed power factor value:

    0.01 to 1.00, factory-set to "1.00"

    (Note) When the fifth digit of the code symbol is specified as "E" (without voltage measurement), the instrument operates at this power factor setting.

• Transmission rate:

    9.6 (9.6kbps), 19.2 (19.2kbps), 4.8 (4.8kbps)

    Factory-set to "9.6"

• Data length and parity:

    8n (data 8 bits, no parity),
    8o (data 8 bits, odd parity),
    8E (data 8 bits, even parity),
    7n (data 7 bits, no parity),
    7o (data 7 bits, odd parity),
    7E (data 7 bits, even parity),
    Factory-set to "8n"

    (Note) In case the rtu(MODBUS RTU MODE) is selected at selection of communication protocol, data 7 bit can not be used.

Data saving specification

1. Internal system of this monitor:

• Recording device:

    IC memory

• Data to be saved:

    Year, month, date, hour, minute and second of measurement start, mean voltage, mean current, mean power, maximum voltage, maximum current, maximum power, integrated power, mean reactive power, maximum reactive power, integrated reactive power and mean power factor in each saving time interval

    In case of 1-phase 3-wire sytem and 3-phase 3-wire system, data of voltage and current will be saved in 2 channels.

• Saving time interval:

    1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 30, 40, 45, 50, 60 or 120 min, factory-set to "5 min"

• Data saving volume:

    For 1 day (single/three phases, at saving interval 1 min)

    (Note) When an SD memory card is inserted into this monitor, one-day data saved in the monitor will be transferred to the memory card at 00:00 every day and at the same time, the data saved in the monitor will be deleted.

    When the monitor does not have an SD memory card, its data will be overwritten in the chronological order.

• Memory protection:

    By lithium battery cell having a service life of 5 years or longer (at normal temperature)

• Saved data readout method:

    Data transferred to an SD memory card can be read out. For details, refer to item 2 below.

2. SD memory card (option):

    Memory card must be separately purchased.

• Recording medium:

    Flash memory of 128MB to 2GB CLAS94

• Trademark: SD memory card

• Data to be saved:

    Year, month, date, hour, minute and second of measurement start, mean voltage, mean current, mean power, maximum voltage, maximum current, maximum power, integrated power, mean reactive power, maximum reactive power, integrated reactive power and mean power factor in each saving time interval

    In case of 1-phase 3-wire system and 3-phase 3-wire system, data of voltage and current will be saved in 2 channels.

• Saving method:

    Automatically (daily at 00:00) or manually saved

    File name: (ID No.)¥(yymmddnn)

        yymmdd: year, month, day
        nn   : 2-digit serial No.

• Saving time interval:

    1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 30, 40, 45, 50, 60 or 120 min, factory-set to "5 min"

• Data saving volume:

    1 year or longer (at saving time interval 5 min)

    (Note) When memory has been used completely, data saving stops with "FULL" messaged in the indication block. For reusing the memory, the data-saved file must be deleted. The file can be deleted by the same method as with a personal computer.

• Saved data readout method:

    Saved data can be read out with a host machine such as a personal computer via a communication interface using the data acquisition software for personal computers separately sold, or directly read out by a personal computer via a SD card adapter.

    (Note) While a memory card is inserted or data is saved, functions for input/output, calculation and communication remain inactive (for about 3 to 10 sec).

• Data format: CSVformat

    (Note) It takes a while to save the measured data if too much saved files exist in the SD card. In this case, the data saving time interval may not conducted properly for measured data. When the number of file data exceed to 60 files, please remove the measured data from SD card.

Calendar specification

- Item to be set and indicated:

  Year, month, day, hour, minute, second
- Yearly error:

  0.3 hour or less
- Memory protection:

  By lithium battery cell having a service life of 5 years or longer (at normal temperature)
- Time setting:

  Year, month, day, hour, minute, and second can be set on the master side using communication function. Hour and minute can also be set using the operation switch on this instrument.

