

# Power Monitor

## KM-N2



### Power Monitoring Functions for Control Panels in a Single Unit

- Power Monitor applicable around the globe.
- Solve design, installation, wiring, and commissioning issues with just one Power Monitor.
- You can measure up to four circuits with one Power Monitor.
- Use general-purpose CTs and handle a variety of worksites.
- Easy-to-read white LCD.
- IEC Class 0.5S high-precision measurements (Power Monitor only).



For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

 Refer to *Safety Precautions* on page 7.

## Ordering Information

### Power Monitor

Model	Applicable phase wiring methods	Power supply voltage	Dimensions	Communications
KM-N2-FLK	Single-phase, 2-wire: 100 to 277 VAC Single-phase, 3-wire: 100 to 240 VAC (L-N) or 200 to 480 VAC (L-L) Three-phase, 3-wire: 173 to 480 VAC (L-L) Three-phase, 4-wire: 100 to 277 VAC (L-N) or 173 to 480 VAC (L-L)	Same as measured circuits: 100 to 277 VAC (L-N) 173 to 480 VAC (L-L)	90 × 90 × 65 mm (H×W×D)	RS-485 communications, pulse output

To use a commercially available current transformer, use a CT with a secondary current rating of 1 A or 5 A, and a rated load of at least 1.0 VA.

# KM-N2

## Specifications

### Ratings (Power Monitor)

Item	Model	KM-N2-FLK
Applicable phase wiring methods		Single-phase two-wire, single-phase three-wire, three-phase three-wire, and three-phase four-wire
Maximum number of measured circuits *1		Single-phase two-wire: 4 circuits, Single-phase three-wire or three-phase three-wire: 2 circuits, Three-phase four-wire: 1 circuit
Allowable frequency range		45 to 65 Hz
Power consumption		7 VA max.
Input	Rated input voltages (power supply voltages)	Single-phase, 2-wire: 100 to 277 VAC Single-phase, 3-wire: 100 to 240 VAC (L-N) or 200 to 480 VAC (L-L) Three-phase, 3-wire: 173 to 480 VAC (L-L) Three-phase, 4-wire: 100 to 277 VAC (L-N) or 173 to 480 VAC (L-L)
	Allowable input voltage	85% to 115% of rated power supply voltage
	Allowable supply voltage range	85% to 115% of rated power supply voltage
	Input current (CT2 primary-side current) *2	General-purpose CT: 1 A or 5 A Rated load: 1.0 VA min.
	Allowable input current	6 A max.
	Rated input frequency	50/60 Hz
Ambient operating temperature		-25 to 55°C (with no condensation or icing)
Ambient operating humidity		25% to 85%
Storage temperature		-25 to 85°C (with no condensation or icing)
Storage humidity		25% to 85%
Operating altitude		2,000 m max.
Installation environment		Overvoltage category II, measurement category II, pollution degree 2
Electromagnetic environment		Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)
Compliant standards		EN 61010-2-030, EN 61326-1, and UL 61010-1

\*1. A CT with a different capacity can be specified for each circuit.

\*2. The KM-series CTs (the KM20-CTF or KM-NCT Series) cannot be used. Use general-purpose CTs with a secondary-side output of 1 A or 5 A.

