General Specifications

Model UPM100
Universal Power Monitor

GS 77C01H01-43EN

■ OVERVIEW

The UPM100 is a compact power monitor that can be attached in industrial machinery etc. and measure instantaneous apparent power, instantaneous active power, instantaneous reactive power, instantaneous rms voltage and rms current of each phase, active energy, reactive energy, regenerative energy, apparent energy and instantaneous power factor.

The UPM100 can measure one of the single-phase 2-wire, single-phase 3-wire, three-phase 3-wire or three-phase 4-wire.

(This General Specification can only be used in the Korea.)

■ FEATURES

- Various electric power and energy can be monitored by using a wide array of measuring functions.
- Communication via RS-485 communication is possible.
- The UPM100 is compact and can be mounted on DIN rail or a wall.
- Good readability is realized by using a large LED display. In addition, since the 6-digit value with the decimal point which can move by key operation on a front panel is displayed, detailed electric power and energy can be checked.
- Wireless communication (920.6 to 923.4 MHz): The addition of a 920 MHz wireless function to the UPM100 enables wireless data communication with the GX20/GP20 paperless recorder or GM data acquisition system (/CM3 option) as the base station. It can also be used as a repeater.

920 MHz Communication Wireless type

■ MEASURING FUNCTION

- Instantaneous apparent power, apparent energy and regenerative energy
- Instantaneous active power, active energy and optional electric energy
- Instantaneous reactive power[*1] and reactive energy[*1*2]
- Instantaneous rms voltage of each phase and maximum/minimum rms voltages of each phase
- Instantaneous rms current of each phase and maximum rms current of each phase
- Instantaneous power factor[*1]
- Frequency

*1: When “optional measuring function” is specified.
*2: Reactive energy LEAD and LAG are integrated. When “with pulse output” is specified, active energy pulse and reactive energy pulse are outputted. However, either LEAD or LAG is output for reactive energy pulse.

■ INPUT AND OUTPUT SPECIFICATIONS

- Phase and Wire Type: Single-phase 2-wire, single-phase 3-wire, three-phase 3-wire, three-phase 4-wire
- Input Frequency: 45-65 Hz
- Rated Input Voltage: 220V AC[*1], 440V AC Either 127V AC or 277V AC for three-phase 4-wire
- Input Voltage Range: 0-264V AC for 220V AC input, 0-520V AC for 440V AC input
- Allowable Input Voltage:
  1.2 times of rated voltage (continuous)
  1.5 times of rated voltage (for 10 seconds)
- Rated Input Current: 1A AC, 5A AC
- Allowable Input Current:
  1.2 times of rated current (continuous)
  Twice of rated current (for 10 seconds),
  10 times of rated current (for 3 seconds)
- Approximate Consumed VA:
  Voltage input: 0.4VA/phase
  Current input: 0.2VA/phase

YOKOGAWA

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GS 77C01H01-43EN

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- Pulse Output of Electric Energy[*2]: Open collectors
  Output capacity: 30V DC, 200mA
  When output is ON[*3]: Within range of 10-1270 ms
  Pulse unit[*3]: Within range of 10-500000 (Wh/pulse, varh/pulse), however, 1-50000(Wh/ pulse, varh/ pulse) when “Integral resolution Wh” is specified.
  Maximum output frequency: 3 Hz
- Communication Output: RS-485, 1 port

*1: 200V AC (100V+100V) for single-phase 3-wire
*2: Pulse output-1: Active energy only
Pulse output-2: Either reactive energy LAG (lag), LEAD (lead) or regenerative energy when with “reactive power option.” Only regenerative energy when without “reactive power option.”
*3: Set them via RS-485 when “without display function” is specified.
Set them by operation key when “with display function” is specified.

■ STANDARD PERFORMANCE

Accuracy Rating:

Active power/Regenerative power	±1.0% FS (equivalent to JIS C1111 grade 1.0)
rms voltage for each phase	±1.0%FS (equivalent to JIS C1111 grade 1.0)
rms current for each phase	±1.0%FS (equivalent to JIS C1111 grade 1.0)
Apparent energy	±1% of rdg (with rated input)
Active energy[*1]	±1% of rdg (with rated input)
Reactive energy[*2]	±1% of rdg (with rated input)
Regenerative energy	±1% of rdg (with rated input)
Optional electric energy	±1% of rdg (with rated input)
Frequency	±1 Hz

Computing Accuracy: Reactive power, instantaneous power factor, apparent power 45-65 Hz: ±1dgt (Value calculated from measured value)

*1: Integration is not performed on minus (-) side.
*2: For reactive power option”
Note 1: If the input is a distortion wave input, the UPM100 will differ from instruments that are based on different measurement principles (including Yokogawa’s PR201, UZ005 or UPM01/02/03).
Note 2: Input voltage shall be 10% or more of rated voltage and input current shall be 5% or more of rated current. The sign of reactive power and instantaneous power factor may not be displayed correctly.
Note 3: The load of 10GW or more cannot be measured.

