

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 only one unit.
- Compact with a selection of several circuit measurements.



Refer to *Safety Precautions* on page 8.

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

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: 100 to 277 VAC (L-N) or 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 × 65 × 90 mm (W×H×D)	RS-485

KM-N2

Specifications

Ratings

Item	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
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: 100 to 277 VAC (L-N) or 173 to 480 VAC (L-L) Three-phase, 4-wire: 100 to 277 VAC (L-N) or 173 to 480 VAC (L-L)
Allowable supply voltage range	85% to 115% of rated power supply voltage
Power consumption	7 VA max.
Input current (CT2 primary-side current)*2	General-purpose CT: 1 A or 5 A Rated load: 0.5 VA min.
Rated input frequency	50/60 Hz
Allowable input voltage	85% to 115% of rated power supply voltage
Allowable input current	6 A max.
Ambient operating temperature	-25 to 55°C (with no condensation or icing)
Storage temperature	-25 to 85°C (with no condensation or icing)
Ambient operating humidity	25% to 85%
Storage humidity	25% to 85%
Operating altitude	2,000 m max.
Installation environment	Overvoltage category II, pollution degree 2, measurement category II
Electromagnetic environment	Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)
Compliant standards	EN 61010-2-030, EN 61326-1, and UL 61010-1

Performance

Item	KM-N2-FLK	
Measurement specifications	Active power	IEC 62053-22 class 0.5S (Accuracy $\pm 0.5\%$ F.S. ± 1 digit)*3
	Reactive power	IEC 62053-23 class 2 (Accuracy $\pm 2\%$ F.S. ± 1 digit)*3
	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 M Ω min. (at 500 VDC) (2) Between all power supply and voltage inputs and all communications and pulse output terminals: 20 M Ω 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 ² , Frequency: 10 to 150 Hz, 10 sweeps for 8 min each along three axes	
Shock resistance	150 m/s ² , 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	1, 10, 100, 1k, 5k, 10k, 50k, or 100k (Wh) Pulse ON time: 500 ms (Cannot be changed.)
Commu- nications interface	Communications method	RS-485 (2-wire half-duplex with start-stop synchronization)
	Communications protocols	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*3
	Maximum number of connected Power Monitors	Modbus: 99, CompoWay/F: 31
Dimensions (WxDxH)	90 × 65 × 90 mm (excluding protrusions)	
Installation method	DIN Rail mounting	
Accessories	Instruction Manual and Compliance Sheet	

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

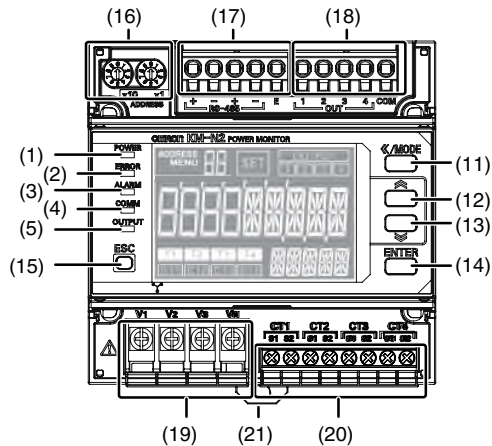
*2. The KM-series CTs (the KM20-CTF or KM-NCT Series) cannot be used. Use general-purpose CTs with a secondary-side output of 1 A or 5 A.

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

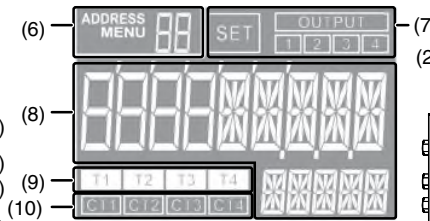
Part Names and Functions

Power Monitor

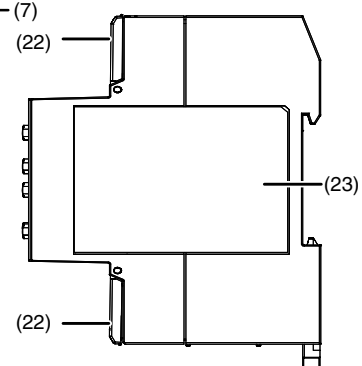
Front Panel with Terminal Block Covers Removed