### Performance (Power Monitor)

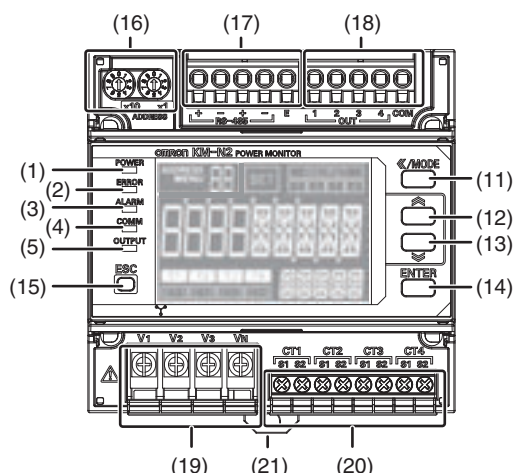
Item	Model	KM-N2-FLK
Measurement specifications	Active power	IEC 62053-22 class 0.5S (Accuracy 0.5%) *
	Reactive power	IEC 62053-23 class 2 (Accuracy 2.0%) *
	Sampling cycle	80 ms for 50 Hz and 66.7 ms for 60 Hz
Insulation resistance		(1) Between all electrical circuits and the case: 20 MΩ min. (at 500 VDC) (2) Between all power supply and voltage inputs and all communications and pulse output terminals: 20 MΩ max. (at 500 VDC)
Dielectric strength		(1) Between all electrical circuits and the case: 2,200 VAC for 1 min (2) Between all voltage and current inputs and all communications and pulse output terminals: 2,200 VAC for 1 min
Vibration resistance		Single amplitude: 0.1 mm, Acceleration: 15 m/s <sup>2</sup> , Frequency: 10 to 150 Hz, 10 sweeps for 8 min each along three axes
Shock resistance		150 m/s <sup>2</sup> , 3 times each in 6 directions (up/down, left/right, forward/backward)
Weight		Approx. 350 g (Power Monitor only)
Degree of protection		IP20
Pulse output	Number of outputs	Number of outputs: 4 (photoMOS relay outputs) Used for the total power consumption pulse output.
	Output capacity	50 mA at 40 VDC ON residual voltage: 1.5 V max. (for output current of 50 mA) OFF leakage current: 0.1 mA max.
	Output unit	Output unit: 1, 10, 100, 1k, 5k, 10k, 50k, or 100k (wh) Pulse ON time: 500 ms (Cannot be changed.)
Communications interface	Communications method	RS-485 (2-wire half-duplex with start-stop synchronization)
	Communications protocol	Modbus (RTU): Binary, CompoWay/F: ASCII
	Baud rate	1.2, 2.4, 4.8, 9.6, 19.2, or 38.4 kbps
	Data length	Data length: 7 or 8 bits Stop bits: 1 or 2 bits Vertical parity: Even, odd, or none
	Maximum transmission distance	1,200 m
	Maximum number of connected Power Monitors	Modbus: 99, CompoWay/F: 31 If you measure more than one circuit with one Power Monitor, the number of circuits is treated as the number of connected Power Monitors.
Dimensions (HxWxD)		90 × 90 × 65 mm (excluding protrusions)
Installation method		DIN Rail mounting
Accessories		Instruction Manual and Compliance Sheet

\* The error of the CT or VT is not included. IEC 62053 is an international standard for power metering.

# Part Names and Functions

## Power Monitor

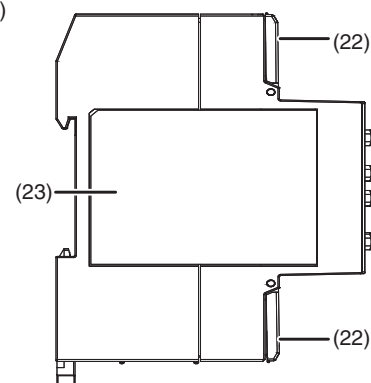
Front Panel with Terminal Block Covers Removed



