General Specifications

Model PR300
Power and Energy Meter

GS 77C01E01-01E

Under application for UL approval

Overview

This panel-mounted power and energy meter with a large, three-row LED display integrates all the measuring functions required for power management in locations such as factories and buildings into a single unit.

With the objective of working toward the preservation of the global environment by saving energy and performing equipment maintenance, the PR300 is designed to display and output the energy of various types of electrical equipment.

Features

- Saves on cost, wiring, and space
  Integrates a wide selection of functions for measuring things like energy (active, regenerative, reactive, and apparent), power (active, regenerative, reactive, and apparent), voltage, current, frequency, and power factor into a single unit.
- Employs a large, three-row LED display
  Capable of displaying three-phase current and voltage simultaneously, and the measurement items you assign.
- Analog output function
  Equipped with a transducer function for power (active, regenerative, reactive, and apparent), voltage, current, frequency, and power factor (4 to 20 mA DC).
- Demand measurement
  Measures the average power and current within a specified period. It also allows you to set up alarm points to output alarms.
- Equipped with a multitude of functions
  Enables measurement of the maximum and minimum values of voltage and the maximum value of current, as well as, for example, the use of external digital input to measure energy at arbitrary times.
- Pulse output
  Capable of outputting pulses proportional to energy (one measurement item from active, regenerative, reactive, and apparent energy).
- Converts the phase and wire system of an AC power system and an input voltage circuit to a universal format
  The PR300 can handle from the single-phase two-wire system and single-phase three-wire system to the three-phase three-wire system and three-phase four-wire system, and also universally cope with input voltage circuits up to 600 V AC.
- Compatible with ANSI 4-inch round form size and DIN 96-square instrument size
  The ability to attach and detach JIS/ANSI-mounting kit makes the PR300 compatible with panel cutouts of ANSI 4-inch round form, JIS 110-square instrument size, and DIN 96-square instrument size.
- Standard equipped with an RS-485 communication function and capable of Ethernet communication
- Compatible with overseas requirements
  Power line indications A, B, and C provided for overseas use, in addition to R, S, and T

ANSI 4-inch round form size

DIN 96-square instrument size

The ability to attach and detach JIS/ANSI-mounting kit ensures compatibility with two sizes.

Model and Suffix Codes

PR300 - □ □ □ □ □ - □ □-0

Model

Phase and wire system
- 3: Universal three-phase three-wire system (single-phase two-wire, single-phase three-wire, and three-phase three-wire systems)
- 4: Universal three-phase four-wire system (single-phase two-wire, single-phase three-wire, three-phase three-wire, and three-phase four-wire systems)
- 5: Three-phase four-wire system (2.5 element)*1

Input voltage/input current
- 1: Universal voltage input*2 (150 V, 300V, 600 V) / 1 A AC
- 2: Universal voltage input*2 (150 V, 300 V, 600 V) / 5 A AC

Additional input and output function
- 0: 1 digital input
- 1: 1 digital input, 1 analog output
- 2: 1 digital input, 1 pulse output
- 3: 1 digital input, 1 analog output, 1 pulse output

Communication function
- 0: RS-485 communication
- 3: RS-485 communication, Ethernet communication*3

Optional measuring function
- 0: None
- 3: Demand measurement (1 demand alarm output)

Power supply
- 6: 100-240 V AC ±10% (50/60 Hz) or 130-300 V DC ±15%

Phase indication format
- A: A, B, and C indications
- R: R, S, and T indications

*1 Can be used only when the voltage is in a state of equilibrium. The phase and wire system cannot be changed.
*2 Set the voltage range (150 V, 300 V, or 600 V) according to the rated input voltage to be measured. (Refer to "Rated Input Voltage" of the Input Specifications on page 6.)
*3 For Ethernet communication, the RS-485 communication interface is exclusively for the Ethernet-serial gateway function.

Ordering Information

Specify the model and suffix codes.
Example: PR300-31000-6A-0

YOKOGAWA
Yokogawa Electric Corporation

GS 77C01E01-01E

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■ Measuring Functions

Measurement item		Single-phase two-wire system	Single-phase three-wire system	Three-phase three-wire system	Three-phase four-wire system	Three-phase four-wire system (2.5 element) *3	Unit and symbol	Remarks
Active energy (+) *1		✔	✔	✔	✔	✔	kWh, MWh	
Active energy (−) *1		✔	✔	✔	✔	✔	−kWh, −MWh	Regenerative energy
Reactive energy (+) *1		✔	✔	✔	✔	*4	kvarh, Mvarh	LAG: +
Reactive energy (−) *1		✔	✔	✔	✔	*4	−kvarh, −Mvarh	LEAD: −
Apparent energy *1		✔	✔	✔	✔	*4	kVAh, MVAh	
Optional active energy *1		✔	✔	✔	✔	✔	Wh	
Active power	Instantaneous	✔	✔	✔	✔	✔	W, kW, MW	
	Maximum							
	Minimum							
Reactive power	Instantaneous	✔	✔	✔	✔	*4	var, kvar, Mvar	
	Maximum							
	Minimum							
Apparent power	Instantaneous	✔	✔	✔	✔	*4	VA, kVA, MVA	
	Maximum							
	Minimum							
Voltage-1	Instantaneous	✔	✔	✔	✔	✔	V, kV	
	Maximum							
	Minimum							
Voltage-2	Instantaneous	–	✔	–	✔	–	V, kV	
	Maximum							
	Minimum							
Voltage-3	Instantaneous	–	–	✔	✔	✔	V, kV	
	Maximum							
	Minimum							
Current-1	Instantaneous	✔	✔	✔	✔	*4	A, kA	
	Maximum							
Current-2	Instantaneous	–	✔	–	✔	–	A, kA	
	Maximum							
Current-3	Instantaneous	–	–	✔	✔	*4	A, kA	
	Maximum							
Frequency	Instantaneous	✔	✔	✔	✔	✔	Hz	Calculated from the voltage-1
	Maximum							
	Minimum							
Power factor	Instantaneous	✔	✔	✔	✔	*4	COSϕ	LAG: + LEAD: −
	Maximum							
	Minimum							
Demand current *2 — Demand current-1	Demand	✔	✔	✔	✔	*4	A, kA	
	Maximum	✔	✔	✔	✔	*4	A, kA	
Demand current-2	Demand	–	✔	–	✔	–	A, kA	
	Maximum	–	✔	–	✔	–	A, kA	
Demand current-3	Demand	–	–	✔	✔	*4	A, kA	
	Maximum	–	–	✔	✔	*4	A, kA	
Demand power *2	Demand	✔	✔	✔	✔	✔	W, kW, MW	
	Maximum	✔	✔	✔	✔	✔	W, kW, MW	

✔: Effective
−: Ineffective

*1 Integrated low-cut power can be set for each energy.
Integrated low-cut power: This is a function for not integrating power less than a set value as energy.
The setting range of integrated low-cut power is 0.05 to 20.00% of the rated power (initial value: 0.05%).
*2 Either demand power or demand current can be set as a measurement item.
*3 Can be used only when the voltage is in a state of equilibrium.
*4 Can be measured only when the current is in a state of equilibrium.

● Optional integrating function

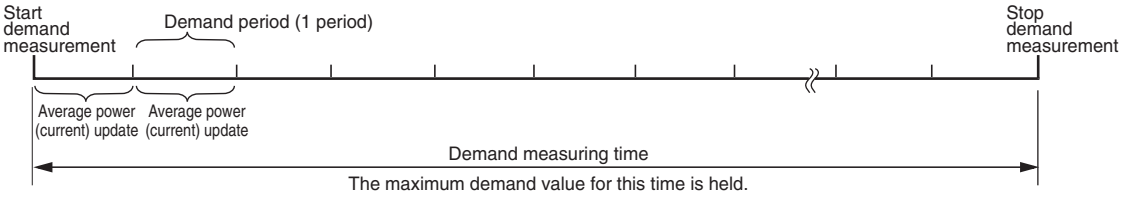
Power is integrated while a control signal for optional integration is on.
When the control signal is switched from off to on, the optional integrated value indication is reset and integration starts. (The integrated value prior to the reset is held in a register.) The integrated value cannot be guaranteed in the event of a power failure occurring during integration.