- Backup at Power Interruption: The final integrated values obtained prior to the power interruption are kept for active / reactive/ apparent/ regenerative energy
- Insulation Resistance: 100 MΩ or more at 500V DC between any two points of the current input, voltage input, power supply, ground, communication output and pulse output.
- Withstand Voltage: 2000V AC for one minute between any two points of current input, voltage input, power supply, ground, communication output and pulse output.
- Integral Low-cut Power: 0.05-20.00% of rated power
- Operating Temperature: 0-50°C
- Operating Humidity: 5-90% RH (no condensation)
- Effect of Supply Voltage Fluctuation: ±0.5%FS (instantaneous value) / 85-264V AC
- Effect of Input Frequency: ±0.5% FS (instantaneous value) / 45-65Hz
- Effect of Ambient Temperature: ±1%FS (instantaneous value) / 10°C
- Power Supply: 85-264V AC, 50/60 Hz
- Consumed Power: Maximum 5VA (without display function) Maximum 7VA (with display function)

■ COMMUNICATION SPECIFICATIONS (Serial Gateway: RS-485)

- Communication Specifications: RS-485 interface (RS-485 port is isolated from internal circuit.)
- Communication Protocols: PC-link (with or without checksum), MODBUS (ASCII, RTU), UPM01 protocol (effective only when “Integral resolution Wh” is specified)
- Transmission Distance: Approx. 1.2 km max. (Using twisted-pair cable with 24AWG shield)
- Maximum Number of Connected Units: 31 (units that can be connected to PC or other device in multi-drop connection)
- Connection Type: Conforming to RS-485
  Cable: A-, B+: Balanced twisted-pair cable
  SG: Signal ground
  Terminating resistor: 120 Ω (sold separately: L3035RK)
- Transmission Type: Half-duplex communication
- Synchronization Type: Start-stop synchronization
- Baud Rate[*1]: 19200, 9600 or 2400 bps
- Data Format:
  Start bit: 1 bit
  Data length[*1]: 8 bits or 7 bits
  Parity[*1]: None, even or odd
  Stop bit[*1]: 1 bit or 2 bits
- Error Detection: Checksum (1 byte, simple addition) CRC-16, LRC (no protocol-based flow control)
- End Character Specification: Yes (CR)
- Address (Station Number) Setting[*1]: Set in range from 1 to 99 (1 to 31 recommended)
  *1: Set it by DIP switch when “without display function” is specified.
  Set it by operation key when “with display function” is specified.
- Reset Switch: One contact

■ 920 MHz WIRELESS COMMUNICATION SPECIFICATIONS

The addition of a 920 MHz wireless function to the UPM100 enables wireless data communication with the GX20/GP20 paperless recorder or GM data acquisition system (/CM3 option) as the base station.

This function can also be used as a repeater to extend the communication distance.

- KC mark conformity: KN301 489-1/-3, KN11, KN61000-6-2
- Wireless communication standard: IEEE 802.15.4g compliant
- Carrier frequency band: 920.6 to 923.4 MHz
- Wireless channel bandwidth: 200 kHz
- Number of wireless channels: 14
- Maximum transmission output:
  10 mW EIRP (920.6 to 922.0 MHz)*
  25 mW EIRP (922.0 to 923.4 MHz)*
  * Equivalent Isotropic Radiated Power: Radiated power including the antenna
- Modulation method: GFSK
- Antenna: External antenna (sold separately), SMA-P(reverse) connector
- Data rate: 100 kbps max.
- Communication distance*1 *2 (line-of-sight distance):700 m max. (depends on the operating environment)
  *1: Communication errors can occur when wireless communication is temporarily interrupted due to environmental factors such as radio interference.
  *2: At an antenna height of 1.5 m or more off the ground. Communication distance varies depending on the installation location and environment.
- Communication format: Mesh/multi-hop* (maximum number of hops: 16)
  * A function that automatically selects the best communication path according to the communication quality between units. It can be used to extend the communication distance and improve the radio quality.
- LED display: Displays the wireless status using ST1 (green/red) and ST2 (green/red)
- Security function: AES 128 bit encryption
- Implemented protocol: Modbus (slave) protocol
- Modbus slave function: Data can be written and read from Modbus master devices.
- With 920 MHz wireless communication, the initial setting for baud rate is fixed 19200 bps. (Serial gateway function)
- Configuration/measurement communication: The following functions are available using the dedicated software(*).
  Wireless communication configuration
  Wireless communication status monitoring
  * MH920 Console International, a console software application made by Oki Electric Industry Co., Ltd.
- Wireless communication configuration interface: USB 2.0 mini-B type)
  Usage: Only for maintenance purposes such as changing wireless communication parameters
- Reboot switch: For rebooting the system after changing wireless settings

Dedicated External Antenna (Sold separately)*1 *2 *3 *4

Item	Type
	Roof top antenna
Part number	A1062ER
Installation environment	Indoors and outdoors
Cable length	2.5m
Antenna type	Monopole
Maximum gain	2 dBi or less
Directivity	No directivity
Connector	SMA-P(reverse)
Operating temperature range	-20 to 65°C
Waterproof property	Water resistant (IPX6)
Dimensions	83 mm (including the base stand)
	

*1: Only dedicated antennas can be used.
*2: When using an external antenna, we recommend aligning the direction of the antenna of the peer device and the direction of the antenna of this device to maintain communication quality.
*3: To bring out the full performance of the roof top antenna, install it on top of a metal rectangle board that is at least 10 x 20 cm long.
*4: Install antennas as far as possible from metal objects and other obstacles. The communication quality may deteriorate if they are close.