Detailed View of LCD



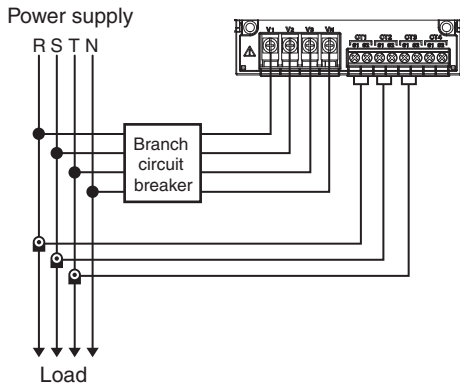
Side View



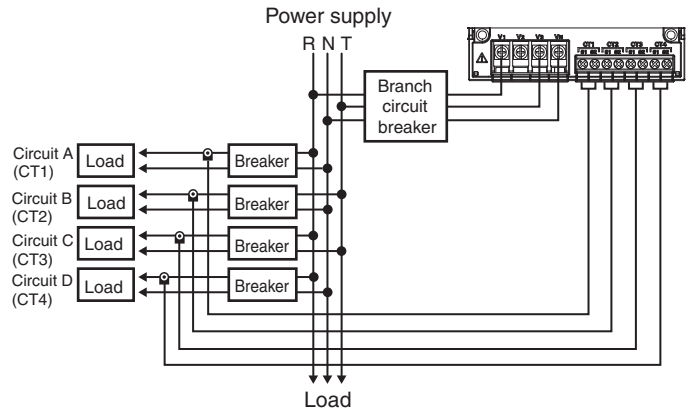
No.	Item	Description	
(1)	Power indicator (green)	Lights when the power supply is turned ON.	
(2)	Error indicator (red)	Flashes when there is an abnormality, such as a failure.	
(3)	Alarm indicator (orange)	Flashes when there is an alarm.	
(4)	Communications indicator (yellow)	Lit during communications.	
(5)	Pulse indicator (yellow)	Lit while pulses are being output from OUT1 (circuit A).	
(6)	Communications address and menu display	When ADDRESS is lit (Measurement Mode), the communications address is being displayed. When MENU is lit (Setting Mode), the menu number is being displayed.	
(7)	Status Indicators	SET	Lit in Setting Mode.
		OUTPUT	Lit while a pulse output is being set up.
		1	Lit while pulses are being output from OUT1.
		2	Lit while pulses are being output from OUT2.
		3	Lit while pulses are being output from OUT3.
(8)	Measured value/set value display	Main display	Displays the measured value or set value.
		Subdisplay	Displays the measurement unit or setting name.
(9)	Tariff display	Displays the tariff number (T1 to T4) a total active power consumption is being saved.	
(10)	CT usage display	Displays the numbers of the CTs (CT1 to CT4) for which measurement or setting operations are in progress.	
(11)	<</MODE Key	Short press: Changes the circuit or moves the digit. Long press: Changes the mode.	
(12)	⬆ Key	Increments the item or value.	
(13)	⬇ Key	Decrements the item or value.	
(14)	ENTER Key	Enters the item or value.	
(15)	ESC Key	Cancel	
(16)	Rotary switches	Set the communications address for circuit A. The left switch (x10) sets the tens place and the right switch (x1) sets the ones place.	
(17)	RS-485 communications terminals	RS-485 + (1)	RS-485 + terminal
		RS-485 - (1)	RS-485 - terminal
		RS-485 + (2)	RS-485 + terminal for crossover wiring
		RS-485 - (2)	RS-485 - terminal for crossover wiring
		RS-485 E	RS-485 terminating resistance terminal
(18)	Pulse output terminals	OUT1	Pulse output terminal for circuit A
		OUT2	Pulse output terminal for circuit B
		OUT3	Pulse output terminal for circuit C
		OUT4	Pulse output terminal for circuit D
		COM	Pulse output common terminal
(19)	Voltage input terminals	Terminal used to input the power supply voltage. These terminals are also used for the measured voltage inputs.	
(20)	CT input terminals	Terminals used to connect the CT cables for CT1 to CT4	
(21)	DIN hook	Hook used to mount the Power Monitor to a DIN Track	
(22)	Terminal block covers	Sealed terminal block covers	
(23)	Terminal arrangement label	Label that provides information, such as the model number, power supply voltage, terminal arrangement, and serial number	

# Connection Wiring Diagrams

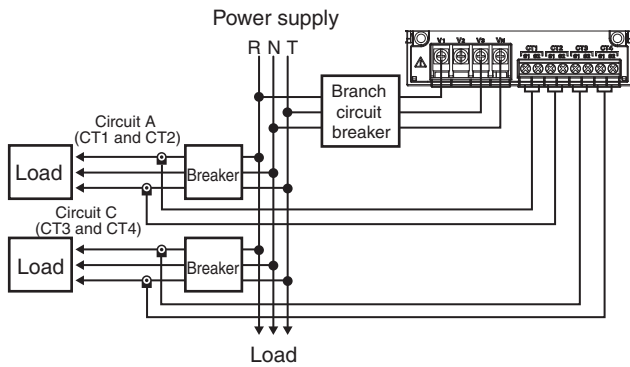
**Three-phase, Four-wire Circuit**



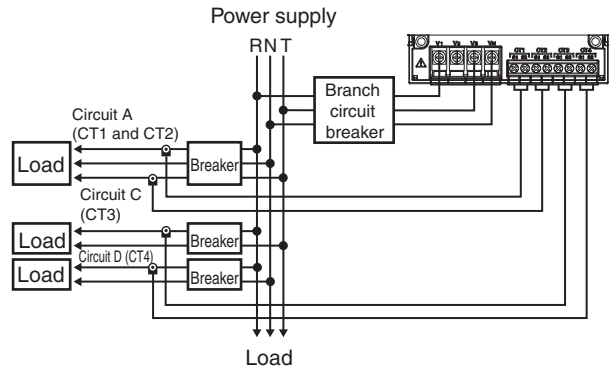
**Single-phase, Two-wire Circuit Branched from Single-phase, Three-wire Circuit**