● Demand measurement (when demand measurement is specified)

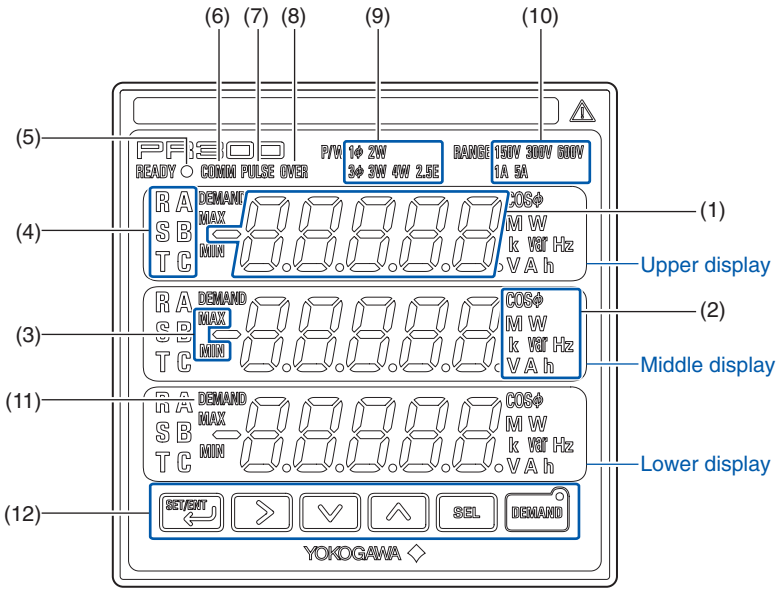
The PR300 measures average power or average current within a set demand period.
The maximum demand value for the demand measuring time is held until the power is turned off, remote reset is executed, or the next demand measurement is started.

Item	Setting Range	Resolution	Initial Value	Remarks
Demand power/current	Active power, current	–	Active power	
Demand period	1 to 60 minutes (Demand alarm mask time to 60 minutes)	1 minute	30 minutes	Demand alarm mask time ≦ Demand period
Demand alarm mask time*	1 minute to length of demand period	1 minute	1 minute	
Demand power alarm point	1 to 1000 kW	1 kW	100 kW	When demand power is selected
Demand current alarm point	1 to 1000 A	1 A	100 A	When demand current is selected
Alarm release function	Automatic release and manual release	–	Automatic release	
Data update interval	10 seconds	–	–	

* This is the time from the start of the demand period to the set time in which no judgment is made for the alarm (alarm masked). During the alarm mask time, no maximum demand value is updated and no alarm is output.



■ Display and Operation Specifications



(1) Measured Value Display

5-digit, 3-row, 7-segment LED display
Display color: red

Measured Value display:

Measurement Item	Display	
Active energy	□□□□□ [kWh, MWh]	*1
Reactive energy	± □□□□□ [kvarh, Mvarh]	*2
Apparent energy	□□□□□ [kVAh, MVAh]	*1
Regenerative energy	– □□□□□ [kWh, MWh]	*2
Optional active energy	□□□□□ [Wh]	
Active/regenerative power (instantaneous, maximum, and minimum values)	□□□□ [W, kW, MW]	*2, *3
Reactive power (instantaneous, maximum, and minimum values)	□□□□ [var, kvar, Mvar]	*2, *3
Apparent power (instantaneous, maximum, and minimum values)	□□□□ [VA, kVA, MVA]	*1, *3
Voltage (instantaneous, maximum, and minimum values)	□□□□ [V, kV]	*1, *3
Current (instantaneous and maximum values)	□□□□ [A, kA]	*2, *4
Power factor (instantaneous, maximum, and minimum values)	LEAD: d □.□□□ [COSφ] LAG: G□.□□□ [COSφ]	*3
Frequency (instantaneous, maximum, and minimum values)	□□.□ [Hz]	*3
Demand power Maximum demand power	□□□□ [W, kW, MW] [DEMAND]	*4
Demand current Maximum demand current	□□□□ [A, kA] [DEMAND]	*4

*1: Without sign, but with a decimal point
*2: With a sign and a decimal point ("+" is not indicated). Regenerative power (energy) always shows "–" negative indication. The position of a decimal point differs depending on the primary rated power, VT ratio, and CT ratio.
*3: "MAX" lights up for the maximum value and "MIN" lights up for the minimum value.
*4: "MAX" lights up for the maximum value.

Measured Value screen:

Display pattern: The measurement items you want to display are assigned to each of the upper, middle, and lower displays to provide indications using three display rows as one pattern. Up to eight display patterns can be set. The initial values are as shown in the following table. (Combinations other than those shown in the following table are also available if the parameters are set.)

Number of display patterns: Can be set in the range of 1 to 8. Pressing the SET/ENT key switches the display from "display pattern-1," "display pattern-2," and so on in order according to the number of patterns set. The initial value is "1" and only display pattern-1 is displayed when this value is set.

	Display Pattern-1	Display Pattern-2	Display Pattern-3	Display Pattern-4	Display Pattern-5	Display Pattern-6	Display Pattern-7	Display Pattern-8
Upper display	Current (Phase switch indication)*	Active power	Active energy	Current-1	Voltage-1	Current (Phase switch indication)*	Current (Phase switch indication)*	Active power
Middle display	Voltage (Phase switch indication)*	Reactive power	LEAD reactive energy	Current-2	Voltage-2	Voltage (Phase switch indication)*	Active power	Maximum demand value
Lower display	Active power	Power factor	Apparent energy	Current-3	Voltage-3	Frequency	Power factor	Demand value

* The display of current (phase switch indication) is switched between current-1, current-2, and current-3 each time the SEL key is pressed. The display of voltage (phase switch indication) is switched between voltage-1, voltage-2, and voltage-3 each time the SEL key is pressed.

<Continued on the following page>

<table>
<tr><td></td><td></td><td>VT ratio/CT ratio:
If the VT ratio and CT ratio are set, input to the PR300 is displayed after converting it to the primary input value before VT or CT. The VT and CT ratios can be set via communication or using the operation keys.
VT ratio setting range: 1 to 6000*
CT ratio setting range: 0.05 to 32000*
* Set the VT ratio and CT ratio so that [secondary rated power] × [VT ratio] × [CT ratio] is smaller than 10 GW.</td></tr>
<tr><td>(2)</td><td>Unit Lamps</td><td>The relevant unit lamp lights up according to a measurement item and measured value.
Display color: red</td></tr>
<tr><td>(3)</td><td>MAX and MIN Lamps</td><td>Either the MAX or MIN lamp lights up when a maximum or minimum measured value is displayed.
Display color: red</td></tr>
<tr><td>(4)</td><td>Phase Indication Lamps</td><td>Indicate the phase to which the measured value corresponds. (The A, B, and C indications or R, S, and T indications should be specified in accordance with the suffix code.)
Display color: red
<table>
<tr><th>Phase and Wire System</th><th>Voltage-1</th><th>Voltage-2</th><th>Voltage-3</th><th>Current-1</th><th>Current-2</th><th>Current-3</th></tr>
<tr><td>Single-phase two-wire system</td><td>A (R)</td><td>–</td><td>–</td><td>A (R)</td><td>–</td><td>–</td></tr>
<tr><td>Single-phase three-wire system</td><td>A, B (R, S)</td><td>B, C (S, T)</td><td>–</td><td>A (R)</td><td>C (T)</td><td>–</td></tr>
<tr><td>Three-phase three-wire system</td><td>A, B (R, S)</td><td>–</td><td>B, C (S, T)</td><td>A (R)</td><td>–</td><td>C (T)</td></tr>
<tr><td>Three-phase four-wire system</td><td>A (R)</td><td>B (S)</td><td>C (T)</td><td>A (R)</td><td>B (S)</td><td>C (T)</td></tr>
<tr><td>Three-phase four-wire system (2.5 element)</td><td>A (R)</td><td>–</td><td>C (T)</td><td>A (R)*</td><td>–</td><td>C (T)*</td></tr>
</table>
* Can be measured only when the current is in a state of equilibrium.</td></tr>
<tr><td>(5)</td><td>Power Lamp</td><td>Lights up when power is supplied.
Blinks (4 times/sec) until it returns to normal when the communication error occurs.
Display color: green</td></tr>
<tr><td>(6)</td><td>Communication Lamp</td><td>Blinks during communication (RS-485 or Ethernet).
Display color: green</td></tr>
<tr><td>(7)</td><td>Pulse Output Lamp</td><td>Lights up when output is produced during pulse output, and goes out when no output is produced.
Display color: green</td></tr>
<tr><td>(8)</td><td>Demand Alarm Lamp</td><td>If a demand value exceeds the demand alarm point at a time other than during the alarm mask time, the OVER lamp lights up to indicate the occurrence of an alarm.
Display color: red</td></tr>
<tr><td>(9)</td><td>Phase and Wire System Lamps</td><td>The lamps of the phase and wire system that have been set light up.
Display color: green</td></tr>
<tr><td>(10)</td><td>Input Range Lamps</td><td>The input voltage range (150 V, 300 V, or 600 V) and input current range (1 A or 5 A) that have been set light up.
Display color: green</td></tr>
<tr><td>(11)</td><td>DEMAND Lamp</td><td>Lights up when a demand value is displayed.
Display color: red</td></tr>
<tr><td rowspan="5">(12)</td><td rowspan="5">Operation Keys</td><td> 