Alarm output specification

- Kind: Power alarm
- Alarm settable range:

  0 to 9999 kW, factory-set to "9999"
- Alarm output:

  Open collector, 1 point, 30 V/100 mA
  Alarm output terminal is also used for integrated power pulse output. So when provision of integrated power pulse output is selected, alarm output function can not be used.

Pulse output specification of integrated power

- Unit of pulse output:

  0.001kWh/pulse, 0.01kWh/pulse, 0.1kWh/pulse, 1kWh/pulse, 10kWh/pulse, 100kWh/pulse non (none)
- Pulse outpu type:

  Open collector, 1 point, 30V/100mA
- Pulse width: 100ms
- Minimum output interval: 1 sec.
  (Note 1) This interval has been factory-set to "non."
  (Note 2) Integrated power pulse output terminal is also used for alarm output. So when provision of alarm output is selected, integrated power pulse output function cannot be used.

Communication specification (option)

1. Interface: EIA RS-485 and RS-232C
2. Communication protocol:

   Unique to our company and MODBUS RTU mode
3. Communication method:

   Half-duplex, bit serial, start-stop synchronization
4. Data format: Data length : 8 bits, 7 bits

   Parity   : no parity, odd, even

   Factory-set : 8 bits, no parity
5. Communication speed:

   4800bps, 9600bps, 19200bps

   Factory-set : 9600bps

   *RS232C/RS-485 signal convertor (in case of using RS485 communication):

   Generally used for connection with personal computer via the RS-485 interface.

Recommended item: Type KS-485PTI (manufacturer: System Sacom,Japan)
Note) In case the rtu(MODBUS RTU MODE) is selected at selection of communication protocol, data 7 bit can not be used.

6. Data acquisition software for Fuji AC power monitor:

   Following operations can be performed by Personal computer using this software.

   ⌈ This software only support fuji's communication protocol and does not support the MODBUS protocol. ⌋

   Data acquisition software can be downloaded at our homepage.

   Note) This software is only applicable to the Japanese OS.

- Real-time readout and deletion of measured data in which the main unit have the specified ID
  - Data to be measured:

    Date of measurement (year, month, day, hour, minute, second), voltage, current, power, reactive power, integrated power, integrated reactive power, frequency, power factor.
- Readout and deletion of data saved on the SD memory card in which the main unit have the specified ID
  - Data to be saved:

    Date of measurement (year, month, day, hour, minute, second), average voltage in data saving time interval, average current, average power, maximum voltage, maximum current, maximum power, integrated power, average reactive power, maximum reactive power, integrated reactive power, average power factor.

    In case of 1-phase 3wire system and 3-phase 3wire system, the data of volatage and current will be saved in 2 channels.
- Operation of the main unit:

  Key operation to the main unit is available on the master side remotely as same as the main unit having the specified ID.
- Readout, change and resetting of measurement conditions set on the main unit having the specified ID.
  - Readable and changeable measurement conditions:

    Primary voltage of measurement circuit of externally installed transformer, CT ratio, power alarm set value, data saving time interval, LED indication ON time, fixed voltage, fixed power factor, pulse output unit, calender (year, month, day, hour, minute, second)
  - Resettable items:

    Alarm, integrated power, integrated reactive power
- Setting of the communication port for personal computer

Power requirement

- Rated line supply voltage:
  100 V to 220 V AC, 50/60 Hz
- Usable line supply voltage:
  90 V to 264 V AC, 50/60 Hz
- Power consumption:
  About 5 VA

Operating environment

- Temperature limits:
  -10 to 50ºC
- Humidity limits:
  90% RH or less (non-condensation)

Transport and storage conditions

- Temperature limits:
  -20 to 60ºC
- Humidity limits:
  90% RH or less (non-condensation)
- Shock: Package endures a fall within a height of 1 m.