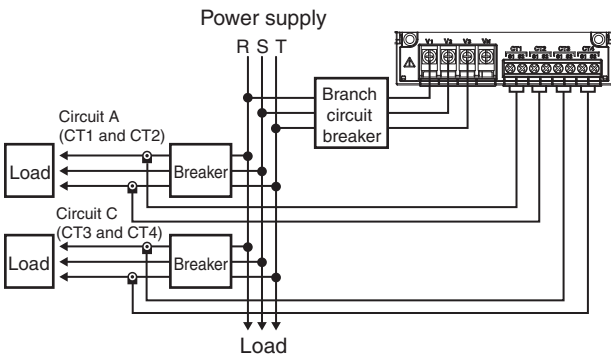
**Single-phase, Three-wire Circuit**



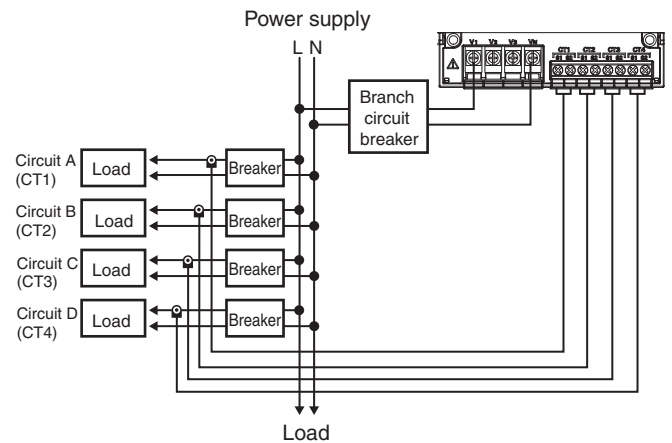
**Single-phase, Three-wire Circuit and Single-phase, Two-wire Circuit Branched from Single-phase, Three-wire Circuit**



**Three-phase, Three-wire Circuit**



**Single-phase, Two-wire Circuit**



## CT Wiring

- Three CTs are required to measure three-phase, four-wire power. Two CTs are required to measure single-phase, three-wire power or three-phase, three-wire power. One CT is required to measure single-phase, two-wire power.
- Use AWG18 to AWG14 (cross-sectional area: 0.75 to 2.0 mm<sup>2</sup>) wires with a heat resistance of 85°C min. to connect to the CT input terminals.
- Use ferrules suitable for the wire diameter to connect to the CT input terminals.
- The recommended tightening torque for M3 terminal screws is 0.5 to 0.6 N·m. Push ferrules all the way in and tighten the screws securely.

## Voltage Wiring

The Power Monitor has voltage input terminals V1, V2, V3, and VN, which function as both the operating power supply terminals and voltage measurement terminals.

Connect a branch circuit breaker between the voltage input terminals and the wiring so that the power supply can be turned OFF immediately.

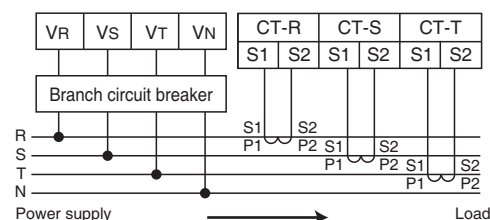
- For safety, always work with the power supply turned OFF both at the main power supply and at the branch circuit breaker.
- Connect the wires in the correct phase sequence. Otherwise, the power and power consumption cannot be measured correctly.
- When wiring the power supply and measured voltage terminals, use round or forked crimp terminals suitable for M3.5 screws and AWG24 to AWG14 (cross-sectional area: 0.2 to 2.0 mm<sup>2</sup>) wires.
- Recommended tightening torque for CT input terminal screws: 0.8 N·m. Push crimp terminals all the way in and tighten the screws securely after securing the wiring, gently pull on the cables to check that they are held securely.
- Always use the Power Monitor with the terminal covers closed.

## Wiring Diagram

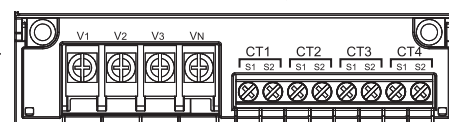
When only one circuit (circuit A) is used with the phase wiring method (three-phase four-wire, single-phase two-wire, single-phase three wire, or three-phase three-wire), connect the voltage input terminals and CT input terminals as given in the following table. Wire according to the phase wiring method.