Used to switch measured value display patterns.
This key is also used for setting parameters.</td></tr>
<tr><td> 
Used to move the display digit during energy indication.
This key is also used for setting parameters.</td></tr>
<tr><td> 
Used to display the maximum or minimum measured value.
These keys are also used for setting parameters.</td></tr>
<tr><td> 

Used to switch phase indications when the PR300 displays a voltage or current for which phase indication can be changed. (Phase switch indication is not available for single-phase two-wire system.)
This key is also used for setting parameters.</td></tr>
<tr><td> 

Used to start/stop demand measurement.
The lamp in the key lights up during demand measurement. Display color: green</td></tr>
<tr><td colspan="2">Indicator-out Mode Setting</td><td>This function turns off LEDs after a certain time elapses, with the exception of the power lamp (LED).
The ON/OFF setting of the indicator-out mode function and the wait time before entering the indicator-out mode can be set using the operation keys. (Cannot be set via communication.)
Indicator-out mode: ON/OFF (initial value: OFF)
Indicator-out mode wait time: 1 to 60 minutes (resolution: 1 minute) (initial value: 10 minutes)</td></tr>
<tr><td colspan="2">A/D Sampling Rate,
Data Update Interval</td><td>A/D sampling rate: 4.8 kHz
Internal measurement data: display/communication data is updated at an interval of 1 second or less</td></tr>
</table>

■ Input Specifications

Phase and Wire System

- Universal three-phase three-wire system (switch the setting from single-phase two-wire system, single-phase three-wire system, or three-phase three-wire system)
- Universal three-phase four-wire system (switch the setting from single-phase two-wire system, single-phase three-wire system, three-phase three-wire system, or three-phase four-wire system)
- Three-phase four-wire system (2.5 element)

Frequency

45 to 65 Hz

Rated Input Voltage

Rated Voltage	Voltage Range (Variable)	Allowable Input Voltage
120 V	150 V	150 V
240 V	300 V	300 V
480 V	600 V	600 V

Rated Input Current

Rated Current	Current Range (Fixed)	Allowable Input Current
1 A	1 A	1.2 times the current range (continuous) Twice the current range (10 seconds) or 10 times the current range (3 seconds)
5 A	5 A	

Rated Input Power and Measuring Range (When VT and CT are used, their respective secondary values)

• Single-phase two-wire system

Input (AC) Rated Power	Input Measuring Range	Approximate Consumed VA Voltage	Approximate Consumed VA Current
120 V / 1 A 100 W	−120 to 120 W	0.2 VA	0.2 VA
120 V / 5 A 500 W	−600 to 600 W		
240 V / 1 A 200 W	−240 to 240 W	0.4 VA	
240 V / 5 A 1000 W	−1200 to 1200 W		
480 V / 1 A 400 W	−480 to 480 W	0.8 VA	
480 V / 5 A 2000 W	−2400 to 2400 W		

• Single-phase three-wire system

Input (AC) Rated Power	Input Measuring Range	Approximate Consumed VA Voltage	Approximate Consumed VA Current
240 V / 1 A 200 W	−240 to 240 W	0.2 VA/ phase	0.2 VA/ phase
240 V / 5 A 1000 W	−1200 to 1200 W		

• Three-phase three-wire system

Input (AC) Rated Power	Input Measuring Range	Approximate Consumed VA Voltage	Approximate Consumed VA Current
120 V / 1 A 200 W	−240 to 240 W	0.2 VA/ phase	0.2 VA/ phase
120 V / 5 A 1000 W	−1200 to 1200 W		
240 V / 1 A 400 W	−480 to 480 W	0.4 VA/ phase	
240 V / 5 A 2000 W	−2400 to 2400 W		
480 V / 1 A 800 W	−960 to 960 W	0.8 VA/ phase	
480 V / 5 A 4000 W	−4800 to 4800 W		

• Three-phase four-wire system

Input (AC) Rated Power	Input Measuring Range	Approximate Consumed VA Voltage	Approximate Consumed VA Current
120 V / 1 A 300 W	−360 to 360 W	0.2 VA/ phase	0.2 VA/ phase
120 V / 5 A 1500 W	−1800 to 1800 W		
240 V / 1 A 600 W	−720 to 720 W	0.4 VA/ phase	
240 V / 5 A 3000 W	−3600 to 3600 W		
480 V / 1 A 1200 W	−1440 to 1440 W	0.8 VA/ phase	
480 V / 5 A 6000 W	−7200 to 7200 W		

• Input measuring range when VT and CT are used

The primary input power (Secondary rated power × 1.2 × VT ratio × CT ratio) is smaller than 10 GW and the value calculated by the following equation is within the input measuring range mentioned above.

$$\text{Input measuring range (W)} = \frac{\text{Primary input power (W)}}{\text{VT ratio} \times \text{CT ratio}}$$

■ Digital Input Specifications

For digital input, either the optional integration start/stop or the demand alarm release can be used.
If demand measurement is specified for an optional measuring function, digital input enters demand alarm release status. In this case, the optional integration start/stop cannot be used.

● Control signal for optional integration

Function	Starts or stops optional integration.
Number of Inputs	1
Input Signal	Voltage signal* ON signal: 4.5 to 25 V DC OFF signal: within ±1 V DC
Minimum ON time	50 ms

* A special order can be placed for no-voltage contact.

Note: Optional integration control is also possible via communication.
Once control is performed by digital input, only digital input-based control is available. Communication-based control is no longer possible until the power is turned off/on or remote reset is executed.

● Demand alarm release (when demand measurement is specified)

Function	Cancels demand alarm.
Number of Inputs	1
Input Signal	Voltage signal* ON signal:4.5 to 25 V DC OFF signal: within ±1 V DC
Minimum ON time	50 ms

* A special order can be placed for no-voltage contact.

■ Analog Output Specifications (When Analog Output is Specified)

Function	Converts measurement data into DC current for output.	
Measurement Item for Output	One item selected from active power, reactive power, apparent power, voltage (1 to 3), current (1 to 3), power factor, and frequency	
Output Signal	4 to 20 mA DC	
Output Accuracy	Measurement accuracy of measurement item for output + (±0.5% of F.S.)	
Allowable Load Resistance	0 to 600 Ω	
Response speed	2 seconds or less (until ±1% of the final value is reached)	
Setting Item	Measurement item for output and the lower and upper limits of scaling. Initial value: active power (W), lower limit of scaling: 50% (0 W), upper limit of scaling: 100% (maximum value of the input measuring range W) Scaling setting condition: upper limit of scaling − lower limit of scaling ≧ 50%	
Setting Range of Lower/Upper Limits of Scaling According to Measurement Item for Output	Active power	−rated power (W) to rated power (W)
	Reactive power	−rated power (var) to rated power (var)
	Apparent power	0 to rated power (VA)
	Voltage (1 to 3)	0 to rated voltage (V)
	Current (1 to 3)	0 to rated current (A)
	Power factor	(LEAD)0.5 to 1 to (LAG)0.5
	Frequency	45 to 65 (Hz)

■ Pulse Output Specifications (When Pulse Output is Specified)

Function	Outputs pulses proportional to energy.
Measurement Item for Output	One item selected from active energy, regenerative energy, reactive energy (LEAD, LAG), and apparent energy
Number of Outputs	1
Output Signal	Open collector
Contact Capacity	30 V DC at 200 mA
Pulse Unit	0.1 to 5000.0 kWh/pulse* (set in 100 Wh increments)
Setting Item	Measurement item for output, pulse unit, and ON pulse width Initial value: active energy (kWh), pulse unit: 1 kWh/pulse, and ON pulse width: 50 ms
ON Pulse Width	Represents the ON time of pulses to be output. (Set the pulse width so that the maximum ON pulse width obtained by the following equation is not exceeded.) Within the range of 10 to 1270 ms (set in 10 ms increments) $\text{Maximum ON pulse width (ms)} = \frac{\text{Pulse unit [kWh/pulse]}^* \times 3600 \times 1000^2}{\text{Secondary rated power [W]} \times \text{VT ratio} \times \text{CT ratio} \times 1.2 \times 2}$

* The units are kvarh/pulse for reactive energy and kVAh/pulse for apparent energy.