- Connectable registers depending on the Modbus communication cycle of the GX/GM base station

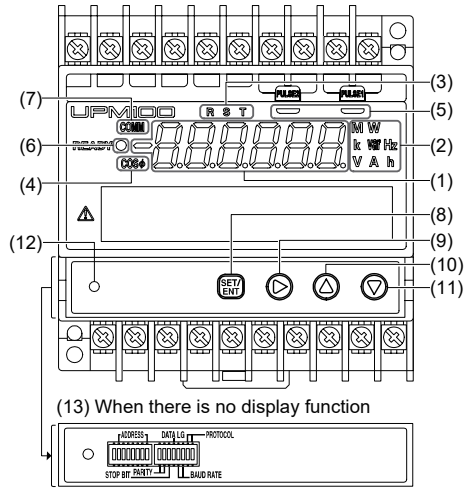
Connectable units	Modbus communication cycle		
	2 s	5 s	10 s
1	50	50	50
2	50	50	50
4	27	50	50
8	-	50	50

* The number of readout registers when the GX20/GP20 or GM10 is the base station. This varies depending on the processing load in the device and communication quality.

EMC Standards

- The UPM100's 920 MHz wireless communication (with serial gateway function) comply with the Korea Certification mark.

■ DISPLAY AND OPERATION SPECIFICATIONS



(1) Measured Value Display: 6-digit, 7-segment red LED (Only when “with display function” is specified.)
VT Ratio / CT Ratio: Set VT and CT ratio to display a converted primary-side input value before VT and CT.
VT ratio setting range: 1-6000
CT ratio setting range: 0.05-32000
(with 5 significant digits; can be set to the second place of a decimal point.)

Measured Value Displayed Items

Displayed Item	Indication
Active energy	xxxxxx [kWh and MWh]*1
Reactive energy	± xxxxx [kvarh and Mvarh] *2
Apparent energy	xxxxxx [kVAh and MVAh] *1
Regenerative energy	- xxxxxx [kWh and MWh]*2
Optional electric energy	xxxxxx [Wh]
Instantaneous active power, instantaneous regenerative power	xxxx [W, kW and MW]*2
Instantaneous reactive power	xxxx [var, kvar and Mvar]*2
Instantaneous apparent power	xxxx [VA, kVA, and MVA]*1
Instantaneous voltage Maximum and Minimum voltages	xxxx [V and kV]*1
Instantaneous current Maximum current	xxxx [A and kA]*1
Instantaneous power factor	Lead (LEAD) :dx.xxx [COSφ] Lag (LAG) :Gx.xxx [COSφ]
Frequency	xx.x [Hz]

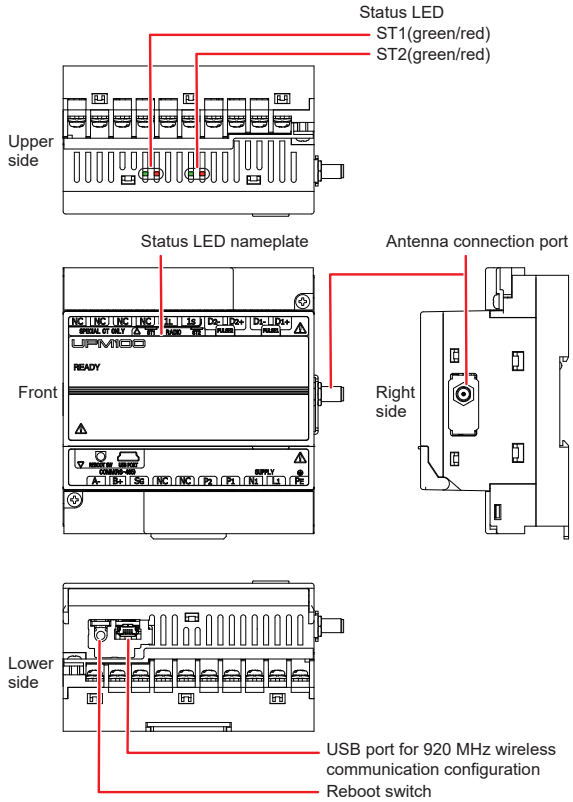
*1: No signs, with decimal point.
*2: With signs and decimal point. However, the plus sign (+) is not displayed. The minus sign (-) is always displayed for regenerative power. The decimal point position depends on primary-side rated power, VT ratio and CT ratio.