	VR	VS	VT	VN	Per circuit			Number of measured circuits
					CT-R	CT-S	CT-T	
Three-phase, four-wire	V1	V2	V3	VN	CT1	CT2	CT3	1
Single-phase, two-wire	V1	---	---	VN	CT1	---	---	4
Single-phase, three-wire	V1	---	V3	VN	CT1	---	CT2	2
Three-phase, three-wire	V1	V2	V3	---	CT1	---	CT2	2

(This is an example for a three-phase, four-wire circuit.)  
P1/P2: Primary  
S1/S2: Secondary

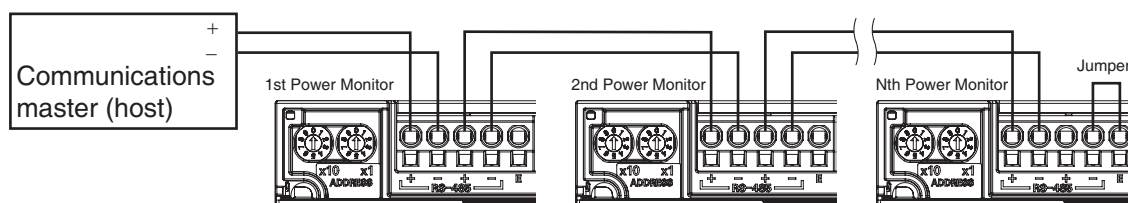


The relationship between the wiring table and the Power Monitor terminals is shown in the figure on the right.



## RS-485 Communications Wiring Diagram

- The terminal block has push-in terminals. Refer also to *Cautions when connecting the Push-In Plus Terminal Blocks (RS-485 Communications Terminals and Pulse Output Terminals)* on page 8 when you wire communications.

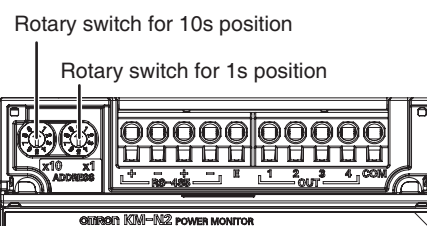


- The KM-N2 does not have a FG terminal. Connect only the positive and negative lines for RS-485.
- Use twisted-pair cables.
- Wire the RS-485 communications lines and power lines separately to prevent the influences of noise.
- The maximum transmission distance is 1,200 m.
- Always test communications on the actual system regardless of the transmission distances and number of connected Power Monitors.
- Always close the terminal block covers before you use the Power Monitor.

## Communications Address Setting

Turn the rotary switches to set the communications address. The value on the left side is set as the 10s position of the communications address for circuit A and the value on the right side as the 1s position.

- The value on the rotary switches is assigned as the communications address for circuit A (1st circuit). When multiple addresses are used, the values given in the following table are allocated automatically.
- The communications addresses for circuit B through circuit D cannot be set individually.



	Circuit A	Circuit B	Circuit C	Circuit D
Three-phase, four-wire	Set value	---	---	---
Single-phase, two-wire circuit branched from single-phase, two-wire circuit or single-phase, three-wire circuit	Set value	Set value + 1	Set value + 2	Set value + 3
Single-phase, three-wire circuit or three-phase, three-wire circuit	Set value	---	Set value + 1	---
Single-phase, three-wire circuit and single-phase, two-wire circuit branched from single-phase, three-wire circuit	Set value	---	Set value + 1	Set value + 2

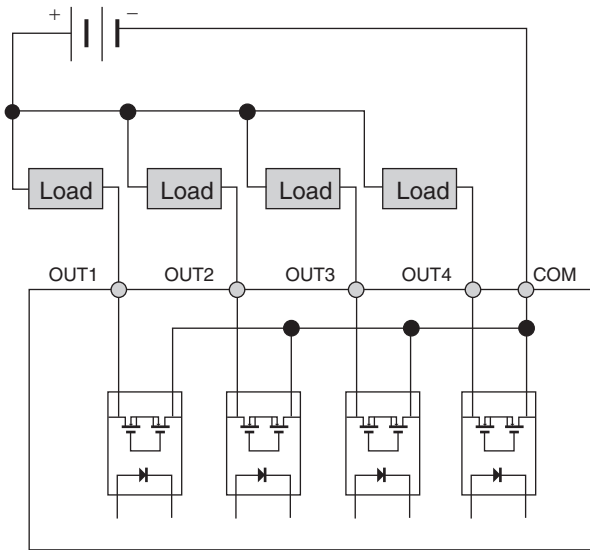
## Terminating Resistance Setting

- The Power Monitor has terminating resistance built in. On the last node on the communications line, connect a jumper between the RS-485 negative terminal and the RS-485 E terminal. The internal terminating resistance will be connected.
- When using a host that does not have built-in terminating resistance, connect terminating resistance to the host as well. The terminating resistance is 120 Ω (1/2 W).
- Do not wire terminating resistance to the KM-N2 partway along the transmission path. Communications failures may occur.