■ Demand Alarm Output Specifications (When Demand Measurement is Specified)

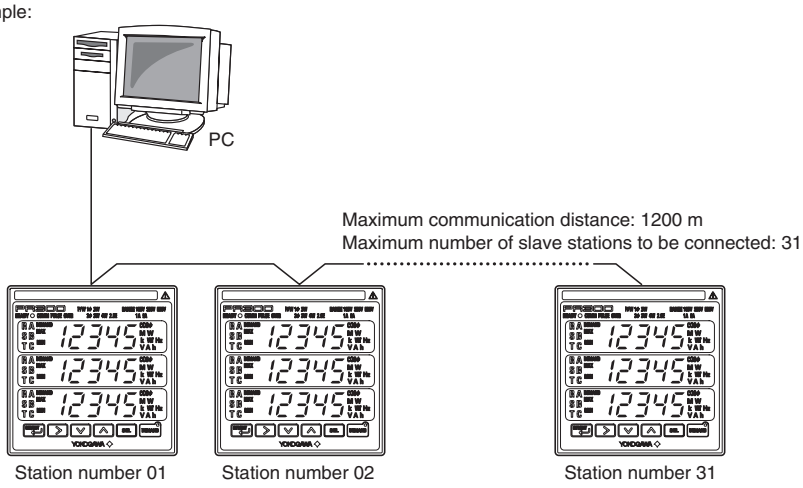
Function	Outputs an alarm if the measured demand value exceeds the set demand alarm point.
Output Signal	Open collector
Contact Capacity	30 V DC at 200 mA
Alarm Release Function	Automatic release: Cancels the alarm if demand falls below the demand alarm point when the next measurement is performed. Manual release*: Holds the status of an alarm that occurred once. Cancels the alarm by digital input or the operation key, or via communication.

* Refer to “Demand alarm release” of the Digital Input Specifications.

■ Communication Specifications

● RS-485 communication

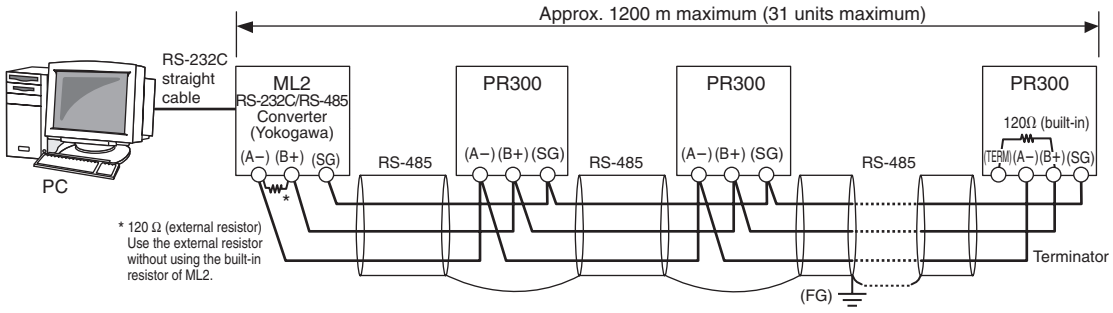
Example:



Function	RS-485 communication enables you to use the command/response method to read a variety of measurements and write various settings.	
Protocol	PC link (with checksum, without checksum), Modbus (RTU, ASCII)	
Transmission Distance	Approx. 1200 m maximum (when 24 AWG twisted-pair cable is used)	
Connection Method	Multi-drop connection (a maximum of 32 units [including a higher-level device])	
Station Number	01 to 99 (maximum number of units to be connected: 31 [number of units that can be connected to a PC etc.]) (Setting range: 01 to 31 is recommended)	
Transmission Method	Half-duplex communication	
Synchronization Method	Start-stop synchronization	
Baud Rate	19200, 9600, and 2400 bps	
Xon/Xoff Control	None	
Data Format	Data length	8 bits, 7 bits
	Parity	None, even, odd
	Stop bit	1 bit, 2 bits

For details, refer to the user's manual for communications of each device to be connected.

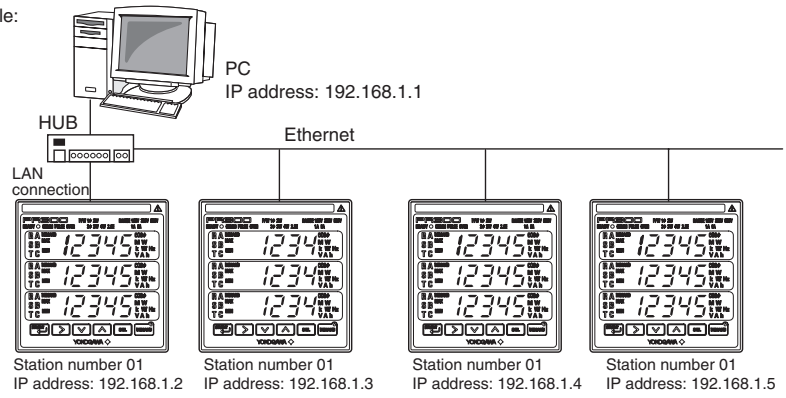
Example of Connection Diagram



Notes:
The PR300 employs a two-wire system for RS-485 communication.
SG: The SG terminal is connected to match the signal level of the RS-485 communication line.
FG: All shielded wires must be connected and then grounded at one place to provide noise protection for RS-485 communication lines.

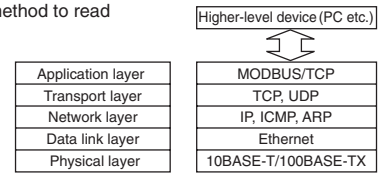
● Ethernet communication (when the Ethernet communication function is specified)

Example:



Function

Ethernet communication enables you to use the command/response method to read a variety of measurements and write various settings.
The PR300 can be connected to IEEE802.3-compliant networks (10BASE-T/100BASE-TX).



Communication Specifications

Protocol	Modbus/TCP
Access Control	CSMA/CD
Baud Rate	10 Mbps/100 Mbps
Maximum Segment Length	100 m (distance between the hub and module)
Maximum Connecting Configuration	Maximum of 4 levels of cascading (for 10BASE-T) or maximum of 2 levels of cascading (for 100BASE-TX) (Number of hubs that can be cascade connected)

IP Address

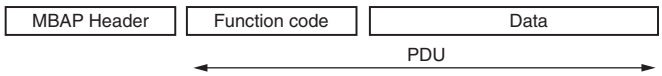
IP addresses can be set using the operation keys on the front of the PR300.

Modbus/TCP Function

Code	Function	Description
03	Reads data from multiple D registers	Capable of reading data from up to 64 registers continuously.
06	Writes data into D register	Capable of writing data into one register.
08	Performs loopback test	Capable of performing a communication test.
16	Writes data into multiple D registers	Capable of writing data into up to 32 registers continuously.

Overview of Modbus/TCP Protocol

The structure of Modbus/TCP protocol is as follows:



The Simple Protocol Data Unit (PDU) is the same as Modbus/RTU (Modbus protocol via serial communication).

The Modbus Application Protocol Header(MBAP Header) is made of the following seven bytes:

Byte No	0	1	2	3	4	5	6
Description	Transaction ID		Protocol ID		Number of bytes		Unit ID

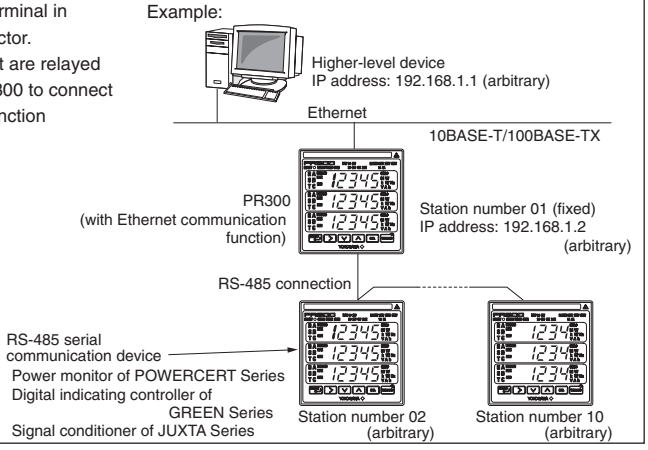
Transaction ID: Set any value for identifying the transaction. The PR300 returns a value received from a higher-level device as a response.
Protocol ID: Specify "0" for the Modbus/TCP protocol.
Number of bytes: Number of bytes after the unit ID (byte number 6)
Unit ID: The PR300 returns a value received from a higher-level device as a response.