Detailed View of LCD



Side View

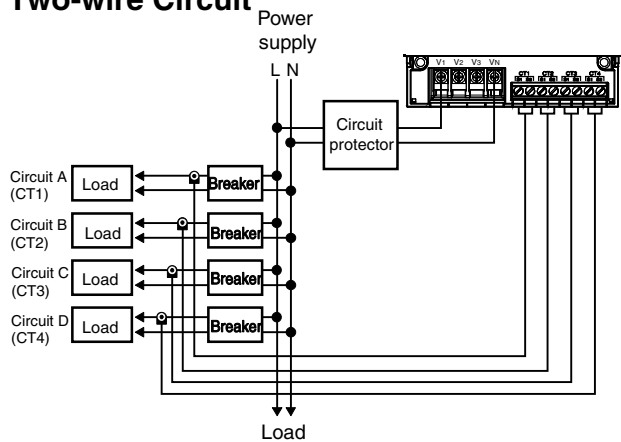


No.	Item	Description	
(1)	Power indicator (green)	Lit when the power supply is turned ON.	
(2)	Error indicator (red)	Flashes when there is an abnormality, such as a failure.	
(3)	Alarm indicator (orange)	Flashes when there is an alarm.	
(4)	Communications indicator (yellow)	Lit during communications.	
(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	

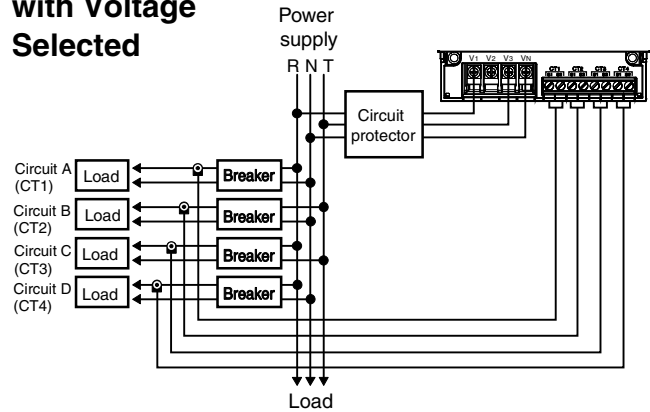
KM-N2

Connection Wiring Diagrams

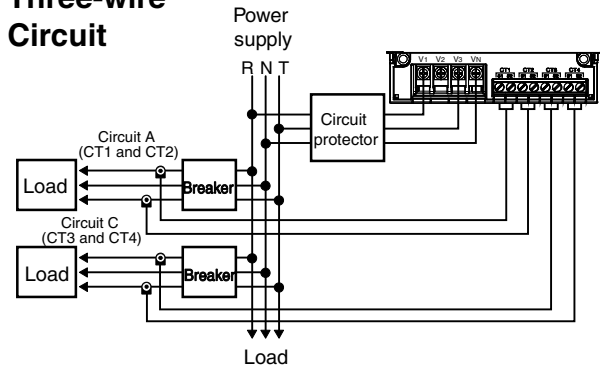
Single-phase, Two-wire Circuit



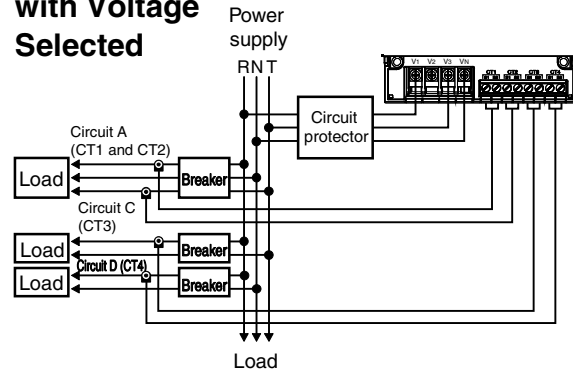
Single-phase, Two-wire Circuit with Voltage Selected