General performance and characteristic

- Response time:
  About 1 sec
- Insulation resistance:
  100 MΩ or more/500 V DC
- Dielectric strength:
  2000 V AC for 1 min between voltage input terminal and internal circuit
  2000 V AC for 1 min between power supply terminal and internal circuit [

Structure

- Enclosure: Plastic case (material: PC-ABS)
- Flame resistance:
  UL94V-0
- Finish color:
  Ivory
- External dimensions (W × H × D):
  48 × 96 × 100 mm
- Mass: About 400 g
- Mounting: Flush with panel
- External terminal:
  Screw terminal (M3.5)

CODE SYMBOLS

1. AC power monitor main unit

PPM

			4	5	6	7	8	9
			C		B		3	

Digit	Specification	Note	4	5	6	7	8	9
4	<Application> General-purpose CT input		C					
5	<No. of phases, with/without voltage measurement> 1-phase 2-wire, 1-phase 3-wire, 3-phase 3-wire/without voltage measurement 1-phase 2-wire, 1-phase 3-wire, 3-phase 3-wire/with voltage measurement	Note		E F				
6	<Operation key, indicator> With operation key, with indicator				B			
7	<Communication function> None RS-485/RS-232C					Y R		
8	<Revision No.>						3	
9	<Memory card function> None Provided (memory card should be ordered separately)							Y S

(Note) Notes in the case where "without voltage measurement" is specified
When "without voltage measurement" is specified, the instrument measures current value only. (It is required to set voltage and power factor value with operation keys or via communication function of the master beforehand.)
Calculate the power and integrated power from the voltage setting, power factor setting, and the actual current measurement value.
It is not suitable for the measurement of the load with large voltage fluctuation or power factor variation, or when these values are not known.
To use the instrument for those purposes, specify "with voltage measurement."

2. Items to be ordered separately

Item	Type
SD Memory card (2GB, CLASS4, Manufactured by Panasonic)	RP-SDP02GJ1K
Front cover	TK4G1615p1

3. Recommended items

Item	Type
SD Memory card (2GB, CLASS4, Manufactured by Panasonic)	RP-SDP02GJ1K
RS-485/RS-232C converter	KS485-PT1
Converter cable	CBL-16

* Prepare the recommended products depending on your usage environment.
* If you use the products other than those above, we cannot guarantee a proper opperation.

4. General-purpose CT

General-purpose CT of secondary-side current of 5A or 1A must be supplied separately.

SCOPE OF DELIVERY

AC power monitor main unit, mounting bracket, instruction manual, overvoltage limitter for current input (2 pcs)
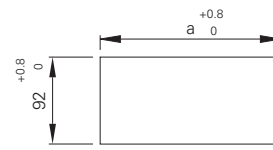
ODERING INFORMATION

1. Type of AC Power Monitor main unit
2. Optional device name and type

OUTLINE DIAGRAM (Unit: mm)

Mounting bracket

12

100

48

96

90.5

114.5

t

Panel

1≦t≦8

Panel cutout

45 +0.6 0

92 +0.8 0

116MIN.