(2) Unit Light: Turns on as the unit corresponding to the measured value
(3) RST Light: Displays the phase of measured value.

Phase and Wire Type	Voltage	Current
Single-phase 2-wire	R	R
Single-phase 3-wire	R-S and S-T	R and T
Three-phase 3-wire	R-S and S-T	R and T
Three-phase 4-wire	R,S and T	R,S and T

(4) COSφ Light: Light on while the instantaneous power factor (optional measuring function) is displayed.
(5) Integrated Pulse Light (Wh, varh): Two green LEDs. Flashes to match the integrated pulse output.
(6) Power Light: One green LED. Turns on while the power is on.
(7) Communication Light: Turns on while communication is in progress.
(8) SET/ENT Key: Used to switch displays and enter parameter settings.
(9) Move Key: Used to change a phase when measured value is displayed or to move the digit position (decimal point position) of set value when setting a parameter.
(10) Up Key: Used to change the set value when setting a parameter. Pressing this key increases the numeric value.
(11) Down Key: Used to change the set value when setting a parameter. Pressing this key decreases the numeric value.
(12) Reset Switch: Restarts the UPM100. Pressing this switch resets all measured values other than active energy, reactive energy, apparent energy and regenerative energy.
(13) DIP Switch: Sets up the communication functions when “without display function” is specified.

Component Names of UPM100 (with 920 MHz wireless communication)



■ POWER ELEMENTS

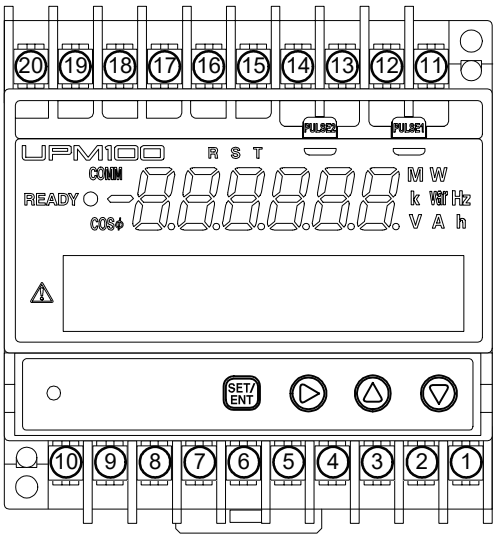
Function	Formula
Active energy (Wh)	$\int Pdt$
Reactive energy (varh)*1	$\int Qdt$
Apparent energy (VAh)	$\int VAdt$
Regenerative energy (Wh)	$\int Pdt$
rms voltage (Vrms), rms current (Arms)	$\overline{v(t)}$, $\overline{i(t)}$
Apparent power (VA)	Vrms · Arms
Active power (P)	v(t) · i(t)
Reactive power (Q)*1	$\sqrt{(VA)^2-P^2}$
Instantaneous power factor*1	P / VA

*1: When with measuring function of instantaneous power factor or reactive power.

■ MOUNTING AND APPEARANCE

- Material: Polycarbonate resin (Case body); polyacetal resin (DIN-rail latch)
- Mounting Method: Wall or DIN rail mounting
- Connection Method: M3.5 screw terminal
- External Dimensions: See “External Dimensions.”
- Wight: Approx. 400 g

■ TERMINAL ARRANGEMENT



- **Single-phase 2-wire**

No.	Terminal Symbol	Signal Name
1	PE	Protective ground
2	L1	Power supply
3	N1	Power supply
4	P1	Voltage input
5	P2	Voltage input
6	NC	Unused terminal
7	NC	Unused terminal
8	SG	RS-485 signal ground
9	B+	RS-485 (+)
10	A-	RS-485 (-)
11	D1+	Pulse output-1 of electric energy (+)
12	D1-	Pulse output-1 of electric energy (-)
13	D2+	Pulse output-2 of electric energy (+)
14	D2-	Pulse output-2 of electric energy (-)
15	1S	Current input
16	1L	Current input
17	NC	Unused terminal
18	NC	Unused terminal
19	NC	Unused terminal
20	NC	Unused terminal

Note: Do not use an unassigned terminal as the relay terminal.