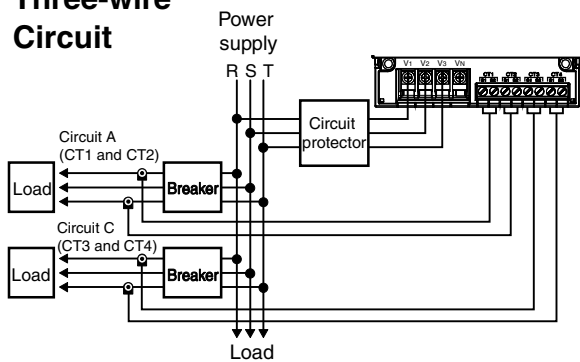
Single-phase, Three-wire Circuit



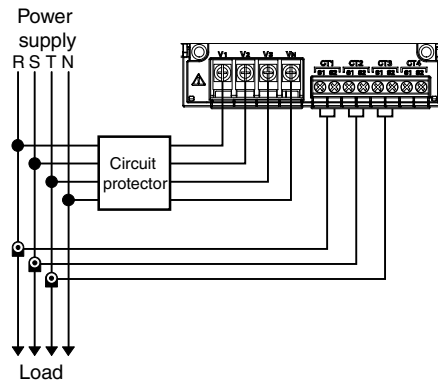
Single-phase, Three-wire Circuit with Voltage Selected