50MIN.
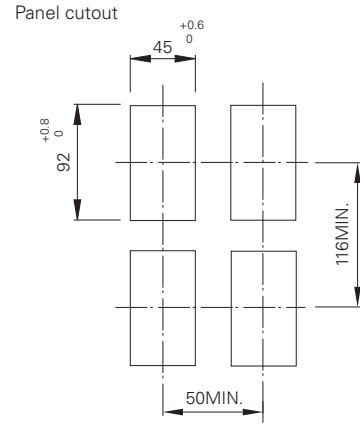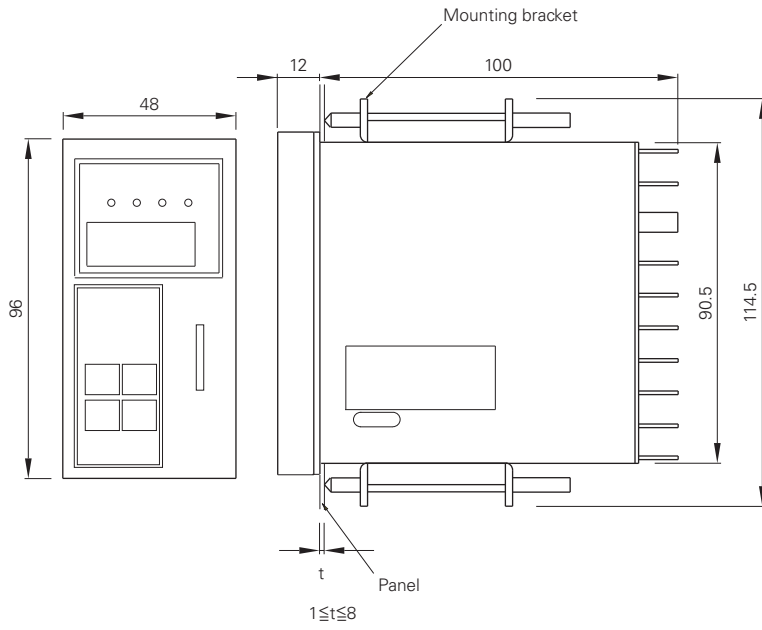
For closely installing multiple units side by side

a +0.8 0

92 +0.8 0

Number of units	2	3	4	5	6
a	93	141	189	237	285

CONNECTION DIAGRAM

External terminal (M3.5 screw)

(Alarm output/integrated power pulse output)	1	10	(R-phase (1) current k (ch0))
(Alarm common/integral power pulse common)	2	11	(R-phase (1) current l (ch0))
(RS485 (A+))	3	12	(T-phase (3) current k (ch1))
(RS485 (B–))	4	13	(T-phase (3) current l (ch1))
(RS232C (TX))	5	14	(R-S phase (1-2) voltage (ch0))
(RS232C (RX))	6	15	(Voltage common)
(RS232C (COM))	7	16	(T-S phase (3-2) voltage (ch1))
(RS485 (Term))	8	17	(Instrument power supply)
(N.C.)	9	18	(Instrument power supply)

(1) In case of 3-phase 3-wire with voltage measurement and 1-phase 3-wire with voltage measurement

(Note) For an inductive load such as relay, addition of a diode is required. Maximum load should be 30V DC, 100mA.
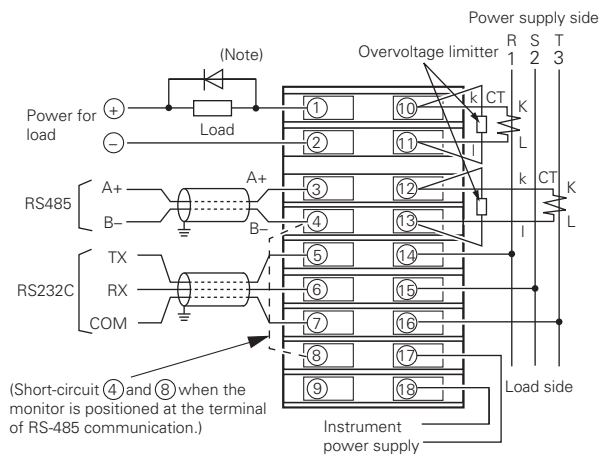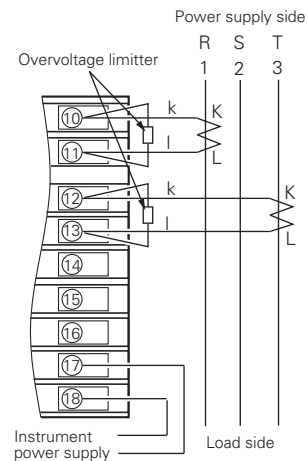
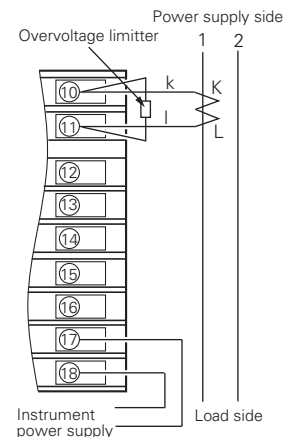### (2) In case of 1-phase 2-wire with voltage measurement
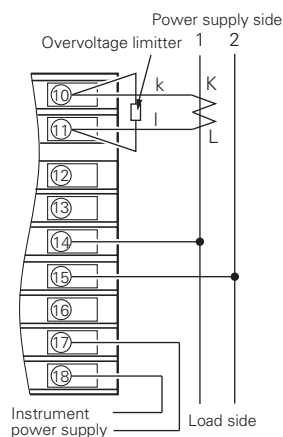
(Note) Be sure to use the overvoltage limiter supplied with this instrument.