Ethernet-Serial Gateway Function

The PR300 has an RS-485 communication terminal in addition to an Ethernet communication connector. Modbus/TCP commands received by Ethernet are relayed to the RS-485 terminal. This enables the PR300 to connect to a device with an RS-485 communication function (Modbus/RTU protocol) via a network.

RS-485 communication	
Protocol	Modbus/RTU
Baud Rate	9600 bps
Parity	Even, odd, or none
Stop Bit	1 bit
Data Length	8 bits

Example:



For details, refer to the user's manual for communications of each device to be connected.
Note: If Ethernet communication is used, the RS-485 communication interface is used specifically for the Ethernet-serial gateway function. Therefore, it is not possible for a higher-level device such as a PC to access the PR300 via the RS-485 communication interface.

■ Standard Performance

Accuracy Rating	Active energy/optional active energy (Wh)	±0.5% (EN60687 accuracy: class 0.5 or equivalent)
	Active power (W)	±0.5% of F.S.
	Voltage (V)	±0.25% of F.S. (voltage rms)
	Current (A)	±0.25% of F.S. (current rms)
	Frequency (Hz)	±0.5Hz
	Demand	±0.5%
Calculation Accuracy	The value is calculated to an accuracy of ±1 digit from the measured value for reactive energy, apparent energy, reactive power, apparent power, power factor or current*. * Current is only for the 2.5 element measurement.	
Backup upon Power Failure	The last integrated values obtained immediately before the power failure are held for active energy, regenerative energy, reactive energy, and apparent energy.	
Insulation Resistance	Between each of the voltage input, current input, power, ground, digital input, pulse output, analog output, RS485 communication output, Ethernet communication output, and alarm output terminals	100 MΩ or more (at 500 V DC)
Withstand Voltage	Between each of the voltage input, current input, power, and ground terminals:	2500 V AC for 1 minute
	Between (the voltage input, current input, power and ground terminals) and the digital input, pulse output, analog output, alarm output, RS-485 communication output, and Ethernet communication output terminals:	2500 V AC for 1 minute
	Between each of the digital input, pulse output, analog output, alarm output, and (RS-485 communication output, Ethernet communication output) terminals:	1000 V AC for 1 minute
	Between the RS-485 communication output, and Ethernet communication output terminals:	500 V AC for 1 minute
Impulse Withstand Voltage	Between all of the voltage input, current input, and power terminals and the ground terminal: Between all of the output and ground terminals and all of the voltage input and current input terminals: 6 kV (1.2/50μs), 10 times for positive and negative	
Effects of Magnetic Field	400 A/m or less Active power: ± 0.5% of F.S. Voltage/Current: ± 0.25% of F.S.	
Effects of Changes in Ambient Temperature	± 0.03%/°C for a temperature change rate of 10°C/h or less (when 0.05 In ≤ I ≤ I max, power factor = 1) ± 0.05%/°C for a temperature change rate of 10°C/h or less (when 0.1 In ≤ I ≤ I max, power factor = LAG 0.5) In: rated current, I: present current input	
Effects of Power Supply Voltage Variations	Active power: ± 0.25%, Voltage/Current: ± 0.125% (for variations within the power supply operating range (when 0.01 In and power factor = 1)) In: rated current	
Effects of Input Frequency	Active power: ± 0.25%, Voltage/Current: ± 0.125% (for variation of 45 to 65 Hz)	
Dustproof and Dripproof	IP5X	
Power Supply	100-240 V AC ±10% (50/60 Hz) or 130-300 V DC ± 15%	
Power Consumption	AC drive: 10 VA maximum, DC drive: 5 W maximum	

■ Safety and EMC Standards

Safety Standards	Compliant with IEC/EN61010-1 Under application for UL61010 approval
Measurement category	600V CAT. III
Installation category	CAT. II Pollution degree: 2 (IEC/EN61010-1)
Rated measurement input	Voltage input: 600V AC (between terminals) Current input: 600V AC (across ground)
EMC-compliant Standards	Compliant with EN61326 During testing, the instrument continues to operate at a measurement accuracy within the range of ±20%.

Measurement Category	Description	Remarks
CAT.I	Circuits not directly connected to main power supply	
CAT.II	Circuits directly connected to low-voltage facility	Home-use equipment, portable tools, etc.
CAT.III	Circuits in building facilities	Switchboards, circuit breakers, etc.
CAT.IV	Supply sources to low-voltage facilities	Overhead lines, cable systems, etc.

■ Environmental Conditions

Normal Operating Conditions		
	Warm-up time	At least 30 minutes
	Ambient temperature	0 to 50°C (reference temperature: 23 ±2°C)
	Temperature change	10°C/h or less
	Ambient humidity	20 to 90% RH (no condensation)
	Magnetic field	400 A/m or less
	Continuous vibration	10 to 60 Hz, 0.035 mm, 75 minutes 60 to 150 Hz, 4.9 m/s^2, 75 minutes
	Short-time vibration	14.7 m/s^2 for 15 seconds or less
	Shock	98 m/s^2 or less (for shock time of 11 ms)
	Mounting position	Vertical surface mounting only
	Installation altitude	2000 m or less
Effects on Operating Conditions		
	Effects of ambient temperature	Analog output: ±0.05% of F.S./°C or less
	Effects on supply voltage variations	Analog output: ±0.05% of F.S./°C or less
Transport and Storage Conditions		
	Temperature	−20 to 70°C
	Humidity	5 to 95% RH (no condensation)
	Shock and dropping of package	90 cm (provided that an external packing box is used)

■ Power Items and Equations

(V and A are rms values)

Phase and Wire Syatem	Apparent Power	Reactive Power (without using reactive power meter method)	Power Factor
Single-phase two-wire system	VA= V×A	$Q=\sqrt{((VA)^2-P^2)}$	ΣP / ΣVA (without using reactive power meter method)
Single-phase three-wire system	VAi= Vi×Ai i=1, 2 ΣVA= VA1+VA2	$Qi=\sqrt{((VAi)^2-Pi^2)}$ i= 1, 2 ΣQ = Q1+Q2	
Three-phase three-wire system	VAi= Vi×Ai i= 1, 3 $\Sigma VA=\sqrt{3}/2(VA1+VA3)$	$Qi=\sqrt{((VAi)^2-Pi^2)}$ i= 1, 3 ΣQ = Q1+Q3	
Three-phase four-wire system	VAi= Vi×Ai i=1, 2, 3 ΣVA= VA1+VA2+VA3	$Qi=\sqrt{((VAi)^2-Pi^2)}$ i= 1, 2, 3 ΣQ = Q1+Q2+Q3	
Three-phase four-wire system (2.5 element)	VAi= Vi×Ai i= 1, 3 $\Sigma VA=\sqrt{3}/2(VA1+VA3)$	$Qi=\sqrt{(\sqrt{3}/2(VAi)^2-Pi^2)}$ i= 1, 3 ΣQ = Q1+Q3	

* For distorted wave input, there may be differences between the PR300 and a measuring instrument that uses a different measurement principle.

■ Initial Settings (Time of Shipment)

The PR300 has the following initial settings at the time of shipment. Settings can be modified after delivery.

	Setting Item	Initial Value
Input	Phase and wire system	Three-phase three-wire system (for three-phase three-wire system)
		Three-phase four-wire system (for three-phase four-wire system)
	Voltage range	300 V
	VT ratio	1
	CT ratio	1.00
	Integrated low-cut power	0.05 %
Communication	Station number	01
	Protocol	PC link with checksum
	Baud rate	9600 bps
	Parity	None
	Stop bit	1 bit
	Data length	8 bits
	IP address *1	192.168.1.1
	Port number *1	502
	Subnet mask *1	255.255.255.0
	Default gateway *1	0.0.0.0
Pulse Output *2	Measurement item for pulse output	Active energy (kWh)
	Pulse unit	1 kWh/pulse
	ON pulse width	50 ms
Analog Output *3	Measurement item for analog output	Active power (W)
	Lower limit of scaling	50% (0 W)
	Upper limit of scaling	100% (maximum value of the input measuring range W)
Demand Measurement *4	Demand power/current	Active power
	Demand period	30 minutes
	Demand alarm mask time	1 minute
	Demand power alarm point	100 kW
	Demand current alarm point	100 A
	Alarm release function	Automatic release
Other	Indicator-out mode/indicator-out mode wait time	Off/10 minutes

*1 When the Ethernet communication function is specified
*2 When pulse output is specified
*3 When analog output is specified
*4 When demand measurement is specified

