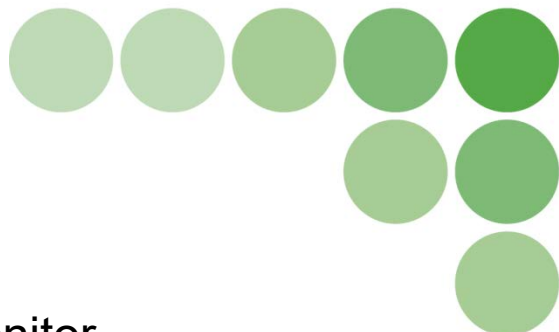




Smart Power Monitor

KM-N1-□□□

User's Manual



Catalog No. N244-E1-01

Notice

- (1) It is forbidden to duplicate, copy or reprint this manual in part or in whole without permission.
- (2) Please understand beforehand that the specifications in this manual may change without prior notice for the purpose of product improvement.
- (3) Best efforts have been applied to make sure that the details in this manual are correct; however, if there are any points which are incorrect or seem to be incorrect, please contact a branch office of Omron or one of its sales offices given at the end of this manual.

In doing so, please also state the catalog number given at the end of the manual.

Introduction

Thank you for purchasing this smart power monitor, model KM-N1-□□□ (referred to as model KM-N1 in this manual) and terminal block adapter model KM-N1OP-01.

This User's Manual describes the functions, performance, and application methods needed for optimum use of KM-N1 and KM-N1OP-01.

Please observe the following when using this unit.

- This product is designed for use by qualified personnel with knowledge of electrical systems.
- Before using the product, thoroughly read and understand this User's Manual to ensure correct use.
- Keep this User's Manual in a safe location so that it is available for reference whenever required.

Copyright and trademarks

- Modbus is a registered trademark of Schneider Electric.
 - BACnet is a registered trademark of ASHRAE.
 - Other company names and product names in this document are the trademarks or registered trademarks of their respective companies.
-

Agreement regarding use

Unless otherwise specifically agreed, you agree that the conditions in this agreement apply to your use of this Omron product, irrespective of the place of purchase.

1. Definitions

This defines some terms used in this agreement.

- (1) Omron products: FA system equipment, general-purpose control devices, sensors, and electronic/mechanical components under Omron brand.
- (2) Catalogs: Omron catalogues, including, without limitation, Omron "Best" Control Equipment Catalog, and General Catalog for Electronic/Mechanical Components, specifications, instructions, and user manuals for Omron Products, whether provided electronically.
- (3) Usage Conditions: Usage conditions, rating, performance, operating environment, handling instructions, warnings, restrictions on use, etc. of Omron Products described in the Catalogs.
- (4) Customer Application: Any application of Omron Products by a customer to include, but are not limited to, embedding and/or using Omron Products in their parts/components, electronic substrates, devices, equipment, or systems manufactured by customers.
- (5) Fitness: (a) fitness for a particular purpose, (b) performance, (c) non-infringement of third-party intellectual property, (d) compliance with laws and regulations and (e) conformity to standards of an Omron Product in the Customer Application.

2. Cautions regarding content

Be aware of the following points regarding the content of Catalogs.

- (1) Rated values and performance values are based on stand-alone tests using each separate condition, and Omron does NOT warrant any rated values and performance values for multiple composite conditions.
- (2) Reference data is provided for your reference only. Omron does NOT warrant that Omron Products always work properly as provided in the reference data.
- (3) Application examples are provided for your reference only. Omron does NOT warrant the Fitness of Omron Products under such application.
- (4) Omron may discontinue the production of Omron Products or change their specifications for the purpose of improving such products or for other reasons entirely at its own discretion.

3. Precautions

You are deemed to accept the following terms when you adopt or use Omron Products:

- (1) Use Omron Products in compliance with Usage Conditions including rating and performance.
- (2) Confirm Fitness of Omron Products in Customer Application and use your own judgment to determine the appropriateness of using them in such application. Omron does NOT warrant the Fitness of Omron Products in Customer Application.

- (3) Confirm beforehand that Omron Products are properly wired and installed for their intended use in your overall system.
- (4) When using Omron Products, make sure to (i) maintain a margin of safety in relation to the published rated and performance values, such as introducing redundancy, (ii) design to minimize risks to any Customer Application in case of failure of any Omron Products, (iii) adopt system-wide safety measures to notify risks to users, and (iv) conduct regular maintenance on Omron Products and Customer Application.
- (5) Omron Products are designed and manufactured as general-purpose products for use in general industrial products. They are not intended to be used in the applications described below, therefore if you use Omron products in these applications, Omron provides no warranty for Omron products. However, this excepts cases where the use is a special use intended by Omron or where Omron has specifically agreed, even when used in the following applications.
 - (a) Applications with stringent safety requirements (For example, nuclear power control equipment, combustion equipment, aerospace equipment, railway equipment, elevator and lift equipment, amusement equipment, medical equipment, safety equipment, and other applications that could cause physical injury or result in the loss of life.)
 - (b) Applications that require high reliability (For example, supply systems for gas, water and electricity, etc., 24 hour continuous operating systems, financial settlement systems and other applications that handle rights and property.)
 - (c) Applications under severe conditions or in severe environments (For example, outdoor equipment, equipment exposed to chemical contamination, equipment exposed to electromagnetic interference and equipment exposed to vibration and shocks.)
 - (d) Applications under conditions or environments not described in catalogs or other publications.
- (6) In addition to the applications listed in 3. (5) (a) to (d), the products in this publication are not intended for use in automobiles (including for two-wheeled vehicles, and this description applies hereafter). Do not use for applications involving fitting to automobiles. Consult Omron staff for information about products suitable for use in automobiles.

4. Warranty

The warranty for Omron Products is as follows:

- (1) Warranty period: The Warranty shall apply for one year from the date of purchase.
(Unless otherwise described in Catalogs.)
- (2) Warranty content: Omron will provide, at its own discretion, either of the following two services as the sole remedy for a malfunctioning Omron Product:
 - (a) Repair of the malfunctioning Omron Product(s) at an Omron maintenance service location at no charge to the customer (This repair service is not available for electronic/mechanical parts.)
 - (b) Replacement of the malfunctioning Omron Product(s) with the same number of replacement/alternative products at no charge to the customer.

(3) Exceptions: This warranty of Omron Products does not apply if the cause of the malfunction falls under any of the following:

- (a) Usage in a manner other than the original intended use for the Omron Products.
- (b) Usage other than as described in the Usage Conditions.
- (c) Usage that is not in accordance with Section 3 (Precautions) above.
- (d) Modification or repair made to the Omron Products by other than Omron personnel.
- (e) Software program by other than Omron staff
- (f) Causes which could not have been foreseen with the level of science and technology at the time of shipping from Omron.
- (g) Causes other than those above originating from other than Omron or Omron Products (including force majeure such as natural disasters).

5. Limitation of liability

The warranty express in this agreement is the entire warranty for this Omron product.

Omron and dealers selling Omron products accept no responsibility for damages arising from the use of Omron products.

6. Export control

Comply with the applicable laws and regulations of Japan and related nations relating to security export controls when exporting or providing this Omron product or technical documents to non-residents. If you do not comply with these laws and regulations, we may be unable to supply you with Omron products or technical documents.

Notice

- It is not permitted to reproduce, copy, or reprint this manual in part or in full without permission.
- Changes to this manual may be made without notice.
- Every effort has been made to ensure the accuracy of this manual, however please contact us or your dealer at one of the addresses shown at the back of this manual if you find any unclear points or errors. At this time, please also advise us of the catalog number found at the back of this manual.

Safety Precautions

To ensure the safe use of the KM-N1 and KM-N1OP-01, we use several safety icons to alert the reader to certain safety issues in this manual. The warning messages listed here indicate extremely important safety issues. Be sure to follow these guidelines. The icons and their meanings are as follows:

The following signal words are used in this manual.

 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.
--	--

Meanings of Alert Symbols

	●Disassembly prohibition This indicates that there is the danger of electric shock or other injury if the unit is disassembled.
	●Mandatory actions Indicates a general action that must be performed by the user.
	●Electrical shock caution Indicates possibility of electric shock under special conditions.
	●Explosion caution Indicates possibility of explosion under special conditions.
	●General prohibitions Indicates a general prohibition without particular categorization.



CAUTION

Property damage may occur due to fire. Tighten the terminal screws to the specified torques. After tightening the screw, check that the screw is not loose. Specified torque for terminal screws M2 screw: 0.22 to 0.25 N·m M3 screw: 0.50 to 0.60 N·m	
Minor or moderate injury or property damage may occur due to explosion. Do not use in locations exposed to flammable or explosive gases.	
Breakdown or explosion may occasionally occur. Use the power voltage within the specified and rate ranges.	
Breakdown or explosion may occasionally occur. Isolation isn't obtained between the voltage input circuit and the Current Transformer (CT) secondary circuit. When grounding the dedicated CT, wrong wiring may cause short circuit between the voltage input circuit and the CT secondary circuit. To avoid failure, be sure not to ground CT. The dedicated CT works without grounding.	
Electric shock may occasionally occur. Do not touch any of the terminals while the power is being supplied.	
Electric shock may occasionally occur. Always make sure that the power is turned OFF and no current is flowing before connecting the dedicated CT.	
Electric shock may occasionally occur. For the primary side electric wire where the dedicated CT is clamped, be sure to use a covered electric wire, which has been at least basically insulated.	
Electric shock, minor degree of injuries, ignition, or equipment failures may occasionally occur. Do not perform assembling, repairing, or remodeling.	
Minor electric shock, fire, or malfunction may occasionally occur. Do not supply a current to the CT input terminal that exceeds the maximum CT secondary current.	

* CT: Current Transformer

Precautions for Safe Use

Observe the following precautions for safe use of KM-N1 and KM-N1OP-01.

- 1) Do not store and manage, install, or use the product in any of the following locations.
 - Locations subject to vibration or strong shocks.
 - Locations where the product is unstable.
 - Locations subject to outdoor, direct sunlight, or weather.
 - Locations subject to temperature or humidity beyond the specifications.
 - Locations subject to extreme change in temperature and humidity, resulting in icing or condensation.
 - Locations subject to static electricity or noise.
 - Locations subject to an electric field or a magnetic field.
 - Locations subject to strong high-frequency noise and/or surges
 - Locations subject to corrosive gases (in particular, sulfide gas and ammonia gas).
 - Locations subject to dust (including iron dust).
 - Locations subject to exposure to water or oil.
 - Locations subject to exposure to saltwater.
 - Locations subject to miscible liquids.
- 2) Do not let a metallic chip into the product.
- 3) Install a switch or circuit breaker conforming to requirement in IEC60947-1 and IEC60947-3, and display how to turn off the power and prevent the short circuit accident. We recommend that you use a circuit breaker with a rated current of 1 A.
- 4) Be sure to check the wiring before turning ON the power of the product. Incorrect wiring may cause electric shock, injury, accident, failure, or malfunction.
- 5) To connect wires to the voltage terminal, use wire of AWG24 to 14 (cross-section area of 0.2 to 2.5 mm²).
- 6) To connect wires to the pulse output terminal, use wire of AWG26 to 18 (cross-section area of 0.14 to 1.0mm²). When connecting two wires to COM terminal, use the wires of AWG22 (cross-section area of 0.3 to 0.34 mm²).
- 7) To connect wires to the RS-485 communication terminal, use wire of AWG22 to 18 (cross-section area of 0.14 to 1.0 mm²). When connecting two wires to RS-485 communication terminal, use the wires of AWG22 (cross-section area of 0.3 to 0.34 mm²).
- 8) Before using the product, thoroughly read and understand the instruction manual and user's manual to ensure correct use. Otherwise electric shock, injury, accident, failure, or malfunction may occur.
- 9) Do not pull wires.
- 10) Be sure to touch grounded metal prior to touching of the product for eliminating static electricity.
- 11) Be sure to wire properly with the correct terminal number. Do not wire the terminals which are not used.
- 12) Do not install the product close to heat-producing devices, a coil for instance.
- 13) Allow for proper ventilation. Do not block the ventilation holes of the product.

- 14) Install DIN rails using screws without looseness. Fix the product on the DIN rails firmly. Looseness may cause the DIN rails, product and wiring to unfasten due to vibration or impact.
- 15) Use 35mm width DIN rails (OMRON, model PFP-50N/-100N).
- 16) When mounting the product on the DIN rail, slide the DIN hook unit until a clicking sound is heard.
- 17) Separate the product wiring from high-voltage or high-current power lines to prevent inductive noise, and do not place the product wiring parallel to or in the same ducts or conduits as power lines. Use separate ducts, separate conduits, or shielded cables.
- 18) Use dedicated CTs and dedicated CT cables.
- 19) Use dedicated CT under 600V voltage circuit.
- 20) This is a class A product. In residential areas it may cause radio interference, in which case a user may be required to take adequate measures to reduce interference.
- 21) Dispose of this product in accordance with local and national disposal regulations.
- 22) Use crimp terminals suitable for M3.5 (3.5 mm) screws (terminal screws of KM-N1OP-01) for wiring.
- 23) Be sure to check that the specifications and the wiring are correct before turning on the power.
- 24) KM-N1OP-01 is a dedicated terminal block adapter for KM-N1-FLK. Do not install other equipment to the bracket.
- 25) When mounting KM-N1-FLK on KM-N1OP-01 bracket, slide the DIN hook unit until a clicking sound is heard.
- 26) Do not touch any terminal while power is ON.

Precautions for Correct Use

- 1) This product is not categorized as "a specified measuring instrument" officially approved by an organization specified in relevant measurement acts. Therefore, the measured data provided by this product cannot be used for official energy certificates.
- 2) Set the parameters of the product so that they are suitable for the system being measured.
- 3) Mount this product on DIN rails for use.
- 4) Use varistors between each wire when this product is installed under overvoltage category III.
- 5) This Product cannot be used to measure the inverter's secondary side.
- 6) Make sure that the connector is properly connected before the power is turned on.
- 7) Reach the rated voltage within 2 seconds after the power is turned on.
- 8) If the power interruption occurs, the amount of power of up to before 5 minutes will not be added to the integral power consumption.
- 9) Do not use thinner or similar solvent for cleaning. Use commercial alcohol.
- 10) Do not use dedicated CTs by allowable input current continuously under the maximum operating temperature (60°C).
- 11) KM-N1OP-01 must be used with KM-N1-FLK installed.
- 12) In a power supply system where it is unearthed neutral, a varistor cannot be installed between the voltage input terminal and the ground, so it cannot be used in an overvoltage category III environment.
- 13) The data for active energy is saved at 5-minute intervals. The data for the 5 minutes preceding the unit powering off may not be saved under some circumstances.
- 14) Dispose of this product appropriately as industrial refuse in accordance with local and national regulations.
- 15) This product is intended for use in industrial environments. Do not use it in residential environment.

Manual Revision History

A manual revision code is added to the end of the catalog number on the front and back covers.

Catalog No. N244-E1-01

↑
Revision code

Revision code	Date	Revised contents
01	July 2025	First edition

Table of Contents

Introduction	1
Safety Precautions	5
Precautions for Safe Use	7
Precautions for Correct Use	9
Manual Revision History	10
Table of Contents	11
Chapter 1. Overview of KM-N1	1-1
1.1. Main Features	1-2
1.2. Configuration	1-4
1.3. Part Names and Functions	1-5
1.3.1. Main unit	1-5
1.3.2. Dedicated CT	1-9
1.3.3. Cable	1-10
1.4. Dimensions	1-11
1.4.1. Main unit	1-11
1.4.2. Dedicated CT	1-11
1.4.3. Cable	1-12
1.5. Multi-circuit metering	1-13
1.6. Mode configuration	1-15
1.7. Function List	1-17
Chapter 2. Installation and Wiring	2-1
2.1. Installation of Main Unit	2-2
2.2. Connection of Dedicated CT and Main Unit	2-4
2.3. Wiring for power and monitored voltage input	2-5
2.4. Pulse output wiring	2-7
2.5. RS-485 wiring	2-9
2.6. Fitting the dedicated CTs to the measuring wires	2-10
2.7. Wiring Diagram	2-11
Chapter 3. How to Use KM-N1	3-1
3.1. Multi-unit system	3-2

3.2.	Power ON.....	3-2
3.3.	Measured value display	3-3
3.4.	Display of Settings.....	3-6
3.5.	Setting items for measuring electricity	3-12
3.6.	Measurement setting	3-13
3.6.1.	Settings for circuit A	3-13
3.6.2.	Settings for circuits B to D (when measuring 2 circuits or more).....	3-16
3.7.	RS-485 communications setting	3-18
3.8.	Pulse output settings	3-21
3.8.1.	Pulse output overview	3-21
3.8.2.	Pulse output waveform.....	3-22
3.8.3.	Pulse output unit setting.....	3-22
Chapter 4.	How to Use Other Functions	4-1
4.1.	Measuring large current.....	4-2
4.2.	Current low cut	4-3
4.3.	Voltage assignment	4-4
4.4.	Simple measurement.....	4-5
4.5.	Measuring high voltage.....	4-7
4.6.	Converting unit of display	4-8
4.7.	Fixing display unit.....	4-10
4.8.	Power saving mode	4-11
4.9.	Voltage misconnection detection warning	4-12
4.10.	Checking software version.....	4-13
4.11.	Initialization.....	4-14
4.12.	Mode lock	4-16
4.13.	Reset.....	4-16
Chapter 5.	Communications Specifications	5-1
5.1.	Communications overview	5-2
5.2.	CompoWay/F.....	5-4
5.2.1.	Data format.....	5-4
5.2.2.	PDU (Protocol Data Unit) configuration	5-6

5.2.3.	Type code.....	5-7
5.2.4.	List of services	5-7
5.2.5.	Response code list.....	5-7
5.2.6.	Service details	5-13
5.3.	Modbus.....	5-16
5.3.1.	Data format.....	5-16
5.3.2.	Function code (FC) list	5-18
5.3.3.	Error code list	5-18
5.3.4.	Service details	5-18
5.4.	BACnet MS/TP	5-24
5.4.1.	Overview	5-24
5.4.2.	List of protocol implementation conformance	5-24
5.5.	Address map (CompoWay/F, Modbus)	5-25
5.5.1.	List of variable areas (measurement values).....	5-25
5.5.2.	Variable area (parameter) list.....	5-27
5.6.	Support frame type object property (BACnet MS/TP).....	5-29
5.6.1.	List of support frame types	5-29
5.6.2.	List of supported objects	5-30
5.6.3.	List of supported properties.....	5-32
Chapter 6.	KM-N1OP-01 and KM20 Mode.....	6-1
6.1.	Overview of KM-N1OP-01 and KM20 mode	6-2
6.1.1.	Main features of KM-N1OP-01 and KM20 mode	6-2
6.1.2.	Difference between KM20 mode and KM20-B40.....	6-3
6.1.3.	Difference between KM20 mode and KM-N1-FLK.....	6-4
6.2.	Part names and functions	6-6
6.2.1.	Terminal block adapter	6-6
6.2.2.	Included cables	6-8
6.2.3.	CT for KM20 (When using terminal block adapter).....	6-10
6.2.4.	CT cable (When using terminal block adapter).....	6-10
6.3.	Dimensions.....	6-11
6.3.1.	Terminal block adapter dimensions.....	6-11
6.3.2.	Included cable dimensions.....	6-12
6.3.3.	CT dimensions	6-13
6.3.4.	CT cable dimensions.....	6-14

6.4.	Installation and wiring	6-15
6.4.1.	Overview of installation and wiring steps	6-15
6.4.2.	Attaching terminal block adapter and connection cables.....	6-16
6.4.3.	Installing terminal block adapter	6-17
6.4.4.	Wiring to terminal block adapter	6-20
6.4.5.	Installing KM-N1-FLK	6-21
6.4.6.	Connecting terminal block adapter and KM-N1-FLK	6-23
6.4.7.	Wiring when using terminal block adapter	6-24
6.5.	How to use KM20 mode	6-26
6.5.1.	How to transition to KM20 mode.....	6-26
6.5.2.	Measurement items in KM20 mode	6-27
6.5.3.	Setting items in KM20 mode	6-32
6.6.	Communications specifications in KM20 mode	6-35
6.6.1.	Communications overview	6-35
6.6.2.	CompoWay/F (KM20 mode)	6-35
6.6.3.	Data format.....	6-35
6.6.4.	PDU (Protocol Data Unit) configuration	6-35
6.6.5.	Type code.....	6-36
6.6.6.	List of services	6-36
6.6.7.	End code list.....	6-36
6.6.8.	Service details	6-36
6.6.9.	Response code	6-38
6.6.10.	Address map (KM20 mode)	6-38
6.7.	Communication with host device in KM20 mode.....	6-40
6.7.1.	List of supported host devices	6-40
6.7.2.	Cautions for communication with host device in KM20 mode	6-40
Chapter 7.	Troubleshooting	7-1
7.1.	Alert list.....	7-2
7.2.	Troubleshooting.....	7-3
Chapter 8.	Appendix	8-1
8.1.	Specifications	8-2
8.2.	ASCII code table.....	8-6
8.3.	11-segment display.....	8-8

Chapter 1. Overview of KM-N1

1.1.	Main Features.....	1-2
1.2.	Configuration	1-4
1.3.	Part Names and Functions	1-5
1.3.1.	Main unit.....	1-5
1.3.2.	Dedicated CT	1-9
1.3.3.	Cable	1-10
1.4.	Dimensions.....	1-11
1.4.1.	Main unit.....	1-11
1.4.2.	Dedicated CT	1-11
1.4.3.	Cable	1-12
1.5.	Multi-circuit metering.....	1-13
1.6.	Mode configuration	1-15
1.7.	Function List	1-17

1.1. Main Features

- (1) Compact power monitor that can be installed in a small distribution board
With a width of 22.5 mm and a depth of 65 mm, it is small enough to be installed inside a distribution board. It can be easily installed on a small distribution board with little space for installation or distribution board with little depth, contributing to more efficient installation work in the field.
- (2) High precision measurement
Current and voltage measurement accuracy: $\pm 0.5\%$ F.S.; power measurement accuracy: $\pm 1.0\%$ F.S. The power at each measuring point can be measured with high accuracy.
- (3) Multi-circuit metering
A single unit can measure multiple circuits: up to 4 circuits for 1-phase 2-wire, and up to 2 circuits for 1-phase 3-wire and 3-phase 3-wire. It can also measure multiple 1-phase 2-wires with different phases branched from a 1-phase 3-wire, or simultaneously measure 1-phase 3-wires and 1-phase 2-wires.
- (4) Multi-unit system
A single unit can have up to four circuits. Each circuit operates as an independent power monitor, can perform the measurement and setting, and can be assigned a different unit number.
From a host system, it can be managed as a single-circuit power monitor, making it easy to construct a communication system and add measurement points.
- (5) Pulse output
Two pulse output ports are provided to output a pulse every time the integral power consumption exceeds a set value. For multi-circuit metering, a pulse output port can be assigned to each circuit.
- (6) RS-485 communications
KM-N1-FLK can use CompoWay/F(*1) and Modbus(*2) as the RS-485 communication protocol. KM-N1-BAC can use BACnet MS/TP(*3) and Modbus(*2).

*1 CompoWay/F is OMRON's unified communication procedure for general-purpose serial communication. It has a unified frame format and commands compliant with FINS, which has a proven track record in OMRON programmable controllers and other products, facilitating communication between the PC and components.

*2 Modbus is a communication control method compliant with the RTU Mode of the Modbus Protocol.

Modbus is a registered trademark of Schneider Electric.

*3 BACnet MS/TP is a communication control method compliant with ANSI/ASHRAE 135-2012.

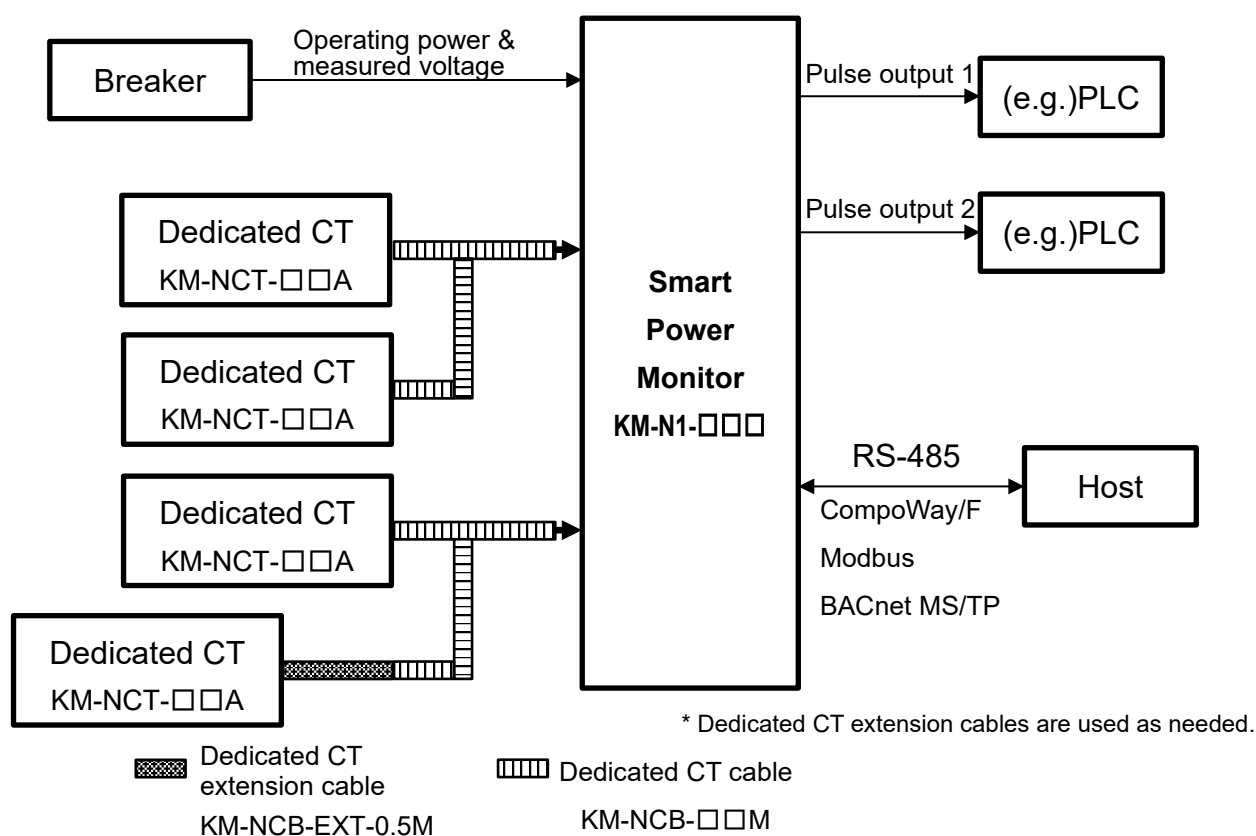
BACnet is a registered trademark of ASHRAE.

(7) KM20 mode (*4)

The KM20 mode has the same communication address map as KM20-B40-FLK. When replacing KM20-B40 with KM-N1-FLK, there is no need to change the address to acquire measurement values in a host device, and the system can continue to be used as is.

*4 KM20 mode is selectable with the KM-N1-FLK. Some functions differ from those of KM20-B40. See "Chapter 6 KM-N1OP-01 and KM20 Mode" for details.

1.2. Configuration



KM-N1 is available with 5 types of dedicated CTs, 6 types of cables to connect the dedicated CTs to the main unit, and 1 type of dedicated CT extension cable to extend the distance between the dedicated CTs and the dedicated CT cable. Use an appropriate combination depending on your environment.

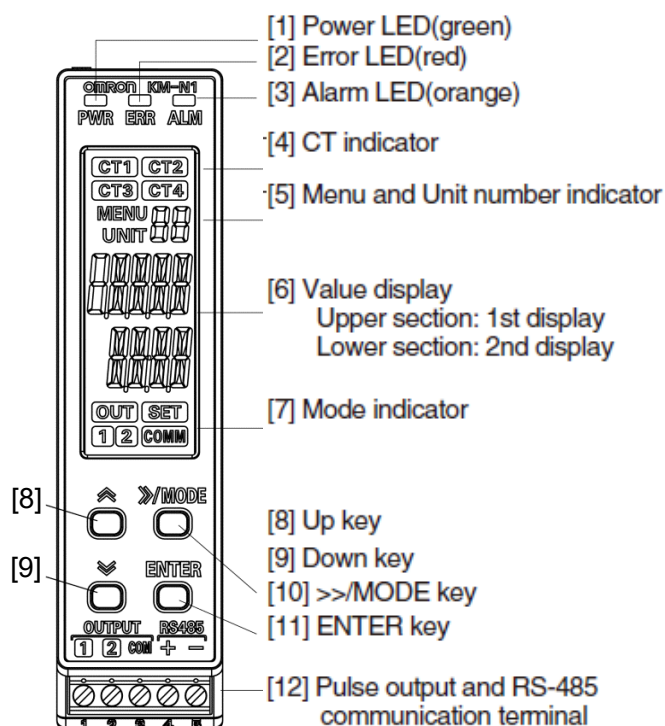
Product	Model	Details
Dedicated CT	KM-NCT-5A/50A	Common for rated 5A and 50A
	KM-NCT-100A	Rated 100A
	KM-NCT-225A	Rated 225A
	KM-NCT-400A	Rated 400A
	KM-NCT-600A	Rated 600A
Dedicated CT cable	KM-NCB-1M	Cable length: 1m
	KM-NCB-3M	Cable length: 3m
	KM-NCB-5M	Cable length: 5m
	KM-NCB-10M	Cable length: 10m
	KM-NCB-20M	Cable length: 20m
	KM-NCB-30M	Cable length: 30m
Dedicated CT extension cable	KM-NCB-EXT-0.5M	Cable length: 0.5m

1.3. Part Names and Functions

1.3.1. Main unit

<Front end>

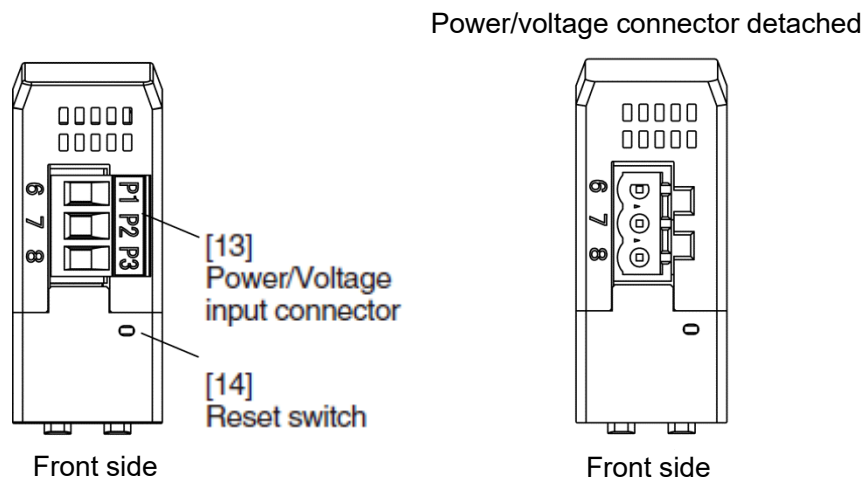
Power/voltage connector detached



Item		Details
[1] Power LED (green)		Lights when power is supplied
[2] Error LED (red)		Flashes when there is an error such as a malfunction
[3] Alarm LED (orange)		Flashes to indicate a warning
[4] CT indicator		Displays CT indicating measured values
[5] Menu and Unit number indicator		When MENU is illuminated (in setting mode): Displays the menu number
		When UNIT is illuminated (in measuring mode): Displays the unit number
[6] Value display	1st display	Displays measured values and setting values
	2nd display	Displays the units and the names of the setting items
[7] Mode indicator	OUT	Lights when pulse output terminal is assigned
	1	Lights when outputting pulse from OUT1
	2	Lights when outputting pulse from OUT2
	SET	Lights in setting mode
	COMM	Lights during RS-485 communication
[8] Up key		Display shift
[9] Down key		Display shift (in the opposite direction of the Up key)
[10] >>/MODE key		Circuit transition / Switches between the measuring mode and the setting mode
[11] ENTER key		Determines values/menus
[12] Pulse output & RS-485 communication	OUTPUT 1	Pulse output 1 terminal
	OUTPUT 2	Pulse output 2 terminal
	OUTPUT	Common terminal for pulse output

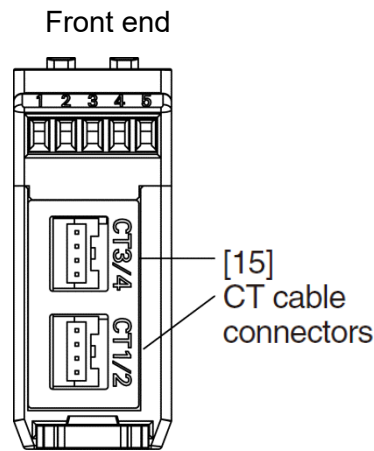
terminal	RS485 +	RS-485 + terminal
	RS485 -	RS-485 - terminal

<Top>



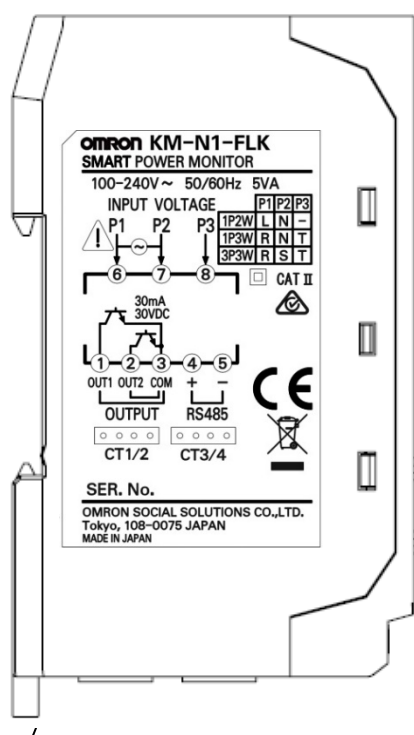
Item	Details
[13] Power supply and voltage input connector	Connector for inputting supply voltage and measurement voltage (Common for power supply voltage input and measurement voltage input)
[14] Reset switch	Switch to reboot the unit

<Bottom>

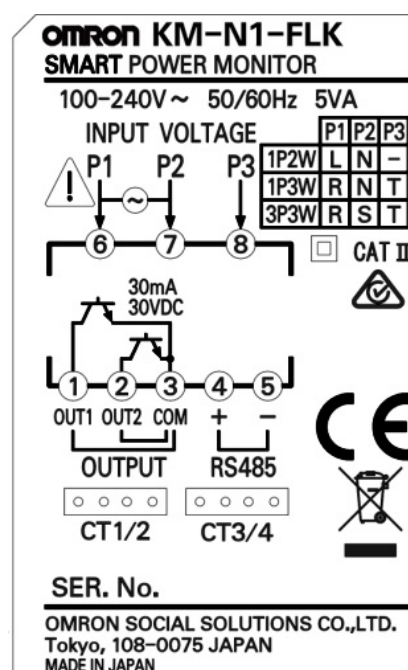


Item		Details
[15] CT connector	CT1/2	Connector to attach a dedicated CT cable for CT1 and CT2
	CT3/4	Connector to attach a dedicated CT cable for CT3 and CT4

<Left side>



[16] Terminal layout label

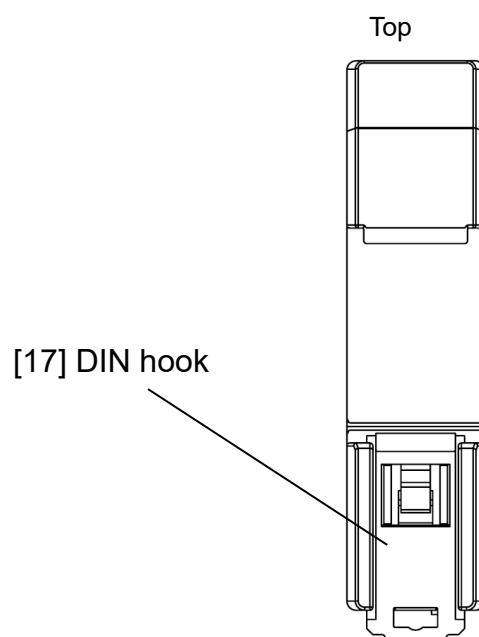


Enlarged view of terminal layout label

Item	Details
[16] Terminal layout label	Label with information such as the model, power voltage, connector layout, and serial number

* The label for KM-N1-BAC is OMRON KM-N1-BAC.