- **Single-phase 3-wire/ Three-phase 3-wire**

No.	Terminal Symbol	Signal Name
1	PE	Protective ground
2	L1	Power supply
3	N1	Power supply
4	P1	Voltage input
5	P0 [P2]	Voltage input
6	P2 [P3]	Voltage input
7	NC	Unused terminal
8	SG	RS-485 signal ground
9	B+	RS-485 (+)
10	A-	RS-485 (-)
11	D1+	Pulse output-1 of electric energy (+)
12	D1-	Pulse output-1 of electric energy (-)
13	D2+	Pulse output-2 of electric energy (+)
14	D2-	Pulse output-2 of electric energy (-)
15	1S	Current input
16	1L	Current input
17	2S [3S]	Current input
18	2L [3L]	Current input
19	NC	Unused terminal
20	NC	Unused terminal

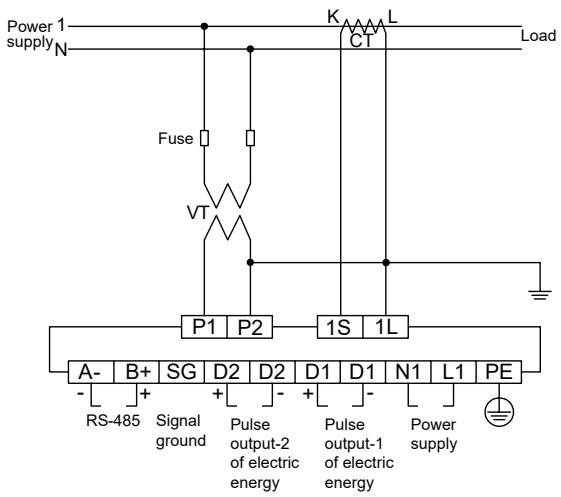
The inside of brackets in Terminal Symbol means the case of three-phase 3-wire.

- **Three-phase 4-wire**

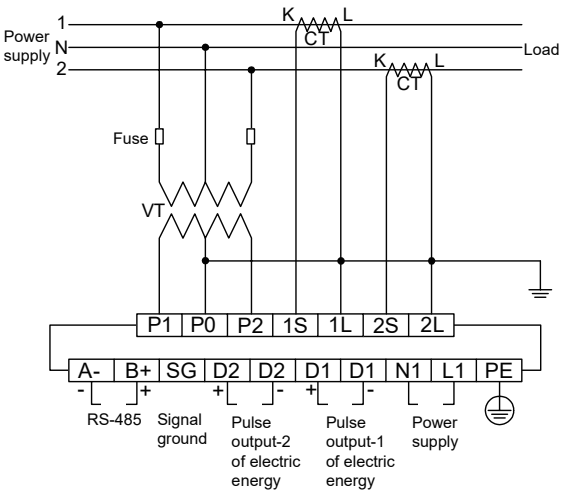
No.	Terminal Symbol	Signal Name
1	PE	Protective ground
2	L1	Power supply
3	N1	Power supply
4	P1	Voltage input
5	P0	Voltage input
6	P2	Voltage input
7	P3	Voltage input
8	SG	RS-485 signal ground
9	B+	RS-485 (+)
10	A-	RS-485 (-)
11	D1+	Pulse output-1 of electric energy (+)
12	D1-	Pulse output-1 of electric energy (-)
13	D2+	Pulse output-2 of electric energy (+)
14	D2-	Pulse output-2 of electric energy (-)
15	1S	Current input
16	1L	Current input
17	2S	Current input
18	2L	Current input
19	3S	Current input
20	3L	Current input