■ Mounting and Shape

Materials	Casing: polycarbonate resin (PC), UL94 V-0 Terminal block: polybutylene terephthalate (PBT), UL94 V-0 Terminal cover: polyamide resin (PA6), UL94 V-2
Mounting Method	Panel mounting (refer to Panel Cutout Dimensions)
Connection Method	M3 screws for terminal connections: analog output, pulse output, demand alarm output, digital input, and RS-485 communication M4 screws for terminal connections: voltage/current input and power supply RJ45 connection: Ethernet communication
External Dimensions (including a terminal cover)	110(H) × 110(W) × 128(D) mm or 96(H) × 96(W) × 126(D) mm
Weight	Approx. 600 g (when the accessories such as mounting bracket are attached)

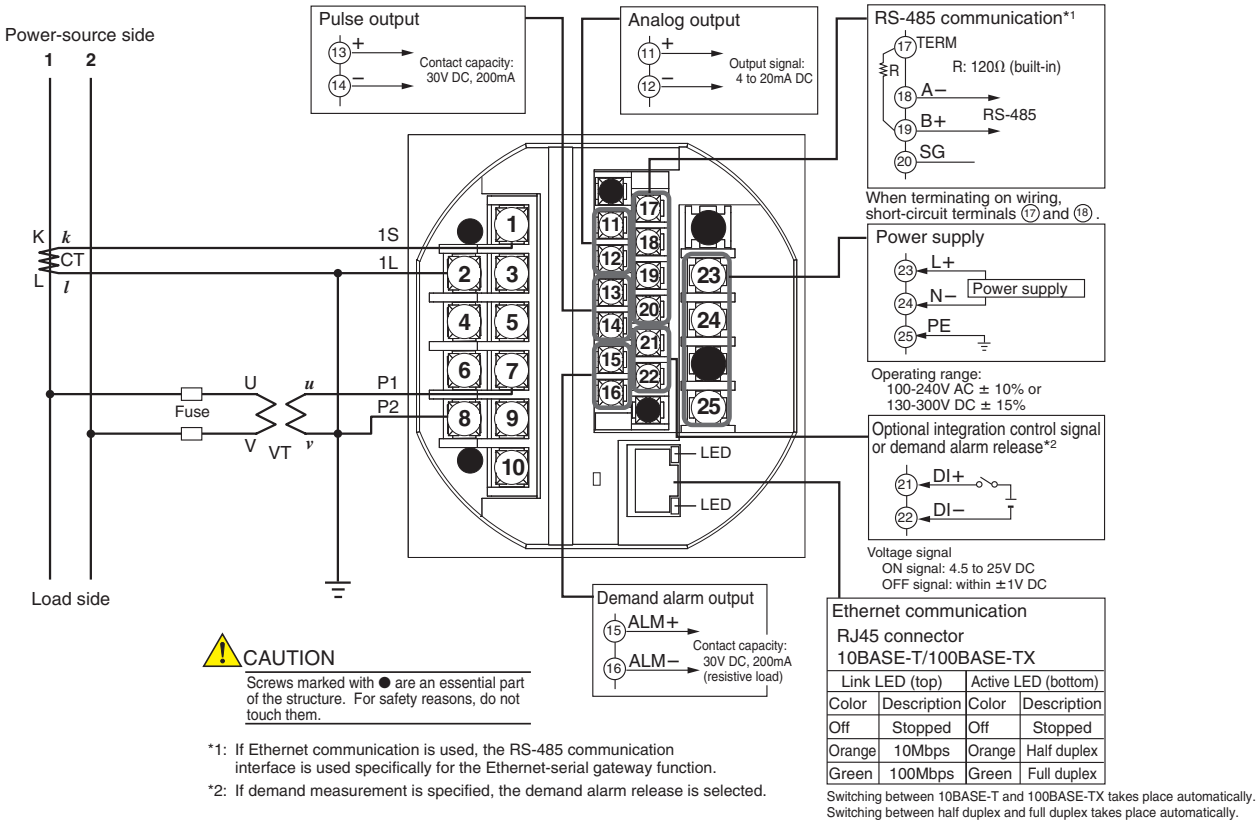
■ Accessories

JIS/ANSI-mounting kit	1 set
DIN-mounting bracket	2
Dust cover (with a screw)	1
Terminal cover (with screws)	1
Shorting bar (for RS-485 communication termination)	1
Tag number label	2

■ Connection Diagrams

A phase and wire system can be selected by specifying the parameters.
If measurement input does not exceed 600 V AC or 5A AC, direct input without using a VT or CT is possible. Do not ground the input circuit when a VT or CT is not used. Perform wiring for the voltage and current in the same circuit.

● Single-phase two-wire system



CAUTION

Screws marked with ● are an essential part of the structure. For safety reasons, do not touch them.

*1: If Ethernet communication is used, the RS-485 communication interface is used specifically for the Ethernet-serial gateway function.

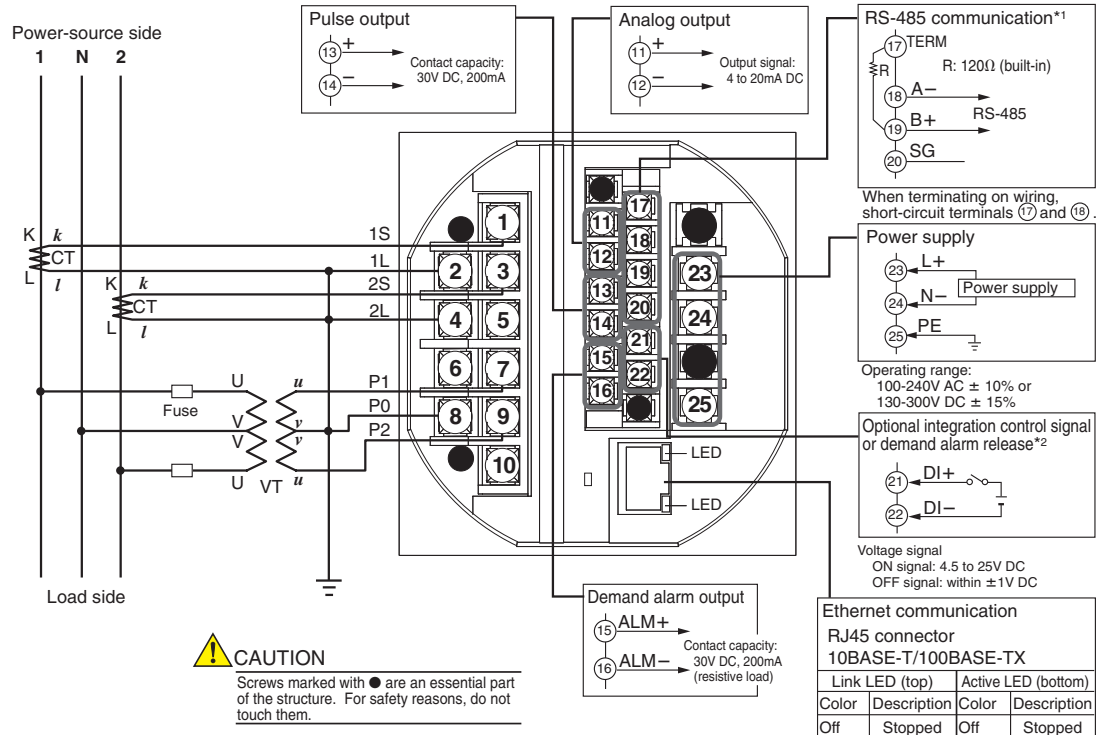
*2: If demand measurement is specified, the demand alarm release is selected.

Ethernet communication
RJ45 connector
10BASE-T/100BASE-TX

Link LED (top)		Active LED (bottom)	
Color	Description	Color	Description
Off	Stopped	Off	Stopped
Orange	10Mbps	Orange	Half duplex
Green	100Mbps	Green	Full duplex

Switching between 10BASE-T and 100BASE-TX takes place automatically.
Switching between half duplex and full duplex takes place automatically.