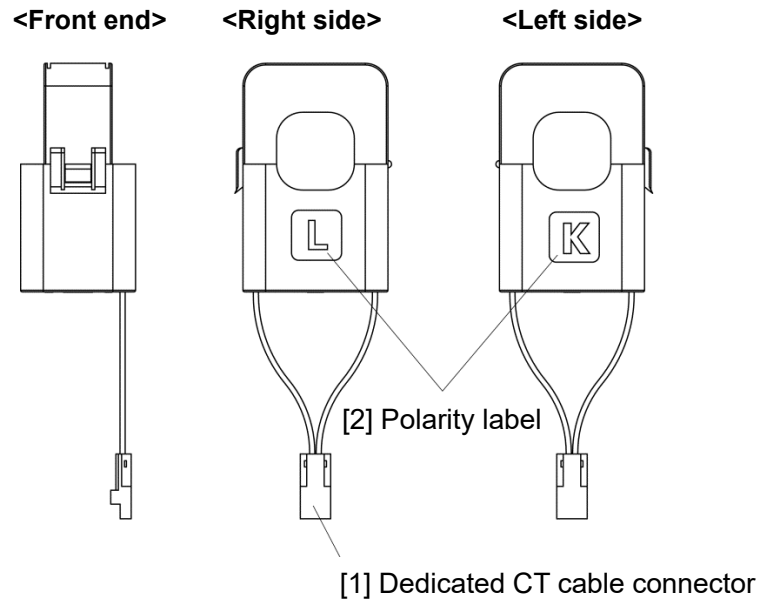
<Back>



Item	Details
[17] DIN hook	Hook for attaching to the DIN rail

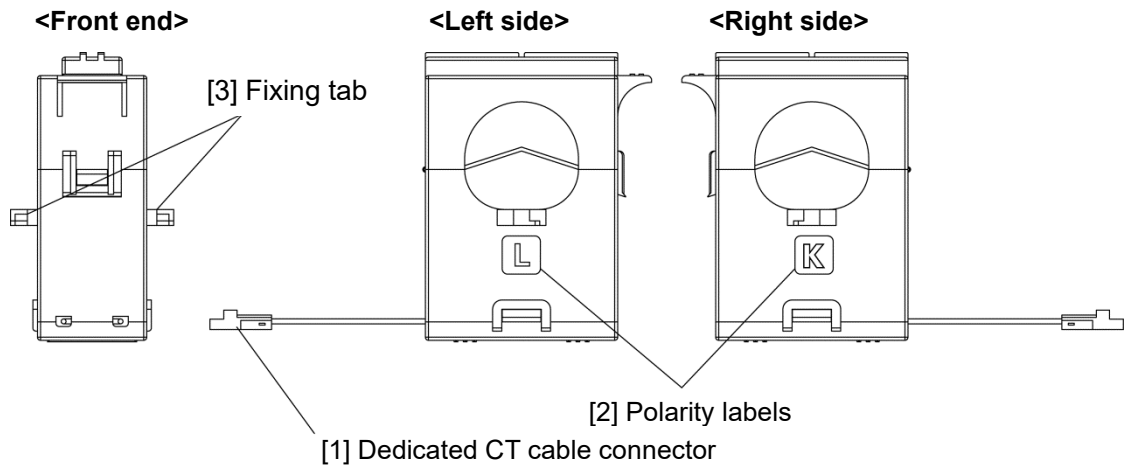
1.3.2. Dedicated CT

<KM-NCT-5A/50A, -100A, -225A>



Item		Details
[1] Dedicated CT cable connector		Connector for dedicated CT cable or dedicated CT extension cable
[2] Polarity label	K	Label indicating power supply end
	L	Label indicating load end

<KM-NCT-400A, -600A>

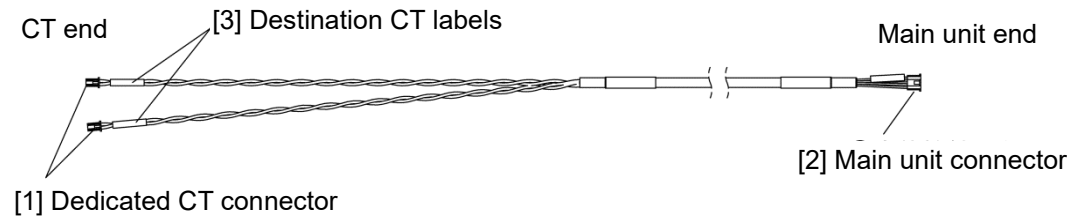


Item		Details
[1] Dedicated CT cable connector		Connector for dedicated CT cable or dedicated CT extension cable
[2] Polarity label	K	Label indicating power supply end
	L	Label indicating load end
[3] Fixing tab		Tab to fix dedicated CT with a cable tie

1.3.3. Cable

<Dedicated CT cable: KM-NCB-□□M>

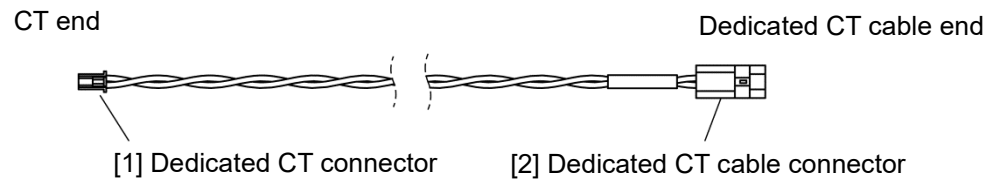
The dedicated CT cable is used to connect KM-N1 and dedicated CT. Up to 2 dedicated CTs can be connected to one cable.



Item	Details
[1] Dedicated CT connector	Connector to attach to dedicated CT
[2] Main unit connector	Connector to attach to KM-N1 main unit
[3] Destination CT label	Label indicating that the cable connects CT1 or CT3
	Label indicating that the cable connects CT2 or CT4

<Dedicated CT extension cable: KM-NCB-EXT-0.5M>

The dedicated CT extension cable is used to extend connection between dedicated CT and dedicated CT cable.

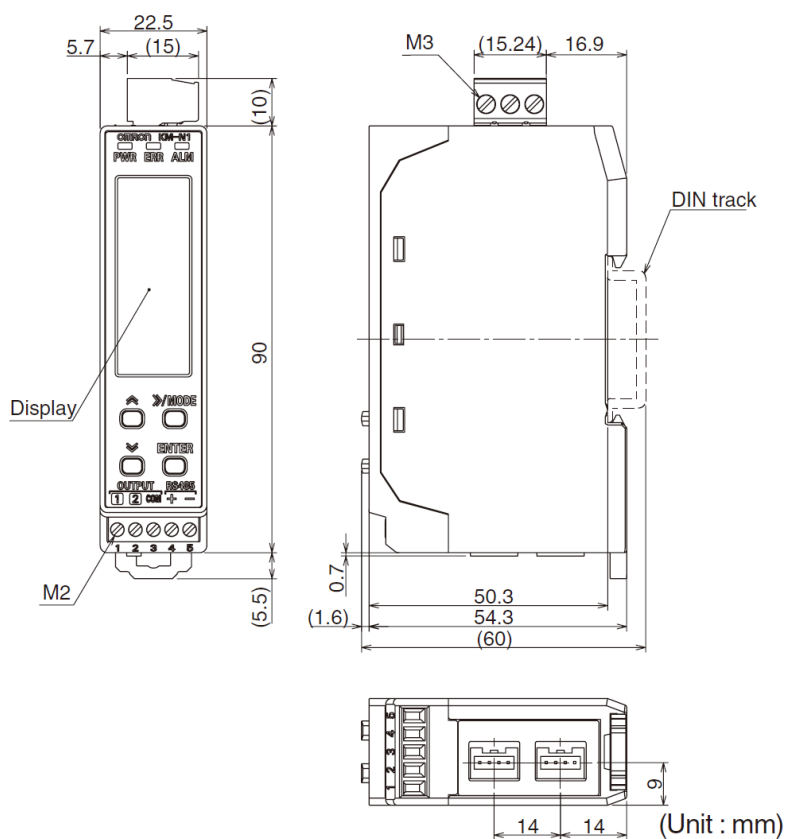


Item	Details
[1] Dedicated CT connector	Connector to attach to dedicated CT
[2] Dedicated CT cable connector	Connector to attach to dedicated CT cable

1.4. Dimensions

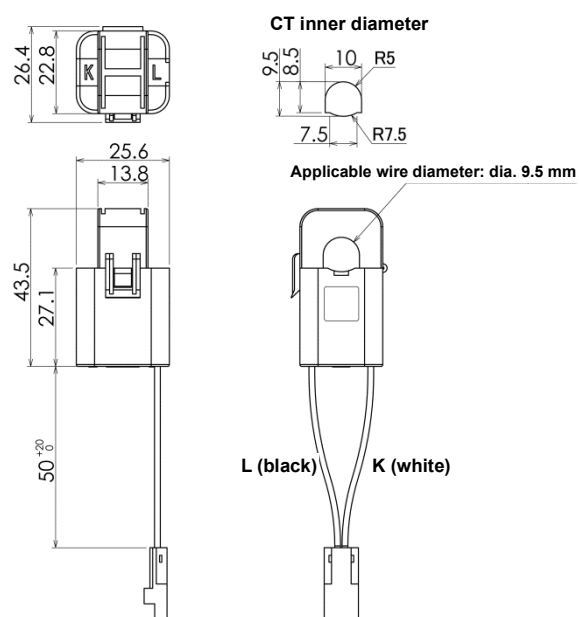
1.4.1. Main unit

<KM-N1-□□□>

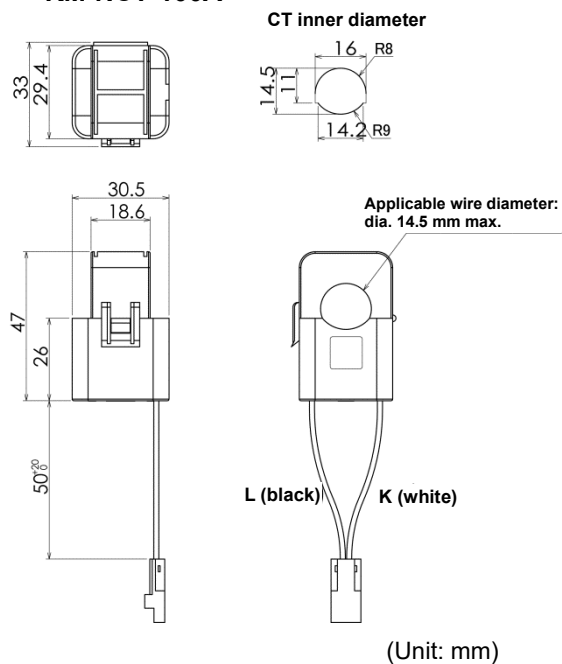


1.4.2. Dedicated CT

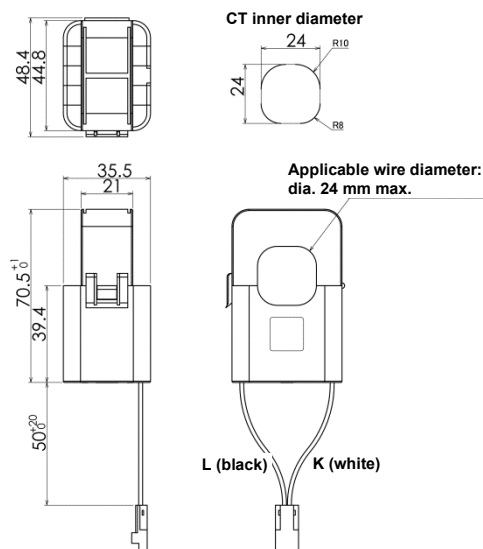
<KM-NCT-5A/50A>



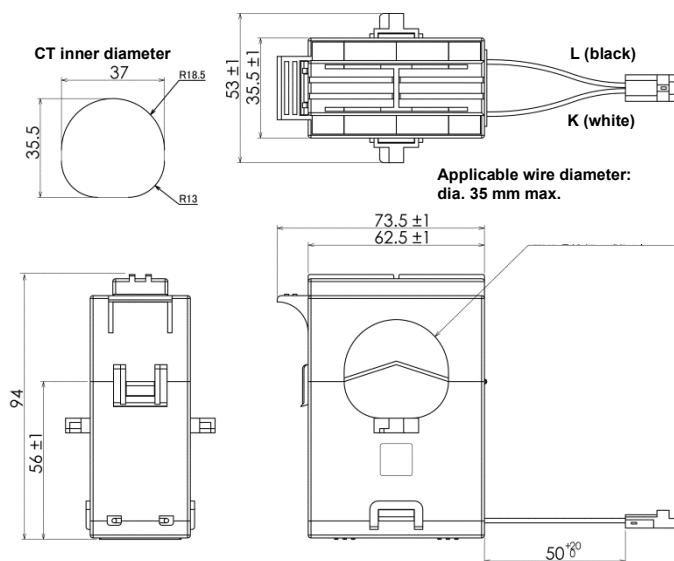
<KM-NCT-100A>



<KM-NCT-225A>



<KM-NCT-400A, -600A>

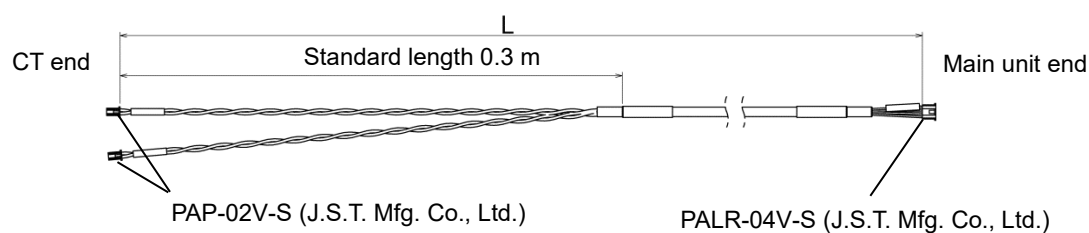


(Unit: mm)

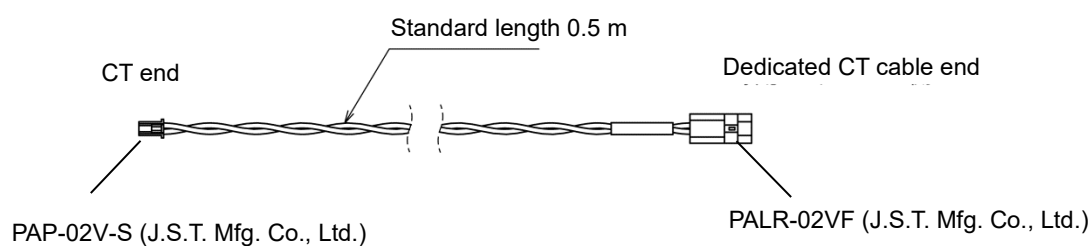
1.4.3. Cable

<Dedicated CT cable: KM-NCB-1M/3M/5M/10M/20M/30M>

Model	Cable length (L)
KM-NCB-1M	1m
KM-NCB-3M	3m
KM-NCB-5M	5m
KM-NCB-10M	10m
KM-NCB-20M	20m
KM-NCB-30M	30m



<Dedicated CT extension cable: KM-NCB-EXT-0.5M>



1.5. Multi-circuit metering

KM-N1 can perform multi-circuit metering (multi-point measurement).

Measurement circuit is a measurement point to perform power measurement. KM-N1 measures voltage for all circuits, and current for each circuit using a dedicated CT.

KM-N1 can connect up to four dedicated CTs. Shown below are phase-wire and number of available measuring circuits.

Phase-Wire	Phase-Wire (abbr.)	Maximum number of measuring circuits	Circuit to use
Single-phase two-wire	1P2W	4 circuits	Circuit A, Circuit B, Circuit C, Circuit D
Single-phase three-wire	1P3W	2 circuits	Circuit A, Circuit C
Three-phase three-wire	3P3W	2 circuits	Circuit A, Circuit C
Single-phase two-wire voltage option	1P2W2	4 circuits	Circuit A, Circuit B, Circuit C, Circuit D
Single-phase three-wire composite	1P3W2	1-phase 3-wire: 1 circuit	Circuit A
		1-phase 2-wire: 2 circuits	Circuit C, Circuit D

* Set 1-phase 2-wire voltage selected when measuring multiple 1-phase 2-wire with different phases branching off a 1-phase 3-wire distribution board. You can measure 1-phase 2-wire by selecting the corresponding voltage.

* Set 1-phase 3-wire composite to measure both the main 1-phase 3-wire distribution board and a 1-phase 2-wire branching off. You can measure 1-phase 2-wire by selecting the corresponding voltage.

* Refer to "2.7 Wiring Diagram" for more on wiring each of the phase and wire types.

* Refer to "4.3 Voltage assignment" for more on 1-phase 2-wire voltage selected and 1-phase 3-wire composite.

Ref: 2.7 Wiring Diagram (P2-11)

4.3 Voltage assignment (P4-4)

Shown below are assignment of phase-wire and CT of each measuring circuit.

Phase-Wire	Phase-Wire (abbr.)	Measuring circuit			
		Circuit A	Circuit B	Circuit C	Circuit D
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 voltage option	1P2W2	CT1	CT2	CT3	CT4
Single-phase three-wire composite	1P3W2	CT1, CT2		CT3	CT4

As circuit A is used irrespective of the phase and wire type, you must make settings for measurement ("3.6.1 Settings for circuit A").

By enabling circuits B to D to increase the number of measurement points ("3.6.2 Settings for circuits B to D (when measuring 2 circuits or more)"), you can meter electricity using the required number of circuits. The setting is disabled by default.

Circuits B and D are not used for 1-phase 3-wire and 3-phase 3-wire. Circuit B is not used for 1-phase 3-wire composite.

Ref: 3.6.1 Settings for circuit A (P3-13)

3.6.2 Settings for circuits B to D (when measuring 2 circuits or more) (P3-16)

You cannot select circuits C and D in 1-phase 2-wire in KM20 mode. As you can use only circuits A and B, connect the CT cable to the CT1/2 side.

See "6.4.4 Wiring to terminal block adapter" for details on the relationship between the circuits and the CT used in KM20 mode.

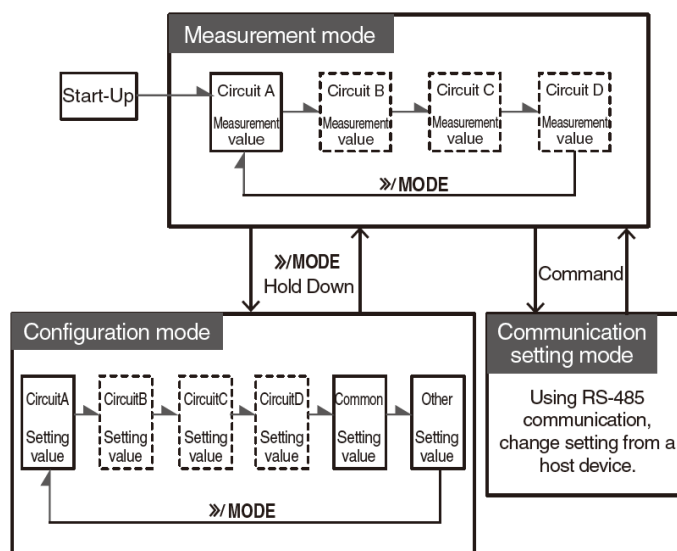
1.6. Mode configuration

KM-N1 has three modes: measuring mode, setting mode, and communication setting mode.

Measuring mode: The measured values for each circuit are displayed.

Setting mode: By operating keys on the body of the unit you can change settings for each of the circuits, and make common settings for communications, output, the display, etc.

Communication setting mode: Make settings on the units using RS-485 communication.



- * In the measuring mode and setting mode, the circuit B to D items are displayed by switching the enable/disable settings for each of the circuits to "ON" (enabled). (The circuits indicated inside the dotted lines in the above diagram are "OFF" (disabled) in the default state)
- * To move between circuits in the measurement or setting mode, press [>>/MODE].

[Reference]

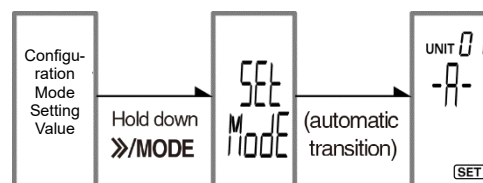
- "Press and hold" means pressing the key for 1 or more seconds.

■ Mode transition method

- To switch between measuring mode and setting mode, press and hold [>>/MODE].

[Measuring mode > Setting mode]

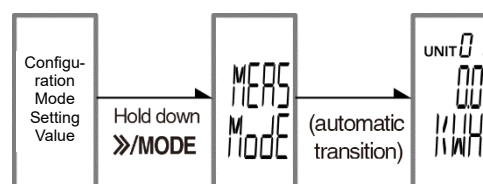
"SET MODE" displayed > Transitions to Setting mode



[Setting mode > Measuring mode]

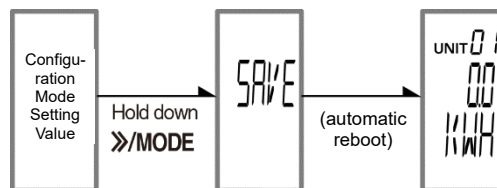
(1) If settings are not changed in the setting mode

"MEAS MODE" displayed > Transitions to Measuring mode



- (2) If settings are changed in the setting mode
 "SAVE" displayed > Restart > Transitions to
 Measuring mode

* Restarting is done automatically.



- To transitions to the communication setting mode, send a specific command under the measuring mode.

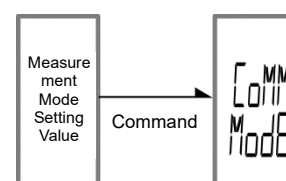
Refer to "Chapter 5 Communications Specifications" for details about the commands to move to each mode.

Ref: Chapter 5 Communications Specifications (P5-1)

[Measuring mode > Communication setting mode]

Command sent > "COMM MODE" displayed

("COMM MODE" is displayed while in communication setting mode)

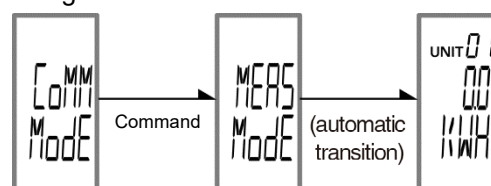


[Communication setting mode > Measuring mode]

Command sent > "MEAS MODE" displayed > Transitions to Measuring mode

- (1) If settings are not changed in the communication setting mode:

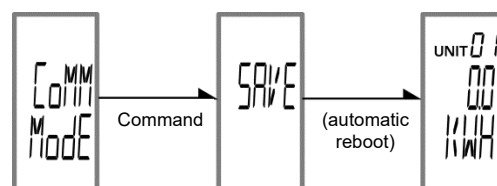
"MEAS MODE" displayed > Transitions to Measuring mode



- (2) If settings are changed in the communication setting mode:

"SAVE" displayed > Restart > Transitions to
 Measuring mode

* Restarting is done automatically.



1.7. Function List

The functions available in this product are as follows:

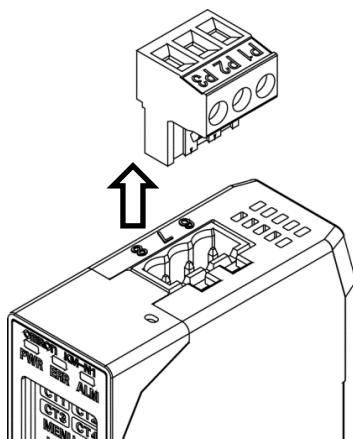
Category	Function	Application
Measurement	Setting VT ratios	Sets the ratio for voltage input using VT when measuring power at a voltage value higher than the rated value.
	Setting CT ratios	Sets the ratio between the primary and secondary outputs when measuring a large current that is greater than or equal to the dedicated CT using a general-purpose CT with a secondary output of 5A.
	Simple measurement	Used to manually input voltage and power factor values for simplified power measurement when it is not possible to input the measured voltage.
	Voltage phase error detection	Detects missing and reverse phases of voltage lines and issues a warning.
	Low-cut current setting	Cuts the current value measured due to dielectric noise at no load to zero.
	Conversion	Calculates the conversion value by multiplying the integral power consumption value by an arbitrary factor. Used to convert to electricity rates, etc.
Display	Mode lock	Fixes the mode to the measuring mode to prevent accidental transition to the setting mode.
	Auto LCD OFF	Turns off all LCDs after a set time to save energy.
	Fix display unit to kWh/MWh	Fixes the display digits to kWh or MWh so that changes in the display can be seen when the value of the integral power consumption increases.

Chapter 2. Installation and Wiring

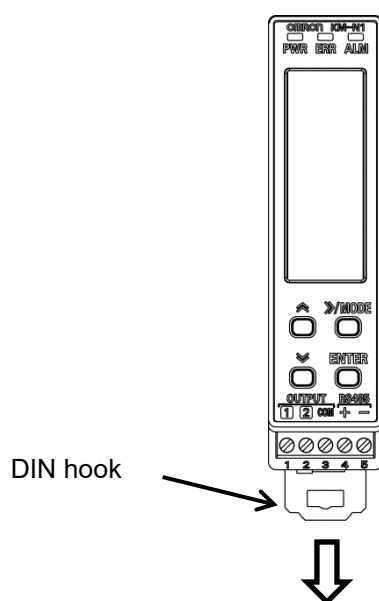
2.1.	Installation of Main Unit	2-2
2.2.	Connection of Dedicated CT and Main Unit	2-4
2.3.	Wiring for power and monitored voltage input.....	2-5
2.4.	Pulse output wiring	2-7
2.5.	RS-485 wiring	2-9
2.6.	Fitting the dedicated CTs to the measuring wires.....	2-10
2.7.	Wiring Diagram.....	2-11

2.1. Installation of Main Unit

- ① To wire power supply/voltage connector, pull out the power supply/voltage connector from the KM-N1 main body.



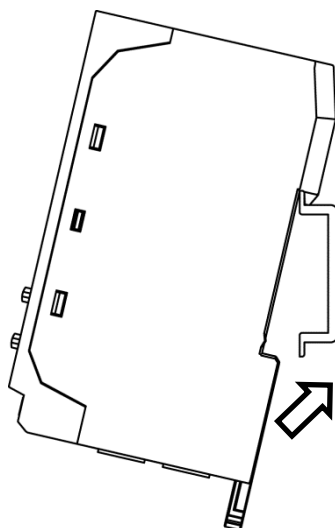
- ② Install the DIN rail on the proper location.
Recommendation: PFP-50N/-100N (OMRON)
- ③ Pull the DIN rail of the lower main unit.



Important

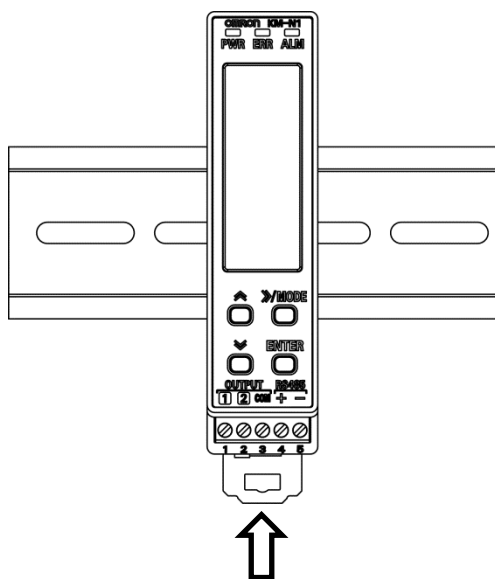
- Attach the power/voltage connector to the KM-N1 main body after wiring.
See "2.3 Wiring for power and monitored voltage input (P2-5)" for wiring of power supply/voltage connectors.
- Keep the power/voltage connector so that it is not lost.

- ④ Hook the KM-N1 main body's tab to the DIN rail and fit it as shown in the figure below.



- ⑤ Raise the DIN hook and fix the body to the DIN rail.

* When removing the body from the DIN rail, use a flathead screwdriver to flick open the DIN hook and open downwards.



Important

- Ensure that the DIN rails and the body are attached properly. Looseness may cause the DIN rails, body, and wires to separate if vibrations or impacts occur.
- Fix end plates to the body units at each end of the DIN rail.
These stop the units from jumping off the DIN rail due to vibration or impacts.
Recommendation: PFP-M (Omron)
- Provide the installation space at the top and bottom of the main body.
(about 50 mm above the unit and 30 mm below the unit)
- Make sure to turn off the breaker.

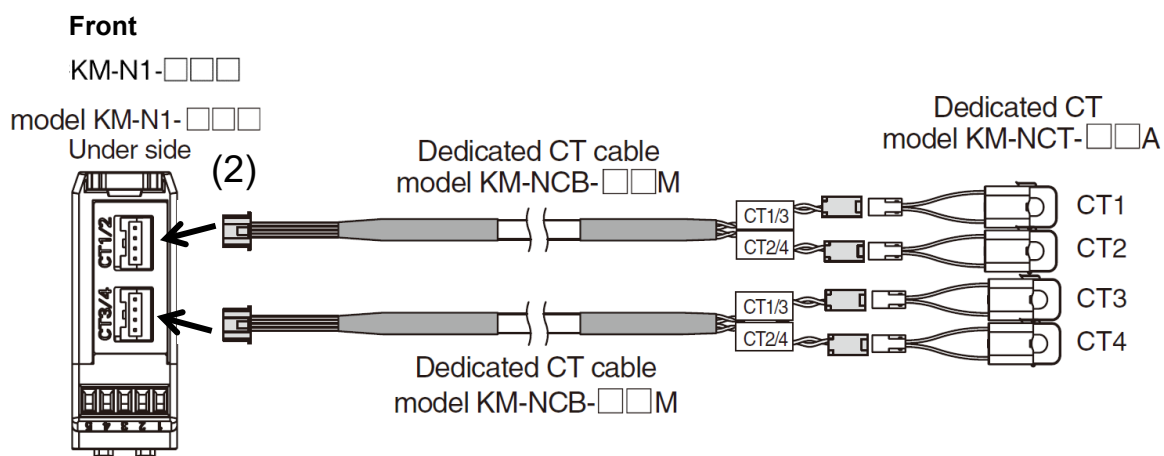
2.2. Connection of Dedicated CT and Main Unit

You can connect up to a maximum of 4 dedicated CTs to this product. The number of CTs to use depends on the phase-wire of the power supply to measure. The table below shows the CT to use for each phase-wire and circuit. For example, use CT1 to measure a circuit of 1-phase 2-wire. To measure two circuits of 1-phase 3-wire, use CT1 and CT2 for circuit A, and CT3 and CT4 for circuit C.

Ref: 1.5 Multi-circuit metering (P1-13)

Shown below are assignment of phase-wire and CT of each measuring circuit.

Phase-Wire	Phase-Wire (abbr.)	Measuring circuit			
		Circuit A	Circuit B	Circuit C	Circuit D
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	
1-phase 2-wire voltage option	1P2W2	CT1	CT2	CT3	CT4
1-phase 3-wire composite	1P3W2	CT1, CT2		CT3	CT4



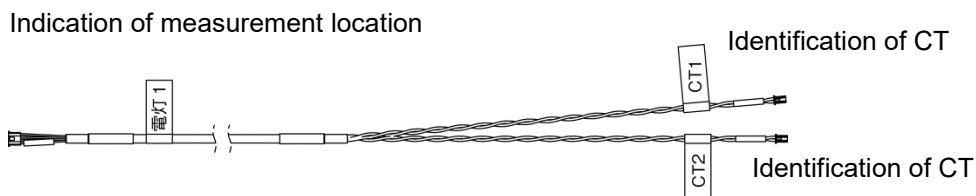
- ① Connect the dedicated CT to the dedicated CT cable. One (1) dedicated CT cable can connect to up to two (2) dedicated CTs.
 - ② The dedicated CT cables for CT1 and CT2 should be attached to the connectors marked CT1/2 on the main unit.
 - ③ The dedicated CT cables for CT3 and CT4 should be attached to the connectors marked CT3/4 on the main unit.
- * You can use the dedicated CT extension cable (KM-NCB-EXT-0.5M) to extend between the dedicated CT and the dedicated CT cable in case the cable length is not enough. Only one (1) extension cable can be used between them.

You cannot select circuits C and D in 1-phase 2-wire in KM20 mode. As you can use only circuits A and B, connect the CT cable to the CT1/2 side.

See "6.4.4 Wiring to terminal block adapter" for details on the relationship between the circuits and the CT used in KM20 mode.

[Reference]

- Three (3) plain labels are attached to the dedicated CT cable (KM-NCB-□□M). The labels can be attached to the cords as shown below to identify the measurement location and connection.



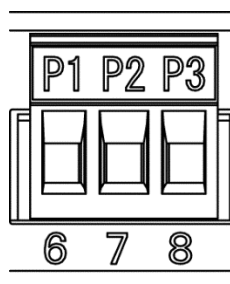
Important

- Do not ground the dedicated CT. Doing so may cause a failure.
- Do not attach or detach the dedicated CT and device CT cable during measurement or while power of KM-N1 is on. Doing so may cause malfunction of KM-N1 and/or dedicated CT.

2.3. Wiring for power and monitored voltage input

The terminal layout of power supply/measurement voltage connector terminals is as follows. In KM-N1, the No.6 (P1) and No.7 (P2) terminals serve as both the operating power supply terminal and the measurement voltage terminal.

Use them based on the phase-wire.



Phase-Wire	Power supply/measurement voltage terminal		
	6 (P1)	7 (P2)	8 (P3)
1-phase 2-wire	L	N	—
1-phase 3-wire	R	N	T
3-phase 3-wire	R	S	T
1-phase 2-wire voltage option	R	N	T
1-phase 3-wire composite	R	N	T

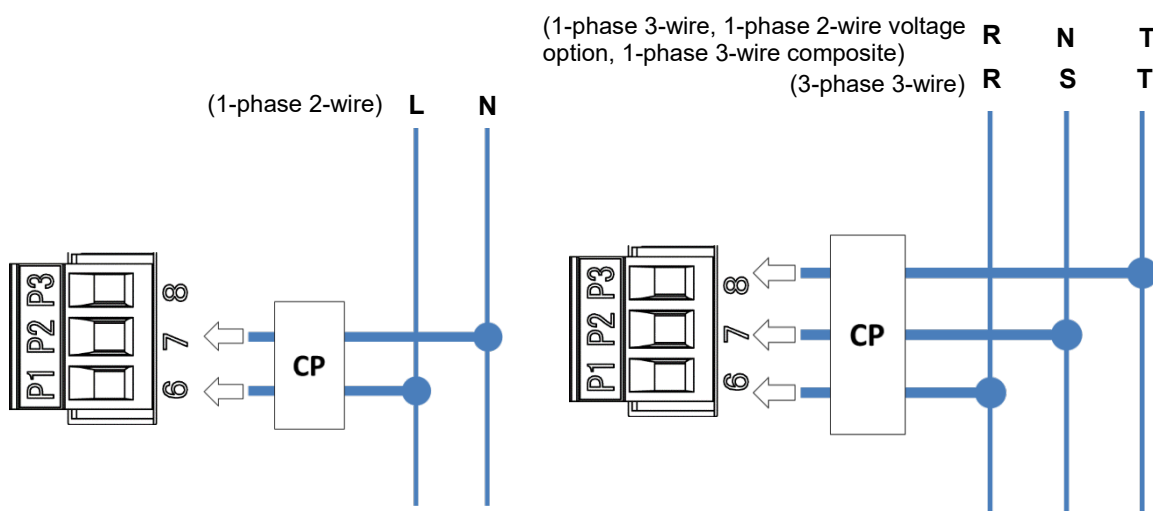
[Reference]

- R/N/T may be labeled U/O/W or L1/N/L2 in some cases.
- R/S/T may be labeled U/V/W in some cases.