(3) In case of 3-phase 3-wire without voltage measurement and 1-phase 3-wire without voltage measurement
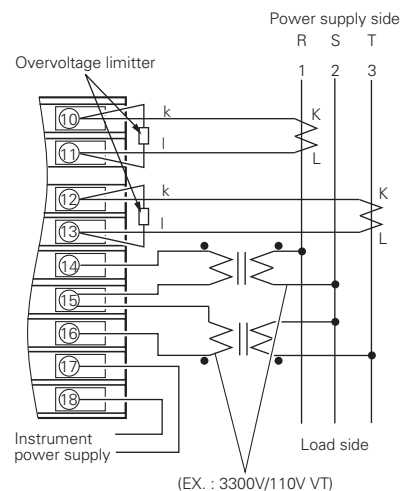

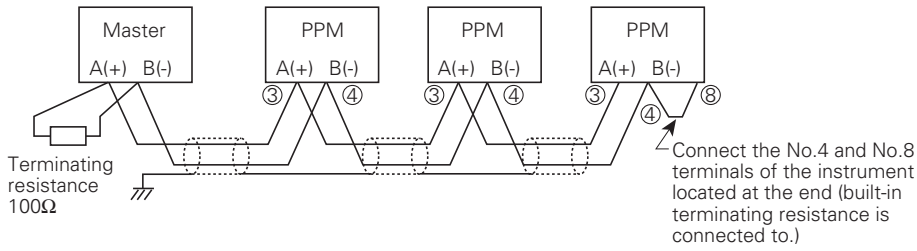### (4) In case of 1-phase 2-wire without voltage measurement

(5) Measuring example for 3300V
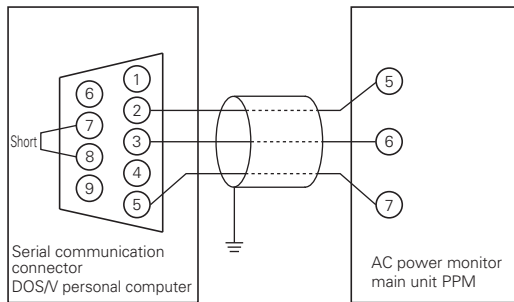
Ex.: 3-phase 3-wire measuring circuit

* Use a step-down transformer whose secondary output is 110 V.

(EX. : 3300V/110V VT)

(6) Wiring for RS-485 communication

Master
A(+) B(-)

PPM
A(+) B(-)
③   ④

PPM
A(+) B(-)
③   ④

PPM
A(+) B(-)
③   ④ ⑧

Terminating
resistance
100Ω

Connect the No.4 and No.8
terminals of the instrument
located at the end (built-in
terminating resistance is
connected to.)

(7) Wiring for RS-232C communication

6 1
7 2
Short 8 3
9 4
5

5

6

7

Serial communication
connector
DOS/V personal computer

AC power monitor
main unit PPM

Note: This monitor is not a supply meter.
Note: SD™ is a registered trademark of SD Card Association.
Note: Windows and Excel are registered trademarks of Microsoft Corporation, U.S.A.

⚠ Caution on Safety

*Before using this product, be sure to read its instruction manual in advance.

Information in this catalog is subject to change without notice.   Printed in Japan