● Single-phase three-wire system



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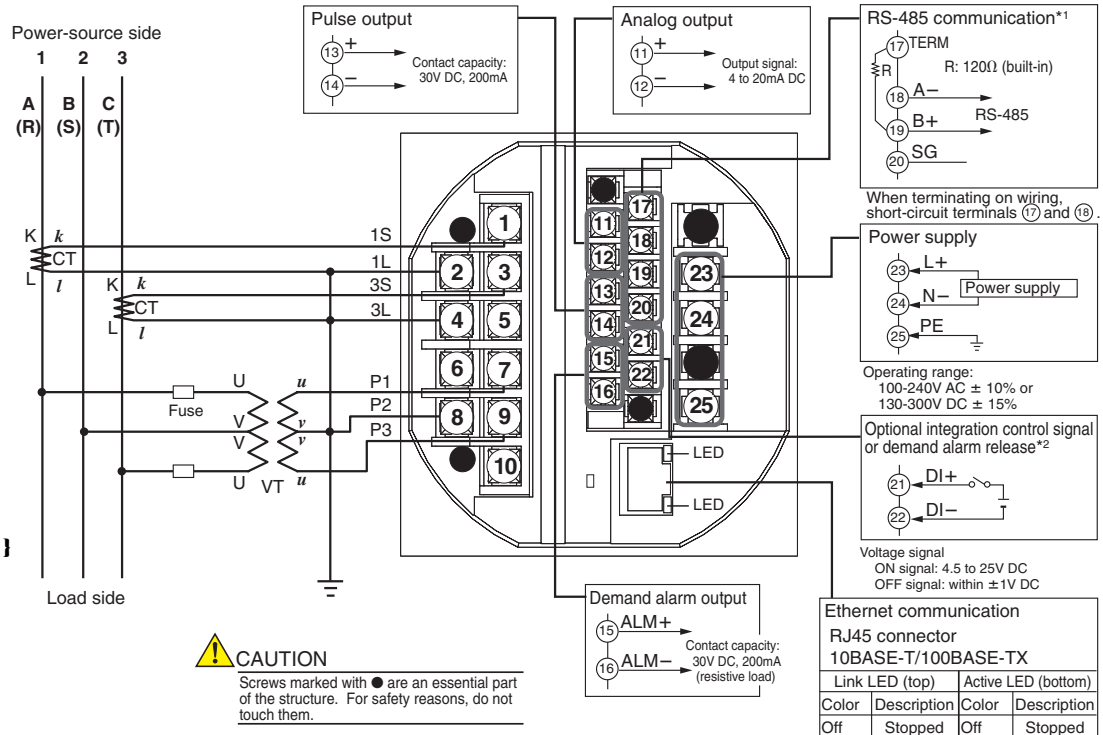
*2: If demand measurement is specified, the demand alarm release is selected.

Ethernet communication
RJ45 connector
10BASE-T/100BASE-TX

Link LED (top)		Active LED (bottom)	
Color	Description	Color	Description
Off	Stopped	Off	Stopped
Orange	10Mbps	Orange	Half duplex
Green	100Mbps	Green	Full duplex

Switching between 10BASE-T and 100BASE-TX takes place automatically.
Switching between half duplex and full duplex takes place automatically.

● Three-phase three-wire system



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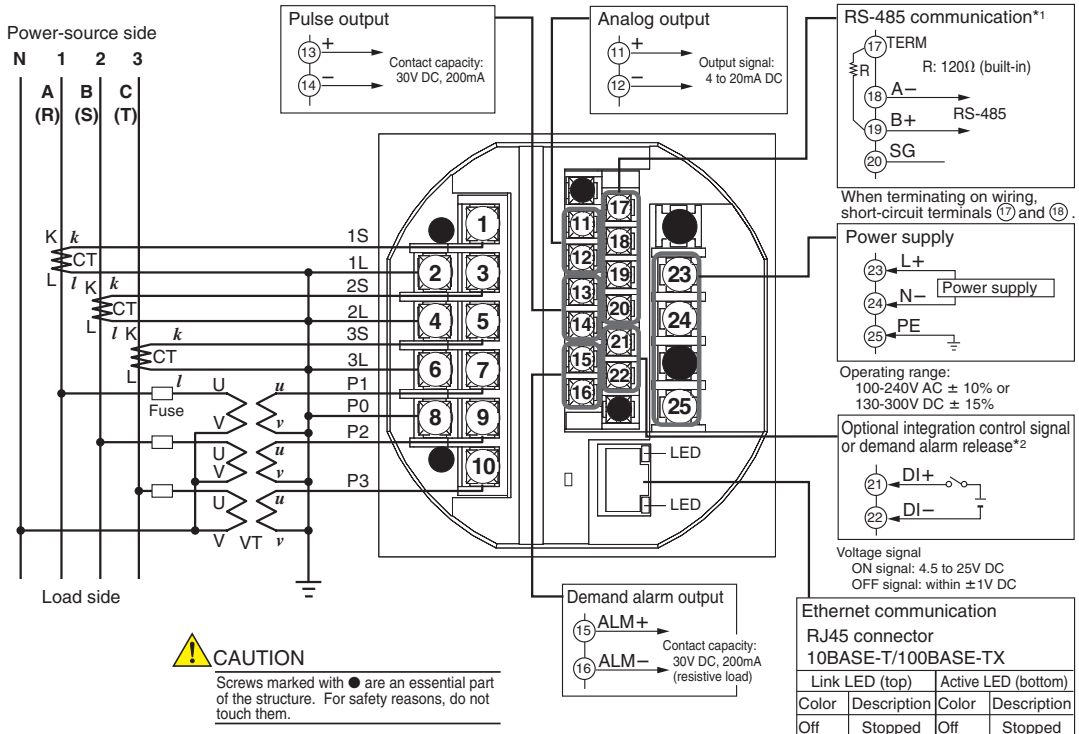
*2: If demand measurement is specified, the demand alarm release is selected.

Ethernet communication
RJ45 connector
10BASE-T/100BASE-TX

Link LED (top)		Active LED (bottom)	
Color	Description	Color	Description
Off	Stopped	Off	Stopped
Orange	10Mbps	Orange	Half duplex
Green	100Mbps	Green	Full duplex

Switching between 10BASE-T and 100BASE-TX takes place automatically.
Switching between half duplex and full duplex takes place automatically.

● Three-phase four-wire system



CAUTION

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*1: If Ethernet communication is used, the RS-485 communication interface is used specifically for the Ethernet-serial gateway function.

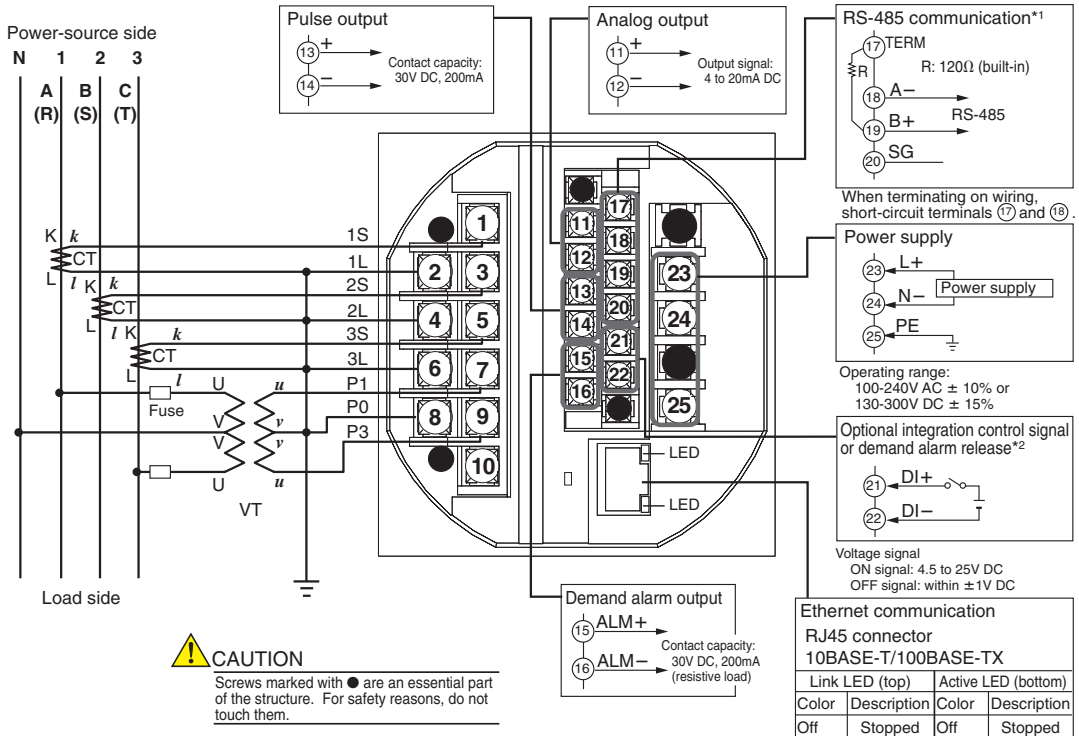
*2: If demand measurement is specified, the demand alarm release is selected.

Ethernet communication
RJ45 connector
10BASE-T/100BASE-TX

Link LED (top)		Active LED (bottom)	
Color	Description	Color	Description
Off	Stopped	Off	Stopped
Orange	10Mbps	Orange	Half duplex
Green	100Mbps	Green	Full duplex

Switching between 10BASE-T and 100BASE-TX takes place automatically.
Switching between half duplex and full duplex takes place automatically.