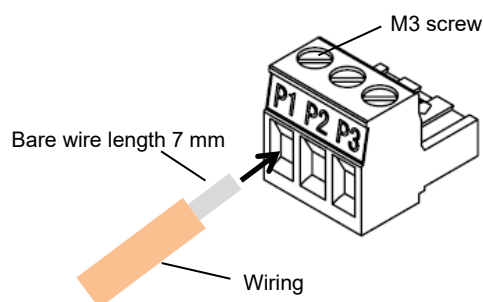
Wire the power and measurement voltage inputs to terminals No.6 (P1) to No.8 (P3) of the power/voltage connector.

Wire the device according to the phase and wire type as shown in the following diagram.

A circuit protector (CP) should be placed between the power/voltage connector and the wiring so that the power can be turned off immediately.



To wire the power supply/voltage connector, loosen the 3 mm screw on the connector, push the wire completely into the connector and fix it. After wiring the power/voltage input connector, install it in main unit.

**Important**

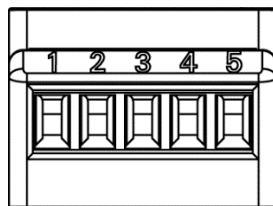
- For safety purposes, turn off the mains power and set the circuit protector to off to ensure there is no power supply while you are working.
- Wire correctly so the phase sequence is correct. You will be unable to measure the power and power consumption correctly if you fail to do so.
- To connect wires to the power supply/voltage connector, use wire of AWG24 to 14 (cross-section area of 0.2 to 2.5 mm²) with the bare wire length of 7 mm.
- The recommended tightening torque for M3 screws is 0.50 to 0.60 N·m. Tighten the fixation screw of the terminal with recommended torque. After fixing the wiring in place with the screw, pull gently to confirm that the wiring is fixed firmly.

2.4. Pulse output wiring

The layout of pulse output/RS-485 communication terminals is as follows.

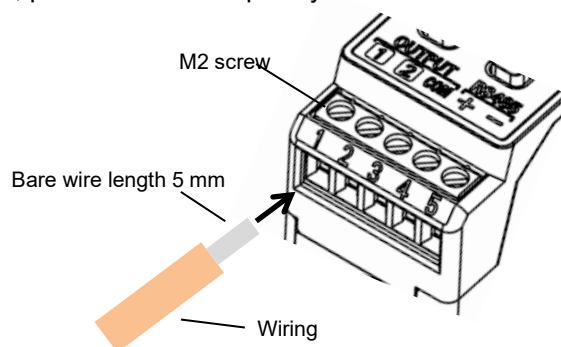
Pulse outputs use terminals 1 to 3. See "2.5 RS-485 wiring" for RS-485 wiring.

Ref: 2.5 RS-485 wiring (P2-9)



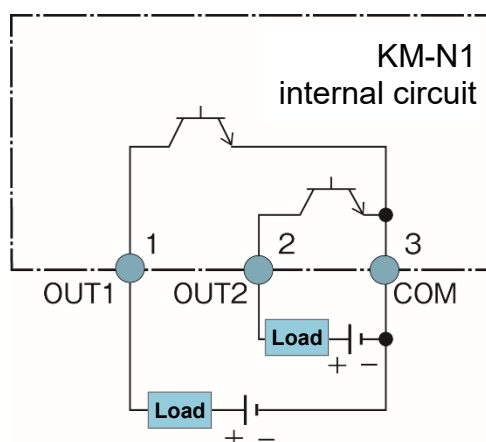
Pulse output/RS-485 communication terminal				
Pulse output			RS-485	
1	2	3	4	5
OUTPUT 1	OUTPUT 2	OUTPUT COM	RS485 +	RS485 -

To wire the pulse output/RS-485 communication terminals, loosen the M2 (2 mm) screw on the terminal block, push the wire completely into the terminal block and fix it.



The following diagram shows wiring for pulse output.

KM-N1 has two pulse outputs, with the common terminal (No.3).



The table below shows the output specifications.

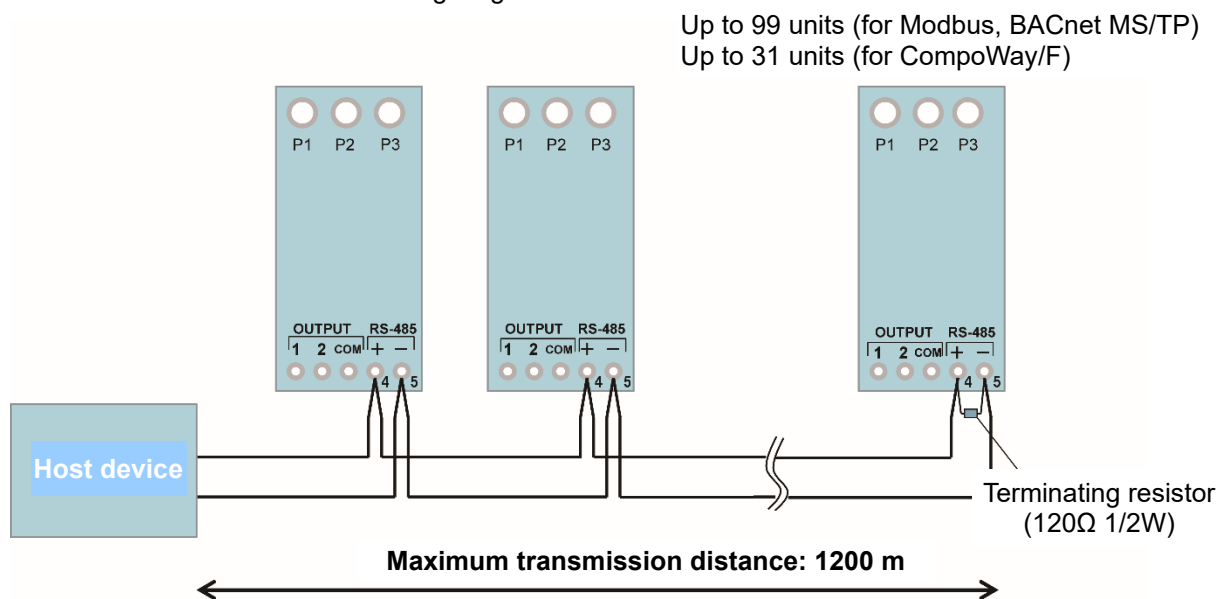
Output capacity	12 to 30 DCV, 30 mA max.
Residual voltage when ON	1.2 V max.
Current leakage when OFF	0.1 mA max.
Pulse output unit	1, 10, 100, 1k, 5k, 10k, 50k, 100k (Wh)
Pulse ON time	500 ms fixed

Important

- Do not directly connect an external power source to OUT or COM. Make sure the load is connected.
- To connect wires to the pulse output terminal, use wire of AWG26 to 18 (cross-section area of 0.14 to 1.0 mm²).
- When connecting two wires to COM terminal, use the wires of AWG22 (cross-section area of 0.3 to 0.34 mm²).
- The recommended tightening torque for M2 (2 mm) screws is 0.22 to 0.25 N·m. Tighten the fixation screw of the terminal with recommended torque.
- To avoid the influence of noise, use separate wiring for the signals and for the power.

2.5. RS-485 wiring

Wire the pulse output/RS-485 communication terminals if using the RS-485 communication feature. Shown below is the wiring diagram.



The configuration of the connection should be either 1:1 or 1:N. For 1:N connections, up to 31 KM-N1 units can be connected for CompoWay/F, 99 KM-N1 units for Modbus, and 99 KM-N1 units for BACnet MS/TP.

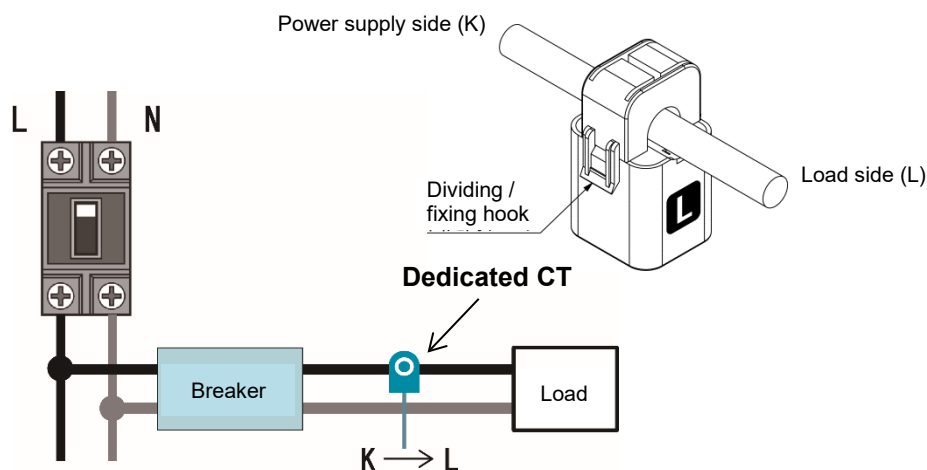
The number of connections is equal to the number of circuits if one unit measures more than one circuit.

Important

- Connect the supplied terminating resistor to the transmission line termination KM-N1. The terminating resistance is 120Ω (1/2W).
- If the host device you are using does not have its own built in terminating resistor, connect a terminating resistor to the host device. The terminating resistance is 120Ω (1/2W).
- Do not connect a terminating resistor to the KM-N1 in the middle of the transmission line. This can cause communication failures.
- The common terminal No.3 of the pulse output/RS-485 communication terminal is for pulse output.
- There is no FG terminal on KM-N1. Connect only the + and - wires of RS-485.
- Use twisted pair cables.
- To connect wires to the RS-485 terminal, use wire of AWG22 to 18 (cross-section area of 0.14 to 1.0 mm²).
- When connecting two wires to RS-485 terminals, use the wires of AWG22 (cross-section area of 0.3 to 0.34 mm²) with the same size (bare wire length of 5 mm).
- The recommended tightening torque for M2 screws is 0.22 to 0.25 N·m. Tighten the fixation screw of the terminal with recommended torque.
- To avoid the influence of noise, use separate wiring for the RS-485 communications and for the power.
- Irrespective of the transmission distance and number of units connected, perform communications checks with the actual units.

2.6. Fitting the dedicated CTs to the measuring wires

One dedicated CT is required for 1-phase 2-wire 1-circuit measurement, and two CTs are required for 1-phase 3-wire and 3-phase 3-wire 1-circuit measurement. The following diagram is an example of fitting a dedicated CT when measuring one circuit with 1-phase 2-wire.



- Fit the dedicated CTs to the measuring wires after connecting the dedicated CT cables to the main unit.
- The dedicated CT clamps L-Phase for 1-phase 2-wire measurement. The dedicated CTs attach R-Phase and T-Phase for 1-phase 3-wire or 3-phase 3-wire measurement.
- Dedicated CTs have polarity. Be sure to check the directions of power supply side (K) and load side (L) before connecting the dedicated CT. The wrong connecting direction will result in incorrect measurement.
- Open dividing/fixing hook and clamp to the measuring wire. After clamping, make sure a clicking sound is heard to ensure engagement.

Important

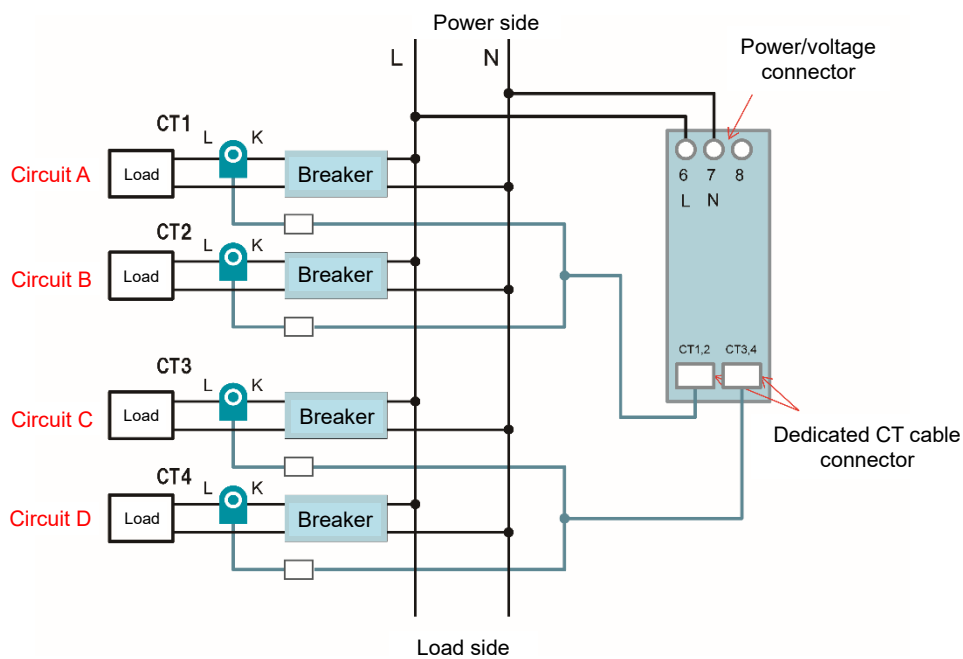
- Electric shock may occasionally occur. Use coated wires with over 600 V basic insulation for the primary side cable cramped by a dedicated CT.
- Do not clamp directly to lines of 600 VAC or more.
- Do not expose the CTs to excessive vibrations or impacts.

2.7. Wiring Diagram

Shown below are hard wiring of power supply voltage and dedicated CT based on the phase-wire types.

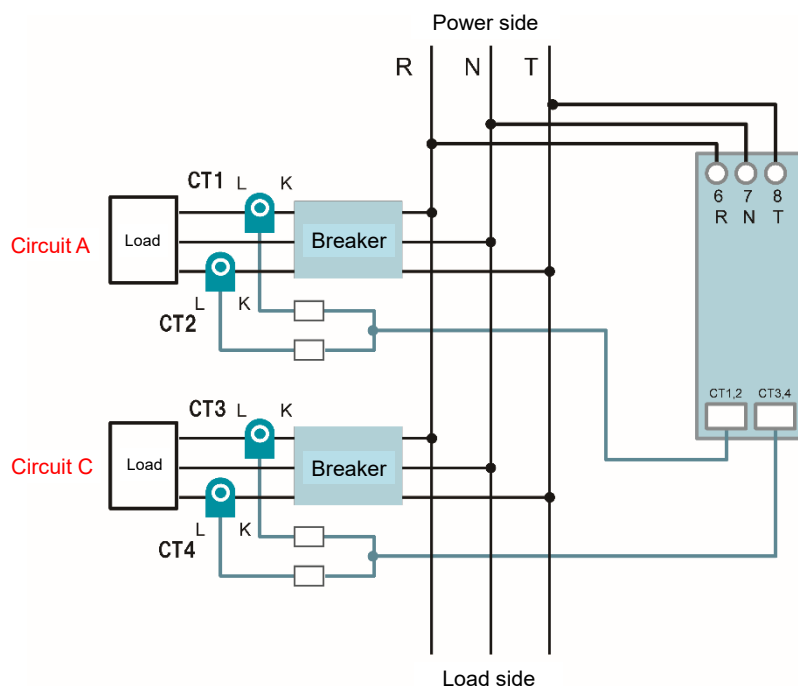
■ For 1-phase 2-wire

As shown below, 1-phase 2-wire can measure a maximum of 4 circuits. The dedicated CT must be attached to the L-phase.



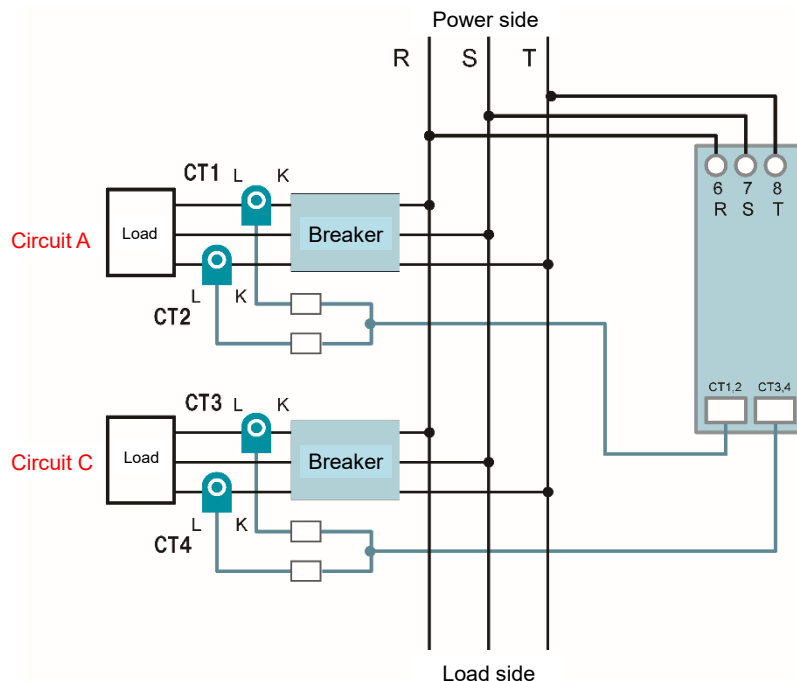
■ For 1-phase 3-wire

As shown below, 1-phase 2-wire can measure up to 2 circuits. To measure only 1 circuit, use CT1/CT2. The dedicated CTs must be attached to the R-phase and T-phase.



■ For 3-phase 3-wire

As shown below, 3-phase 3-wire can measure up to 2 circuits. To measure only 1 circuit, use CT1/CT2. The dedicated CTs must be attached to the R-phase and T-phase.



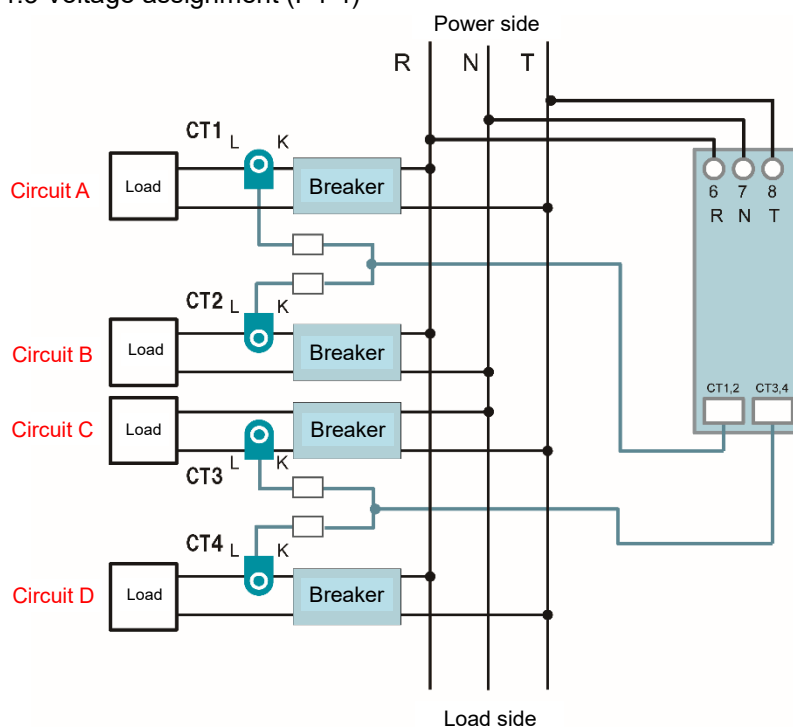
The following wiring can be measured as an applied measurement.

■ For 1-phase 2-wire voltage option

1-phase 2-wire can be measured which branched from 1-phase 3-wire. With this connection, a setting is required according to which of R-N phase, T-N phase, or R-T phase is connected to the 1-phase 2-wire circuit.

The dedicated CTs must be attached to either R-phase or T-phase.

Ref: 4.3 Voltage assignment (P4-4)

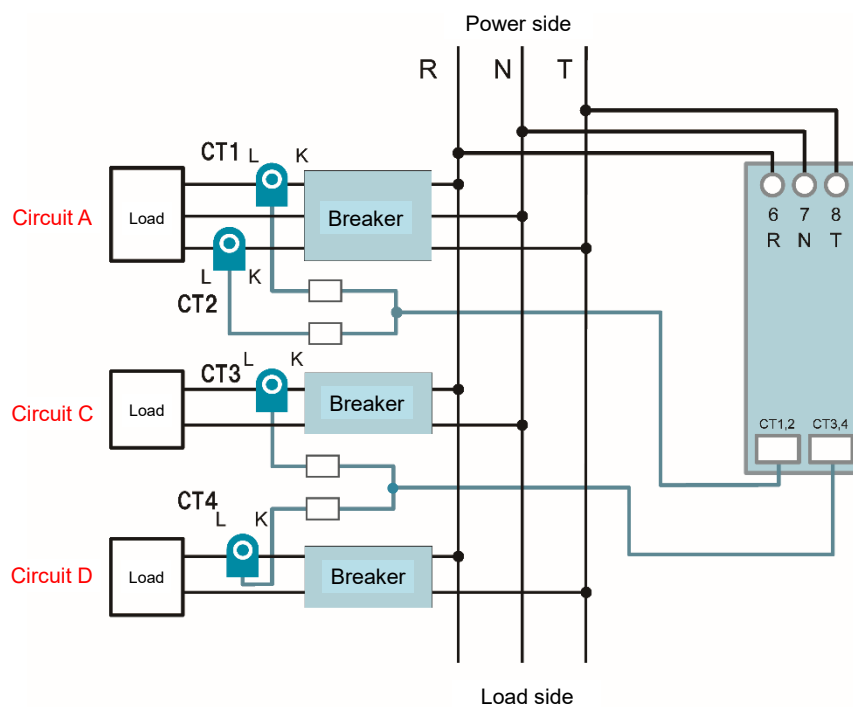


■ For 1-phase 3-wire composite

1P3W2 can measure simultaneously 1-phase 3-wire and 1-phase 2-wire, which branched from 1-phase 3-wire. With this connection, a setting is required according to which of R-N phase, T-N phase, or R-T phase is connected to the 1-phase 2-wire circuit.

The 1-phase 2-wire circuit dedicated CT must be attached to the R-phase or the T-phase.

Ref: 4.3 Voltage assignment (P4-4)



Chapter 3. How to Use KM-N1

3.1. Multi-unit system.....	3-2
3.2. Power ON.....	3-2
3.3. Measured value display	3-3
3.4. Display of settings	3-6
3.5. Setting items for measuring electricity	3-12
3.6. Measurement setting	3-13
3.6.1. Settings for circuit A	3-13
3.6.2. Settings for circuits B to D (when measuring 2 circuits or more)	3-16
3.7. RS-485 communications setting	3-18
3.8. Pulse output settings	3-21
3.8.1. Pulse output overview	3-21
3.8.2. Pulse output waveform.....	3-22
3.8.3. Pulse output unit setting.....	3-22

3.1. Multi-unit system

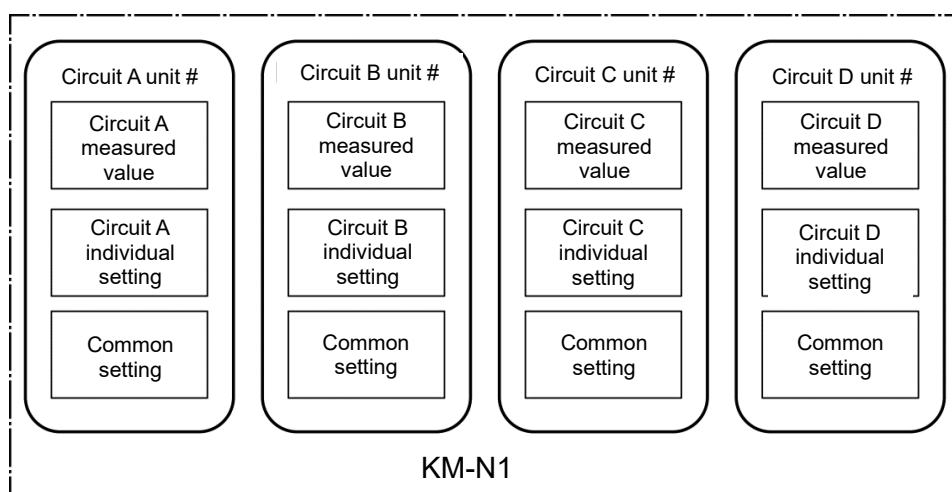
KM-N1 is used by assigning a unit number to each circuit. The unit number corresponds to each measuring point, so data transmission management from the host device is simplified.

The following diagram is an overview of the multi-unit system.

The measurement values and setting values for individual circuits are accessed via unit number for each of the circuits. The common settings are common to all of the circuits, so they can be accessed using any of the unit numbers, which allows changes to settings for all of the circuits at once.

Refer to "Chapter 5 Communications Specifications" for details about commands, responses, and address maps.

Ref: Chapter 5 Communications Specifications (P5-1)



[Caution]

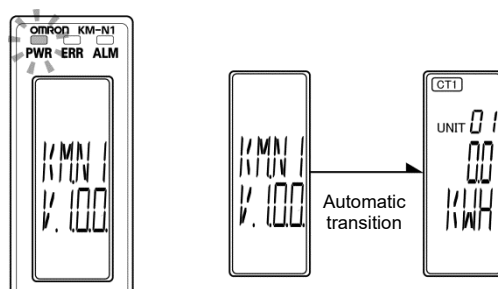
- For KM-N1, you need to assign a different unit number to each circuit. Even if you connect several KM-N1 units on the same RS-485 line, all of the circuits need to be allocated different unit numbers.

3.2. Power ON

Important

- Before turning on the power, ensure that there are no problems with the wiring.

- ① Turn the power ON.
- ② When power is turned on, the main display shows the model name "KM.N1" for KM-N1-FLK, "N1.bA" for KM-N1-BAC, the software version in the sub-display, and "PWR" on the display LED.
- ③ After this, the measuring mode is moved to automatically and the integral active power consumption (kWh) for circuit A is displayed.



* Example of KM-N1-FLK,
Ver.1.0.0

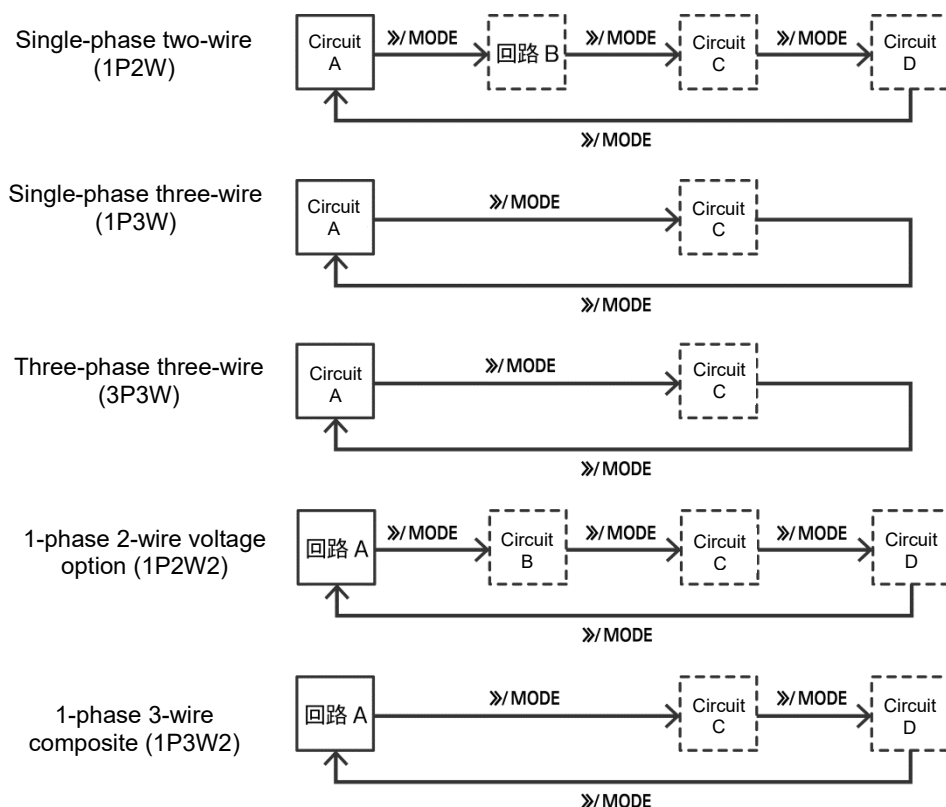
3.3. Measured value display

The measured value is shown for each of the circuits A to D in the measuring mode.

The display of each circuit is switched by pressing a [>>/MODE] key. Depending on the phase and wire type selected, the displayed settings for the measured value change as follows. The circuits as dashed squares are only displayed when use is enabled.

The setting items for circuits B to D are displayed when the circuit settings are enabled (ON). Refer to "3.6.2 Settings for circuits B to D (when measuring 2 circuits or more)" for details.

Ref: 3.6.2 Settings for circuits B to D (when measuring 2 circuits or more) (P3-16)

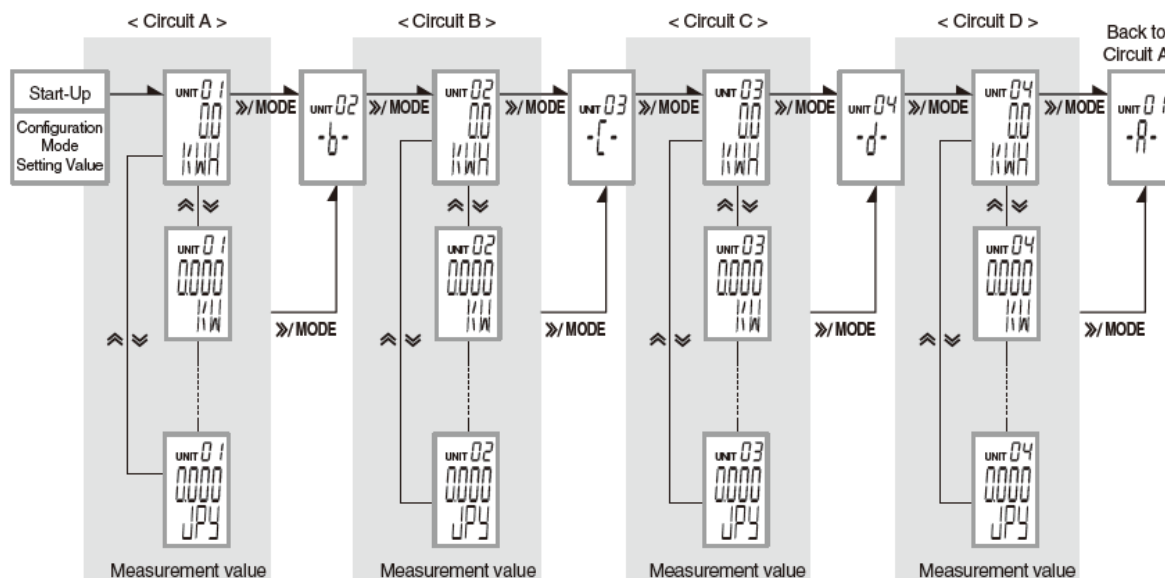


[Reference]

- Circuit B and D cannot be used depending on the phase-wire type. In that case, the measured values of circuit B and circuit D are not displayed. (e.g.: When measuring 2 circuits of 3-phase 3-wire, circuits B and D cannot be used and the measured values are not displayed, but only circuits A and C are displayed)

■ Measured value display transition

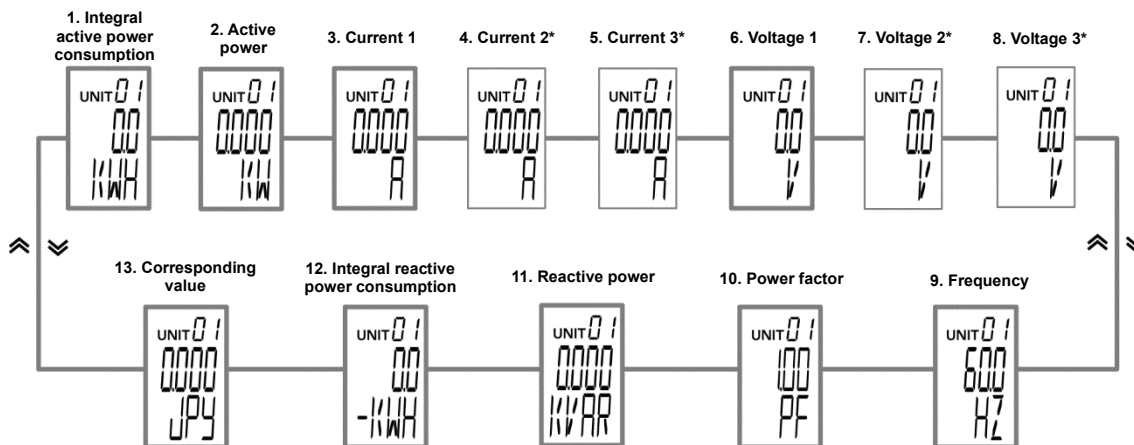
- To move to each circuit, press [>>/MODE].
- When transitioning between circuits, a screen indicating the destination circuit is initially displayed, and pressing [>>/MODE] again displays the measured values.
- The measuring items for circuits B to D are displayed when the circuit settings are enabled (ON).



*Circuit B,C,D will be displayed when configuration menu b0, c0, d0 'Circuit active/no active' sets as 'ON'.

- To move between measuring items, press the Up or Down key.
- Refer to "How to use other functions" for details about all the measuring items.

Ref: Measurement display list (P3-5)



* Not shown for 1-phase 2-wire

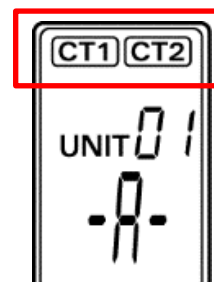
11. Integral reactive power consumption

■ Display of CTs to use

KM-N1 can connect up to four (4) CTs, allowing measurement of up to four (4) circuits (for 1-phase 2-wire).

The measured values are shown for each of the circuits in the measuring mode. The CTs being used by each circuit are displayed in the CT-in-use display field.

For example, for 1-phase 3-wire or 3-phase 3-wire, the measurement display for circuit A also displays CT1 and CT2 as shown at right.



■ Measurement display list

Priority	Item	Main display/value	Sub-display/unit	Note
1	Integral active power consumption	0.0 to 9999.9	kWh	Auto unit set**
		10.0 to 9999.9	MWh	
2	Active power	-9999 to 99999	kW	Decimal point moves according to measured value -9999 to -1000 -999.9 to -100.0 -99.99 to -10.00 -9.999 to 99.999 100.00 to 999.99 1000.0 to 9999.9 100.00 to 99999
3	Current 1	0.000 to 99999	A: 1-phase 2-wire	Decimal point moves according to measured value 0.000 to 99.999 100.00 to 999.99 1000.0 to 9999.9 10000 to 99999
			A-R: 1-phase 3-wire	
			A-R: 3-phase 3-wire	
			A: 1-phase 2-wire voltage option	
			A (A-R for circuit A on: 1-phase 3-wire composite)	
4	Current 2*	0.000 to 99999	None: 1-phase 2-wire	Decimal point moves according to measured value 0.000 to 99.999 100.00 to 999.99 1000.0 to 9999.9 10000 to 99999
			A-T: 1-phase 3-wire	
			A-T: 3-phase 3-wire	
			None: 1-phase 2-wire voltage option	
			None (A-T for circuit A: 1-phase 3-wire composite)	
5	Current 3*	0.000 to 99999	None: 1-phase 2-wire voltage option	Decimal point moves according to measured value 0.000 to 99.999 100.00 to 999.99 1000.0 to 9999.9 10000 to 99999
			A-N: 1-phase 3-wire	
			A-S: 3-phase 3-wire	
			None: 1-phase 2-wire voltage option	
			None (A-N for circuit A: 1-phase 3-wire composite)	
6	Voltage 1	0.0 to 9999.9	V: 1-phase 2-wire	*1 Varies depending on voltage assignment setting *2 Varies depending on voltage assignment setting
			V-RN: 1-phase 3-wire	
			V-RS: 3-phase 3-wire	
			*1 V-RN V-TN V-RT: 1-phase 2-wire voltage option	
			*2 V-RN V-TN V-RT: 1-phase 3-wire composite	
7	Voltage 2*	0.0 to 9999.9	None: 1-phase 2-wire	
			V-TN: 1-phase 3-wire	
			V-ST: 3-phase 3-wire	
			None: 1-phase 2-wire voltage option	
			None: 1-phase 3-wire composite	
8	Voltage 3*	0.0 to 9999.9	None: 1-phase 2-wire	
			V-RT: 1-phase 3-wire	
			V-TR: 3-phase 3-wire	
			None: 1-phase 2-wire voltage option	
			None: 1-phase 3-wire composite	
9	Frequency	45.0 to 65.0	Hz	
10	Power factor	-1.00 to 1.00	PF	
11	Reactive power	-9999 to 99999	kVAR	Decimal point moves according to measured value -9999 to -1000 -999.9 to -100.0 -99.99 to -10.00 -9.999 to 99.999 100.00 to 999.99
12	Integral regenerative power consumption	0.0 to 9999.9	-kWh	Auto unit set**
		10.0 to 9999.9	-MWh	
13	Corresponding value	0.000 to 99999	JPY *Setting changeable	Decimal point moves according to measured value 0.000 to 99.999 100.00 to 999.99 1000.0 to 9999.9 10000 to 99999
		10.000 to 99999	K.JPY *Setting changeable	
		10.000 to 99999	M.JPY *Setting changeable	

* Displayed only when 1-phase 3-wire or 3-phase 3-wire is selected.