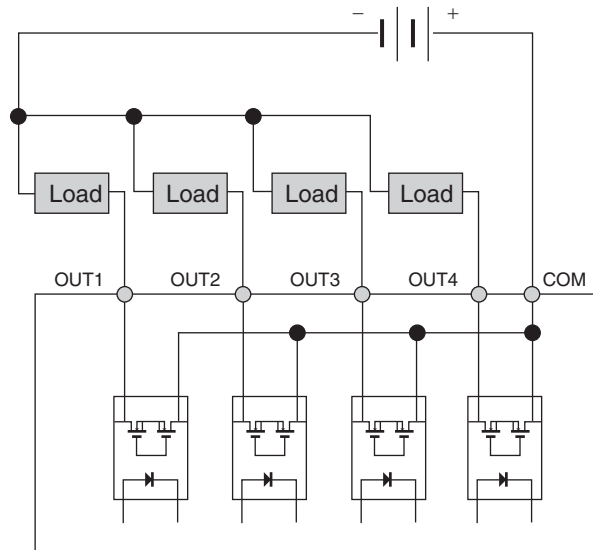
# KM-N2

## Pulse Output Wiring Diagrams

NPN Output Connection Diagram



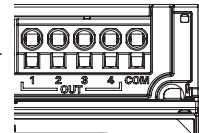
PNP Output Connection Diagram



The Power Monitor provides four pulse output terminals. One common is used, terminal 5.

- The terminal block has push-in terminals. Refer also to *Cautions when connecting the Push-In Plus Terminal Blocks (RS-485 Communications Terminals and Pulse Output Terminals)* on page 8 when you wire the pulse outputs.
- Never connect an external power supply directly between an output terminal and the common. Always connect a load.
- Wire signal lines and power lines separately to prevent the influences of noise.
- The outputs are assigned as follows and cannot be changed: OUT1 is for circuit A, OUT2 is for circuit B, OUT3 is for circuit C, and OUT4 is for circuit D.

The relationship between the wiring table and the Power Monitor terminals is shown in the figure on the right.

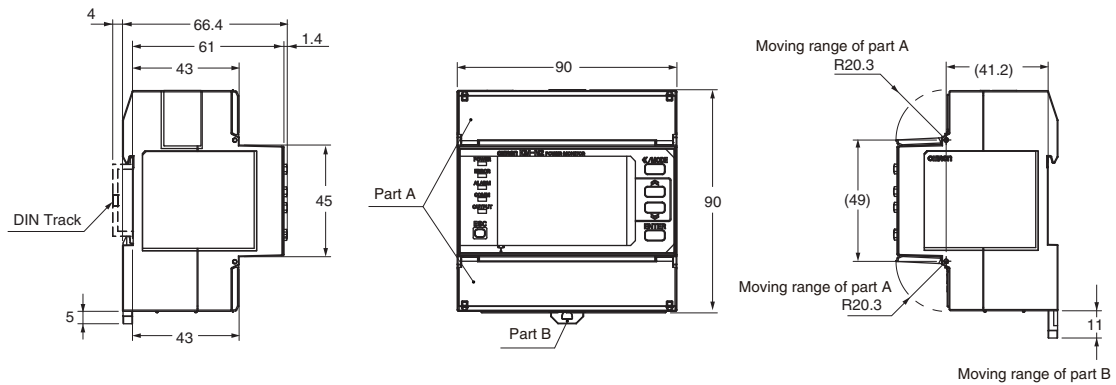


## Dimensions

(Unit: mm)


### Power Monitor

KM-N2-FLK









# Safety Precautions


## Warning Indications

 <b>CAUTION</b>	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
<b>Precautions for Safe Use</b>	Supplementary comments on what to do or avoid doing, to use the product safely.
<b>Precautions for Correct Use</b>	Supplementary comments on what to do or avoid doing, to prevent failure to operate, malfunction or undesirable effect on product performance.

## Meaning of Product Safety Symbols

	Used for general mandatory action precautions for which there is no specified symbol.
	Used to warn of the risk of explosion under specific conditions.
	Used to warn of the risk of electric shock under specific conditions.
	Indicates the possibility of injuries by high temperature under specific conditions.
	Used for general prohibitions for which there is no specific symbol.
	Use to indicate prohibition when there is a risk of minor injury from electrical shock or other source if the product is disassembled.