Three-phase, Three-wire Circuit



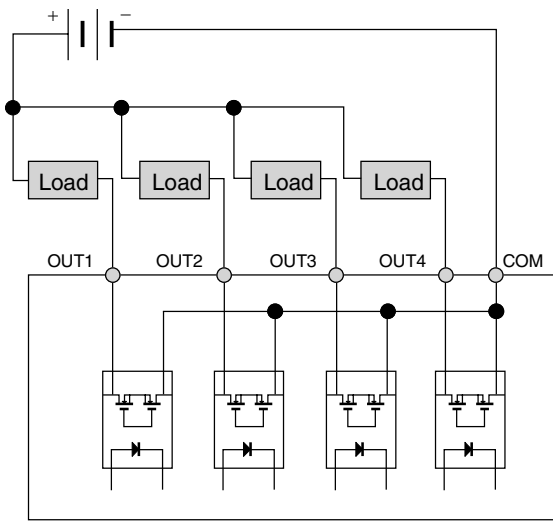
Three-phase, Four-wire Circuit



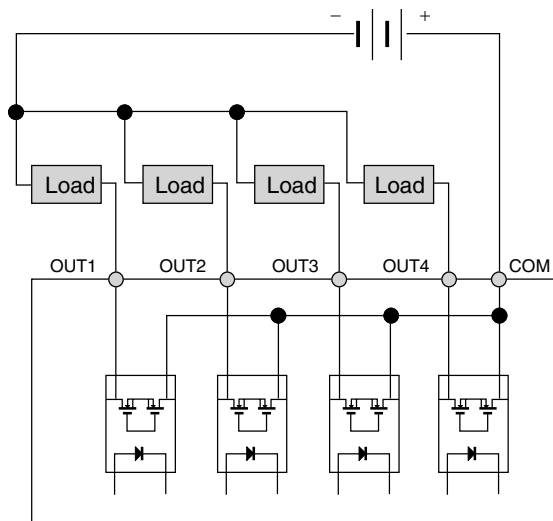
Output Stage Circuit Diagrams

Pulse Output Circuit Diagrams

NPN Output Connection Diagram



PNP Output Connection Diagram



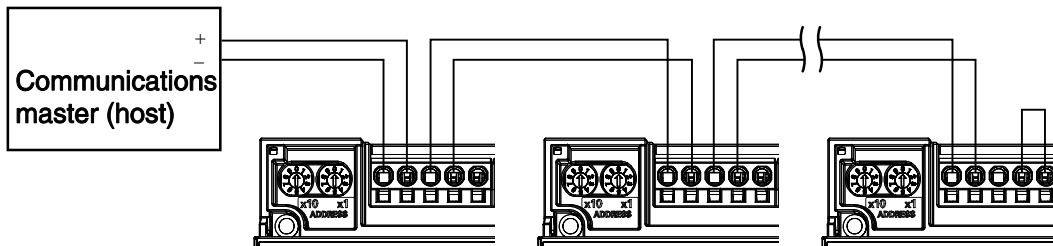
The Power Monitor provides four pulse output terminals. One common is used, terminal 5.

- The terminal block has push-in terminals. Refer also to *Push-In Plus Terminal Blocks (RS-485 Communications Terminals and Pulse Output Terminals)* on page 9 when you wire the pulse outputs.
- Never connect an external power supply directly between an output terminal and the common. Always connect a load.
- Use AWG24 to AWG14 (cross-sectional area: 0.2 to 2.0 mm²) wires to connect to the pulse output terminals.
- You can use solid wires, stranded wires, or ferrules. The recommended wire stripping length for solid wires or stranded wires is 8 to 10 mm. (However, if you use AWG14 wires, always use a stripping length of 10 mm.)
- 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.

RS-485 Communications Wiring Diagram

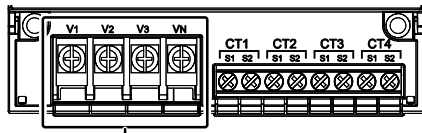
The connection configuration is 1:1 or 1:N. For a 1:N configuration, you can connect up to 99 KM-N2 Power Monitors with Modbus and up to 31 with CompoWay/F.

- The terminal block has push-in terminals. Refer also to *Push-In Plus Terminal Blocks (RS-485 Communications Terminals and Pulse Output Terminals)* on page 9 when you wire communications.



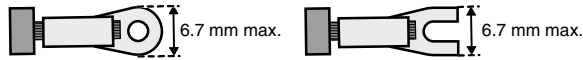
- The KM-N2 does not have a FG terminal. Connect only the positive and negative lines for RS-485.
- Use twisted-pair cables.
- Use AWG24 to AWG14 (cross-sectional area: 0.2 to 2.0 mm²) wires to connect to the RS-485 terminals.
- You can use solid wires, stranded wires, or ferrules. The recommended wire stripping length for solid wires or stranded wires is 8 to 10 mm. (However, if you use AWG14 wires, always use a stripping length of 10 mm.)
- 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.

Power Supply/Voltage Input Terminals

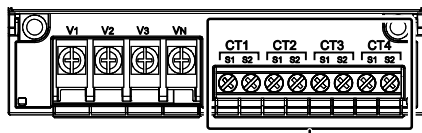


Voltage input terminals

Phase wiring method	Voltage input terminals			
	V ₁	V ₂	V ₃	V _N
Three-phase, four-wire	R	S	T	N
Single-phase, two-wire	L	-	-	N
Single-phase, three-wire	R	-	T	N
Three-phase, three-wire	R	S	T	-

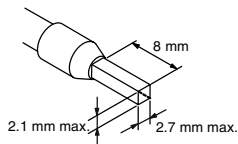


CT Terminals

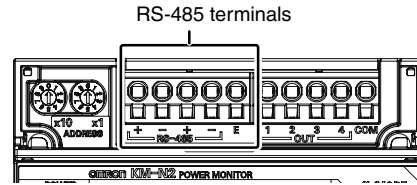


CT input terminals

Phase wiring method	Phase wiring method abbreviation	Measured circuits			
		Circuit A	Circuit B	Circuit C	Circuit D
Three-phase, four-wire	3P4W	CT1, CT2, CT3	-	-	-
Single-phase, two-wire	1P2W	CT1	CT2	CT3	CT4
Single-phase, three-wire	1P3W	CT1, CT2	-	CT3, CT4	-
Three-phase, three-wire	3P3W	CT1, CT2	-	CT3, CT4	-
Single-phase, two-wire circuit with voltage selected	1P2W2	CT1	CT2	CT3	CT4
Single-phase, two-wire composite	1P3W2	CT1, CT2	-	CT3	CT4