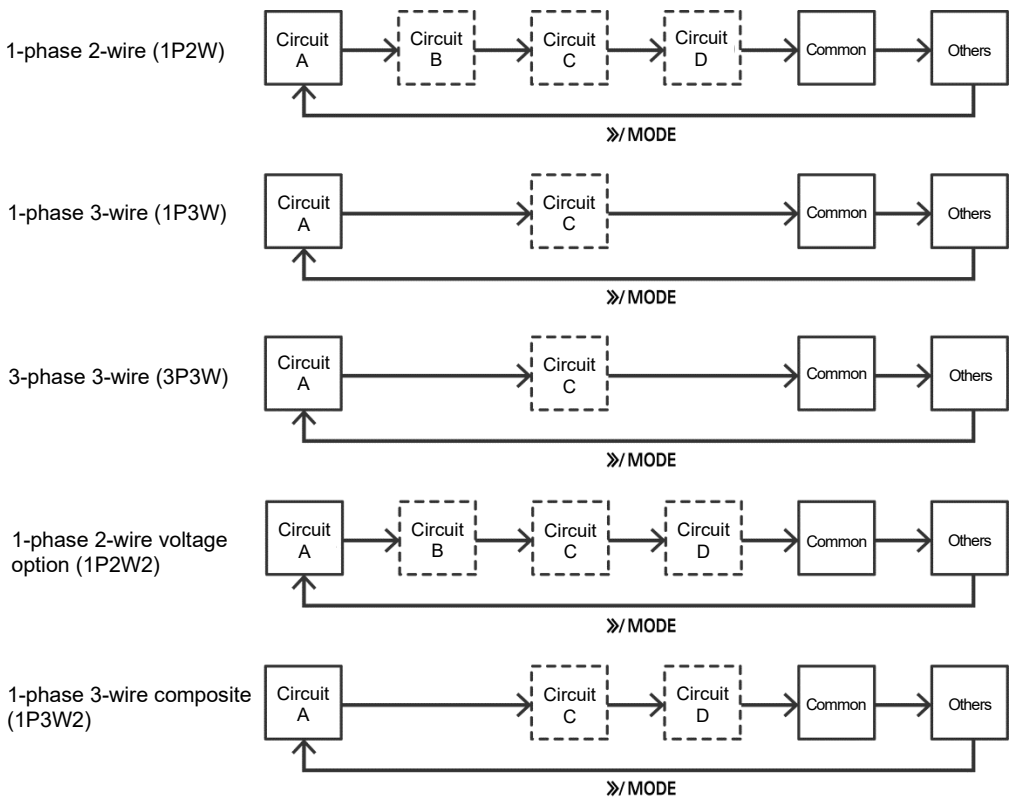
** The units change automatically when the display reaches the maximum value, with the display value on the unit returning to 0, but recording continues. Accurate values can be obtained by using the communication function. When the function to fix the display digits is executed, the unit of the integral value is fixed.

3.4. Display of settings

The setting mode is organized into the categories "Individual setting items for circuits A to D", "Common settings", and "Other settings". The display of each circuit is switched by pressing [>>/MODE].

Category	Details
Circuit (A, B, C, D)	Individual setting items for each circuit
Common (CMMN)	Setting items common to all of the circuits (communication, pulse output, etc.)
Others (ETC)	Settings for initializing, resetting integral values, etc.

Depending on the phase and wire type selected, the displayed settings change as follows. The setting items for circuits in the broken lines are displayed if you have enabled the circuits.

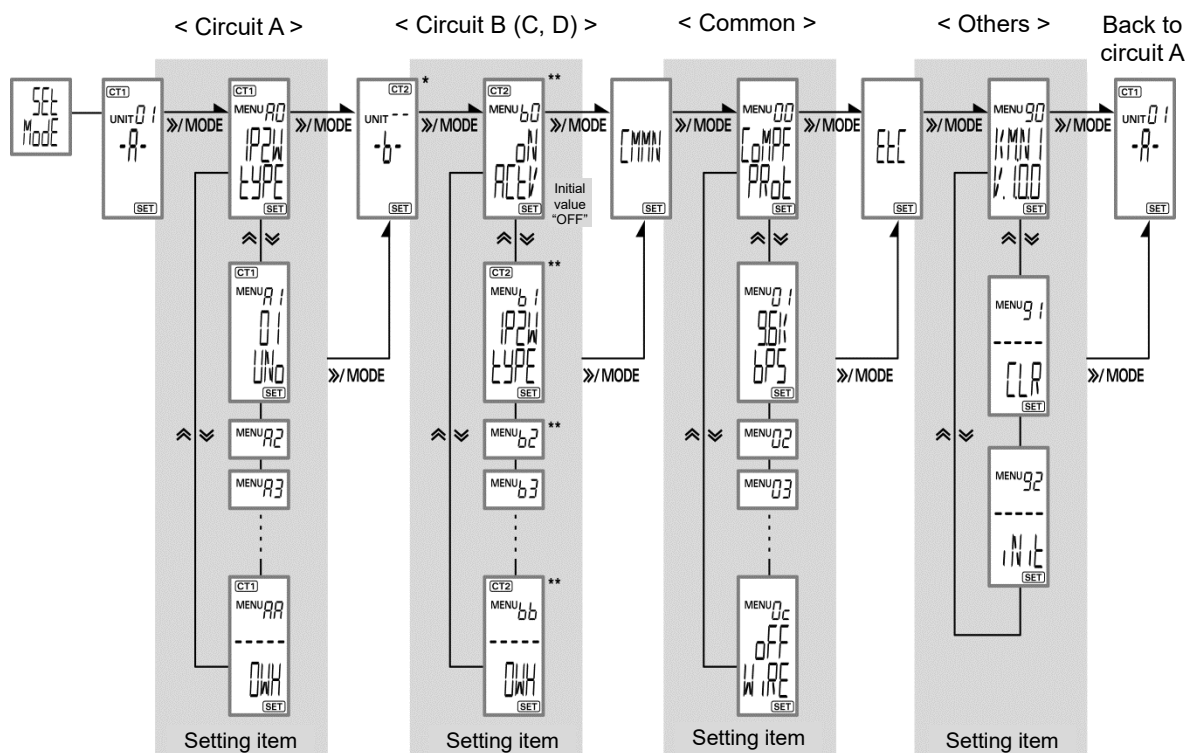


[Reference]

- Circuits B and D cannot be used depending on the phase-wire type. In that case, the setting items of circuits B and D are not displayed. (e.g.: When measuring 2 circuits of 3-phase 3-wire, circuits B and D cannot be used and the setting values are not displayed, but only circuits A and C are displayed)

■ Displaying setting item

- To move to the setting category, press [>>/MODE].
- When transitioning between categories, a screen indicating the destination category is initially displayed, and pressing [>>/MODE] again displays the setting items.
- The setting items for circuits B to D are displayed when the circuit settings are enabled (ON).



* For circuit C: -[-
 For circuit D: -d-
 **For circuit C: CT3 is lit,
 MENU is 00 01 02 03...0b
 For circuit D: CT4 is lit,
 MENU is d0 d1 d2 d3...db

- To move between setting items, press the Up or Down key.
- Refer to "Setting item list" for details about all of the setting items.

Ref: Setting item list (P3-8)

Setting item list

Category	MENU No.	Setting Item	Main display Display of selections and input values	Sub-display Unit	Initial value	Note
Circuit A	A0	Phase-Wire	1P2W / 1P3W / 3P3W 1P2W2 / 1P3W2	TYPE	1P2W	1P2W : 1-phase 2-wire 1P3W : 1-phase 3-wire 3P3W : 3-phase 3-wire 1P2W2 : 1-phase 2-wire voltage option 1P3W2 : 1-phase 3-wire composite
	A1	Circuit A unit number	CompoWay/F : 00 to 99, -- Modbus : 01 to 99, -- BACnet MS/TP : H'00 to H'7F	UNO.	01	Set a different number for each circuit. Set a decimal number for CompoWay/F and Modbus. Set a hexadecimal number for BACnet MS/TP.
	A2	CT to use	5A / 50A / 100A 225A / 400A / 600A	CT	100A	
	A3	CT ratio	1.0 to 9999.9	CT-R	1.0	Available when the dedicated CT set "5A". Set the ratio of the primary current and the secondary current.
	A4	Low-cut current	0.1 to 19.9	A.CUT	0.6	Set the ration to the rating of the CT to use. Set the current to 0 if it is less than or equal to the set value.
	A5	Voltage assignment	R-N / T-N / R-T	V.SET	R-N	Set the voltage phase for 1-phase 2-wire circuits when 1P2W2 is selected.
	A6	Simple measurement ON/OFF	ON / OFF	SMPL	OFF	
	A7	Simple measurement (voltage fixed)	0.0 to 9999.9	S-V	100.0	Available when simple measurement is ON
	A8	Simple measurement (power factor fixed)	0.00 to 1.00	S-PF	1.00	Available when simple measurement is ON
	A9	Pulse terminal assignment	OUT1 / OUT2 / OFF	OUT	OFF	
	AA	Clear integral power consumption	-----	0WH	-----	Clears the integral power consumption for the circuit.
Circuit B	b0	Enable/disable circuit	ON / OFF	ACTV	OFF	ON: Enable the circuit to perform measurement and setting. OFF: Disable the circuit so that measurement and setting should not be performed.
	b1	Setup phase-wire type display	Phase-wire type set by A0	TYPE		Not selectable
	b2	Circuit B unit number	CompoWay/F : 00 to 99, -- Modbus : 01 to 99, -- BACnet MS/TP : H'00 to H'7F	UNO.	--	Set a different number for each circuit. Set a decimal number for CompoWay/F and Modbus. Set a hexadecimal number for BACnet MS/TP.
	b3	CT to use	5A / 50A / 100A 225A / 400A / 600A	CT	100A	
	b4	CT ratio	1.0 to 9999.9	CT-R	1.0	Available when the dedicated CT set "5A". Set the ratio of the primary current and the secondary current.
	b5	Low-cut current	0.1 to 19.9	A.CUT	0.6	Set the ration to the rating of the CT to use. Set the current to 0 if it is less than the set value.
	b6	Voltage assignment	R-N / T-N / R-T	V.SET	R-N	Set the voltage phase for 1-phase 2-wire circuits when 1P2W2 is selected.
	b7	Simple measurement ON/OFF	ON / OFF	SMPL	OFF	
	b8	Simple measurement (voltage fixed)	0.0 to 9999.9	S-V	100.0	Available when simple measurement is ON
	b9	Simple measurement (power factor fixed)	0.00 to 1.00	S-PF	1.00	Available when simple measurement is ON
	bA	Pulse terminal assignment	OUT1 / OUT2 / OFF	OUT	OFF	OUT1: Pulse output from OUTPUT1 OUT2: Pulse output from OUTPUT2 OFF : No pulse output
	bb	Clear integral power consumption	-----	0WH	-----	Clears the integral power consumption for the circuit.

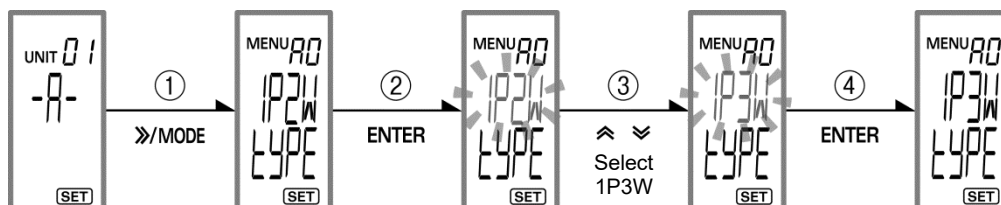
Circuit C	c0	Enable/disable circuit	ON / OFF	ACTV	OFF	ON: Enable the circuit to perform measurement and setting. OFF: Disable the circuit so that measurement and setting should not be performed.
	c1	Setup phase-wire type display	Phase-wire type set by A0	TYPE		Not selectable
	c2	Circuit C unit number	CompoWay/F : 00 to 99, -- Modbus : 01 to 99, -- BACnet MS/TP : H'00 to H'7F	UNO.	--	Set a different number for each circuit. Set a decimal number for CompoWay/F and Modbus. Set a hexadecimal number for BACnet MS/TP.
	c3	CT to use	5A / 50A / 100A 225A / 400A / 600A	CT	100A	
	c4	CT ratio	1.0 to 9999.9	CT-R	1.0	Available when the dedicated CT set "5A". Set the ratio of the primary current and the secondary current.
	c5	Low-cut current	0.1 to 19.9	A.CUT	0.6	Set the ratio to the rating of the CT to use. Set the current to 0 if it is less than the set value.
	c6	Voltage assignment	R-N / T-N / R-T	V.SET	R-N	Set the voltage phase for 1-phase 2-wire circuits when 1P2W2 or 1P3W2 is selected.
	c7	Simple measurement ON/OFF	ON / OFF	SMPL	OFF	
	c8	Simple measurement (voltage fixed)	0.0 to 9999.9	S-V	100.0	Available when simple measurement is ON
	c9	Simple measurement (power factor fixed)	0.00 to 1.00	S-PF	1.00	Available when simple measurement is ON
	cA	Pulse terminal assignment	OUT1 / OUT2 / OFF	OUT	OFF	OUT1: Pulse output from OUTPUT1 OUT2: Pulse output from OUTPUT2 OFF : No pulse output
	cb	Clear integral power consumption	-----	0WH	-----	Clears the integral power consumption for the circuit.
Circuit D	d0	Enable/disable circuit	ON / OFF	ACTV	OFF	ON: Enable the circuit to perform measurement and setting. OFF: Disable the circuit so that measurement and setting should not be performed.
	d1	Setup phase-wire type display	Phase-wire type set by A0	TYPE		Not selectable
	d2	Circuit D unit number	CompoWay/F : 00 to 99, -- Modbus : 01 to 99, -- BACnet MS/TP : H'00 to H'7F	UNO.	--	Set a different number for each circuit. Set a decimal number for CompoWay/F and Modbus. Set a hexadecimal number for BACnet MS/TP.
	d3	CT to use	5A / 50A / 100A 225A / 400A / 600A	CT	100A	
	d4	CT ratio	1.0 to 9999.9	CT-R	1.0	Available when the dedicated CT set "5A". Set the ratio of the primary current and the secondary current.
	d5	Low-cut current	0.1 to 19.9	A.CUT	0.6	Set the ratio to the rating of the CT to use. Set the current to 0 if it is less than the set value.
	d6	Voltage assignment	R-N / T-N / R-T	V.SET	R-N	Set the voltage phase for 1-phase 2-wire circuits when 1P2W2 or 1P3W2 is selected.
	d7	Simple measurement ON/OFF	ON / OFF	SMPL	OFF	
	d8	Simple measurement (voltage fixed)	0.0 to 9999.9	S-V	100.0	Available when simple measurement is ON
	d9	Simple measurement (power factor fixed)	0.00 to 1.00	S-PF	1.00	Available when simple measurement is ON
	dA	Pulse terminal assignment	OUT1 / OUT2 / OFF	OUT	OFF	OUT1: Pulse output from OUTPUT1 OUT2: Pulse output from OUTPUT2 OFF : No pulse output
	db	Clear integral power consumption	-----	0WH	-----	Clears the integral power consumption for the circuit.

Common CMMN	00	Protocol	COMPF / MODB / KM20	PROT	COMPF	If KM20 is selected, the address map is the same as KM20-B40-FLK, and the communications protocol is fixed as CompoWay/F. (See Chapter 6)
			BAC / MODB		BAC	
	01	Communication speed	CompoWay/F / Modbus : 1.2K / 2.4K / 4.8K 9.6K / 19.2K / 38.4K	BPS	9.6K	
			BACnet MS/TP : 9.6k / 19.2k / 38.4k Modbus : 1.2k / 2.4k / 4.8k / 9.6k / 19.2k / 38.4k		38.4k	
	02	Data length	CompoWay/F : 7 / 8 Modbus : 8	LEN	See Note	Initial value CompoWay/F: 7 Modbus : 8
			BACnet MS/TP / Modbus : 8		8	
	03	Stop bits	1 / 2	S.BIT	2	
			BACnet MS/TP : 1 Modbus : 1 / 2		1	
	04	Parity	NONE / ODD / EVEN	PRTY	EVEN	
			BACnet MS/TP : NONE Modbus : NONE / ODD / EVEN		NONE	
	05	Time to wait for sending	00 to 99	WAIT	See Note	Initial value FLK: 20, BAC: 01
	06	VT ratio	1.00 to 999.99	VT-R	1.00	Set for voltage input using VT. Set the ratio of the primary voltage and the secondary voltage.
	07	Conversion rate	0.000 to 99.999	RATE	10.000	Set the conversion factor to be multiplied by the integral power consumption of each circuit.
	08	Conversion display unit	Conversion display unit can be set by 3-digit input Each digit: 0 to 9, A to Z, /, -, _	CHAR	JPY	Set any 3-digit character as a unit for the conversion value.
	09	Pulse output unit	1 / 10 / 100 / 1K / 5K 10K / 50K / 100K (Wh)	WH/P	100	
	0A	Fix display digits	OFF / KWH / MWH	DIGT	OFF	
	0b	Auto-LCD OFF time	OFF / 1.0 / 5.0 / 10.0 (minute)	DISP	5.0	When OFF, it is always lit.
	0c	Warning ON/OFF	ON / OFF	ALM	ON	
Others ETC	90	Software version display	FLK : KM.N1, BAC : N1.BA	V.1.0.0		Sub-display example is for Ver.1.0.0.
	91	Clear all integral power consumption values	-----	0WH	-----	Clear the integral power consumption for all circuits.
	92	Initialize all	-----	INIT	-----	Set to factory defaults. All settings and measured values are initialized.

* In the case of the two-tier display, the upper row is for KM-N1-FLK and the lower row is for KM-N1-BAC.

■ Selection and setup steps

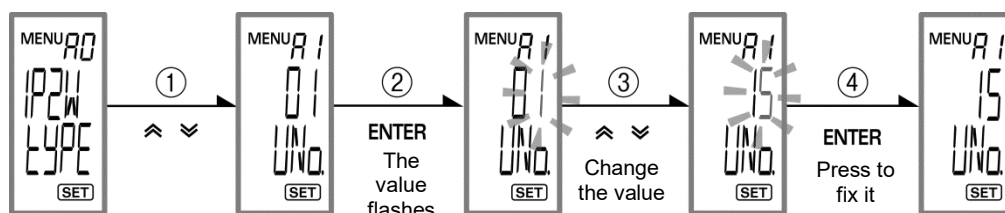
- ① Display the item you want to change.
- ② Press the [ENTER] key to enter the setting mode.
- ③ Press the Up or Down key to change the setting value.
- ④ Press [ENTER] to fix it.



■ Numeric value setting steps

- ① Display the item you want to change.
- ② Press the [ENTER] key to enter the setting mode.
- ③ Press the Up or Down key to change the numeric value.
 - Pressing Up (Down) increases (decreases) the numeric value by 1, from the least significant digit.
 - Pressing and holding the Up or Down key for over one second increases or decreases the most significant digit, as shown in the example below.
- (e.g.) When Up key is pressed and held
1, 2, 3 ... 9, 10, 20, 30 ... 90, 100, 200, 300 ... 900

- ④ Set the numeric value, and press [ENTER] to fix.



You can move between digits using the following operations. This is useful for setting numeric values with a large number of digits.

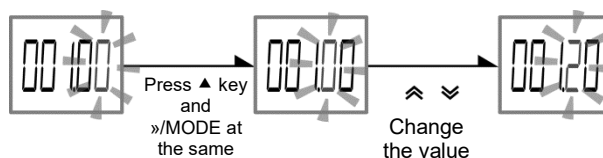
To move to the upper digit

- Pressing Up and [»/MODE] at the same time

To move to the lower digit

- Pressing Down and [»/MODE] at the same time

The figure below shows an example of moving to the higher digit and changing the value.



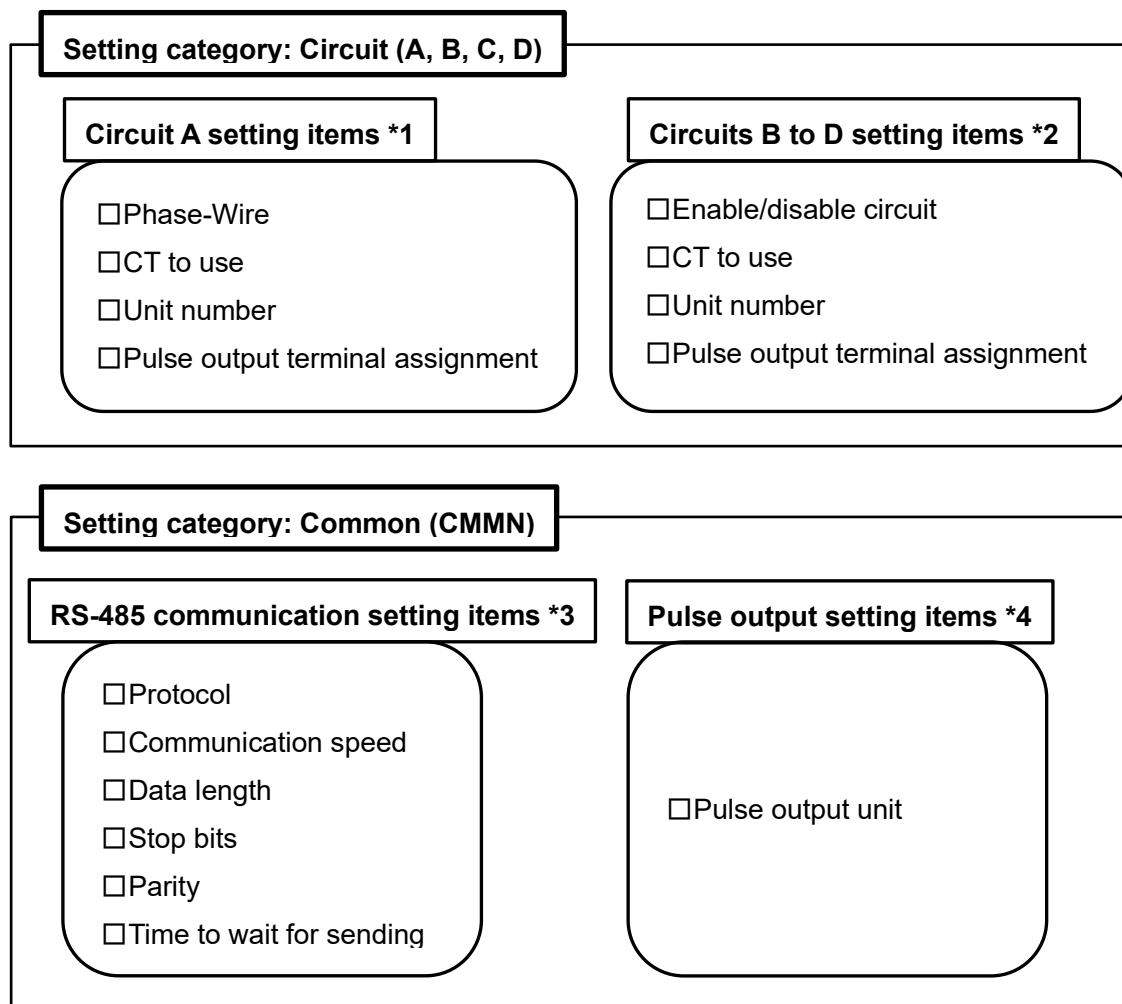
[Reference]

- You can cancel a change by pressing [»/MODE] before fixing the change by pressing [ENTER].

3.5. Setting items for measuring electricity

The following are the requisite setting items for measuring power. To use other functions, see "Chapter 4 How to Use Other Functions".

Ref: Chapter 4 How to Use Other Functions (P4-1)



*1 3.6.1 Settings for circuit A (P3-13)

*2 3.6.2 Settings for circuits B to D (when measuring 2 circuits or more) (P3-16)

*3 3.7 RS-485 communications setting (P3-18)

*4 3.8.3 Pulse output unit setting (P3-22)

3.6. Measurement setting

Correct measurement requires the correct settings for phase and wire type, as well as the CT to use.

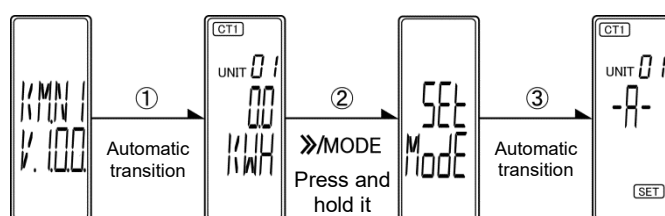
If points of measurement are added, enable the use of circuits B to D and set them.

3.6.1. Settings for circuit A

The following are the setting items required for measuring with circuit A.

Step 1: Move to the setting mode

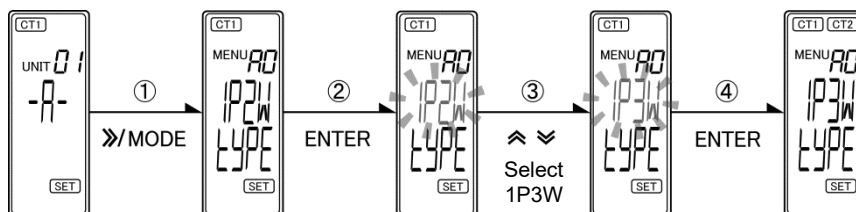
- ① After turning on the power, the measuring mode is moved to automatically and the Integral active power consumption for circuit A is displayed.
- ② Press and hold [>>/MODE] to move from the measuring mode to the setting mode.
- ③ After the "SET MODE" screen is shown for about 1 second, the screen moves to the settings category display for circuit A.



* KM-N1-BAC shows "N1.bA" in the upper row.

Step 2: Set the phase-wire type (e.g.: Set to 1-phase 3-wire)

- ① On the setting category display for circuit A, press [>>/MODE] to transition to the setting items for circuit A.
"Phase-Wire (MENU A0)" is displayed.
- ② Press the [ENTER] key to enter the setting mode. The setting value in the main display flashes.
- ③ Press the Up or Down key to select "1P3W"(1-phase 3-wire).
- ④ Press [ENTER] to fix the selected item.

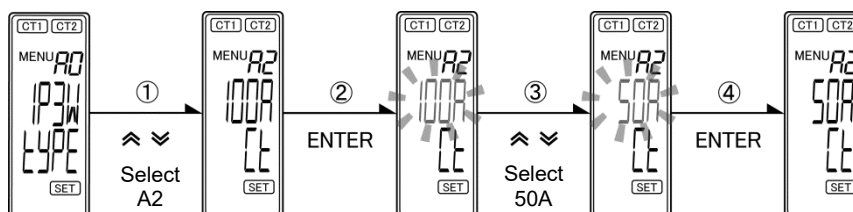


[Caution]

- When the phase and wire type is changed, the enable/disable settings for circuits B to D are switched to "OFF"(disabled), and unit number of each circuit returns to the initial value.

Step 3: Set the CT to use (e.g.: Set to 50A CT)

- ① From the circuit A setting items, press the Up or Down key to move to **"CT to use (MENU A2)"**.
- ② Press the [ENTER] key to enter the setting mode. The setting value in the main display flashes.
- ③ Press the Up or Down key to select "50A".
- ④ Press [ENTER] to fix the selected item.

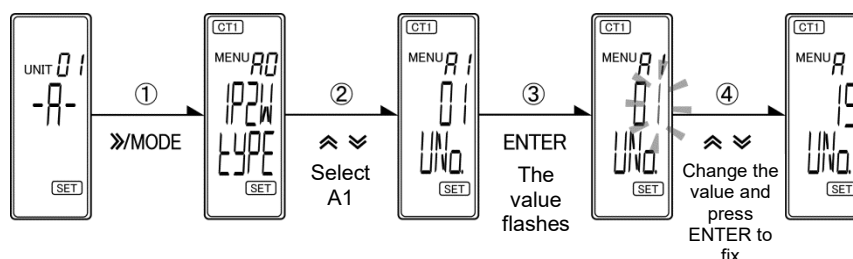


When RS-485 communication is to be used, set the unit number.

You can assign an individual unit number to each circuit. Set a unique unit number to each circuit so that the host device can recognize it individually.

Step 4: Set the unit number (e.g.: Set the unit number 15)

- ① On the setting category display for circuit A, press [>>/MODE] to transition to the setting items for circuit A.
"Phase and wire type (MENU A0)" is displayed.
- ② Press the Down key to move to **"Circuit A unit No. (MENU A1)"**.
- ③ Press [ENTER] to enter the setting mode. The first digit of the setting value in the main display flashes.
- ④ Use the Up or Down key to change the value, and press [ENTER] to fix the change.
• For how to change numeric values, refer to "Numeric value setting steps".



Ref: Numeric value setting steps (P3-11)

Set the pulse terminal assignment if using the pulse output.

You can assign pulse output terminal (OUT1/OUT2) to each circuit. The initial value of the pulse terminal assignment for each circuit is OFF (no pulse output). Assigning OUT1 or OUT2 enables the pulse output function.

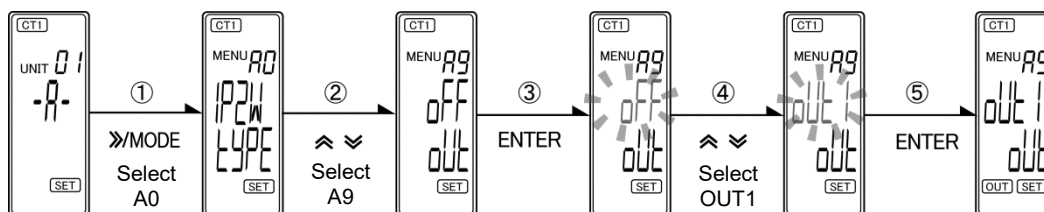
Step 5: Set pulse terminal assignment (e.g.: Set pulse terminal assignment to OUT1)

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① On the setting category display for circuit A, press [>>/MODE] to transition to the setting items for circuit A.

"Phase and wire type (MENU A0)" is displayed.

- ② Press the Down key to move to **"Pulse terminal assignment (MENU A9)"**.
- ③ Press the [ENTER] key to enter the setting mode. The setting value in the main display flashes.
- ④ Press the Up or Down key to select "OUT1".
- ⑤ Press the [ENTER] key to confirm your selection.



The settings required for measuring with circuit A is now complete.

[Caution]

- After changing settings in the setting mode, be sure to transition to the measuring mode. Changes are saved when transitioning to the measuring mode, and the system is automatically restarted.

[Reference]

- You can cancel a change by pressing [>>/MODE] before fixing the change by pressing [ENTER].
- Select 5A when used in combination with a general-purpose CT.
Ref: 4.1 Measuring large current (P4-2)

3.6.2. Settings for circuits B to D (when measuring 2 circuits or more)

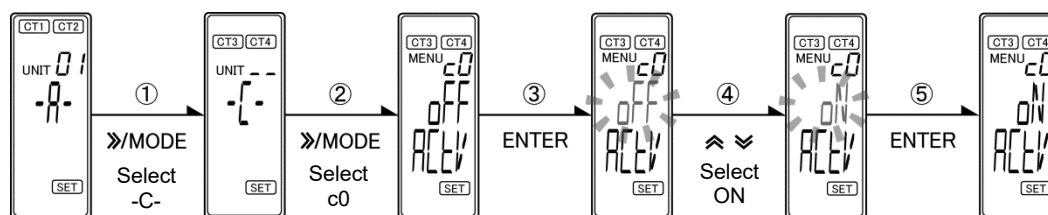
KM-N1 can measure up to 4 circuits. If you increase the number of circuits, you must enable the circuits and set the items for them. Make sure you disable those circuits you are not using.

Ref: 1.5 Multi-circuit metering (P1-13)

Step 1: Enable just those circuits from B to D that will be used (Ex.: enable circuit C)

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

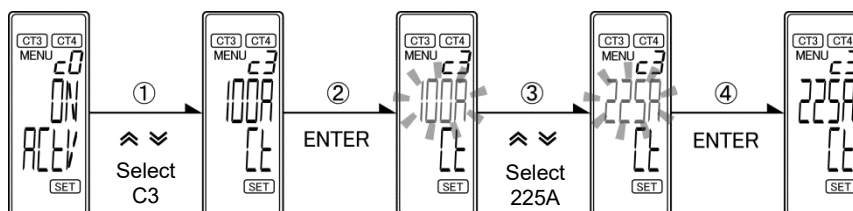
- ① Press [>>/MODE] to move to the settings category display for circuit C.
- ② Press [>>/MODE] to transition to "Circuit C enable/disable setting (MENU c0)".
- ③ Press the [ENTER] key to enter the setting mode.
- ④ Press the Up or Down key to select "ON".
- ⑤ Press [ENTER] to fix the selected item.



Step 2: Set the to use for the enabled circuits from B to D

(e.g.: Set the CT to use in circuit C to 225A)

- ① From the circuit C setting items, press the Up or Down key to move to "CT to use (MENU c3)".
- ② Press the [ENTER] key to enter the setting mode.
- ③ Press the Up or Down key to select "225A".
- ④ Press [ENTER] to fix the selected item.



To use the RS-485 communications, set the unit number.

The MENU No. for the unit number of circuits B to D are "b2"(circuit B), "c2"(circuit C), and "d2"(circuit D).

Set the pulse terminal assignment if using the pulse output.

The MENU No. for the pulse terminal assignment of circuits B to D are "bA"(circuit B), "cA"(circuit C), and "dA"(circuit D).

The settings required for measuring with two (2) or more circuits is now complete.

[Caution]

- The phase and wire type is set in circuit A. The phase and wire type set for circuit A is shown in the circuit B to D setting items (MENU b1, c1, and d1) and cannot be changed.
 - Depending on the phase and wire type set for circuit A, there will be circuits that are unavailable for use.
The setting items for circuits unavailable for use will not be displayed.
 - You need to set the CT to use for each circuit. Confirm the rated values for the dedicated CT you are using and set correctly.
-

3.7. RS-485 communications setting

A unit number is an individual setting for each circuit, but the other setting items are common settings and apply to all circuits.

■How to set up protocols

KM-N1-FLK supports CompoWay/F, Modbus, and KM20 (default: (CompoWay/F)), while KM-N1-BAC supports BACnet MS/TP and Modbus (default: (BACnet MS/TP)).

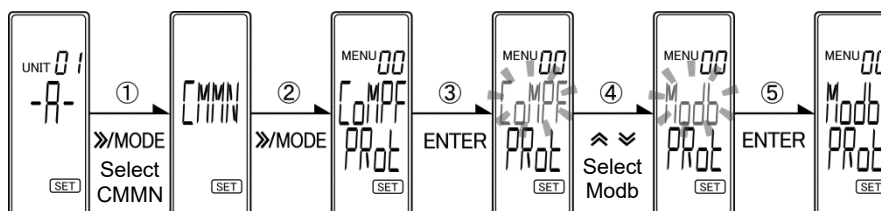
Setting examples are shown for KM-N1-FLK.

See "Chapter 6 KM-N1OP-01 and KM20 Mode" for details of KM20 usage.

To set the protocol to Modbus

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to "**Protocol (MENU 00)**".
- ③ Press the [ENTER] key to enter the setting mode.
- ④ Press the Up or Down key to select "MODB".
- ⑤ Press the [ENTER] key to confirm your selection.