■ CONNECTION DIAGRAM

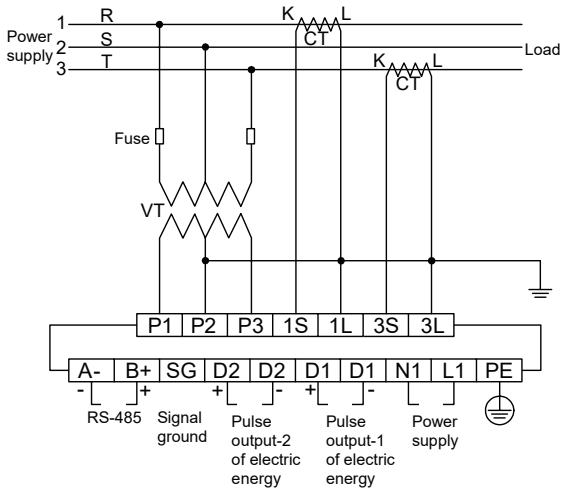
- **Single-phase 2-wire**



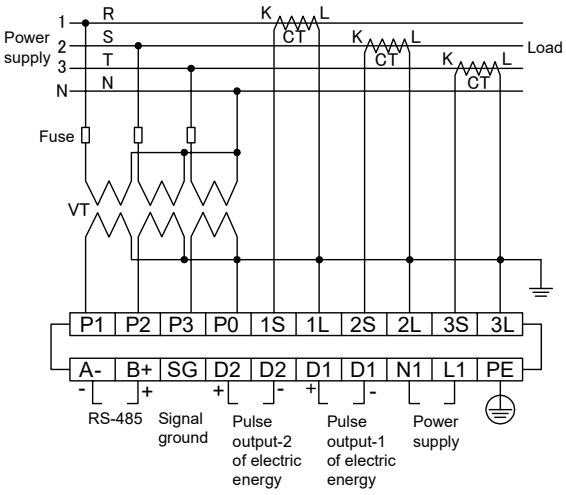
- **Single-phase 3-wire**



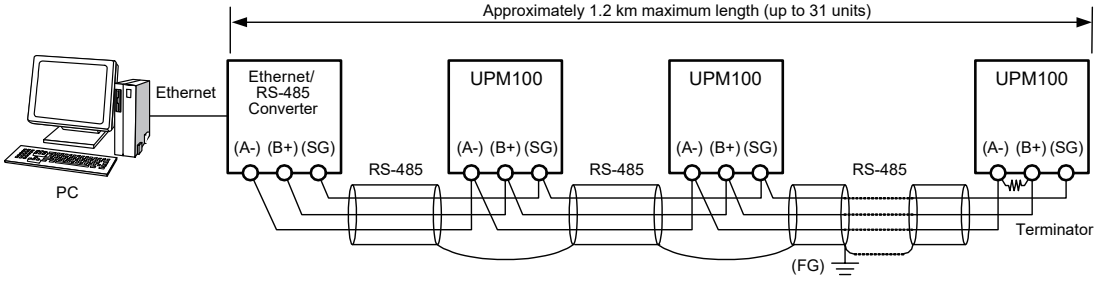
- **Three-phase 3-wire**



- **Three-phase 4-wire**



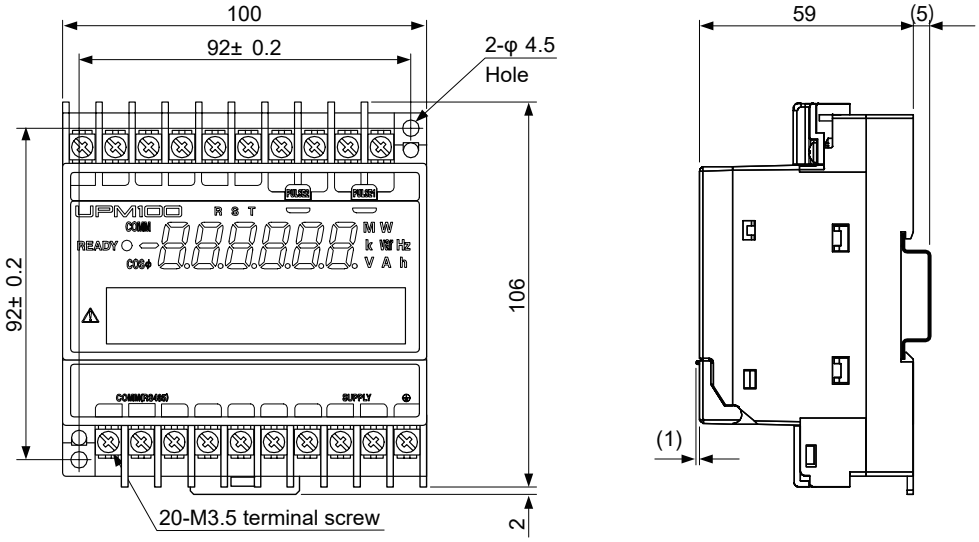
■ EXAMPLE OF SYSTEM CONFIGURATION



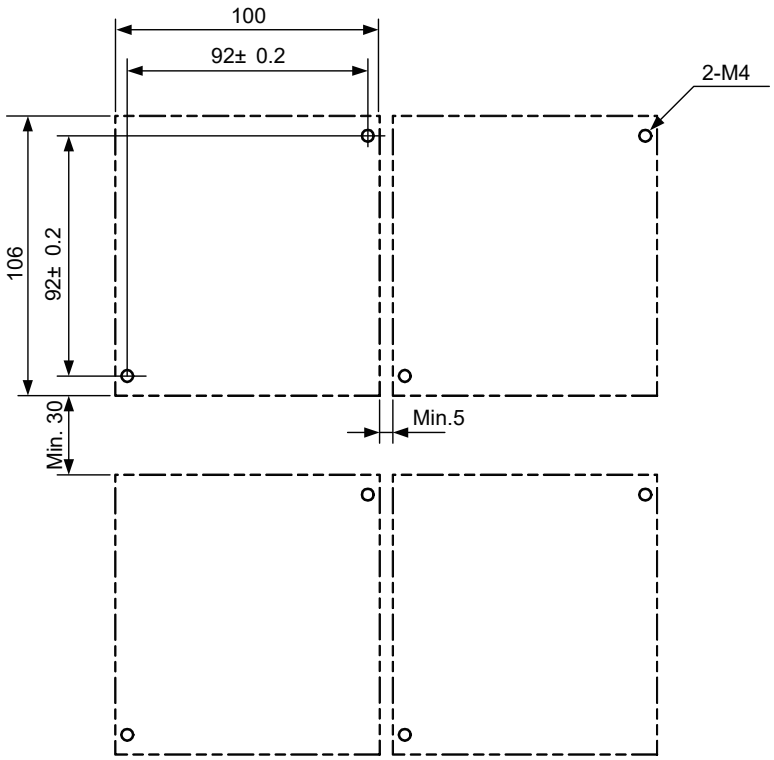
Note: RS-485 communication with the UPM100 is based on a 2-wire. Note the following:
(1)The SG terminal (SG) is connected to match the signal level of the RS-485 communication line. Connect the SG terminal without grounding it.
(2)Connect all shield lines (FG) to provide noise protection on the RS-485 communication line, and ground them in one location.
(3)When using shielded twisted-pair cable, use the shield line as FG without connecting the SG terminal.