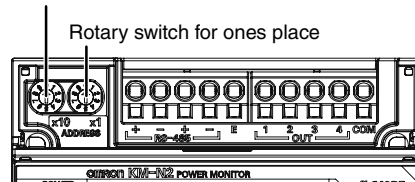


Communications Terminals and Address Setting Switches



Terminal No.	Terminal name	Description
1	RS-485 +	RS-485 + terminal
2	RS-485 -	RS-485 - terminal
3	RS-485 +	RS-485 + terminal for crossover wiring
4	RS-485 -	RS-485 - terminal for crossover wiring
5	RS-485 E	RS-485 terminal resistance terminal (Terminal resistance is connected internally if this terminal is connected to terminal 4.)

Rotary switch for tens place

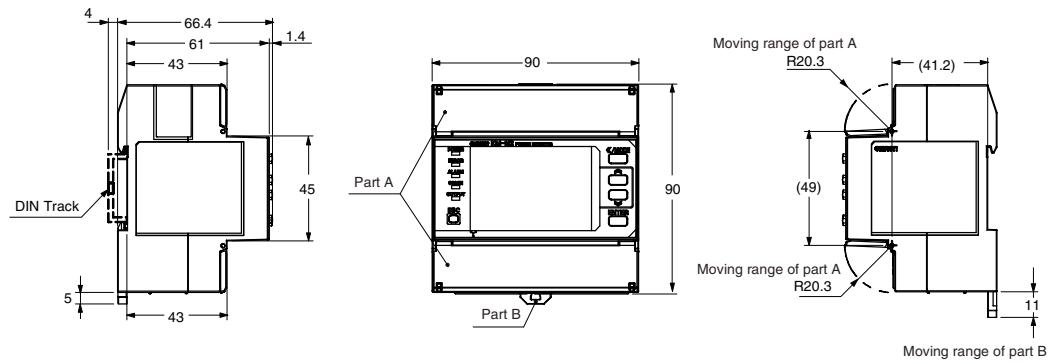


Rotary switch for ones place

Dimensions


Power Monitor

KM-N2-FLK








Safety Precautions

Warning Indications

 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
Precautions for Safe Use	Supplementary comments on what to do or avoid doing, to use the product safely.
Precautions for Correct Use	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.
	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.



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 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 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.
- 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 switch or circuit breaker that complies with IEC 60947-1 and IEC 60947-3 or with other relevant standards.)
We recommend that you use a breaker or switch with a rated current of 0.3 to 1 A and an instantaneous tripping capacity of 10 to 14 times the rated current.
- 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.

CT Terminals

- Always use ferrules.

Recommended wire sizes	Stripping length	
	With ferrules	Without ferrules
0.8 to 2.0 mm ² (AWG18 to AWG14)	10 mm	---

Push-In Plus Terminal Blocks

- Do not wire anything to the release holes.
- Do not tilt or twist a flat-blade screwdriver while it is inserted into a release hole on the terminal block. The terminal block may be damaged.
- Insert a flat-blade screwdriver into the release holes at an angle. The terminal block may be damaged if you insert the screwdriver straight in.
- Do not allow the flat-blade screwdriver to fall out while it is inserted into a release hole.
- Do not bend a wire past its natural bending radius or pull on it with excessive force. Doing so may cause the wire disconnection.
- Do not insert more than one wire into each terminal insertion hole.
- To prevent wiring materials from smoking or ignition, use the wiring materials given in the following table.

Recommended wire gauge	Stripping length	
	Ferrules used	Ferrules not used
0.25 to 1.5mm ² /AWG24 to 16	10 mm	8 mm

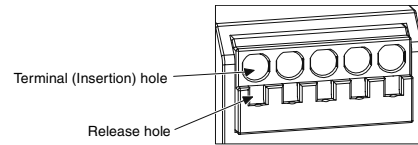
Note: Please use Ferrules with UL certification (R/C).