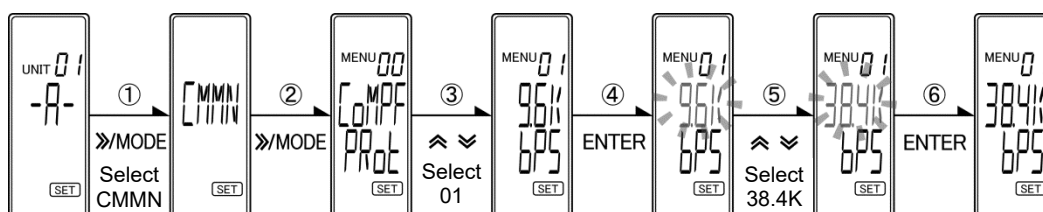
[Caution]

- Changing the protocol resets the unit number of each circuit to the initial value.

■How to set communication speed

To set the communication speed to 38.4 kbps

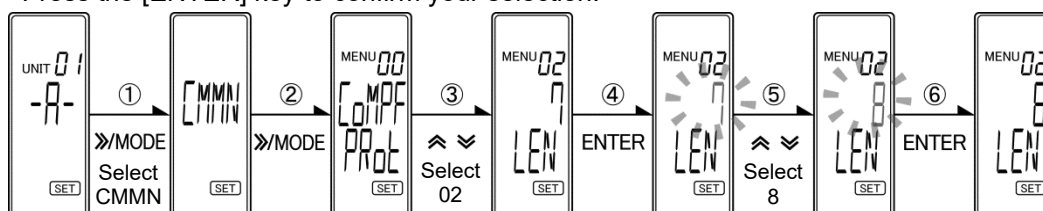
- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Communication speed (MENU 01)**".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "38.4K".
- ⑥ Press the [ENTER] key to confirm your selection.



■How to set data bit length

To set the data bit length to 8 bits

- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Data length (MENU 02)**".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "8".
- ⑥ Press the [ENTER] key to confirm your selection.



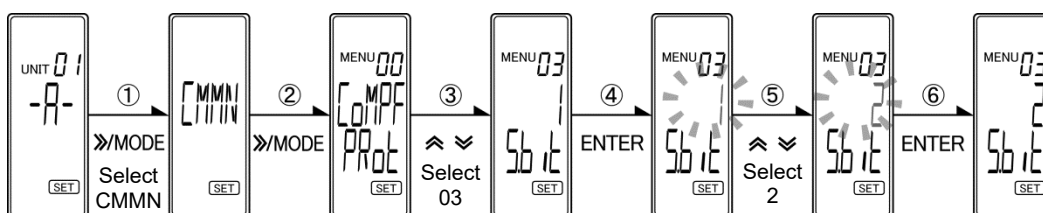
[Caution]

- If the protocol is Modbus, the data bit length is fixed at 8 bits.

■How to set stop bit length

To set the stop bit length to 2 bits

- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Stop bits (MENU 03)**".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "2".
- ⑥ Press the [ENTER] key to confirm your selection.



[Caution]

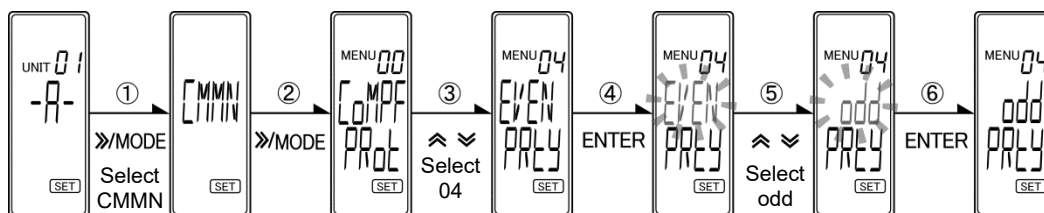
- If the protocol is Modbus, then the stop bit length is automatically set to "2" if the vertical parity is "NONE" or "1" if it is "ODD" or "EVEN".
- The stop bit length must be set only if the protocol is CompoWay/F.

■How to set vertical parity

Select "NONE" for no parity, "EVEN" for even parity, and "ODD" for odd parity.

To set the vertical parity to "ODD"

- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Parity (MENU 04)**".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "ODD".
- ⑥ Press the [ENTER] key to confirm your selection.

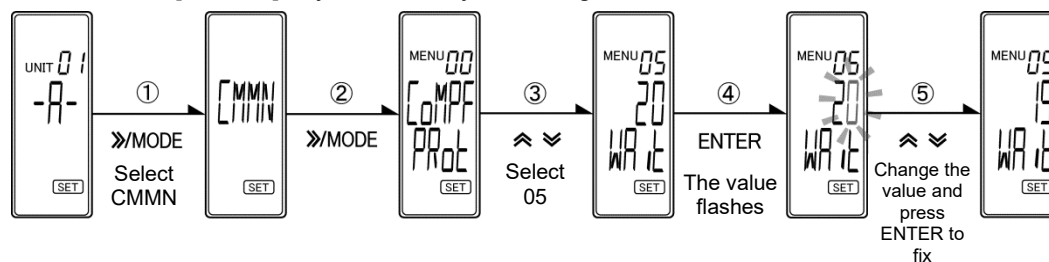


■Time to wait for sending

You can set the time to wait between when a response is created and when it is sent. The setting can be changed in units of 1 ms. The default value is 20 ms.

To set the transmission wait time to 15 ms

- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Time to wait for sending (MENU 05)**".
- ④ Press the [ENTER] key to enter the setting mode. Use the Up or Down key to change the value to "15".
- ⑤ Press the [ENTER] key to confirm your change.



3.8. Pulse output settings

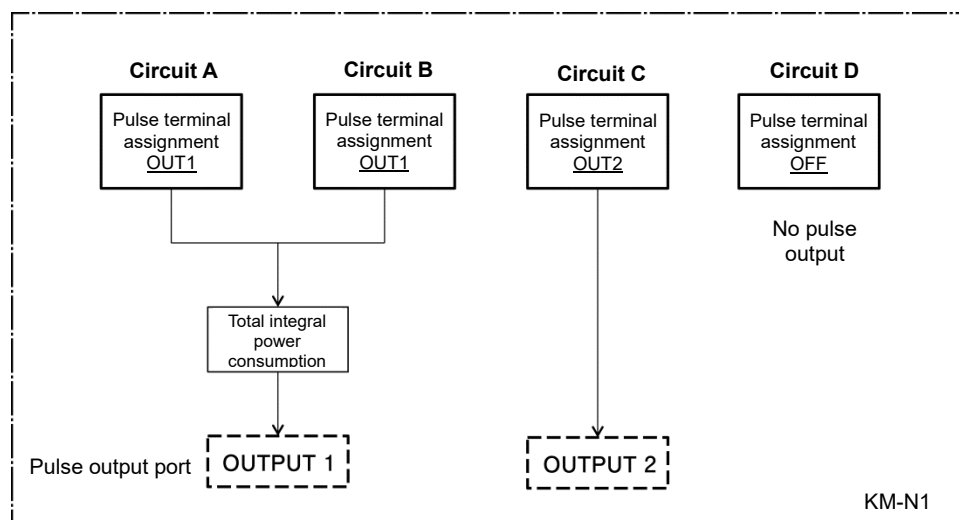
3.8.1. Pulse output overview

KM-N1 has the 2 pulse output ports. (OUTPUT 1, OUTPUT 2)

You can assign which pulse output port to which circuit individually.

The integral power consumption of the circuits to which the same pulse output port is assigned is summed up, and pulse is output if the sum exceeds the output unit.

Shown below is the relationship between the pulse terminal assignment and pulse output port for each circuit. (Pulse output assignment is an example)

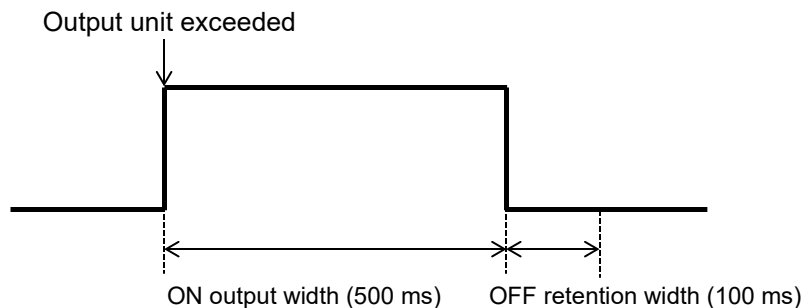


3.8.2. Pulse output waveform

The following diagram shows pulse output waveforms.

When the integral power consumption exceeds the output unit, one pulse is output from the assigned output.

The ON output width is fixed at 500 ms. The OFF sustained width after output is 100 ms.



Basic waveform of pulse output

An alarm is displayed when there is a pulse output error.

A pulse output error may be either of the following two (2) states.

- ① The output unit is exceeded again while still in the ON output state.
Action when error occurs: The pulse output continues for more than 500 ms due to the unit being exceeded again.
- ② Output unit is exceeded within the OFF sustained width.
Action when error occurs: Pulse is output within the time of the OFF sustained width.

The following items are displayed when there is a pulse output error.

- Alarm LED flashes.
- LCD displays "A-P1"(when OUT1 is abnormal) and "A-P2"(when OUT2 is abnormal).

If the above alarm occurs, review the pulse output unit and adjust it to be the basic waveform.

After adjustment, perform a reset and restart the system to clear the alarm indication.

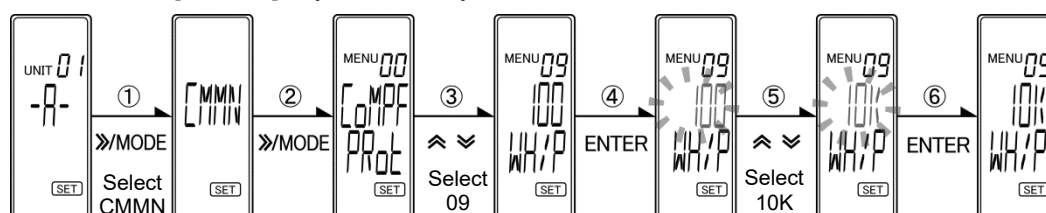
3.8.3. Pulse output unit setting

■ Pulse output unit setting

Pulse output unit is common to OUT1 and OUT2. The default value is 100Wh.

To set the pulse output unit to 10 kWh/pulse

- ① Press [>>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "Pulse output unit (MENU 09)".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "10K".
- ⑥ Press the [ENTER] key to confirm your selection.



Chapter 4. How to Use Other Functions

4.1. Measuring large current.....	4-2
4.2. Current low cut	4-3
4.3. Voltage assignment	4-4
4.4. Simple measurement.....	4-5
4.5. Measuring high voltage.....	4-7
4.6. Converting unit of display	4-8
4.7. Fixing display unit.....	4-10
4.8. Power saving mode	4-11
4.9. Voltage misconnection detection warning	4-12
4.10. Checking software version.....	4-13
4.11. Initialization.....	4-14
4.12. Mode lock	4-16
4.13. Reset.....	4-16

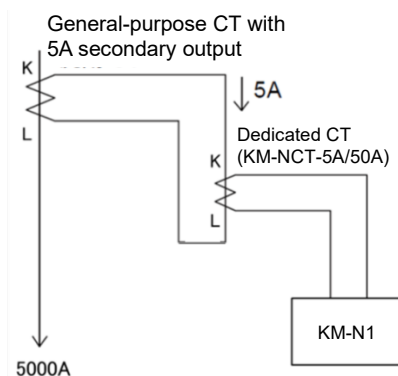
4.1. Measuring large current

■CT ratio

- This function is used to measure high current at low voltage or current at high voltage.
- By combining a dedicated CT (KM-NCT-5A/50A) with a commercially available general-purpose CT with a secondary output of 5A, a higher current than the rating of the dedicated CT can be measured.
- Set the ratio of the primary and secondary currents of the general-purpose CT.
- You can set an individual CT ratio for each circuit. To use this function in multi-point measurement, set the CT ratio for each circuit.

[Caution]

- This function is available only when the KM-NCT-5A/50A is used and the setting of CT in use is set to "5A".
- Because of the error of the general-purpose CT, the measurement accuracy is lower than that when the original current is measured with the dedicated CT. This function should be used in consideration of the errors of the general-purpose CT.

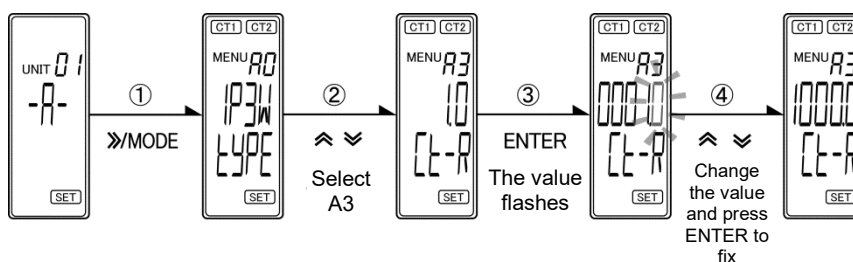


To measure in combination with a general-purpose CT rated at primary current of 5000 A in circuit A

Set the current ratio (5000A/5A) of the primary and secondary currents of the general-purpose CT.

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① On the setting category display for circuit A, press [>>/MODE] to transition to the setting items for circuit A.
"Phase and wire type (MENU A0)" is displayed.
- ② Press the Down key to move to "CT ratio (MENU A3)".
- ③ Press the [ENTER] key to enter the setting mode. The first digit of the setting value in the main display flashes.
- ④ Use the Up or Down key to change the value to "1000", and press [ENTER] to fix the change.



[Caution]

- The CT ratio setting is displayed only when "5A" is selected for the CT used (MENU A2, b3, c3, d3).
- The MENU No. for the CT ration of circuits B to D are "b4"(circuit B), "c4"(circuit C), and "d4"(circuit D).

4.2. Current low cut

- This function forcibly sets the current measurement as 0 when the current value falls below (rated current) x (configured ratio). The rated current is the rated value of the dedicated CT.
- By setting the current value to 0, the power value can be reduced to 0. By setting this function, the current and power measured by the inductive noise in the no-load state can be cut off, so set an appropriate value beforehand.
- The current low cut threshold can be set for each circuit.

[Caution]

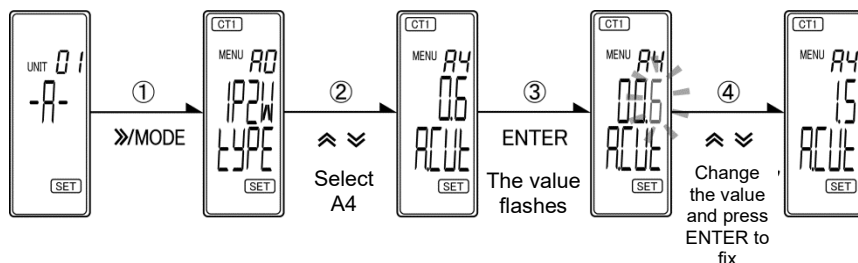
- As the low cut is determined by the effective value, the low cut function will work if the effective value is below the low cut value even if the peak value exceeds the low cut value.

Circuit A current is 1.5A with no-load condition while using KM-NCT-100A

To cut the unnecessary current, specify 1.5% ($1.5A/100A \times 100$).

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① On the setting category display for circuit A, press [>>/MODE] to transition to the setting items for circuit A.
"Phase and wire type (MENU A0)" is displayed.
- ② Press the Down key to move to "**Low-cut current (MENU A4)**".
- ③ Press the [ENTER] key to enter the setting mode. The first decimal place of the setting value in the main display flashes.
- ④ Use the Up or Down key to change the value to "1.5", and press the [ENTER] key to confirm your change.



[Caution]

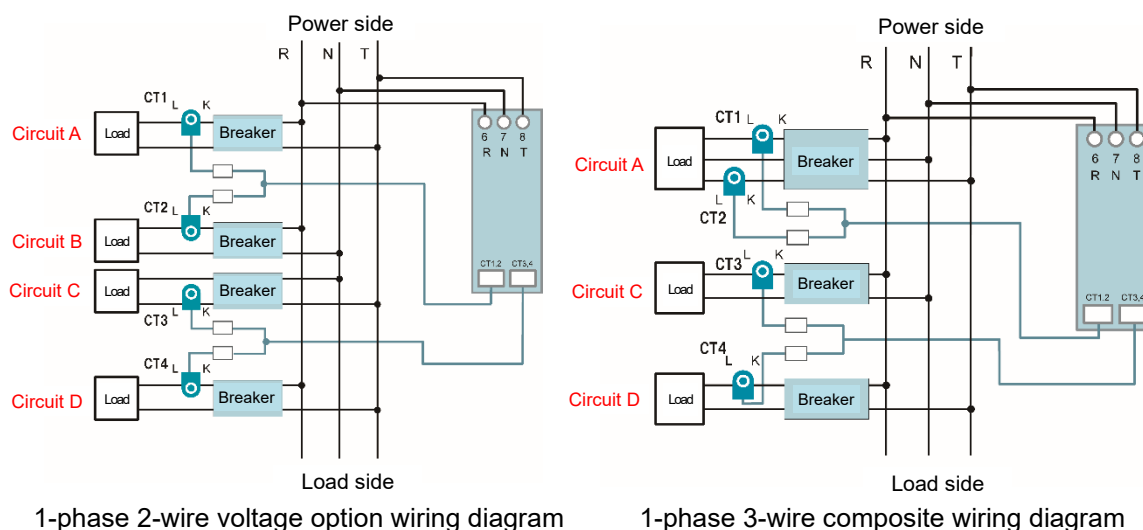
- The MENU No. for the low-cut current of circuits B to D are "b5"(circuit B), "c5"(circuit C), and "d5"(circuit D).

4.3. Voltage assignment

When the 1-phase 2-wire voltage selection (1P2W2) or 1-phase 3-wire composite (1P3W2) is set up in the phase-wire, the voltage assignment of the 1-phase 2-wire circuit to be measured must be configured. Set either the R-N or T-N phase when the input voltage is 100VAC, and the R-T phase when the input voltage is 200 VAC.

As shown in the figure below, a 1-phase 2-wire circuit to set the voltage assignment corresponds to circuits A, B, C, and D in the 1P2W2 wiring, and to circuits C and D in the 1P3W2 wiring diagram.

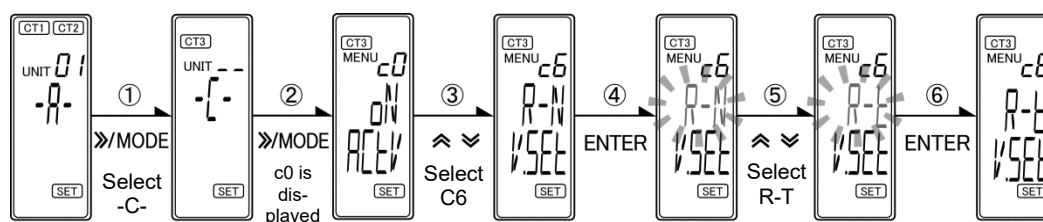
The voltage assignment must be individually set for each circuit.



Step 1: Set the voltage assignment (Ex.: set the voltage assignment for circuit C to R-T phase)

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press [>>/MODE] to move to the settings category display for circuit C.
- ② Press [>>/MODE] again and transition to circuit C setting items.
- ③ Press the Down key to move to **"Voltage assignment (MENU C6)"**.
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "R-T".
- ⑥ Press [ENTER] to fix the selected item.



[Reference]

- The MENU No. for allocating voltage for circuit A is "A5".
- The MENU No. for the voltage assignment of circuits B to D are "b6"(circuit B), "c6"(circuit C), and "d6"(circuit D).

4.4. Simple measurement

- The simple measurement is a function to determine the general power of the installed circuit without measuring the voltage.
- Use this when the voltage cannot be input to KM-D1 due to field conditions or wiring difficulties.
- You can set any voltage and power factor for each circuit as "fixed voltage" and "fixed power factor".
- The simple measurement calculates the power based on the fixed voltage, the fixed power factor, and the actual measured current values.
- You can switch ON/OFF for each circuit.
- You can enable the simple measurement for a circuit, the voltage and power factor values flash in the measured value display.

[Caution]_____

- When this function is used, measurement accuracy is not guaranteed as the voltage and power factor are fixed values.

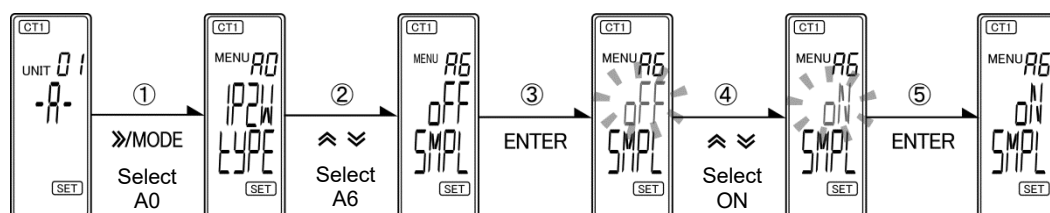
Simple measurement steps (e.g.: Circuit A uses simple measurement)

(1) Set the simple measurement function ON

First, enable the simple measurement function for the circuit A.

If a measured value is displayed, press and hold [>>>/MODE] to enter the setting mode.

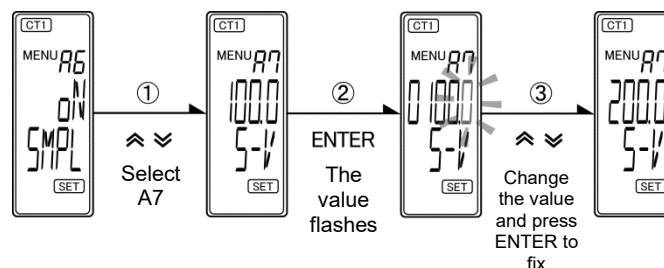
- ① On the setting category display for circuit A, press [>>>/MODE] to transition to the setting items for circuit A. "Phase and wire type (MENU A0)" is displayed.
- ② Press the Down key to move to "**Simple measurement ON/OFF (MENU A6)**".
- ③ Press the [ENTER] key to enter the setting mode.
- ④ Press the Up or Down key to select "ON".
- ⑤ Press [ENTER] to fix the selected item.



(2) Set fixed voltage value

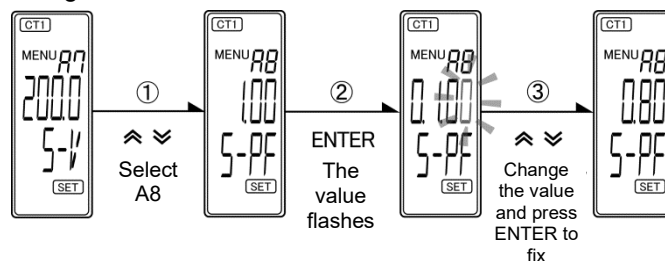
Next, set the fixed voltage value. Shown below is an example of configuring 200 V.

- ① From the circuit A setting items, press the Up or Down key to move to **"Simple measurement (voltage fixed)(MENU A7)"**.
- ② Press [ENTER] to enter the setting mode. The first decimal place of the setting value in the main display flashes.
- ③ Use the Up or Down key to change the value to "200.0", and press [ENTER] to fix the change.

(3) Set fixed power factor value

Next, set the fixed power factor value. Shown below is an example of configuring 0.8.

- ① From the circuit A setting items, press the Up or Down key to move to **"Simple measurement (power factor fixed)(MENU A8)"**.
- ② Press [ENTER] to enter the setting mode. The first decimal place of the setting value in the main display flashes.
- ③ Use the Up or Down key to change the value to "0.8", and press the [ENTER] key to confirm your change.

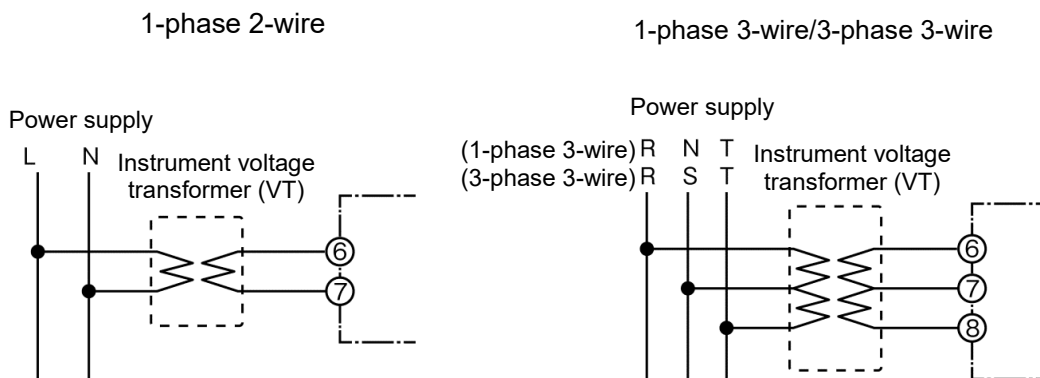
[Caution]

- The MENU No. for the simple measurement, fixed voltage value, fixed power factor of circuits B to D are b7 to b9 (circuit B), c7 to c9 (circuit C), and d7 to d9 (circuit D).

4.5. Measuring high voltage

■ VT ratio

- When measuring 6600V within a cubicle, for example, and the measured voltage exceeds 240 V, you need to use a transformer to convert the voltage to fit within the input voltage range of KM-N1.
- Set a magnification value based on the primary and secondary voltage values. For example, if the primary and secondary voltages are 440 and 110, it is $440/110=4.00$.

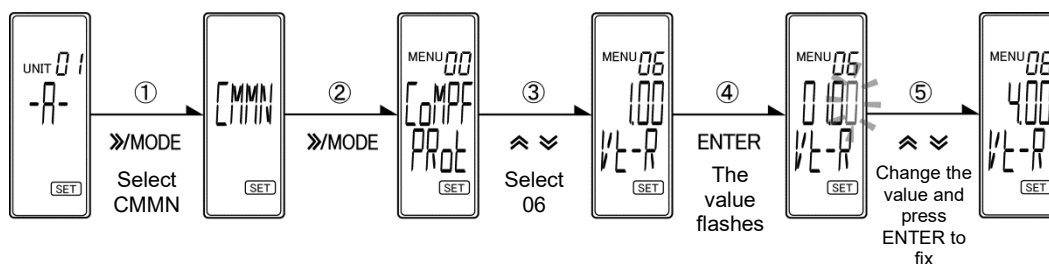


Using transformer with primary and secondary voltages of 440V and 110 V

Set the VT ratio as 4.0 (440V/110V).

If a measured value is displayed, press and hold [$\gg$]/MODE] to enter the setting mode.

- Press [$\gg$]/MODE] to move to the common settings "CMMN" category display.
- Press [$\gg$]/MODE] again to transition to the common setting items.
- Press the Down key to move to "VT ratio (MENU 06)".
- Press the [ENTER] key to enter the setting mode. The first decimal place of the setting value in the main display flashes.
- Press the Up or Down key to select "4.0", and press the [ENTER] key to confirm your change.



[Caution]

- To measure a voltage of 240 V or lower, accuracy will be higher by directly inputting the voltage without using a transformer.

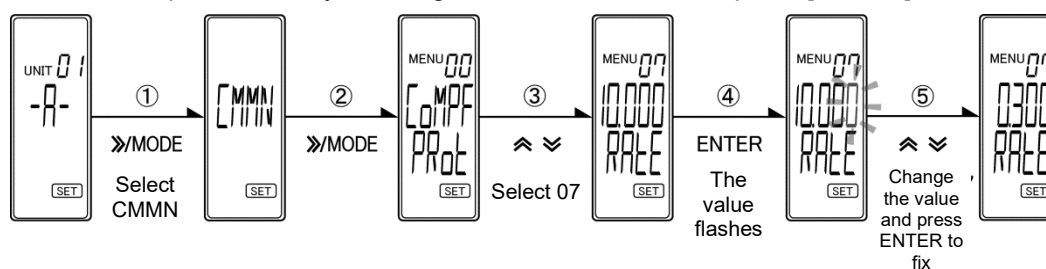
4.6. Converting unit of display

- You can multiply the integral power consumption for each circuit by a specified factor and display the result along with a unit.
- You can convert the integral power consumption into a monetary amount or CO₂ emissions.
- You can include any 3 letters of the alphabet or numbers for the units displayed.

Configuring conversion rate as 0.3

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

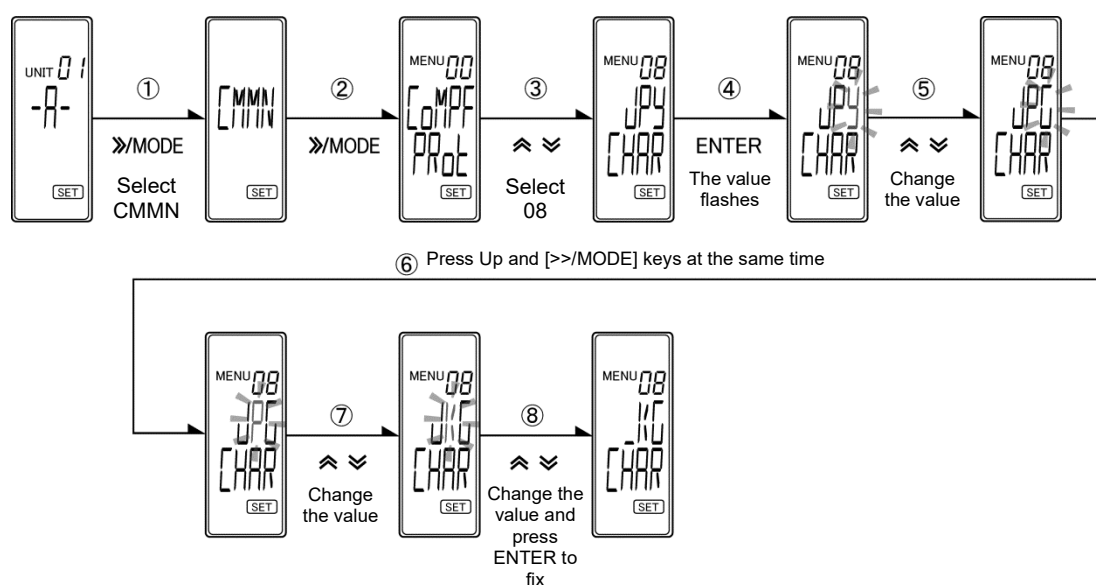
- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Conversion rate (MENU 07)**".
- ④ Press [ENTER] to enter the setting mode. The first decimal place of the setting value in the main display flashes.
- ⑤ Use the Up or Down key to change the value to "0.3", and press [ENTER] to fix the change.



Configuring conversion display unit as "_KG"

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Conversion display unit (MENU 08)**".
- ④ Press [ENTER] to enter the setting mode. The rightmost value of the setting value in the main display flashes.
- ⑤ Use the Up or Down key to change the value to "G".
- ⑥ Pressing the Up and [<</MODE] keys at the same time moves one digit to the left.
- ⑦ Use the Up or Down key to change the value to "K".
- ⑧ After repeating the same steps and finished inputting "_KG", press [ENTER] to fix the change.

**[Caution]**

- Use 3 characters, being alphanumeric characters or symbols, for the conversion display units.

[Reference]

- If a space is required for the displayed units, you can use the underscore (_) instead.
- You can use the following characters for each digit of the conversion display unit.
Numerical: 0 to 9, Alphabet: A to Z, Symbol: /(forward slash), -(hyphen), _(underscore)

4.7. Fixing display unit

- This function fixes the displayed digits in kWh or MWh.
- Even if the integral power consumption increases over time, the display unit is not switched, making it convenient to grasp the amount of change at a glance.

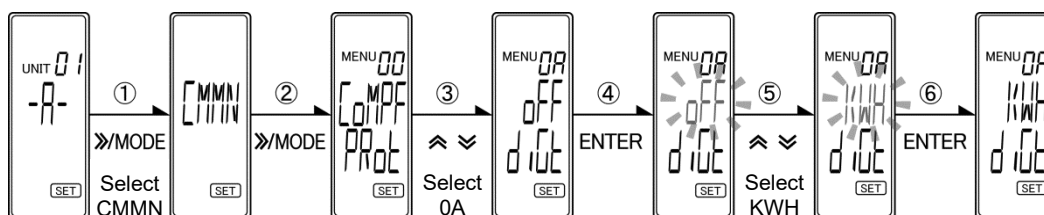
[Caution]

- If the value gets larger than the displayable value in MWh (9999.9 MWh), the LCD main display will show 0 and the sub display will show MWh. Note that the integral power consumption value continues to be measured internally, and the integral power consumption value can be obtained via communications.

Fixing the display unit to KWh

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press [>>/MODE] to move to the common settings "CMMN".
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Display digits fixed (MENU 0A)**".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "KWH".
- ⑥ Press the [ENTER] key to confirm your selection.



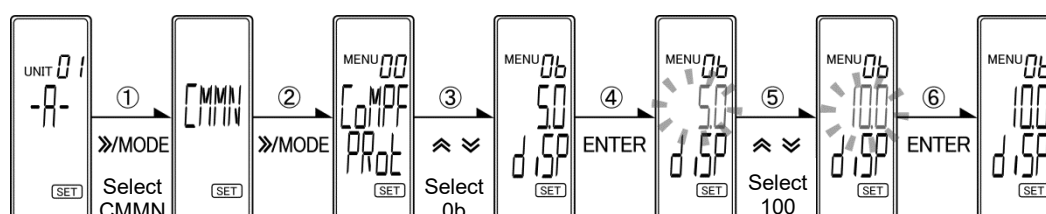
4.8. Power saving mode

- This function turns the LCD display off after the set time elapses.
- The power saving mode can be canceled by operating any key.
- When the power saving mode is turned OFF, the LCD display is always on.

Setting LCD auto off time to 10 minutes

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press [>>/MODE] to move to the common settings "CMMN".
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Auto-LCD OFF time (MENU 0b)**".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "10.0".
- ⑥ Press the [ENTER] key to confirm your selection.



4.9. Voltage misconnection detection warning

- This function detects the missing phase and the reverse phase (in the case of 1-phase 3-wire and 3-phase 3-wire) of the voltage phase according to the phase-wire and warns the user when the frequency is out of the rated value.
- If the voltage phase based on the phase-wire is 85 V or lower, it is the missing phase.
- If the phase sequence of 1-phase 3-wire and 3-phase 3-wire is not correct, it is the reverse phase.
- If the frequency goes out of the range between 45 and 65Hz, the error is input frequency error warning.
- When a missing phase or reverse phase is detected, the LCD display shows "A-W1" and an alarm, alternating with the current measured value.
- When an input frequency error is detected, the LCD display shows "A-F1" and an alarm, alternating with the current measured value.

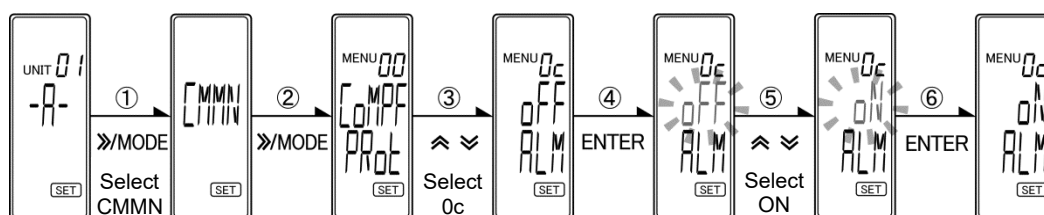
[Reference]

- If an alarm is displayed, correct the wiring and/or inputs and then reboot the product to clear the alarm.
- In the simple measurement, faulty wiring detection is not judged.

Using voltage misconnection detection warning

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press [>>/MODE] to move to the common settings "CMMN".
- ② Press [>>/MODE] again to transition to the common setting items.
- ③ Press the Down key to move to "**Warning ON/OFF (MENU 0c)**".
- ④ Press the [ENTER] key to enter the setting mode.
- ⑤ Press the Up or Down key to select "ON".
- ⑥ Press the [ENTER] key to confirm your selection.



* The example is for KM-N1-FLK.

4.10. Checking software version

You can check the product's software version.