■ EXTERNAL DIMENSIONS

Unit: mm

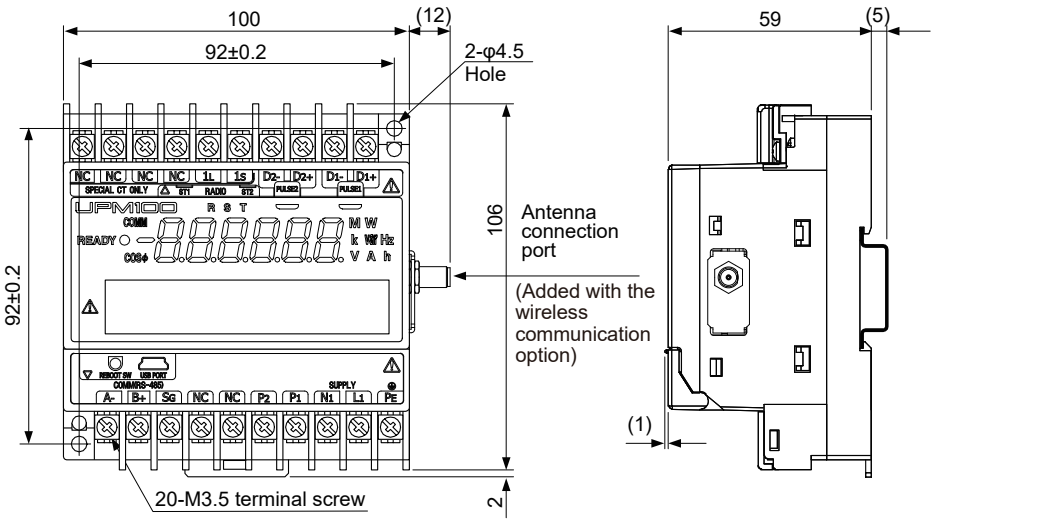


- **Mounting Dimensions**

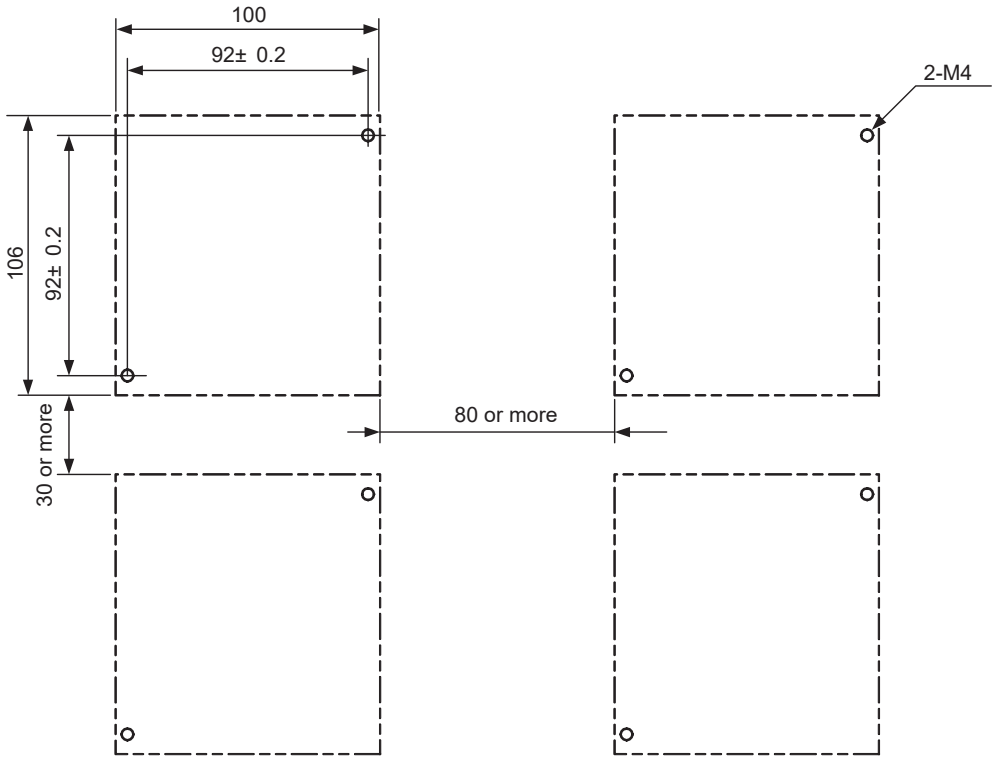


■ EXTERNAL DIMENSIONS (with 920 MHz WIRELESS COMMUNICATION)