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.
- Do not use solvents, such as paint thinners, to clean the Power Monitor. Use commercially available alcohol instead.
- 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.

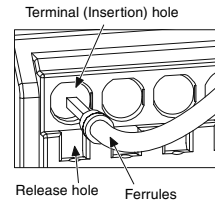
Push-In Plus Terminal Blocks (RS-485 Communications Terminals and Pulse Output Terminals)

1. Connecting Wires to the Push-In Plus Terminal Block Part Names of the Terminal Block



Connecting Wires with Ferrules

Insert the ferrule straight into the terminal block until the end strikes the terminal block.

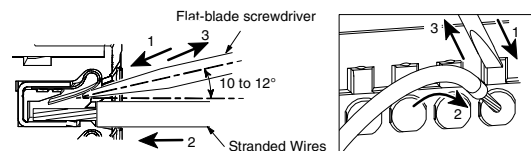


- If a wire is difficult to connect because it is too thin, use a flat-blade screwdriver in the same way as when connecting stranded wire.

Connecting Stranded Wires

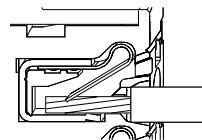
Use the following procedure to connect the wires to the terminal block.

- 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.
- With the flat-blade screwdriver still inserted into the release hole, insert the wire into the terminal hole until it strikes the terminal block.
- Remove the flat-blade screwdriver from the release hole.



Checking Connections

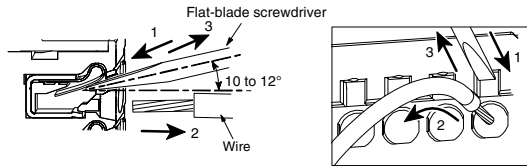
- After the insertion, pull gently on the wire to make sure that it will not come off and the wire is securely fastened to the terminal block.
- To prevent short circuits, insert the stripped part of a stranded or solid wire or the conductor part of a ferrule until it is hidden inside the terminal insertion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

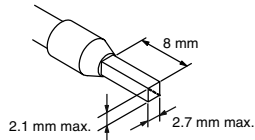


3. Recommended Ferrules and Crimp Tools

Recommended Ferrules

Applicable wire		Ferrule Conduct or length (mm)	Recommended ferrules		
(mm ²)	(AWG)		Phoenix Contact product	Weidmuller product	Wago product
0.25	24	8	AI0.25-8	H0.25/12	FE-0.25-8N-YE
0.34	22	8	AI0.34-8	H0.34/12	FE-0.34-8N-TQ
0.5	20	8	AI0.5-8	H0.5/14	FE-0.5-8N-WH
0.75	18	8	AI0.75-8	H0.75/14	FE-0.75-8N-GY
1	18	8	AI1-8	H1.0/14	FE-1.0-8N-RD
1.5	16	8	AI1.5-8	H1.5/14	FE-1.5-8N-BK
Recommended crimp tool			CRIMPFOX6 CRIMPFOX6-F CRIMPFOX10S	PZ6 roto	Variocrimp4

- *1. Make sure that the outer diameter of the wire coating is smaller than the inner diameter of the insulation sleeve of the recommended ferrule.
- *2. Make sure that the ferrule processing dimensions conform to the following figures.

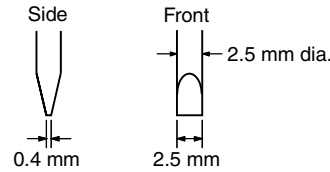


Recommended Flat-blade Screwdriver

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

Use the following flat-blade screwdriver.

The following table shows manufacturers and models as of 2015/Dec.



Model	Manufacturer
XW4Z-00B	Omron
ESD0.40X2.5	Wera
SZF 0.4X2.5	Phoenix Contact
0.4X2.5X75 302	Wiha
AEF.2.5X75	Facom
210-719	Wago
SDI 0.4X2.5X75	Weidmuller

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