## Caution


**Property damage may occasionally occur due to fire. Tighten terminal screws to the specified tightening torque.** 


**Confirm that there is no looseness in the screws after tightening them.**


**M3.5 screws: 0.8 N·m**


**M3 screws: 0.5 to 0.6 N·m**

**Minor or moderate bodily harm or property damage may occasionally occur due to explosion. Do not use the Power Monitor near inflammable or explosive gas.** 


**Destruction or rupture may occasionally occur. Make sure that the power supply voltages and loads are within specifications and ratings.** 


**Electrical shock may occasionally occur. Do not touch any of the terminals while the power is being supplied.** 

**Electric shock may occasionally occur. Always turn OFF the power supply to the circuit where a CT is mounted before you connect the CT terminals on the Power Monitor.** 

**Burn injury may occasionally occur due to contact with high temperature. Do not touch any wiring connected to the Power Monitor while the power is ON or immediately after it is turned OFF.** 

**Use wire with a heat resistance of 85°C min. for all wiring to the Power Monitor.**

**Electrical shock, minor injury, fire, or equipment malfunction may occasionally occur. Do not apply a current that exceeds the maximum current for the CT secondary side to the CT input terminals.** 

**Electrical shock, minor injury, fire, or equipment malfunction may occasionally occur. Do not disassemble, repair, or modify the Power Monitor.** 

\* CT: Current transformer

## Precautions for Safe Use

Observe the following precautions to ensure the safe usage of the KM-N2.

- Do not store, install, or use the Power Monitor in the following locations.
  - Locations that are greatly affected by vibration or shock
  - Unstable locations
  - Locations where the specified range of temperature or humidity would be exceeded
  - Locations that are subject to rapid changes in temperature or humidity where condensation or icing may occur
  - Outdoors or locations that are subject to direct sunlight, wind, or rain
  - Locations that are affected by static electricity or noise
  - Locations that are affected by electric or magnetic fields
  - Locations that are subject to flooding or oil
  - Locations that are subject to splashing brine
  - Locations that are subject to corrosive gas (particularly sulfide or ammonia gas)
  - Locations that are excessively dusty or dirty
  - Locations with miscible liquids
- Use AWG24 to AWG14 wires with a heat resistance of 85°C to connect the power supply and voltage input terminals.
- Use AWG18 to AWG14 wires with a heat resistance of 85°C to connect to the CT terminals.
- Use AWG24 to AWG14 wires with a heat resistance of 85°C to connect the communications terminals.
- Check all terminal numbers before wiring. Do not connect anything to unused terminals.
- Check the specifications and wiring and make sure there are no mistakes before you turn ON the power supply.
- Read and understand the Operation Manual before attempting to install, use, or maintain the Power Monitor.
- Understand the user manuals when you set the Power Monitor.
- Do not pull on the cables.
- Do not use any application methods that are not given in the operation manual. Protection implemented in the equipment could be lost.
- Install and suitably label a switch or circuit breaker that is appropriate for the voltage that is being used and complies with the relevant standards for your country so that the operator can immediately turn OFF the power supply. (USA: Use a UL-listed switch or circuit breaker, Canada: Use a cUL-listed switch or circuit breaker, Other countries: Use a branch circuit breaker that complies with IEC 60947-1 and IEC 60947-3 or with other relevant standards.)

We recommend that you use a branch circuit breaker with a rated current of 1 A.



- Always check the wiring and confirm that it is correct before turning ON the power supply. Incorrect or improper wiring may result in electrical shock, injury, accidents, failure, or malfunction.
- Do not touch any of the terminals while the power is being supplied.
- Do not install the Power Monitors near sources of heat, such as devices with coils or windings.
- When you install the DIN Tracks, make sure that the screws are tightened securely. Mount the Power Monitor securely to the DIN Track. If the Power Monitor is loose, vibration or shock can cause the DIN Track, Power Monitor, or wires to become disconnected.
- Use DIN Tracks with a width of 35 mm (OMRON PFP-50N/-100N).
- If you mount the Power Monitor on DIN Track, slide the DIN hook until it securely and audibly locks in place.
- To prevent inductive noise, wire the lines connected to the Power Monitor separately from power lines carrying high voltages or currents. Do not wire in parallel with or in the same cable as power lines. Other measures for reducing noise include running lines in separate ducts and using twisted-pair cables.
- The Power Monitor is a Class A product (for use in industrial environments). In residential environment areas, it may cause radio interference. If it causes radio interference, the user may be required to take adequate measures to reduce interference.