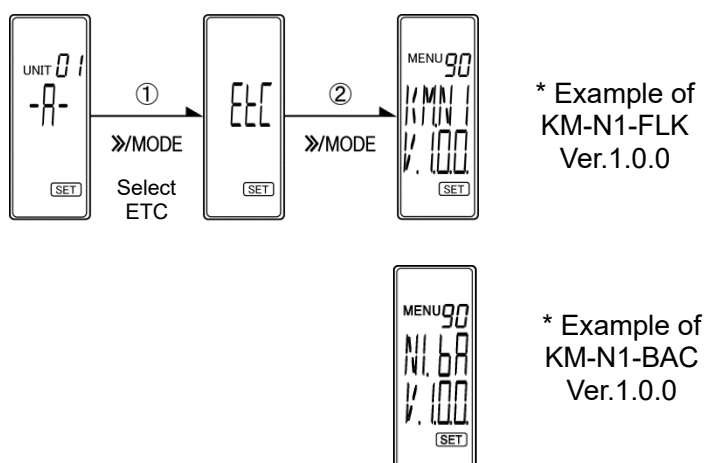
How to check software version

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press the [>>/MODE] key to move to the other settings "ETC" category display screen.
- ② Press [>>/MODE] again to transition to the other setting items.

"Software version display (MENU 90)" is displayed.

The main display shows the product model and the sub display shows the software version.



4.11. Initialization

There are following three types of initialization:

- (1) Resetting (clearing) the integral power consumption for each circuit
 - (2) Resetting (clearing) the integral power consumption for all circuits
 - (3) Resetting to factory defaults
- Setting values remain unchanged if you do either (1) or (2).
 - The settings for each of the circuits are also reset if you do (3). The unit restarts after you do this.

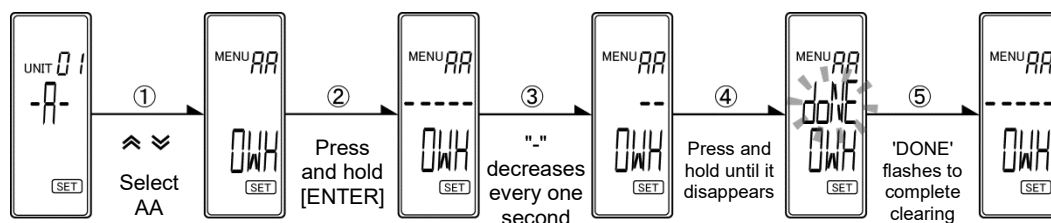
Initializing (clearing) total power consumption for circuit

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① On the setting category display for circuit A, press [>>/MODE] to transition to the setting items for circuit A.

Press the Down key to move to **"Clear integral power consumption (MENU AA)"**.

- ② When you press and hold the [ENTER] key, the dashes (-) decrease from the left side of the main screen every one second.
- ③ Keep pressing the [ENTER] key.
- ④ When the dash (-) disappears, and "DONE" flashes on the screen, the integral power consumption has been reset.
- ⑤ After completing initialization (clear), "MENU AA" is displayed again.



[Reference]

- You can cancel the resetting by releasing [ENTER] before "DONE" is displayed.
- The MENU No. for the integral power consumption of circuits B to D are "bb"(circuit B), "cb"(circuit C), and "db"(circuit D).

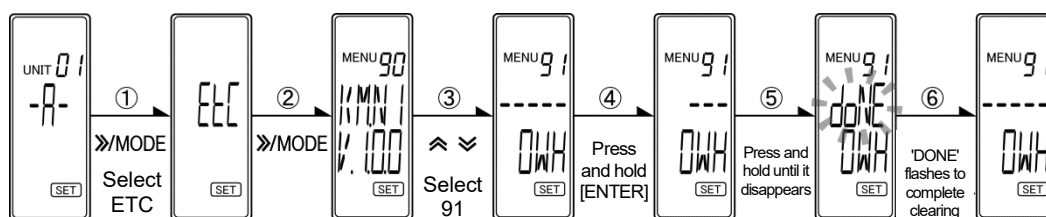
```

Initializing (clear) total power consumption for all circuits

```

If a measured value is displayed, press and hold [$\gg$ /MODE] to enter the setting mode.

- ① Press the [>>/MODE] key to move to the other settings "ETC" category display screen.
- ② Press [>>/MODE] again to transition to the other setting items.
- ③ Press the Down key to move to **"Clear all integral power consumption values (MENU 91)"**.
- ④ When you press and hold the [ENTER] key, the dashes (-) decrease from the left side of the main screen every one second.
- ⑤ When the dash (-) disappears, and "DONE" flashes on the screen, the integral power consumption for all circuits has been reset (cleared).
- ⑥ After completing initialization (clear), "MENU 91" is displayed again.



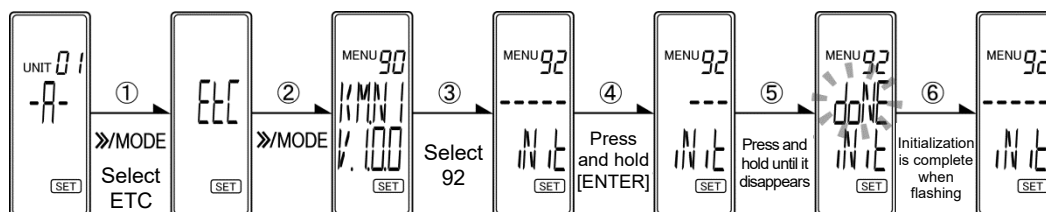
[Reference].

- You can cancel the resetting by releasing [ENTER] before "DONE" is displayed.

Restoring factory settings

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press the [>>/MODE] key to move to the other settings "ETC" category display screen.
- ② Press [>>/MODE] again to transition to the other setting items.
- ③ Press the Down key to move to **"Initialize all (MENU 92)"**.
- ④ When you press and hold the [ENTER] key, the dashes (-) decrease from the left side of the main screen every one second.
- ⑤ When the dash (-) disappears, and "DONE" flashes on the screen, the setting values and integral power consumption for all circuits are reset to the factory defaults.
- ⑥ After initializing, press and hold the [>>/MODE] key to move to the measuring mode and restart the unit.



[Reference].

- You can cancel the resetting by releasing [ENTER] before "DONE" is displayed.

4.12. Mode lock

This function inhibits the transition from measuring mode to setting mode.

■ How to turn the mode lock ON/OFF

- To turn it ON

In measuring mode, press and hold the Up key and the [ENTER] key simultaneously.

When the mode is locked, "LOCK" is displayed on the main display and "ON" on the sub-display for 1 second, then the display returns to the measuring mode.

- To turn it OFF

While the mode is being locked, press and hold the Up key and the [ENTER] key simultaneously.

■ Operation during mode lock

- When pressing and holding [>>/MODE] while the mode is being locked, "LOCK" is displayed on the main display and "ON" on the sub-display for 1 second, then the display returns to the measuring mode.
- Measurement and communication continue during mode lock.

4.13. Reset

- If the alarm LED flashes to notify warning, you need to reset and reboot the product. When the unit is reset, "KM.N1" is displayed on the main display, the software version is displayed on the sub-display, the "PWR" is lit on the LED design, and the display shifts to the total active power consumption of circuit A, as with power ON.
- Reset can be classified as software reset and hardware rest. Although the execution results are the same.

■ Reset software

Press and hold the Up, Down, and [ENTER] keys simultaneously.

■ Reset hardware

Press the reset button on the top of the main unit.

Important

- When pressing the reset switch to perform a hardware reset, be very careful to avoid electric shock.
-

[Reference]

- Even if you perform resetting, the setting values and total power consumption before the reset are retained.
-

Chapter 5. Communications Specifications

5.1.	Communications overview	5-2
5.2.	CompoWay/F	5-4
5.3.	Modbus.....	5-16
5.4.	BACnet MS/TP	5-24
5.5.	Address map (CompoWay/F, Modbus)	5-25
5.6.	Support frame type object property (BACnet MS/TP).....	5-29

5.1. Communications overview

Using the communications features enables you to create programs on host devices (such as computers) to collect the data measured by KM-N1 and to change its settings.

For KM-N1, you need to assign a different unit number to each circuit. Even if you connect several KM-N1 units on the same RS-485 line, all of the circuits need to be allocated different unit numbers.

Circuits are identified by their unit numbers. Circuits are identified by their communications addresses. These are indicated in the address maps in "Address map" and the addresses for each circuit are all the same.

Ref: 3.1 Multi-unit system (P3-2)

3.7 RS-485 communications setting (P3-18)

KM-N1-FLK supports CompoWay/F and Modbus communications protocol, and KM-N1-BAC supports BACnet MS/TP and Modbus.

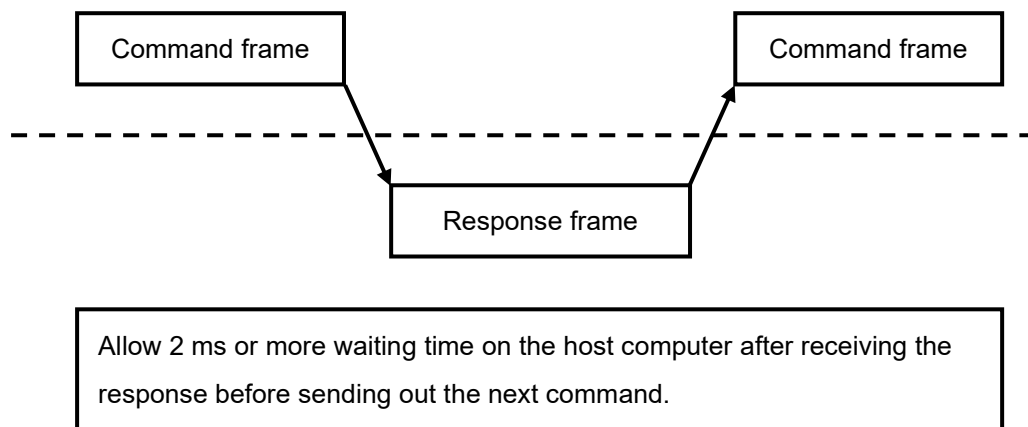
■ Communications specifications

Applicable model	KM-N1-FLK		
		KM-N1-BAC	
Protocol	CompoWay/F	Modbus RTU	BACnet MS/TP
Connection type	Multidrop (1:N)		
Communication type	2-wire half-duplex		
Sync method	Start-stop synchronization		
Baud rate	2.4, 4.8, <u>9.6</u> , 19.2, 38.4 kbps		9.6, 19.2, <u>38.4</u> kbps
Transmission code	ASCII	Binary	
Data bit length	7, 8 bits	8 bits (fixed)	
Stop bits	1, 2 bits	With parity : 1 bit Without parity : 2 bits	1 bit (fixed)
Error checking	Vertical parity (none, even, odd) Check code: BCC	Vertical parity (none, even, odd) Check code: CRC-16	Vertical parity (none)(fixed) Check code: CRC-16
Flow Control	None		
Interface	RS-485		
Retry function	None		
Communication response transmission waiting time	0 to 99 (ms) KM-N1-FLK <u>Initial value 20 (ms)</u> KM-N1-BAC <u>Initial value 1 (ms)</u>		

* Default values are underlined.

■Transmission procedure

The host device (a computer, for example) sends the command frame and model KM-N1 sends the response frame that corresponds to the command content. So 1 response frame is sent in response to one command frame. The command frame and response frame act as follows.



5.2. CompoWay/F

5.2.1. Data format

In the following explanations, values preceded by H' (as in H'02) indicate hexadecimal values. Only items expressed as normal numerals or characters indicate ASCII characters.

The numbers under the frame sections are the number of bytes.

■ Command frame

	Unit No.	Sub-address	SID	Command text	BCC
STX		0 0	0		ETX
1	2	2	1		1 1

STX	This is the start code for the communication frame (H'02). Make sure you set this code as the first byte.
Unit No.	- Specify the "unit number" of KM-N1. - You can set a number between 00 and 99 or XX (upper case). - Specify "XX" to communicate to all at the same time. There will be no response if this is specified however. - Specify the unit number between 00 and 99 (BCD). - There will be no response to any other unit numbers.
Sub-address	Not used for KM-N1. Specify "00".
SID	Not used for KM-N1. Specify "0".
Command text	This part describes the command.
ETX	Code (H'03) to indicate the end of text.
BCC	The block check character. The BCC shall be the value gained from an exclusive OR (XOR) function conducted on each byte from the unit number to ETX.

■ Example of BCC calculation

The block check character (BCC) is calculated using an exclusive OR function on each byte of the values between the unit number and ETX, then that 8-bit data is set in the BCC section.

STX	Unit No.		Sub-address		SID	Command text				ETX	BCC
02H	0(30H)	0(30H)	0(30H)	0(30H)	0(30H)	0(30H)	5(35H)	0(30H)	3(33H)	03H	35H
BCC calculation range											

$$\text{BCC} = 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 30\text{H} \oplus 35\text{H} \oplus 30\text{H} \oplus 33\text{H} \oplus 03\text{H} = 35\text{H}$$

The calculation result 35H is set in the BCC section.

■ Response frame

	Unit No.	Sub-address	End code	Command text	ETX	BCC
STX		0 0				
1	2	2	2		1	1

End code	Name	Details	Error-detecting priority
00	Normal end	This indicates that the command ended normally and that there was no error.	None
0F	FINS command error	The specified FINS command could not be executed. Determine the reason for non-execution from the FINS response code.	3
14	Format error	- The characters other than 0-9 and A-F are used in command text except in echo back tests. - There is no SID or command text. Alternatively, there is no command text. - MRC/SRC in the command text is incomplete.	2
16	Sub-address error	The sub-address is invalid.	1

- The exit code is returned as the reply when 1 command frame is received when sent to this unit.
- There is no response if the command is not complete between ETX and BCC.
- The error detection priority is the order when more than one error occurs.

■ Example exit codes

The following is an example of exit codes when the command did not end normally.
For example: When there is no command text

- Command

	Unit No.	Sub-address	SID	BCC
STX		0 0	0	ETX

- Response

	Unit No.	Sub-address	End code	BCC
STX		0 0	1 4	ETX

The exit code will be "14" (format error).

For example: The sub-address is less than 2 characters and there is no SID or FINS-mini

• Command

Unit No.			BCC	
STX			ETX	

The sub-address lacks a character

• Response

Unit No.		Sub-address		End code		BCC	
STX		0	0	1	6	ETX	

The sub-address is "00" and the exit code is "16" (a sub-address error).

5.2.2. PDU (Protocol Data Unit) configuration

Command text (or PDU) consists of the main request code (MRC), the sub-request code (SRC), and the respective data required by these, and these are transferred.

• Service request PDU

MRC	SRC	Data			

Continuing on from the above MRC and SRC, main response codes (MRES) and sub-response codes (SRES) are transferred to the response frame, and then the data is transferred.

• Service response PDU (normal)

MRC	SRC	Response code		Data			
		MRES	SRES				

If the specified command text could not be executed, then the service response PDU will consist of only the MRC/SRC and response code.

5.2.3. Type code

The type codes used with KM-N1 are as follows.

■ Variable area

Variable type code	Details
C0	Measured values

■ Parameter area

Variable type code	Details
C000	Setting parameter values

5.2.4. List of services

MRC	SRC	Service name	Process
01	01	Read variable area	Variable area is read.
02	01	Read parameter area	Parameter area is read.
02	02	Write parameter area	Parameter area is written.
05	03	Read unit properties	Model and communication buffer size are read.
06	01	Read controller status	Operation status is read.
08	01	Echo back test	Echo back test is performed.
30	05	Operation command	Operations are performed according to commands.

5.2.5. Response code list

On normal end

Code	Name	Details	Priority
0000	Normal end	No error occurred.	None

On error occurrence

Code	Name	Details	Priority
0401	Unsupported command	Unsupported service function.	1
1001	Command too long	Command length is too long.	2
1002	Command too short	Command length is not long enough.	3
1003	Unmatched element count/data count	The number of elements and the number of data are unmatched.	6
1100	Parameter error	Parameter value not supported.	8
1101	Area type error	Unsupported area type specified.	4
1103	Start address out of range	The start address is out of range.	5
110B	Response too long	The length exceeds the communication buffer.	7
2203	Operation error	Unable to process the command.	10
3000	Status error (error occurred)	A failure occurred.	11
3003	Read only	Tried to write to the parameter area.	9

5.2.6. Service details

Addresses, numbers of elements, and data are shown in hexadecimal notation.

■ Read variable area (0101)

Variable area is read.

• Service request PDU

MRC		SRC		Variable type		Start reading address				Bit position		Number of elements			
0	1	0	1	C	0					0	0				
2		2		2		4				2					

• Service response PDU (normal)

MRC		SRC		Response code				Readout data (as many as elements)							
0	1	0	1												
2		2		4				8xn(n: 0 to 25)							

- (1) Variable type and address to start reading
Refer to "5.5 Address map " for the variable types and the start reading address.
Ref: 5.5 Address map (P5-25)
- (2) Bit position
KM-N1 does not support bit access. Fixed at "00".
- (3) Number of elements
Specify the number of variables to read.

Number of elements	Process
0000	Nothing is read and the end is normal (read data is not appended to the service response PDU).
0001 to 0019	A maximum of 25 (H'19) are read and the end is normal.

* When the start reading address is an address within the variable area and the end reading address (the start reading address plus the number of elements) exceeds the valid addresses of the variable area, then if the number of data up to the end of the end address is within the range specified by the number of elements, reading is done and the end is normal. In this case, the number of data read will be fewer than the number of elements specified in the command. Further, if the start reading address is outside of the variable area, there will be a "start address out of range error".

- (4) Response code
Refer to "5.2.5 Response code list" for details about each response code.
Ref: 5.2.5 Response code list (P5-7)

● Example of read variable area communications

This example shows how to read the two measurement values with one command when the measurement is of voltage 1 at 103.7V and voltage 2 at 103.6V.

<Command>

“(H'02) 00 00 0 01 01 C0 0000 00 0002 (H'03) (H'42)”

STX	Unit No.	Sub-address	SID	MRC	SRC	Variable type	Start reading	Bit addr.	# of elements	ETX	BCC
-----	----------	-------------	-----	-----	-----	---------------	---------------	-----------	---------------	-----	-----

<Response>

“(H'02) 00 00 00 01 01 0000 0000040D 0000040C (H'03) (H'02)”

STX	Unit No.	Sub-address	End code	MRC	SRC	Response code	Voltage 1	Voltage 2	ETX	BCC
-----	----------	-------------	----------	-----	-----	---------------	-----------	-----------	-----	-----

KM-N1 converts measured values to hexadecimal without decimal points for response.

H'0000040D = 1037 (decimal)

■ Read parameter area (0201)

Parameter area is read.

• Service request PDU

MRC	SRC	Parameter type				Start reading address				Number of elements			
0	2	0	1	C	0	0	0	0					
2		2		4				4				4	

• Service response PDU (normal)

MRC	SRC					Parameter type	Start reading address	Number of elements	Readout data (as many as elements)			
0	2	0	1									
2		2		4				4	8xn(n: 0 to 25)			

- (1) Variable type and address to start reading
Refer to "5.5 Address map " for the variable types and the start reading address.
Ref: 5.5 Address map (P5-25)

- (2) Number of elements
Specify the number of variables to read.

Number of elements	Process
8000	Nothing is read and the end is normal (data to be read is not appended to the service response PDU).
8001 to 8019	A maximum of 25 (H'19) are read and the end is normal.

- * Setting range for the number of elements: "8001" to "8019" > The uppermost bit must always be set to 1.
- * When the start reading address is an address within the variable area and the end reading address (the start reading address plus the number of elements) exceeds the valid addresses of the variable area, then if the number of data up to the end of the end address is within the range specified by the number of elements, reading is done and the end is normal. In this case, the number of data read will be fewer than the number of elements specified in the command. Further, if the start reading address is outside of the variable area, there will be a "start address out of range error".

(3) Response code

Refer to "5.2.5 Response code list" for details about each response code.

Ref: 5.2.5 Response code list (P5-7)

●Example of parameter area reading communications

This example shows how to read two settings with one command where the phase and wire type is set to 1-phase 2-wire and the unit number is 10.

<Command>

"(H'02)	10	00	0	02	01	C000	1000	8002	(H'03)	(H'49)"
STX	Unit No.	Sub-address	SID	MRC	SRC	Parameter type	Start reading addr.	Elements	ETX	BCC

<Response>

"(H'02)	10	00	00	02	01	0000	1000	8002		
STX	Unit No.	Sub-address	End code	MRC	SRC	Parameter type	Start reading addr.	Elements		
						00000000	0000000A	(H'03)	(H'08)"	
						Phase-Wire	Unit No.	ETX	BCC	

If the phase and wire type is 1-phase 2-wire, H'00000000 is read.

The unit number will be H'0000000A=10 (decimal).

■ Write parameter area (0202)

Parameter area is written.

This service is made valid by using a command to move to the settings mode. The content written is reflected by moving to the measuring mode in response to an instruction after writing of the parameters.

• Service request PDU

MRC	SRC	Parameter type	Start writing address	Number of elements	Written data (as many as elements)
0 2	0 2	C 0 0 0			
2	2	4	4	4	8xn (n: 0 to 25)

• Service response PDU (normal)

MRC	SRC	Response code
0 2	0 2	
2	2	4

- (1) Variable type and address to start writing
Refer to "5.5 Address map " for the different variable types and the start writing address.

Ref: 5.5 Address map (P5-25)

- (2) Number of elements
Specify the number of variables to be written.

Number of elements	Process
8000	Nothing is written and the end is normal (data to be written is not appended to the service response PDU).
8001 to 8019	A maximum of 25 (H'19) are written and the end is normal.

* Setting range for the number of elements: "8001" to "8019" > The uppermost bit must always be set to 1.

* When the start writing address is an address within the variable area and the end writing address (the start writing address plus the number of elements) exceeds the valid addresses of the variable area, then if the number of data up to the end of the end address is within the range specified by the number of elements, writing is done and the end is normal. In this case, the number of data written will be fewer than the number of elements specified in the command. Further, if the start writing address is outside of the variable area, there will be a "start address out of range error".

- (3) Response code
Refer to "5.2.5 Response code list" for details about each response code.
Ref: 5.2.5 Response code list (P5-7)

● Example of write parameter communications

Example of a command to set the CT to use to 100A

<Command>

"(H'02)	00	00	0	02	02	C000	1002	8001	00000002	(H'03)	(H'48)"
STX	Unit No.	Sub-address	SID	MRC	SRC	Parameter type	Start writing addr.	Elements	Written data CT to use:100A	ETX	BCC

<Response>

"(H'02)	00	00	00	02	02	0000	(H'03)	(H'03)"
STX	Unit No.	Sub-address	End code	MRC	SRC	Response code	ETX	BCC

The address for the CT to use is 1002, and CT to use = 100A is H'00000002.

■ Read unit properties (0503)

The model and buffer size are read.

• Service request PDU

MRC	SRC
0 5	0 3
2	2

• Service response PDU

MRC	SRC	Response code	Model	Buffer size
0 5	0 3			0 0 E 6
2	2	4	10	4

(1) Model

The model is displayed in 10 bytes of ASCII code. Space codes are used if the model doesn't take up 10 bytes.

For example: This will be as follows for model KM-N1-FLK.

K	M	-	N	1	-	F	L	K	
---	---	---	---	---	---	---	---	---	--

(2) Buffer size

The buffer size 230 is read as a fixed value "00E6".

(3) Response code

Refer to "5.2.5 Response code list" for details about each response code.

Ref: 5.2.5 Response code list (P5-7)

■ Read controller status (0601)

Operational state and error status are read.

- Service request PDU

MRC		SRC	
0	6	0	1
2		2	

- Service response PDU (normal)

MRC		SRC		Response code			Operational state	Related information
0	6	0	1					
2		2		4			2	2

- Operational state

Operational state	Details
00	The unit is measuring without error.
01	An error has occurred and measuring has stopped. When either of B1 (set value error), B2 (measured value error), or B3 (calibration value error) occurs, the operation status changes to H'01.

- Related information

Bit position	Meaning	Details
B0 (LSB)	Mode indication	0: Measuring mode, 1: Setting mode
B1	Set value error	0: No error, 1: Error
B2	Measured value error	0: No error, 1: Error
B3	Calibration value error	0: No error, 1: Error
B4	Input frequency warning	0: No warning, 1: Warning
B5	Misconnection warning	0: No warning, 1: Warning
B6	Pulse 1 output warning	0: No warning, 1: Warning
B7 (MSB)	Pulse 2 output warning	0: No warning, 1: Warning

Bit B0 in the mode indication indicates whether the set value can be written by communication. 1: Setting mode is entered when the setting mode is shifted by a command via communication.

- Response code

Refer to "5.2.5 Response code list" for details about each response code.

Ref: 5.2.5 Response code list (P5-7)

● Example of bit information for related information

If a set value error (B1) occurs in the measuring mode (B0), the bits in the related information of the status information appear as follows. Displayed as "03" in the PDU.

B7	B6	B5	B4	B3	B2	B1	B0
0	0	0	0	0	0	1	1

● Example of controller status read communications

Shown below is an example of a communication command when a set value error (B1) occurred in the measuring mode (B0).

<Command>

[STX]010000601[ETX][BCC]

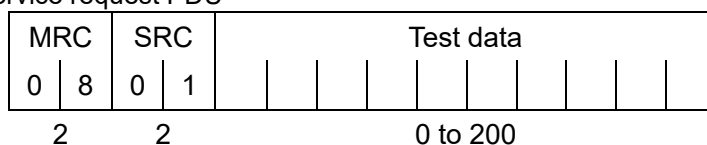
<Response>

[STX]01000060100000103[EXT][BCC]

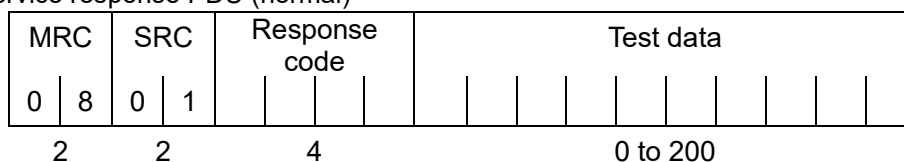
■ Echo back test (0801)

Echo back test is performed.

• Service request PDU



• Service response PDU (normal)



(1) Test data

Set any test data within the range 0 to 200.

(2) Response code

Refer to "5.2.5 Response code list" for details about each response code.

Ref: 5.2.5 Response code list (P5-7)

■ Operation command (3005)

Used when remotely controlling KM-N1.

• Service request PDU

MRC	SRC	Command code	Related information
2	2	2	2

• Service response PDU (normal)

MRC	SRC	Response code
3 0	0 5	
2	2	4

(1) List of command codes and related information

Related information is fixed at 00.

Command code	Related information	Command details
03	00	Reset integral power consumption (individual unit)
04	00	Move to measuring mode
07	00	Move to setting mode
09	00	Reset to factory defaults
99	00	Reset software

(2) Response code

Refer to "5.2.5 Response code list" for details about each response code.

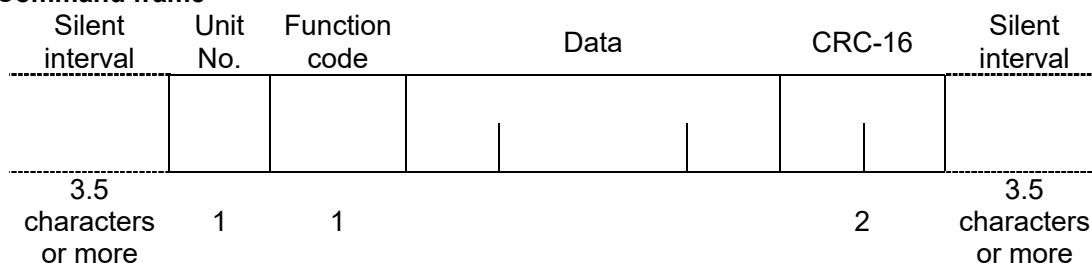
Ref: 5.2.5 Response code list (P5-7)

5.3. Modbus

5.3.1. Data format

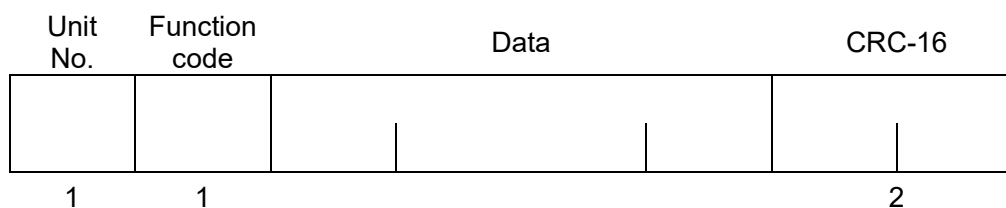
In the following explanations, values preceded by H' (as in H'02) indicate hexadecimal values. The numbers under the frame sections are the number of bytes. Also, the transfer code is binary for Modbus.

■ Command frame



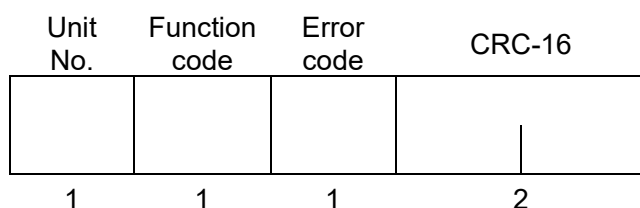
Silent interval	A non-communication time of 3.5 characters worth of time or more
Unit No.	- Specify the "unit number" of KM-N1. - Figures in hexadecimal format between H'00 to H'63 (0 to 99) can be set. - Specify H'00 to communicate to all at the same time. There will be no response if this is specified however.
Function code	Code to indicate the type of command.
Data	Data text to match the function code.
CRC-16	Cyclical Redundancy Check This check code is for the unit number until the end of the data.
Silent interval	A non-communication time of 3.5 characters worth of time or more

■ Response frame when normal



Unit No.	The number specified by the command from is inserted as is. The unit number that returned the response.
Function code	Function code that was received.
Data	Data received.
CRC-16	Cyclical Redundancy Check This check code is for the unit number until the end of the data.

■ Response frame when error



Unit No.	The number specified by the command from is inserted as is. The unit number that returned the response.
Function code	In the response frame when an error occurs, the addition of "H'80" to the received function code indicates that it is an error response. For example: If the response is H'03 normally, then a response when there is an error would be H'83.
Error code	An exit code to describe an error.
CRC-16	Cyclical Redundancy Check This check code is for the unit number until the end of the data.

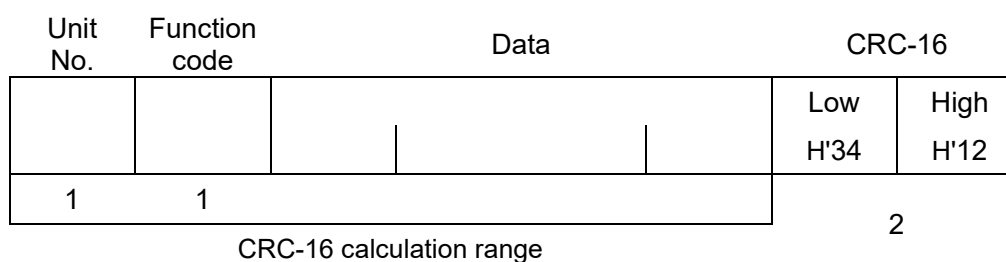
■ Example for CRC-16 calculation

The work for calculation (16 bit register: CRC register hereunder) is processed byte by byte in the message.

- (1) Make the initial value of the CRC register H'FFFF.
- (2) Use an XOR on the lower 8 bits of the CRC register and the first byte of data, return that result to the CRC register.
- (3) While embedding the "0", move the CRC register 1 bit to the right.
- (4) If the bit shifted from the LSB is "0", repeat step (3)(the following bit shift process). If the bit shifted from the LSB is a "1", use an XOR calculation on the CRC register and H'A001, returning that result to the CRC register.
- (5) Repeat steps (3) and (4) until 8 bits worth of data has been shifted.
- (6) If the end of the message is not reached, use an XOR on the CRC register and the next byte of data, return that result to the CRC register and repeat step (3).
- (7) The calculated result (the value of the CRC register) is appended to the message starting from the lower byte.

(Example of appending the calculated result)

If the calculated CRC value is H'1234, it is appended to the command frame as below.



5.3.2. Function code (FC) list

Function code	Name	Details
03 (H'03)	Read (multiple) variables	Variable area is read successively.
16 (H'10)	Write (multiple) variables	Variable area is written successively.
06 (H'06)	Write (single) variable	Variable area is written once.
08 (H'08)	Echo back test	Echo back test is performed.

5.3.3. Error code list

Error code	Name	Details	Error-detecting priority
H'01	Function code error	Unsupported function code used.	1
H'02	Variable address error	Invalid value specified for variable address.	2
H'03	Variable data error	Data is invalid. • Mismatch with the number of elements • Data out of range	3
H'04	Operation error	The mode is not appropriate.	4
H'05	Status error (error occurred)	Malfunction occurred and the unit continues to be unusable.	5

5.3.4. Service details

■ Read variable area (03: H'03)

This service allows you to read all variable areas.

Reading of the variable areas is conducted by setting the required data in the following command frame.

To read setting values (see "5.5.2 Variable area (parameter) list"), you need to first move to the setting mode with a command. To read measurement values (see "5.5.1 List of variable areas (measurement values)"), you can be in either the measuring mode or the setting mode. Also, measuring continues even while in the setting mode.

Ref: 5.5 Address map (P5-25)

• Command frame

UN	FC	Start reading address	Number of elements	CRC-16
	H'03			
1	1	2	2	2

UN: Unit number, FC: Function code

- (1) Start reading address
Specify the address for the measurement value or setting data you want to read.
Refer to "5.5 Address map " for the address.
- (2) Number of elements
Specify the number of pieces of data that you want to read times 2 as the number of elements. Only the consecutive addresses can be read in a batch.
Range: H'0002 to 0032 (2 to 50)

(3) CRC-16

This is a check code calculated from the unit number until the end of the data.

Refer to "Example for CRC-16 calculation" for the calculation.

Ref: Example for CRC-16 calculation (P5-17)

• Response frame

UN	FC	Byte counter	Data1	Data1	Data2	Data2	
	H'03		Upper	Lower	Upper	Lower	
1	1	1	Number of elements x 4 bytes				

Data	Data	CRC-16
Upper	Lower	Upper
		2

(1) Byte counter

The number of bytes of the read data is put here.

(2) Number of elements

The value of the read data is put here.

(3) CRC-16

This is a check code calculated from the unit number until the end of the data.

Refer to "Example for CRC-16 calculation" for the calculation.

Ref: Example for CRC-16 calculation (P5-17)

● Command/Response example

The following is an example of reading voltage 1.

(For unit No.(UN): H'01)

<Command>

UN	FC	Start reading address	Number of elements	CRC-16
01	03	0000	0002	C40B

<Response>

UN	FC	Byte counter	Data1	Data1	CRC-16
01	03	04	0000	0960	FC4B

■ Write variable area (16: H'10)

Writing to the variable areas is conducted by setting the required data in the following command frame.

Only the parameter area can be written to. Before writing, you need to first move to the setting mode with a command. The content written is reflected by moving to the measuring mode in response to an instruction after writing of the parameters. Measuring continues even while in the setting mode.

• Command frame

UN	FC	Start writing address	Number of elements	Byte counter	Data1	Data1	
	H'10				Upper	Lower	
1	1	2	2	1	Number of elements x 4 bytes		

UN: Unit No
FC: Function code

Data	Data	CRC-16
Upper	Lower	Upper

- (1) Start writing address
Specify the address for setting data you want to write. Refer to "5.5 Address map " for the address.
- (2) Number of elements
Specify the number of pieces of data that you want to write times 2 as the number of elements.
Range: H'0002 to 0032 (2 to 50)
- (3) Byte counter
Specify the number of bytes for written data.
- (4) CRC-16
This is a check code calculated from the unit number until the end of the data.
Refer to "Example for CRC-16 calculation" for the calculation.
Ref: 5.5 Address map (P5-25)
Example for CRC-16 calculation (P5-17)

• Response frame

UN	FC	Start writing address	Number of elements	CRC-16
	H'10			
1	1	2	2	2

- (1) Start writing address
The start writing address that was received.
- (2) Number of elements
The number of elements that were received.
- (3) CRC-16
This is a check code calculated from the unit number until the end of the data.
Refer to "Example for CRC-16 calculation" for the calculation.
Ref: Example for CRC-16 calculation (P5-17)

● Command/Response example

The following shows an example of writing when changing the phase and wire type to 1-phase 2-wire.