● Three-phase four-wire system (2.5 element)



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*2: If demand measurement is specified, the demand alarm release is selected.

Ethernet communication
RJ45 connector
10BASE-T/100BASE-TX

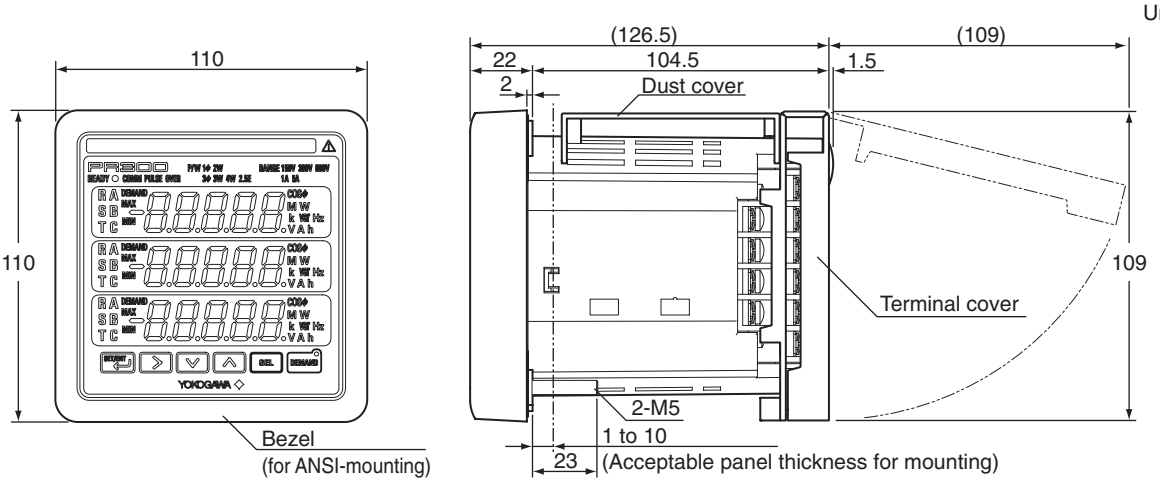
Link LED (top)		Active LED (bottom)	
Color	Description	Color	Description
Off	Stopped	Off	Stopped
Orange	10Mbps	Orange	Half duplex
Green	100Mbps	Green	Full duplex

Switching between 10BASE-T and 100BASE-TX takes place automatically.
Switching between half duplex and full duplex takes place automatically.

■ External Dimensions

● ANSI 4-inch round form size (when a bezel is attached)

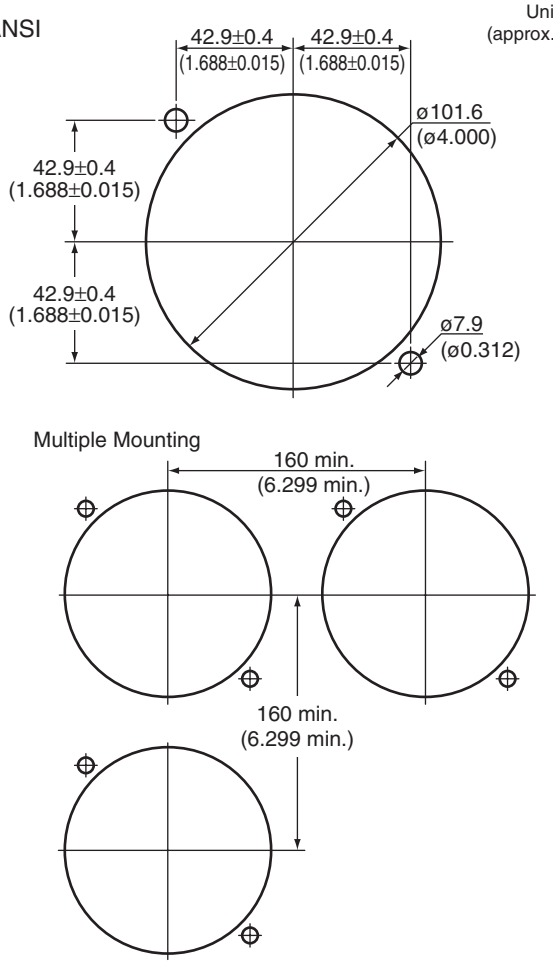
Unit: mm



<Panel Cutout Dimensions>

ANSI

Unit: mm
(approx. inch)

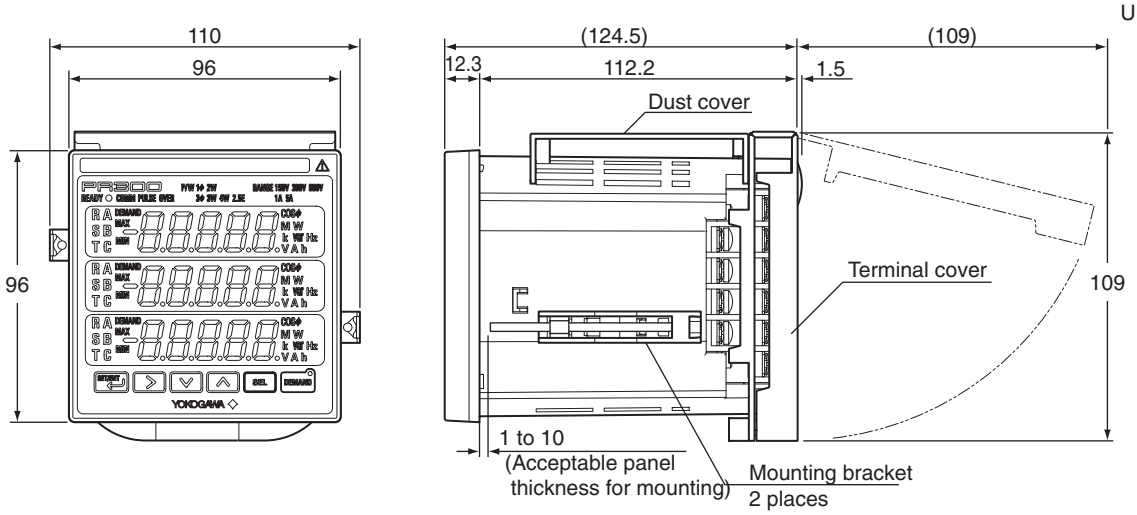


Multiple Mounting

Normal Allowable Deviation= ±(Value of JIS B 0401-1999 tolerance grade IT18)/2

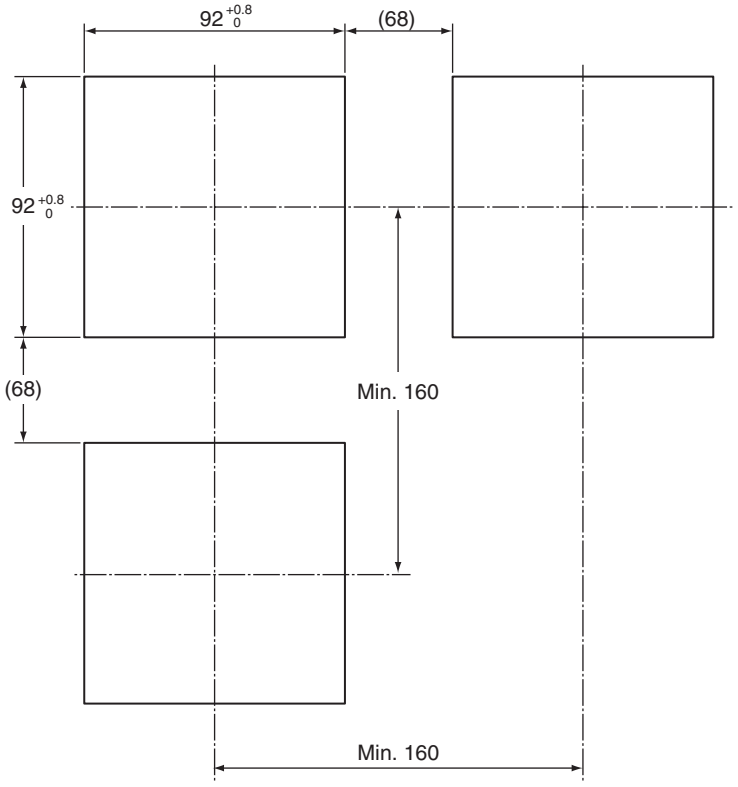
● DIN 96-square instrument size

Unit: mm



<Panel Cutout Dimensions>

Unit: mm



Normal Allowable Deviation= ±(Value of JIS B 0401-1999 tolerance grade IT18)/2