### Precautions for Correct Use

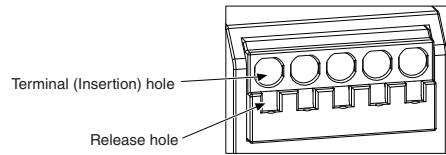
- This Power Monitor is not a Special Measuring Instrument that has passed testing by a specified body under the Measurement Act of Japan. It cannot be used to certify power consumption under Japanese law.
- Make sure that all settings are set suitably for the measurement targets.
- Mount the Power Meter to a DIN Track.
- When using the Power Monitor in an Overvoltage Category III environment, externally install varistors between the power supply and voltage measurement inputs to the Power Monitor.
- Do not use the Power Monitor for measurement on the secondary side of an inverter.
- Make sure the rated voltage is reached within 2 seconds after the power is turned ON.
- Always turn OFF all power before cleaning the Power Monitor. Dry wipe the surfaces of the Power Monitor with a soft, dry cloth. Never use any chemical that contains solvents such as paint thinner, benzene, or alcohol.
- OMRON's KM-series CTs (e.g., the KM20-CTF or KM-NCT Series) cannot be used. Use CTs with a secondary-side output of 1 A or 5 A.
- To comply with standards, always use ferrules when you connect to the input terminals on CTs.
- The total power consumption and other data is saved every 5 minutes. When the power supply to the Power Monitor is turned OFF, the last 5 minutes worth of data may not have been saved.
- When discarding the Power Meter, properly dispose of it as industrial waste according to all applicable local ordinances.

### Cautions when connecting the Push-In Plus Terminal Blocks (RS-485 Communications Terminals and Pulse Output Terminals)

When connecting Push-in Plus Terminal Blocks (RS-485 communications terminals and pulse output terminals), use the following procedure.

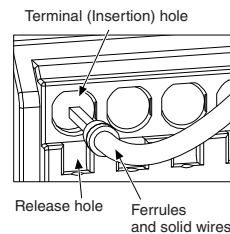
#### 1. Connecting Wires to the Push-In Plus Terminal Block

##### Part Names of the Terminal Block



#### Connecting Wires with Ferrules and Solid Wires

Insert the solid wire or ferrule straight into the terminal block until the end strikes the terminal block.

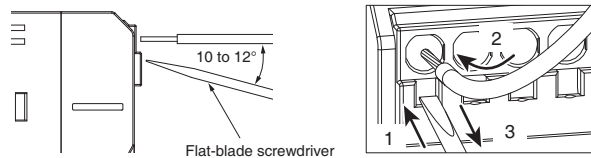


- If a wire is difficult to connect because it is too thin, use a flat-blade screwdriver in the same way as when connecting stranded wire.

#### Connecting Stranded Wires

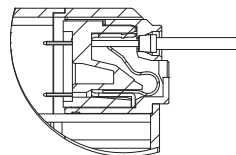
Use the following procedure to connect the wires to the terminal block.

1. Hold a flat-blade screwdriver at an angle and insert it into the release hole. The angle should be between 10° and 12°. If the flat-blade screwdriver is inserted correctly, you will feel the spring in the release hole.
2. With the flat-blade screwdriver still inserted into the release hole, insert the wire into the terminal hole until it strikes the terminal block.
3. Remove the flat-blade screwdriver from the release hole.



#### Checking Connections

- After the insertion, pull gently on the wire to make sure that it will not come off and the wire is securely fastened to the terminal block.
- To prevent short circuits, insert the stripped part of a stranded or solid wire or the conductor part of a ferrule until it is hidden inside the terminal insertion hole. (See the following diagram.)

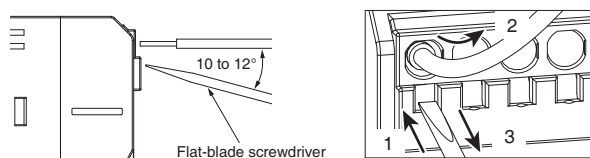




## 2. Removing Wires from the Push-In Plus Terminal Block

Use the following procedure to remove wires from the terminal block. The same method is used to remove stranded wires, solid wires, and ferrules.

1. Hold a flat-blade screwdriver at an angle and insert it into the release hole.
2. With the flat-blade screwdriver still inserted into the release hole, remove the wire from the terminal insertion hole.
3. Remove the flat-blade screwdriver from the release hole.

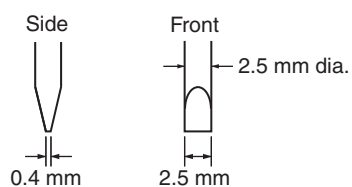


## 3. Recommended Crimp Tools

### Recommended Flat-blade Screwdriver

Use a flat-blade screwdriver to connect and remove wires.

Use the following flat-blade screwdriver.



Model	Manufacturer
XW4Z-00B	Omron



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