(For unit No.(UN): H'01)

Address: H'2000, Data to be written: H'00000000

<Command>

UN	FC	Start writing address	Number of elements	Byte counter	Data1	Data1	CRC-16
01	10	2000	0002	04	0000	0000	6A6E

<Response>

UN	FC	Byte counter	Number of elements	CRC-16
01	10	04	0002	DD00

■ Operation command (06: H'06)

• Command frame

UN	FC	Start writing address		Data to be written	CRC-16
	H'06	H'FF	H'FF		
		Fixed	Fixed		
1	1	2		2	2

UN: Unit No

FC: Function code

• Response frame

UN	FC	Start writing address		Data to be written	CRC-16
	H'06	H'FF	H'FF		
		Fixed	Fixed		
1	1	2		2	2

(1) Start writing address

Set "FFFF" as the dedicated address for commands.

(2) Data to be written

The data to be written is 4 digits consisting of the command code plus the related information. Commands are as follows. Specify command codes using hexadecimal numbers.

Command code	Related information	Command details
03 (H'03)	00	Reset integral power consumption (individual unit)
04 (H'04)	00	Move to measuring mode
07 (H'07)	00	Move to setting mode
09 (H'09)	00	Reset to factory defaults
153 (H'99)	00	Reset software

● Command/Response example

The following is an example of an instruction for clearing the integral power consumption.

(For unit No.(UN): H'01)

Command code: "03" Related information: "00"

<Command>

UN	FC	Start writing address	Data to be written	CRC-16
01	06	FFFF	0300	891E

<Response>

UN	FC	Start writing address	Data to be written	CRC-16
01	06	FFFF	0300	891E

■ Echo back test

• Command frame

UN	FC	Fixed value	Test data	CRC-16
	H'08	H'00		
1	1	2	2	2

UN: Unit No

FC: Function code

• Response frame

UN	FC	Fixed value	Test data	CRC-16
	H'08	H'00		
1	1	2	2	2

- (1) Start writing address
Set "0000" as the address for the echo back test.
- (2) Test data
This is any data in 2-byte HEX format.

5.4. BACnet MS/TP

5.4.1. Overview

KM-N1-BAC supports BACnet Smart Sensor (B-SS).

KM-N1-BAC's BACnet MS/TP communications specifications comply with ANSI/ASHRAE Standard 135-2012.

BACnet MS/TP communications specifications describe information largely related to KM-N1-BAC and may not describe ANSI/ASHRAE Standard 135-2012 standard. Refer to ANSI/ASHRAE Standard 135-2012 for details.

5.4.2. List of protocol implementation conformance

- Applied standards/versions
 - ANSI/ASHRAE 135-2012
 - BACnet standardized device profile (Annex L)
 - BACnet Smart Sensor (B-SS)
 - Data Link Layer options
 - MS/TP slave (Clause 9) Baud rates: 9600, 19200, 38400 bps
 - *) Partially compatible with MS/TP master (Clause 9)
 - BACnet interoperability building blocks supported (Annex K)
 - Data Sharing - Read Property-B (DS-RP-B)
 - Data Sharing - Write Property-B (DS-WP-B)
 - Device Management - Dynamic Device Binding-B (DM-DDB-B)
- KM-N1-BAC does not support over-the-router messages.

5.5. Address map (CompoWay/F, Modbus)

This section describes the address map of CompoWay/F and Modbus.

Refer to 5.6 for BACnet MS/TP.

5.5.1. List of variable areas (measurement values)

Address		Item		R/ W
CompoWay/F (Variable type C0)	Modbus	Parameter name	Monitor value	
0000	0000	Voltage 1 (V) *	H'00000000 to H'0098967F (0 to 9999999) 10x voltage value	R
0001	0002	Voltage 2 (V) *		R
0002	0004	Voltage 3 (V) *		R
0003	0006	Current 1 (A) *	H'00000000 to H'05F5E0FF (0 to 99999999) 1000x current value	R
0004	0008	Current 2 (A) *		R
0005	000A	Current 3 (A) *		R
0006	000C	Power factor	H'FFFFFF9C to H'00000064 (-100 to 100) 100x power factor value	R
0007	000E	Frequency (Hz)	H'000001C2 to H'0000028A (450 to 650) 10x frequency value	R
0008	0010	Active power (W)	H'80000000 to H'7FFFFFFF (-2147483648 to 2147483647) 10x active/reactive power value	R
0009	0012	Reactive power (Var)		R
0100	0200	Integral active power consumption (Wh)	H'00000000 to H'3B9AC9FF (0 to 999999999) 1x value	R
0101	0202	Integral regenerative power consumption (Wh)		R
0102	0204	Integral leading reactive power consumption (Varh)		R
0103	0206	Integral lagging reactive power consumption (Varh)		R
0104	0208	Integral total reactive power consumption (Varh)		R
0110	0220	Integral active power consumption (kWh)		R
0111	0222	Integral regenerative power consumption (kWh)		R
0112	0224	Integral leading reactive power consumption (kVarh)		R
0113	0226	Integral lagging reactive power consumption (kVarh)		R
0114	0228	Integral total reactive power consumption (kVarh)		R
0180	0300	Conversion value (e.g. JPY)		R
0181	0302	Conversion value (e.g. K.JPY)		R

- Current 2 is the value measured by either CT2 or CT4.
- Current 3 is the measured value calculated from current 1 and current 2.
- Figures with units of Wh and kWh can be read to the integral value. You can use the most easy to read according to the changes in the integral value.
- Negative numbers are shown as two's complement.
- Only the consecutive address items can be read in a batch.

*Shown below is the relationship between the phase-wire and data.

CompoWay/F	Modbus	1P2W	1P3W	3P3W	Meaning
0000	0000	Yes	Yes	Yes	1P2W, 1P3W: R-phase voltage, 3P3W: R-S voltage
0001	0002	N/A	Yes	Yes	1P3W: T-phase voltage, 3P3W: S-T voltage
0002	0004	N/A	Yes	Yes	R-T voltage
0003	0006	Yes	Yes	Yes	R-phase current
0004	0008	N/A	Yes	Yes	T-phase current
0005	000A	N/A	Yes	Yes	1P3W: N-phase current, 3P3W: S-phase current

5.5.2. Variable area (parameter) list

Address		Type	Parameter name	Setting (monitor) value	R/W
CompoWay/F (Variable type C000)	Modbus				
1000	2000	Individual setting	Phase-Wire	H'00000000: 1P2W H'00000001: 1P3W H'00000002: 3P3W H'00000003: 1P2W2 H'00000004: 1P3W2	R/W
1001	2002		Unit No.	H'00000000 to H'00000063 (0 to 99): For CompoWay/F H'00000001 to H'00000063 (1 to 99): For Modbus	R/W
1002	2004		CT to use	H'00000000: 5A H'00000001: 50A H'00000002: 100A H'00000003: 225A H'00000004: 400A H'00000005: 600A	R/W
1003	2006		CT ratio	H'0000000A to H'0001869F (10 to 99999) 10x ratio of primary current and secondary current	R/W
1004	2008		Low-cut current	H'00000001 to H'000000C7 (1 to 199) 10x percentage to CT rating	R/W
1005	200A		Simple measurement	H'00000000: OFF H'00000001: ON	R/W
1006	200C		Simple measurement: Voltage	H'00000000 to H'0001869F (0 to 99999) 10x voltage	R/W
1007	200E		Simple measurement: Power factor	H'00000000 to H'00000064 (0 to 100) 100x power factor	R/W
1008	2010		Pulse terminal assignment	H'00000000: OFF H'00000001: OUT1 H'00000002: OUT2	R/W
1009	2012		Voltage assignment	H'00000000: R-N H'00000001: T-N H'00000002: R-T	R/W
1100	2200	Common setting	Protocol	H'00000000: CompoWay/F H'00000001: Modbus H'00000002: BACnet MS/TP H'00000003: KM20	R/W
1101	2202		Communication speed	H'00000000: 1.2 kbps H'00000001: 2.4 kbps H'00000002: 4.8 kbps H'00000003: 9.6 kbps H'00000004: 19.2 kbps H'00000005: 38.4 kbps	R/W
1102	2204		Data length	H'00000000: 7 bits H'00000001: 8 bits	R/W
1103	2206		Stop bits	H'00000000: 1 bit H'00000001: 2 bits	R/W
1104	2208		Parity	H'00000000: NONE H'00000001: ODD H'00000002: EVEN	R/W
1105	220A		Time to wait for sending	H'00000000 to H'00000063 (0 to 99) Waiting time in ms	R/W

1106	220C		Pulse output unit	H'00000000: 1 Wh H'00000001: 10 Wh H'00000002: 100 Wh H'00000003: 1 kWh H'00000004: 5 kWh H'00000005: 10 kWh H'00000006: 50 kWh H'00000007: 100 kWh	R/W
1107	220E		VT ratio	H'00000064 to H'0001869F (100 to 99999) 100x VT ratio	R/W
1108	2210		Conversion rate	H'00000000 to H'0001869F (0 to 99999) 1000x coefficient value	R/W
1109	2212		Conversion display unit (character string)	Character string represented in hexadecimal of 3 characters in ASCII code	R/W
110A	2214		Auto-LCD OFF time	H'00000000: OFF H'00000001: 1 minute H'00000002: 5 minutes H'00000003: 10 minutes	R/W
110B	2216		Display digits fixed	H'00000000: OFF H'00000001: kWh fixed H'00000002: MWh fixed	R/W
110C	2218		Warning ON/OFF	H'00000000: OFF H'00000001: ON	R/W
1200	2400		Model 1 (character string)	1st to 4th characters in ASCII code from the left when the model is represented by left-justified 12 characters	R
1201	2402		Model 2 (character string)	5th to 8th characters in ASCII code from the left when the model is represented by left-justified 12 characters	R
1202	2404		Model 3 (character string)	9th to 12th characters in ASCII code from the left when the model is represented by left-justified 12 characters	R
1203	2406		Software version	(e.g.) H'00000100 > Ver1.0.0	R
1204	2408		Status information	See "Read controller status (0601)"	R
1205	240A		Buffer size	-FLK H'000000E6: (230) fixed -BAC H'000001E0: (480) fixed	R
1300	2600	Integral value	Integral active power (Wh)	H'00000000 to H'3B9AC9FF (0 to 999999999) 1x value	W
1301	2602		Integral regenerative power (Wh)		W
1302	2604		Integral leading reactive power (Varh)		W
1303	2606		Integral lagging reactive power (Varh)		W
1304	2608		Integral total reactive power (Varh)		W
1310	2620		Integral active power (kWh)		W
1311	2622		Integral regenerative power (kWh)		W
1312	2624		Integral leading reactive power (kVarh)		W
1313	2626		Integral lagging reactive power (kVarh)		W
1314	2628		Integral total reactive power (kVarh)		W

- The integral value setting is used to write the present integrated value to KM-N1 when you want to take over the integrated value of the integral power consumption value when the power monitor is relocated.

5.6. Support frame type object property (BACnet MS/TP)

5.6.1. List of support frame types

No.	Type	Out	In	Purpose
00	Token	Yes	Yes	Sending and receiving of transmission rights
01	Poll For Master	Yes	Yes	Sending of presence detection to other nodes Receiving of presence detection from other nodes
02	Reply To Poll For Master	Yes	Yes	Sending of presence notification to other nodes Receiving of presence notification from other nodes
05	BACnet Data Expecting Reply	No	Yes	Receiving of request from host • Receiving ReadProperty • Receiving WriteProperty
06	BACnet Data Not Expecting Reply	Yes	Yes	Sending of response to host • Sending Complex-ACK • Sending Simple-ACK • Sending Reject • Sending Error • Sending I-Am to host • Receiving Who-is from host

- The frame marked with 'Yes' is interpreted and executed.
- KM-N1-BAC is basically a slave node (B-SS), but it has some master functions to perform token passing. Thus some functions of Token, PollForMaster, and ReplyToPollForMaster are supported.
- KM-N1-BAC does not support over-the-router messages.
- Frame type number FF is used for communication by KM-N Setting Tool. Do not use the frame type number FF.

5.6.2. List of supported objects

●Objects supported by KM-N1-BAC are as follows.

Object	Abbreviation
Accumulator Object Type	AC
Analog Input Object Type	AI
Binary Input Object Type	BI
Binary Output Object Type	BO
Device Object Type	DV

●Details of objects supported by KM-N1-BAC are as follows.

Object	Type	Instance No.	Overview
Accumulator	Integral power consumption	AC1	Integral active power (kWh)
		AC2	Integral regenerative power (kWh)
		AC3	Integral leading reactive power (kVarh)
		AC4	Integral lagging reactive power (kVarh)
		AC5	Integral total reactive power (kVarh)
		AC11	Integral active power (MWh)
		AC12	Integral regenerative power (MWh)
		AC13	Integral leading reactive power (MVarh)
		AC14	Integral lagging reactive power (MVarh)
		AC15	Integral total reactive power (MVarh)
		AC81	Conversion value (e.g. K.JPY)
		AC82	Conversion value (e.g. M.JPY)
Analog Input	Instantaneous value	AI1	Voltage V1 (V)*
		AI2	Voltage V2 (V): Not used for this product.*
		AI3	Voltage V3 (V)*
		AI4	Voltage V1-V2 (V)*
		AI5	Voltage V1-V3 (V)*
		AI6	Voltage V2-V3 (V)*
		AI7	Current I1 (A)*
		AI8	Current I2 (A)*
		AI9	Current I3 (A)*
		AI10	Power factor
		AI11	Frequency (Hz)
		AI12	Active power (W)
		AI13	Reactive power (Var)
	Set value	AI101	Phase-Wire
		AI102	CT to use
		AI103	CT ratio
		AI104	Low-cut current

Object	Type	Instance No.	Overview
		AI105	Pulse terminal assignment
		AI106	Voltage assignment
		AI107	Pulse terminal output
		AI108	VT ratio
Binary Input	Error/warning	BI1	Operational status
		BI2	Mode indication
		BI3	Set value error
		BI4	Measured value error
		BI5	Calibration value error
		BI6	Input frequency warning
		BI7	Misconnection warning
		BI8	Pulse 1 output warning
		BI9	Pulse 2 output warning
Binary Output	Operation command	BO1	Reset integral power consumption (individual unit)
		BO2	Reset software
Device	Model, etc.	DV	Model, software version, parameters, etc. (Instance No. is assigned the same value as the unit No.)

*Shown below is the relationship between the phase-wire and data for AI1 to AI9.

Instance No.	1P2W	1P3W	3P3W	Meaning
AI1	Yes	Yes	N/A	R-phase voltage
AI2	N/A	N/A	N/A	Not used for this product (S-phase voltage).
AI3	N/A	Yes	N/A	T-phase voltage
AI4	N/A	N/A	Yes	R-S voltage
AI5	N/A	Yes	Yes	R-T voltage
AI6	N/A	N/A	Yes	S-T voltage
AI7	Yes	Yes	Yes	R-phase current
AI8	N/A	N/A	Yes	S-phase current
AI9	N/A	Yes	Yes	T-phase current

5.6.3. List of supported properties

● Accumulator Object

(1) List of properties

ID85 (Present Value), ID187 (Scale), and ID117 (Unit) have different values depending on the instance.

Other properties are shown in the table below.

ID	Property Identifier	Property Datatype	R/W	Value
75	Object_Identifier	BACnetObjectIdentifier	R	[Obj] ObjectID
77	Object_Name	CharacterString	R	[Fixed] AC-n (n: Instance #)
79	Object_Type	BACnetObjectType	R	[Type] AC
85	Present_Value	Unsigned	R	[Variable] * See (2) appended table
111	Status_Flags	BACnetStatusFlags	R	[Fixed] 'FFFF'
36	Event_State	BACnetEventState	R	[Fixed] NORMAL
103	Reliability	BACnetReliability	R	[Fixed] NO_FAULT_DETECTED
81	Out_Of_Service	BOOLEAN	R	[Fixed] FALSE
187	Scale	BACnetScale	R	[Fixed] * See (2) appended table
117	Units	BACnetEngineeringUnits	R	[Fixed] * See (2) appended table
65	Max_Pres_Value	Unsigned	R	[Fixed] 999999999
371	Property_List	BACnetARRAY[N] of BACnetPropertyIdentifier	R	[Fixed] { Present_Value, Status_Flags, Event_State, Reliability, Out_Of_Service, Scale, Units, Max_Pres_Value }

(2) Set value by instance for ID85 (Present Value), ID187 (Scale), and ID117 (Unit)

Instance No.	ID85 (Present Value)	ID187 (Scale)	ID117 (Unit)	Overview
AC1	Measured value (0 to 999999999)	0.001	19: kWh	Integral active power (kWh)
AC2	Measured value (0 to 999999999)	0.001	19: kWh	Integral regenerative power (kWh)
AC3	Measured value (0 to 999999999)	0.001	204: kvarh	Integral leading reactive power (kVarh)
AC4	Measured value (0 to 999999999)	0.001	204: kvarh	Integral lagging reactive power (kVarh)
AC5	Measured value (0 to 999999999)	0.001	204: kvarh	Integral total reactive power (kVarh)
AC11	Measured value (0 to 999999999)	0.001	146: MWh	Integral active power (MWh)
AC12	Measured value (0 to 999999999)	0.001	146: MWh	Integral regenerative power (MWh)
AC13	Measured value (0 to 999999999)	0.001	205: Mvarh	Integral leading reactive power (MVarh)
AC14	Measured value (0 to 999999999)	0.001	205: Mvarh	Integral lagging reactive power (MVarh)
AC15	Measured value (0 to 999999999)	0.001	205: Mvarh	Integral total reactive power (MVarh)
AC81	Measured value (0 to 999999999)	0.001	95: no-units	Conversion value (e.g. K.JPY)
AC82	Measured value (0 to 999999999)	0.001	95: no-units	Conversion value (e.g. M.JPY)

The unit of Accumulator is the Present_Value multiplied by Scale.

$$\text{Present_Value[W]} \times \text{Scale}[0.001] = \text{Unit[kWh]}$$

Example of AC1: $1000 \times 0.001 = 1$ [kWh]

● Analog Input Object

(1) List of properties

ID85 (Present Value) and ID117 (Unit) have different values depending on the instance.

Other properties are common for all instances as shown in the table below.

ID	Property Identifier	Property Datatype	R/W	Value
75	Object_Identifier	BACnetObjectIdentifier	R	[Obj] ObjectID
77	Object_Name	CharacterString	R	[Fixed] AI-n (n: Instance #)
79	Object_Type	BACnetObjectType	R	[Type] AI
85	Present_Value	REAL	R	[Variable] * See (2) appended table
111	Status_Flags	BACnetStatusFlags	R	[Fixed] 'FFFF'
36	Event_State	BACnetEventState	R	[Fixed] NORMAL
103	Reliability	BACnetReliability	R	[Fixed] NO_FAULT_DETECTED
81	Out_Of_Service	BOOLEAN	R	[Fixed] FALSE
117	Units	BACnetEngineeringUnits	R	[Fixed] * See (2) appended table
371	Property_List	BACnetARRAY[N] of BACnetPropertyIdentifier	R	[Fixed] { Present_Value, Status_Flags, Event_State, Reliability, Out_Of_Service, Units }

(2) Set value by instance for ID85 (Present Value) and ID117 (Unit)

Instance No.	ID85 (Present Value)	ID117 Unit	Overview
AI1	Measured value (0 to 999999.9)	5: V	Voltage V1 (V)
AI2	Measured value (0 to 999999.9)	5: V	Voltage V2 (V)
AI3	Measured value (0 to 999999.9)	5: V	Voltage V3 (V)
AI4	Measured value (0 to 999999.9)	5: V	Voltage V1-V2 (V)
AI5	Measured value (0 to 999999.9)	5: V	Voltage V1-V3 (V)
AI6	Measured value (0 to 999999.9)	5: V	Voltage V2-V3 (V)
AI7	Measured value (0 to 9999.999)	3: A	Current I1 (A)
AI8	Measured value (0 to 9999.999)	3: A	Current I2 (A)
AI9	Measured value (0 to 9999.999)	3: A	Current I3 (A)
AI10	Measured value (-1.00 to 1.00)	15: PF	Power factor
AI11	Measured value (45.0 to 65.0)	27: Hz	Frequency (Hz)
AI12	Measured value (-214748364.8 to 214748364.7)	47: W	Active power (W)
AI13	Measured value (-214748364.8 to 214748364.7)	11: VAR	Reactive power (Var)

AI101	0: 1P2W 1: 1P3W 2: 3P3W 3: 1P2W2 4: 1P3W2	95: no-units	Phase-Wire
AI102	0: 5A 1: 50A 2: 100A 3: 225A 4: 400A 5: 600A	95: no-units	CT to use
AI103	1.0 to 9999.9	95: no-units	CT ratio
AI104	0.1 to 19.9	95: no-units	Low-cut current
AI105	0: OFF 1: OUT1 2: OUT2	95: no-units	Pulse terminal assignment
AI106	0: R-N 1: T-N 2: R-T	95: no-units	Voltage assignment
AI107	0: 1Wh 1: 10Wh 2: 100Wh 3: 1kWh 4: 5kWh 5: 10kWh 6: 50kWh 7: 100kWh	95: no-units	Pulse terminal output
AI108	1.00 to 999.99	95: no-units	VT ratio

● Binary Input Object

(1) List of properties

ID85 (Present Value) has different values depending on the instance.

Other properties are common for all instances as shown in the table below.

ID	Property Identifier	Property Datatype	R/W	Value
75	Object_Identifier	BACnetObjectIdentifier	R	[Obj] ObjectID
77	Object_Name	CharacterString	R	[Fixed] BI-n (n: Instance #)
79	Object_Type	BACnetObjectType	R	[Type] BI
85	Present_Value	BACnetBinaryPV	R	[Variable] * See (2) appended table
111	Status_Flags	BACnetStatusFlags	R	[Fixed] 'FFFF'
36	Event_State	BACnetEventState	R	[Fixed] NORMAL
103	Reliability	BACnetReliability	R	[Fixed] NO_FAULT_DETECTED
81	Out_Of_Service	BOOLEAN	R	[Fixed] FALSE
84	Polarity	BACnetPolarity	R	[Fixed] NORMAL
371	Property_List	BACnetARRAY[N] of BACnetPropertyIdentifier	R	[Fixed] { Present_Value, Status_Flags, Event_State, Reliability, Out_Of_Service, Polarity }

(2) Set value by instance for ID85 (Present Value)

Instance No.	ID85 (Present Value)	Overview
BI1	0: No warning, 1: Warning	Operational state "1" is set when any of BI2 to BI9 is "1".
BI2	0: Measuring mode, 1: Setting mode	Mode indication The mode indication in the setting mode is "1" because it is in the measuring mode during normal operation.
BI3	0: No warning, 1: Warning	Set value error
BI4	0: No warning, 1: Warning	Measured value error
BI5	0: No warning, 1: Warning	Calibration value error
BI6	0: No warning, 1: Warning	Input frequency warning
BI7	0: No warning, 1: Warning	Misconnection warning
BI8	0: No warning, 1: Warning	Pulse 1 output warning
BI9	0: No warning, 1: Warning	Pulse 2 output warning

● Binary Output Object

(1) List of properties

Common for all instances as shown in the table below.

ID	Property Identifier	Property Datatype	R/W	Value
75	Object_Identifier	BACnetObjectIdentifier	R	[Obj] ObjectID
77	Object_Name	CharacterString	R	[Fixed] BO-n (n: Instance #)
79	Object_Type	BACnetObjectType	R	[Type] BO
85	Present_Value	BACnetBinaryPV	R/W	[Variable] 1 (ACTIVE) while running. 0 (INACTIVE) after operation is completed.
111	Status_Flags	BACnetStatusFlags	R	[Fixed] 'FFFF'
36	Event_State	BACnetEventState	R	[Fixed] NORMAL
103	Reliability	BACnetReliability	R	[Fixed] NO_FAULT_DETECTED
81	Out_Of_Service	BOOLEAN	R	[Fixed] FALSE
84	Polarity	BACnetPolarity	R	[Fixed] NORMAL
87	Priority_Array	BACnetPriorityArray	R	[Variable] While running, 1 (ACTIVE) for the location of the written priority, and NULL for all others. NULL for all after operation is completed.
104	Relinquish_Default	BACnetBinaryPV	R	[Fixed] 0 (INACTIVE)

*) BO operation

- The specified operation is performed When "1" is specified for Present Value.
- Present_Value is "1" while the specified operation is being executed, but "0" is written by the product itself after operation is completed.
- Due to the above operation, in the case of BO, regardless of which priority in the priority array is used for the command, the Present Value is set back to "0".

● Device Object

(1) List of properties

If the products are used in a multi-unit system, the number of instances is based on the number of units. The properties are shown in the table below, regardless of the number of the units.

ID	Property Identifier	Property Datatype	R/W	Value
75	Object_Identifier	BACnetObjectIdentifier	R	[Obj] ObjectID
77	Object_Name	CharacterString	R	[Fixed] KM-N1-n (n: Instance #)
79	Object_Type	BACnetObjectType	R	[Type] DV
112	System_Status	BACnetDeviceStatus	R	[Fixed] OPERATIONAL
121	Vendor_Name	CharacterString	R	[Fixed] OMRON
120	Vendor_Identifier	Unsigned16	R	[Fixed] 947
70	Model_Name	CharacterString	R	[Fixed] KM-N1-BAC
44	Firmware_Revision	CharacterString	R	[Fixed] Character string representing the version; e.g.: "0100"
12	Application_Software_Version	CharacterString	R	[Fixed] One (1) blank
98	Protocol_Version	Unsigned	R	[Fixed] 1
139	Protocol_Revision	Unsigned	R	[Fixed] 14 (ANSI/ASHRAE 135-2012)
97	Protocol_Services_Supported	BACnetServicesSupported	R	[Fixed] 41 bits. readProperty (12), writeProperty (15), i-Am (26), who-Is (34) are T.
96	Protocol_Object_Types_Supported	BACnetObjectTypesSupported	R	[Fixed] 55 bits. analog-input (0), binary-input (3), device (8), accumulator (23) are T.
76	Object_List	BACnetARRAY[N] of BACnetObjectIdentifier	R	[Fixed] { AI1, ..., AI13, AI101..., AI08, AC1, ..., AC5, AC11, ..., AC15, AC81, AC82, BI1, ..., BI9, BO1, BO2, DVn }
62	Max_APDU_Length_Accepted	Unsigned	R	[Fixed] 50
107	Segmentation_Supported	BACnetSegmentation	R	[Fixed] 3: no-segmentation
11	APDU_Timeout	Unsigned	R	[Fixed] 0
73	Number_Of_APDU_Retries	Unsigned	R	[Fixed] 0
64	Max_Master	Unsigned(1..127)	R	[Fixed] 127
63	Max_Info_Frames	Unsigned	R	[Fixed] 20
30	Device_Address_Binding	BACnetLIST of BACnetAddressBinding	R	[Fixed] empty
155	Database_Revision	Unsigned	R	[Fixed] 0
371	Property_List	BACnetARRAY[N] of BACnetPropertyIdentifier	R	[Fixed] { System_Status, Vendor_Name, Vendor_Identifier, Model_Name, Firmware_Revision, Application_Software_Version, Protocol_Version, Protocol_Revision, Protocol_Services_Supported, Protocol_Object_Types_Supported, Object_List, Max_APDU_Length_Accepted, Segmentation_Supported, APDU_Timeout, Number_Of_APDU_Retries, Max_Master, Max_Info_Frames, Device_Address_Binding, Database_Revision, 1000, 1001, 1002, 1003, 1004,

				1005, 1006, 1007, 1008, 1009, 1100, 1101, 1102, 1103, 1104, 1105, 1106, 1107, 1108, 1109, 1110, 1111, 1112, 1205, 1300, 1301, 1302, 1303, 1304, 1310, 1311, 1312, 1313, 1314, 1404, 1407, 1409 }
1000	Phase-Wire	Unsigned Integer	R/W	[Variable] Set value (0: 1P2W, 1: 1P3W, 2: 3P3W, 3: 1P2W2, 4: 1P3W2)
1001	Unit_No	Unsigned Integer	R/W	[Variable] Set value (H'00 to H'7F)
1002	CT to use	Unsigned Integer	R/W	[Variable] Set value (0: 5A, 1: 50A, 2: 100A, 3: 225A, 4: 400A, 5: 600A)
1003	CT ratio	Real	R/W	[Variable] Set value (10 to 99999) *) 10x value
1004	Low-cut current	Real	R/W	[Variable] Set value (1 to 199) *) 10x value
1005	Simple measurement	Boolean	R/W	[Variable] Set value (False (0): OFF, True(1): ON)
1006	Simple measurement: Voltage	Real	R/W	[Variable] Set value (0 to 99999) *) 10x value
1007	Simple measurement: Power factor	Real	R/W	[Variable] Set value (0 to 100) *) 100x value
1008	Pulse terminal assignment	Unsigned Integer	R/W	[Variable] Set value (0: OFF, 1: OUT1, 2: OUT2)
1009	Voltage assignment	Unsigned Integer	R/W	[Variable] Set value (0: R-N, 1: T-N, 2: R-T)
1100	Protocol	Unsigned Integer	R/W	[Variable] Set value (1: Modbus RTU, 2: BACnet MS/TP)
1101	Communication speed	Unsigned Integer	R/W	[Variable] Set value (3: 9.6 kbps, 4: 19.2kbps, 5: 38.4 kbps)
1102	Data length	Unsigned Integer	R/W	[Fixed] 1: 8bit
1103	Stop bits	Unsigned Integer	R/W	[Variable] Set value (0: 1 bit, 1: 2 bits)
1104	Parity	Unsigned Integer	R/W	[Variable] Set value (0: NONE, 1: ODD, 2: EVEN)
1105	Time to wait for sending	Unsigned Integer	R/W	[Variable] Set value (0 to 99) *) in msc
1106	Pulse output unit	Unsigned Integer	R/W	[Variable] Set value (0: 1Wh, 1: 10Wh, 2: 100Wh, 3: 1kWh, 4: 5kWh, 5: 10kWh, 6: 50kWh, 7: 100kWh)
1107	VT ratio	Real	R/W	[Variable] Set value (100 to 99999) *) 100x value
1108	Conversion rate	Real	R/W	[Variable] Set value (0 to 99999) *)10x value of coefficient
1109	Conversion display unit (character string)	CharacterString	R/W	[Variable] Set value (character string represented in hexadecimal of 3 characters in ASCII code; e.g.: "4A5059" (example for JPY))
1110	Auto-LCD OFF time	Unsigned Integer	R/W	[Variable] Set value (0: OFF, 1: 1 minute, 2: 5 minutes, 3: 10 minutes)
1111	Display digits fixed	Unsigned Integer	R/W	[Variable] Set value (0: OFF, 1: kWh fixed, 2: MWh fixed)
1112	Warning ON/OFF	Boolean	R/W	[Variable] Set value (False (0): OFF, True(1): ON)
1199	Time to wait for receiving T_usage_timeout	Unsigned Integer	R/W	[Variable] Set value (20 to 100) *) msc
1205	Buffer size	Unsigned Integer	R	[Fixed] 480
1300	Integral active power (Wh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)

1301	Integral regenerative power (Wh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1302	Integral leading reactive power (Varh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1303	Integral lagging reactive power (Varh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1304	Integral total reactive power (Varh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1310	Integral active power (kWh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1311	Integral regenerative power (kWh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1312	Integral leading reactive power (kVarh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1313	Integral lagging reactive power (kVarh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1314	Integral total reactive power (kVarh)	Unsigned Integer	W	[Write only] Set value (0 to 999999999)
1404	Move to measuring mode	BOOLEAN	R/W	[Variable] 1 (ACTIVE) when a command is being executed, 0 (INACTIVE) when not being executed. [Write] 1 (ACTIVE) (execution command)
1407	Move to setting mode	BOOLEAN	R/W	[Variable] 1 (ACTIVE) when a command is being executed, 0 (INACTIVE) when not being executed. [Write] 1 (ACTIVE) (execution command)
1409	Reset to factory defaults	BOOLEAN	R/W	[Variable] 1 (ACTIVE) when a command is being executed, 0 (INACTIVE) when not being executed. [Write] 1 (ACTIVE) (execution command)

Chapter 6. KM-N1OP-01 and KM20 Mode

Chapter 6. KM-N1OP-01 and KM20 Mode.....	6-1
6.1. Overview of KM-N1OP-01 and KM20 mode	6-2
6.2. Part names and functions	6-6
6.3. Dimensions.....	6-11
6.4. Installation and wiring	6-15
6.5. How to use KM20 mode	6-26
6.6. Communications specifications in KM20 mode	6-35
6.7. Communication with host device in KM20 mode.....	6-40

6.1. Overview of KM-N1OP-01 and KM20 mode

KM-N1OP-01 (hereafter called "terminal block adapter") is a terminal block adapter with the same terminal assignment as KM20-B40-FLK and KM20-B40 (hereafter called "KM20-B40"). This terminal block adapter is ideal for replacing KM20-B40 with KM-N1-FLK.

The KM20 mode is a special mode of KM20-B40-FLK assuming replacement from KM20-B40. KM20 mode is entered by selecting "KM20" in the protocol selection. See (6.5.1 How to transition to KM20 mode)

The KM20 mode assumes that KM20-B40 is already in use and compatibility is required with a host device such as collecting measured values.

The terminal block adapter and KM20 mode have the following main features.

*) KM20 mode is selectable with the KM-N1-FLK of the version V3.0.0 or later.

6.1.1. Main features of KM-N1OP-01 and KM20 mode

<KM-N1OP-01>

- (1) KM20-CTF-□□□A (hereafter called CT for KM20) can be used with KM-N1-FLK

When replacing KM20-B40 with KM-N1-FLK, the CT for KM20 used until then can be used without modification by using a terminal block adapter. KM20-B40 can be replaced by connecting the CT for KM20 to KM-N1-FLK via a terminal block adapter.

- (2) Same terminal shape and assignment as KM20-B40

The terminal block adapter has the same terminal shape and assignment as KM20-B40. It can be used without changing the wiring positions of CTs, power supply lines, and communication lines that have been used up to now.

<KM20 mode>

- (1) Address map of KM20-B40-FLK is adopted

The KM20 mode can acquire data such as integral power consumption using the same communication address as KM20-B40-FLK (some functions may differ. Refer to 6.1.2 for details). KM20-B40 can be replaced by KM-N1-FLK without any changes to a host system.

- (2) Multi-circuit metering partly adopted

Multi-circuit metering, a feature of KM-N1-FLK, is also employed in KM20 mode. Measurement of up to 2 circuits is available for 1-phase 2-wire, 1-phase 3-wire, and 3-phase 3-wire.

*) When used with a terminal block adapter, 2-circuit measurement is possible for 1-phase 2-wire only.

- (3) "2 k" and "20 kWh" added to pulse output unit

In KM20 mode only, you can select pulse output unit 2k and 20kWh. Compatibility is ensured even if using these pulse output units with KM20-B40. Refer to "6.5.3 Setting items in KM20 mode" for details of the setting items.

6.1.2. Difference between KM20 mode and KM20-B40

Some specifications in KM20 mode differ from those in KM20-B40. Be careful when using KM20 mode.

- ①The address map installed in KM20 mode is Read Only for all items. You cannot write setting values via communications. To change the setting values in KM20 mode, operate the KM-N1-FLK main unit directly.
- ②The concept of the CT ratio and VT ratio setting values differs from that of KM20-B40. The differences are as follows.

Item	KM20 mode	KM20-B40
CT ratio	Primary and secondary current ratio is set. (e.g.: If 1000A on primary side and 5A on secondary side, the value is <u>200</u>)	The rated current value of the primary side is set (e.g.: If 1000A on primary side and 5A on secondary side, the value is <u>1000</u>)
VT ratio	Primary and secondary voltage ratio is set. (e.g.: If 440V on primary side and 110V on secondary side, the ratio is <u>4.00</u>)	The rated voltage value of the primary side is set. (e.g.: If 440V on primary side, the value is <u>440</u>)

- ③The controller status readout differs from that of KM20-B40. Refer to the table below for the differences.