Unit: mm



- **Mounting Dimensions**



■ MODEL AND SUFFIX CODES

Model	Suffix Code	Description
UPM100	-x x x x x -2 0	Universal Power Monitor
Phase and Wire Type	**-1**	Single-phase 2-wire
	-2	Single-phase 3-wire
	-3	Three-phase 3-wire
	-4	Three-phase 4-wire
Rated Input Voltage and Current	**3**	220V/1A AC (phase voltage 127V AC for three-phase 4-wire)*1
	4	220V/5A AC (phase voltage 127V AC for three-phase 4-wire)*1
	5	440V/1A AC (phase voltage 277V AC for three-phase 4-wire)
	6	440V/5A AC (phase voltage 277V AC for three-phase 4-wire)
Output Function	**0**	Without display function, without pulse output
	1	With display function, without pulse output
	2	Without display function, with pulse output
	3	With display function, with pulse output
Optional Communication Function	**0**	None (RS-485 is provided as standard)
	C	Wireless communication (with serial gateway function)*3 <For the Republic of Korea>
Optional Measuring Function	**0**	Integral resolution kWh
	1	Integral resolution kWh / power factor
	2	Integral resolution kWh*2 / reactive power, integrated reactive power
	3	Integral resolution kWh*2 / power factor, reactive power, integrated reactive power
	4	Integral resolution Wh
	5	Integral resolution Wh / power factor
	6	Integral resolution Wh*2 / reactive power, integrated reactive power
	7	Integral resolution Wh*2 / power factor , reactive power, integrated reactive power
Power Supply	**-2**	85 to 264V AC 50/60Hz
Fixed Code	**0**	Always “0”

*1: 200V AC (100V + 100V) for single-phase 3-wire
*2: The unit is kvar or var when reactive power is selected.
*3: Wireless communication option can only be used in the Republic of Korea.

UPM100 Rated Power (Secondary-side Rated Power)

Rated Power	Rated Input Voltage/Current				
Phase and Wiring	**Suffix Code**	**3**	**4**	**5**	**6**
	1	200W	1000W	400W	2000W
	2	200W	1000W		
	3	400W	2000W	800W	4000W
	4	400W	2000W	800W	4000W

■ ORDERING INFORMATION

Optional Specification Items

Specify the model and suffix codes.
Example: UPM100-34000-20

Mandatory Specification Items

Setting range of VT ratio: 1 to 6000 (If not specified, setting value is set to 1.)
Setting range of CT ratio: 1 to 30000 (If not specified, setting value is set to 1.)
(Specify when no display function is specified, or with 920 MHz wireless communication)

Note: When changing the VT ratio / CT ratio after shipment, the model with display function can be set by key operation. Although models without display function can be changed using RS-485 communication, it is necessary to prepare communication converter and setting software, so we recommend that you specify the VT ratio / CT ratio. Note that settings cannot be entered via 920 MHz wireless communication.

- The UPM100 is shipped with the following initial settings.

Setting Item	Initial Value
VT ratio / CT ratio	1/1.00
Communication protocol	PC-link with check-sum*3
Address (station number)	1
Baud rate	9600 bps*3
Parity	None
Stop bit	1 bit
Data length	8 bits
Integral low-cut power	0.05%
Pulse output-1 of electric energy*1	Active energy
Pulse unit-1 of electric energy*1	1 kWh/pulse
ON pulse width-1 of electric energy*1	50 ms
Pulse output-2 of electric energy*1	Regenerative energy or reactive energy LAG (lag)*2
Pulse unit-2 of electric energy*1	1 kWh/pulse or 1 kvarh/pulse*2
ON pulse width-2 of electric energy*1	50 ms
Standby mode / Standby mode timer	ON / 10 minutes

*1: When “with pulse output” is specified.
*2: Regenerative energy when without “reactive power option.”
Reactive energy LAG (lag) when with “reactive power option.”
*3 With 920 MHz wireless communication, the initial settings for communication protocol and transfer speed are MODBUS RTU and 19200 bps, respectively.

■ STANDARD ACCESSORY

- Terminal cover: Two pieces

■ OPTIONAL ACCESSORY (SOLD SEPARATELY)

Product	Part No.
Roof top antenna (indoor and outdoor use, cable length: 2.5 m)	A1062ER
Communication terminator for RS-485 (120 Ω)	L3035RK

■ RELATED INSTRUMENTS

Product	Model	Content
Clamp-on Current Transformers	CTW130	800A/5A
	CTW100	500A/5A
	CTW35	300A/1A
	CTW20	200A/1A
	CTW15	100A/1A
	CTW10	100A/1A

User’s Manual

Product user’s manuals can be downloaded or viewed at the following URL. To view the user’s manual, you need to use Adobe Reader 7 or later by Adobe Systems.

URL: http://www.yokogawa.com/ns/powercert/im/

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