Refer to "6.6.8 Service details" for details.

Bit position	KM20 mode		KM20-B40	
	Meaning	Details	Meaning	Details
B0	None	0 (fixed)	None	None
B1	None	0 (fixed)	None	None
B2	None	0 (fixed)	None	None
B3	None	0 (fixed)	None	None
B4	None	0 (fixed)	Voltage input overflow	0: No warning 1: Warning
B5	None	0 (fixed)	Current input overflow	0: No warning 1: Warning
B6	Voltage input insufficient	0: No warning 1: Warning	Voltage input insufficient	0: No warning 1: Warning
B7	None	0 (fixed)	None	None

6.1.3. Difference between KM20 mode and KM-N1-FLK

When using a terminal block adapter, the maximum number of CTs that can be connected is 2. Some functions of KM-N1-FLK are limited in KM20 mode to match those of KM20-B40. The differences in functions between each combination are described below.

Category	Item	KM20 mode (When using terminal block adapter)	KM20 mode (When not using terminal block adapter)	Other than KM20 mode
Measurement	Number of measuring circuits	1 circuit *)	2 circuits	4 circuits **)
	Measurement item	Items measurable with KM20-B40 (See 6.5.2 Measurement items in KM20 mode)		See Measurement display list (P3-5)
Setting	Phase-Wire	1-phase 2-wire, 1-phase 3-wire, 3-phase 3-wire		1-phase 2-wire, 1-phase 3-wire, 3-phase 3-wire, 1-phase 2-wire voltage option, 1-phase 3-wire composite
	Pulse output unit	1, 10, 100, 1 k, 2 k, 5 k, 10 k, 20 k, 50 k, 100 k (Wh)		1, 10, 100, 1 k, 5 k, 10 k, 50 k, 100 k (Wh)
Communication	Protocol	CompoWay/F		CompoWay/F, Modbus
	Measured value	Items measurable with KM20-B40 (see 6.6.10 Address map (KM20 mode))		See 5.5 Address map (CompoWay/F, Modbus)
	Max value Min value	Measurable in voltage, current, and active power		None
	Set value	Items configurable with KM20-B40 (See 6.6.10 Address map (KM20 mode)) * Read only		See 5.5 Address map (CompoWay/F, Modbus)
Host device (software)	EQ100	Yes		Yes
	EW700 series	Yes		No
	ZN-KMX21	Yes		Yes
	CJ series	Yes		Yes
	Easy KM Manager	Yes		No
	KM-N Setting Tool	No		Yes

*) Two (2) circuits can be measured only for 1-phase 2-wire. For details, see "6.4.7 Wiring when using terminal block adapter".

**) Two (2) circuits only for 1-phase 3-wire and 3-phase 3-wire.

Shown below are the correspondence between the phase-wire type and the assignment of CT to use for each measuring circuit when the terminal block adapter is used or not used in KM20 mode.

■ Phase-wire type and assignment of CT to use for each measuring circuit in KM20 mode (terminal block adapter used)

Phase-Wire	Measuring circuit			
	Circuit A	Circuit B	Circuit C	Circuit D
1-phase 2-wire	CT1	CT2		
1-phase 3-wire	CT1, CT2			
3-phase 3-wire	CT1, CT2			

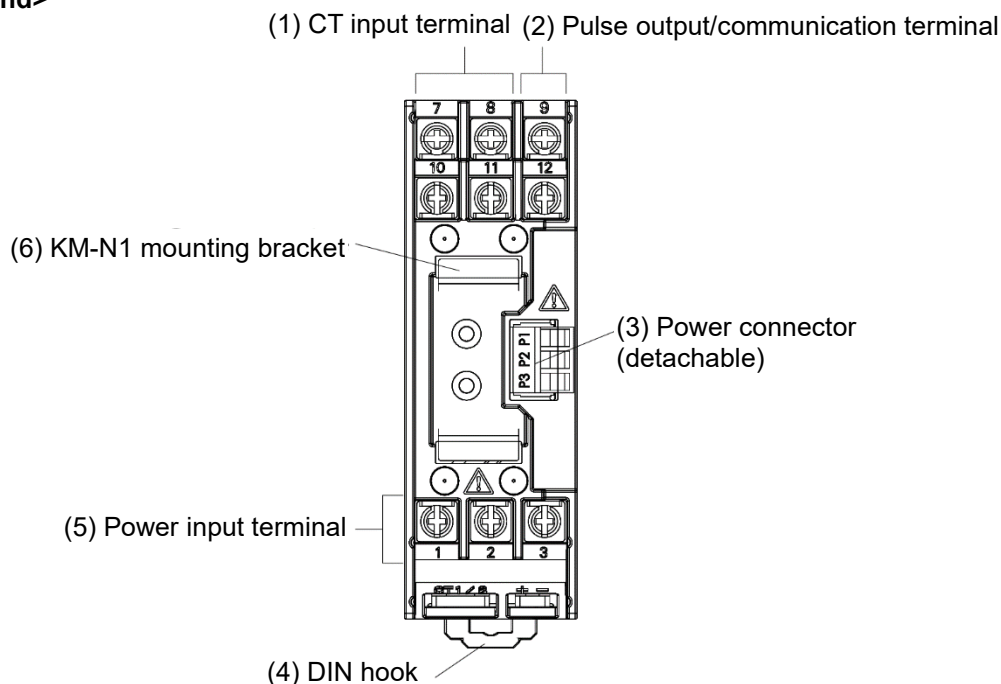
■ Phase-wire type and assignment of CT to use for each measuring circuit in KM20 mode (terminal block adapter not used)

Phase-Wire	Measuring circuit			
	Circuit A	Circuit B	Circuit C	Circuit D
1-phase 2-wire	CT1	CT2		
1-phase 3-wire	CT1, CT2		CT3, CT4	
3-phase 3-wire	CT1, CT2		CT3, CT4	

6.2. Part names and functions

6.2.1. Terminal block adapter

<Front end>

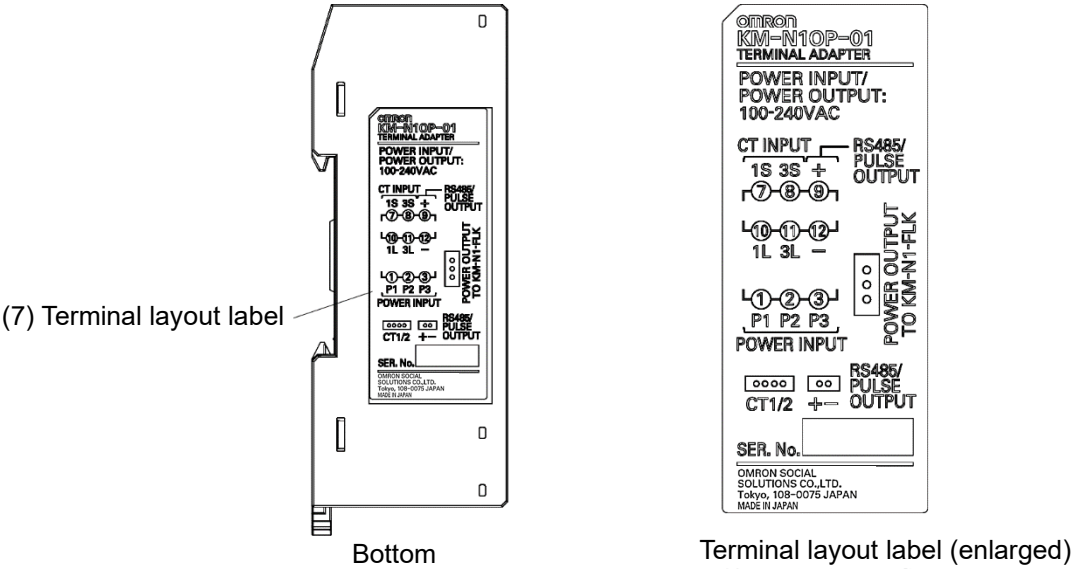


No.	Name	Function
(1)	CT input terminal	Terminal to connect CTs. Up to two (2) CTs can be connected.
(2)	Pulse output/communication terminal	Terminal to connect pulse output or RS-485 communication line.
(3)	Power connector	To connect the power cable and input the voltage from the "power input terminal" to KM-N1-FLK.
(4)	DIN hook	Used to fix the DIN rail.
(5)	Power input terminal	Terminal to connect power supply/measuring voltage.
(6)	KM-N1 mounting bracket	Mounting bracket for fixing KM-N1-FLK to terminal block adapter.

■ Terminal layout

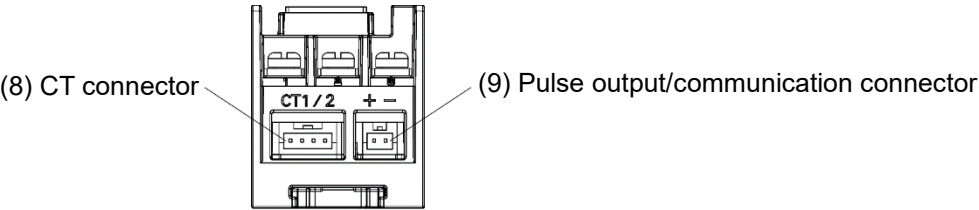
Terminal #	Terminal name	Description of functions
1	Power input P1	1-phase 2-wire: L-phase, 1-phase 3-wire/3-phase 3-wire: R-phase
2	Power input P2	1-phase 2-wire/1-phase 3-wire: N-phase, 3-phase 3-wire: S-phase
3	Power input P3	1-phase 3-wire/3-phase 3-wire: T-phase
7	CT1S	k terminal of dedicated CT1
8	CT3S	k terminal of dedicated CT2
9	Pulse output or RS-485 communication	Pulse output: +, RS485 communication: +
10	CT1L	l terminal of dedicated CT1
11	CT3L	l terminal of dedicated CT2
12	Pulse output or RS-485 communication	Pulse output: COM, RS485 communication: -

<Left side>



No.	Name	Description
(7)	Terminal layout label	Label with information such as the model, power voltage, connector layout, and serial number

<Bottom>



No.	Name	Description
(8)	CT connector	To connect the CT cable and input the current from the "CT input terminal" to KM-N1-FLK.
(9)	Pulse output/communication connector	To connect the output cable and input the signal from the "pulse output/communication terminal" to KM-N1-FLK.

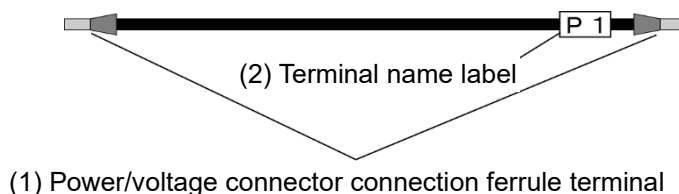
6.2.2. Included cables

<Power cable>

The power cable is used only to input power supply/measuring voltage of the "power input terminal" of the terminal block adapter to KM-N1-FLK.

It is fixed with a screw on the voltage connector of the terminal block adapter and power supply/voltage connector of KM-N1-FLK.

To use this cable, the voltage connector of the terminal block adapter and power supply/voltage connector of KM-N1-FLK must be removed from the main unit to fix the cable with a screw.



Item	Details
(1) Power/voltage connector connection ferrule terminal	Terminal to connect to each connector of terminal block adapter and KM-N1-FLK.
(2) Terminal name label	Label to identify terminals to connect (3 cables included: P1, P2, and P3)

Important

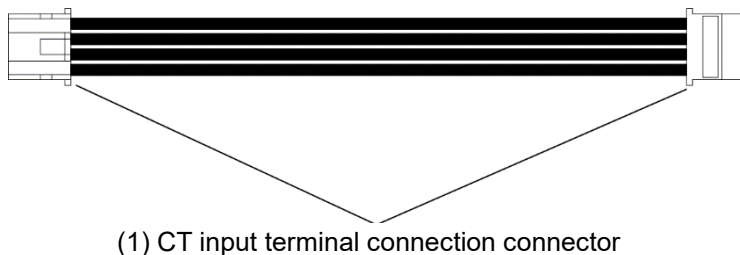
- Screw the power cable into the connector with the following recommended torque.
Terminal block adapter voltage connector screw: 0.2 to 0.25 N·m
KM-N1-FLK power supply/voltage connector screw: 0.5 to 0.6 N·m
- Make sure there are no loose screws at the screw tightening points before use.

<CT cable>

The CT cable is used to connect the "CT input terminal" and the "CT input terminal" of KM-N1-FLK.

Connector on either end of the CT cable is not designated for the terminal block adapter and KM-N1-FLK.

When connecting to KM-N1-FLK, connect to the connector marked CT1/2 on the KM-N1-FLK.

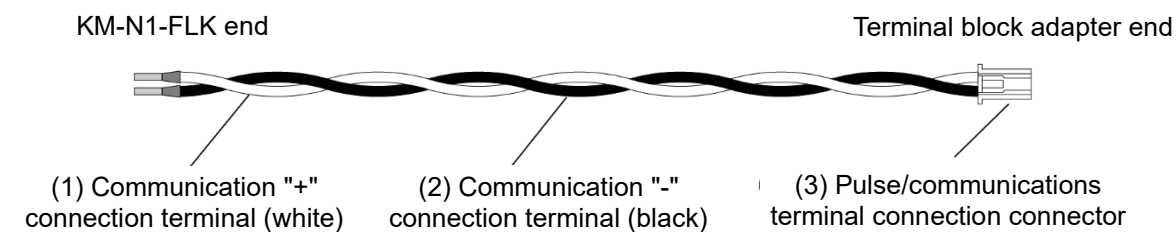


Item	Details
(1) CT input terminal connection connector	Used to connect the CT input terminal of the terminal block adapter and the CT input terminal of KM-N1-FLK.

<Output cable>

The output cable is used to input signals of the "pulse/communication terminal" of the terminal block adapter to KM-N1-FLK.

The polarity of the communication signal is identified by the color of the wire.



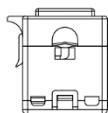
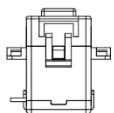
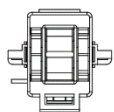
Item	Details
(1) Communication "+" connection terminal (white)	Terminal to connect to the communications terminal "+" of KM-N1-FLK. Case: pulse output: "OUTPUT1" or "OUTPUT2" Case: RS-485 communications: "RS485 +"
(2) Communication "-" connection terminal (black)	Terminal to connect to the communications terminal "-" of KM-N1-FLK. Case: Pulse output: "OUTPUT COM" Case: RS-485 communications: "RS485 -"
(3) (Pulse/communications terminal connection connector	Connector for connection to pulse and communication terminal of terminal block adapter

Important

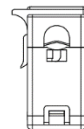
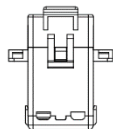
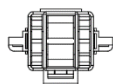
- Screw the output cable into KM-N1-FLK with the following recommended torque.
KM-N1-FLK communication terminal: 0.22 to 0.25 N · m
- Make sure there are no loose screws at the screw tightening points before use.

6.2.3. CT for KM20 (When using terminal block adapter)

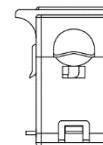
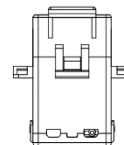
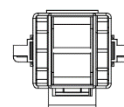
KM20-CTF-5A



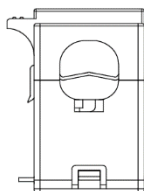
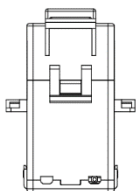
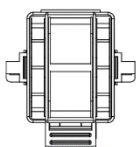
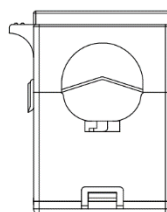
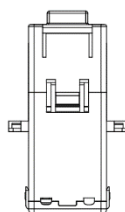
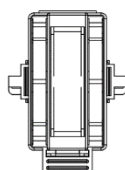
KM20-CTF-50A



KM20-CTF-100A

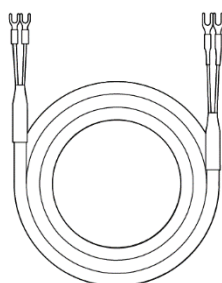


KM20-CTF-200A

KM20-CTF-400A
KM20-CTF-600A

Product	Model	Specifications (Rated primary current)
Current transformer (CT)	KM20-CTF-5A	Rated 5A
	KM20-CTF-50A	Rated 50A
	KM20-CTF-100A	Rated 100A
	KM20-CTF-200A	Rated 200A
	KM20-CTF-400A	Rated 400A
	KM20-CTF-600A	Rated 600A

6.2.4. CT cable (When using terminal block adapter)

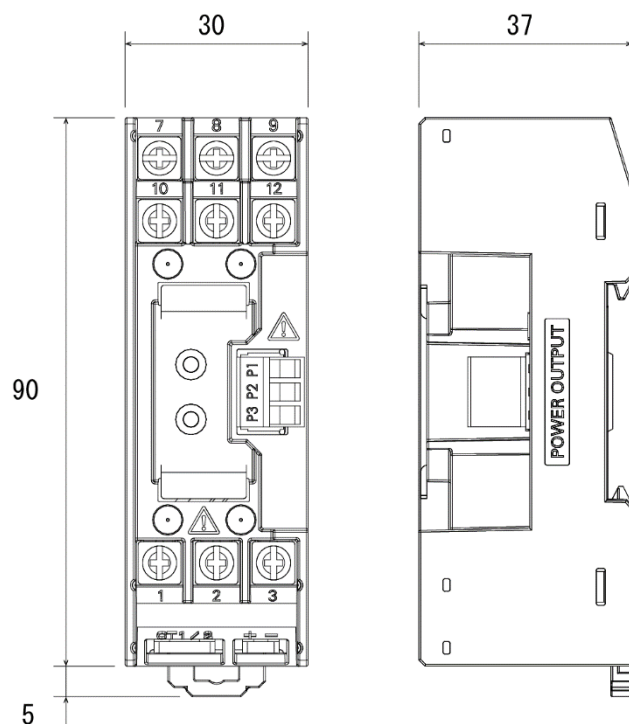


Product	Model	Specifications
Cable for current transformer (CT)	KM20-CTF-CB3	Cable length : 3 m

6.3. Dimensions

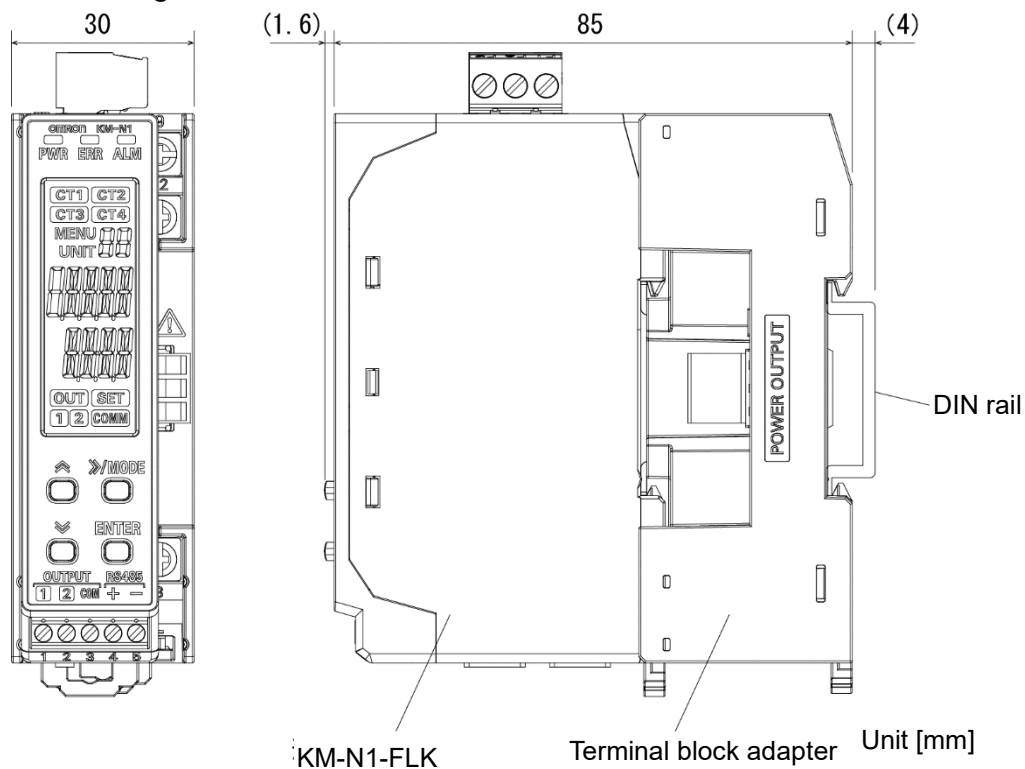
6.3.1. Terminal block adapter dimensions

<Terminal block adapter main body>



Unit [mm]

<When mounting KM-N1-FLK>



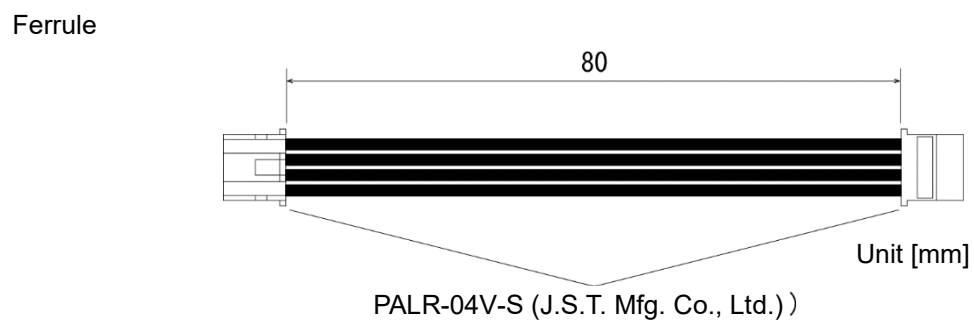
Unit [mm]

6.3.2. Included cable dimensions

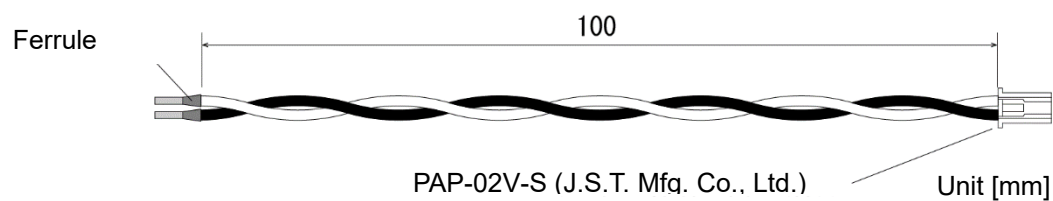
<Power supply cable for terminal block adapter (hereafter called power cable)>



<CT cable for terminal block adapter (hereafter called CT cable)>

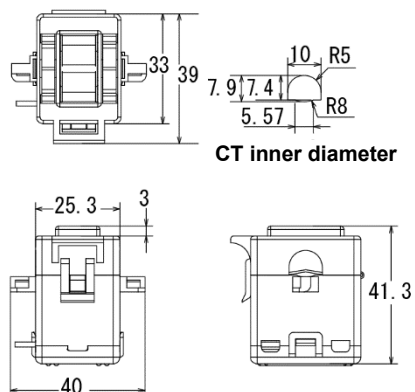


<Output cable for terminal block adapter (hereafter called output cable)>

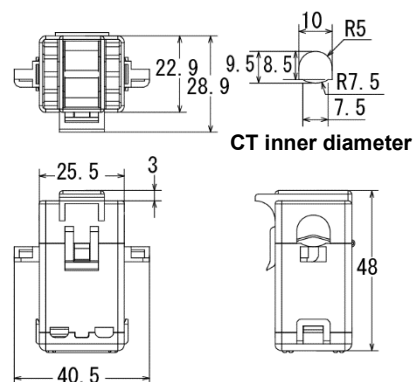


6.3.3. CT dimensions

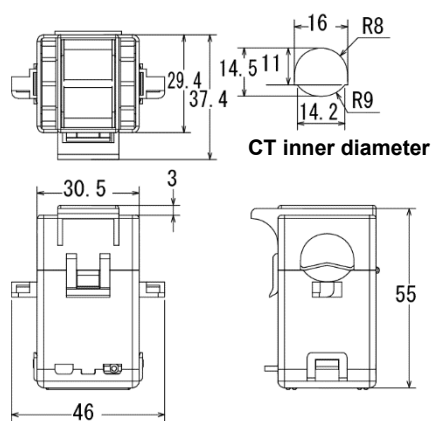
KM20-CTF-5A



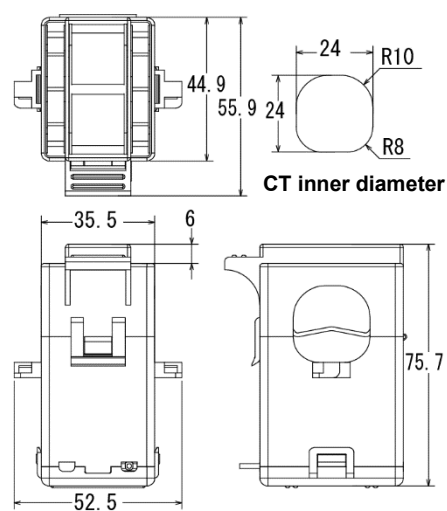
KM20-CTF-50A



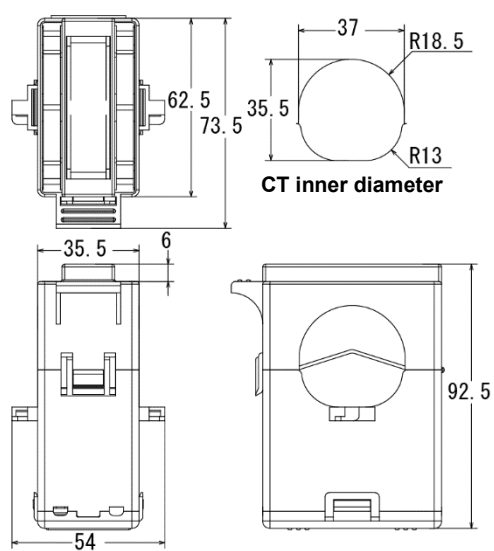
KM20-CTF-100A



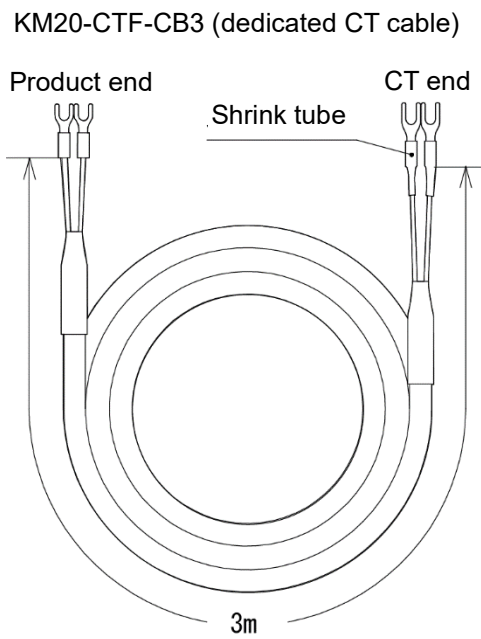
KM20-CTF-200A



**KM20-CTF-400A
KM20-CTF-600A**



6.3.4. CT cable dimensions



6.4. Installation and wiring

6.4.1. Overview of installation and wiring steps

Follow the procedure below for installation and wiring of terminal block adapter.
Using other procedures than below may make installation and wiring more difficult.

Important

- Before installing and wiring terminal block adapters, be sure to turn off the breaker and work without power.

Step 1

Remove the voltage connector from the terminal block adapter and the power/voltage connector from KM-N1-FLK and connect power cable.



Step 2

Attach power cable, CT cable, and output cable to terminal block adapter.



Step 3

Mount the terminal block adapter on the DIN rail.



Step 4

Mount KM-N1-FLK on the terminal block adapter.



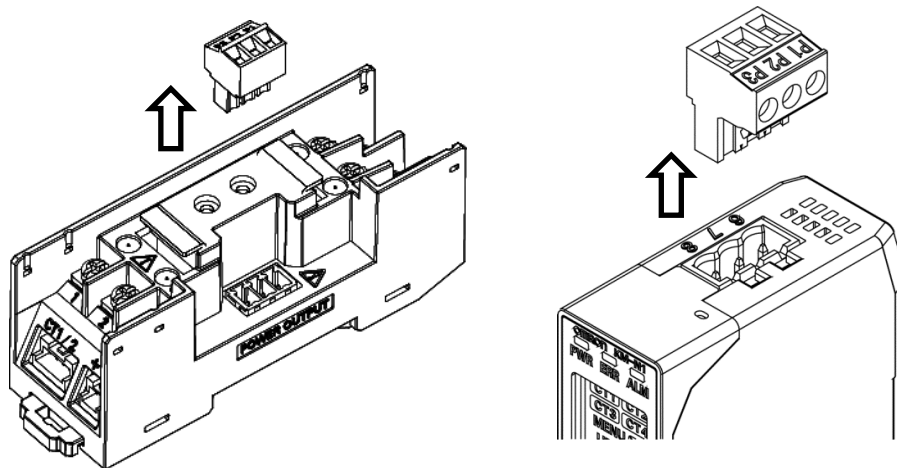
Step 5

Connect the power cable, CT cable, and output cable to KM-N1-FLK.

Refer to the followings for details of the steps.

6.4.2. Attaching terminal block adapter and connection cables

- ① Remove the voltage connector from the terminal block adapter and the power/voltage connector from KM-N1-FLK to connect power cable to those connectors.



<Terminal block adapter>

<KM-N1-FLK>

- ② Based on the phase-wire, fix the bundled power cable with a screw on the voltage connector of the terminal block adapter and power supply/voltage connector of KM-N1-FLK.

The voltage connectors on the terminal block adapter and KM-N1-FLK are marked P1, P2, and P3. Attach the same mark to each other on both connectors with a power cable.

Phase-Wire	P1	P2	P3
1-phase 2-wire	○	○	—
1-phase 3-wire	○	○	○
3-phase 3-wire	○	○	○

*) "○" represents terminals that need to be connected.

*) "—" represents terminals that do not need to be connected.

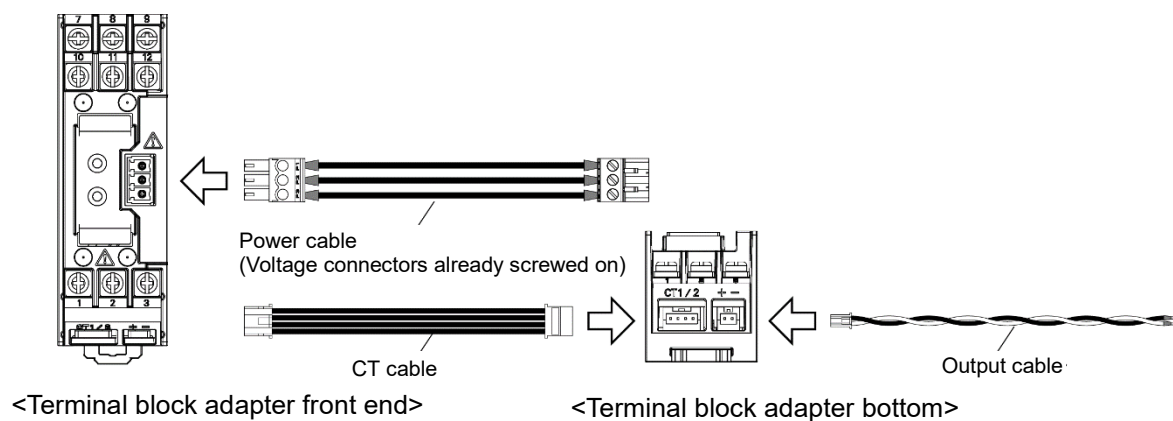
Described below are recommended tightening torque for each connector. Be sure to tighten the screws in accordance with the recommended torque.

- Terminal block adapter voltage connector screw: 0.2 to 0.25 N · m
- KM-N1-FLK power supply/voltage connector screw: 0.5 to 0.6 N · m

Important

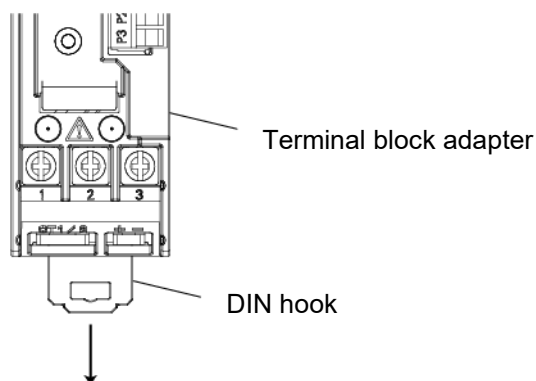
- Make sure there are no loose screws at the screw tightening points before use.

- ③ Attach power cable with the voltage connector attached, CT cable, and output cable to terminal block adapter.

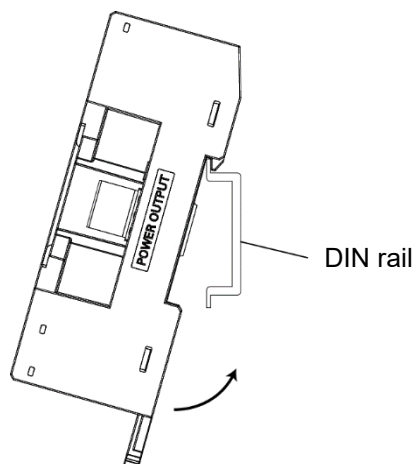


6.4.3. Installing terminal block adapter

- ① Install the DIN rail on the proper location.
Recommendation: PFP-50N/-100N (OMRON)
- ② Pull the DIN hook at the lower part of the terminal block adapter.

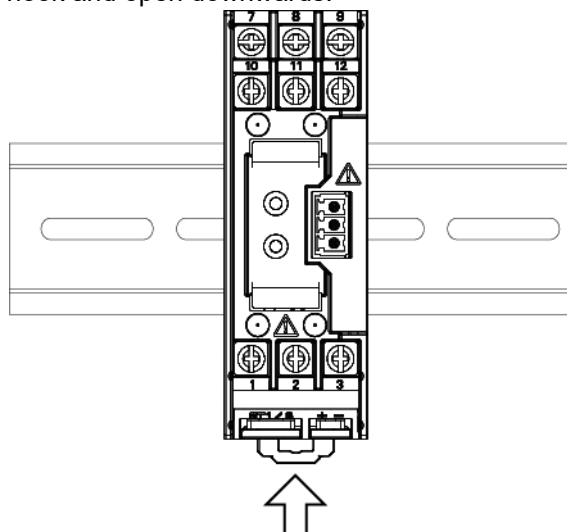


- ③ Hook the upper tab of the terminal block adapter on the DIN rail and fit in the product.



④ Raise the DIN hook and fix the terminal block adapter to the DIN rail.

* When removing the terminal block adapter from the DIN rail, use a flathead screwdriver to flick open the DIN hook and open downwards.



Important

- Ensure that the DIN rails and the terminal block adapter are attached properly. Looseness may cause the DIN rails, terminal block adapter, and wires to separate if vibrations or impacts occur.
- Make sure you install so there is space for wiring above and below the terminal block adapter.
- Make sure to turn off the breaker and work without power.

6.4.4. Wiring to terminal block adapter

<Wiring CTs>

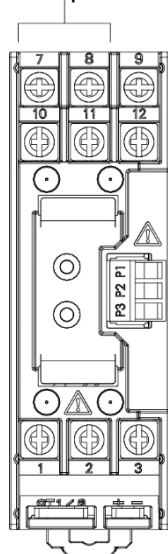
You can connect up to two (2) CTs to a terminal block adapter. The number of CTs to use depends on the phase-wire to measure. The table below shows the CT to use for each phase-wire and circuit.

Phase-Wire	Phase-Wire (abbr.)	Measuring circuit	
		Circuit A	Circuit B
1-phase 2-wire	1P2W	CT1	CT2
1-phase 3-wire	1P3W	CT1, CT2	
3-phase 3-wire	3P3W	CT1, CT2	

Unit numbers can be set for each circuit, as well as CT used individually. For multi-circuit measurement and setting steps, refer to "Chapter 3 How to Use KM-N1".

Wire the CT to the CT input terminal of the terminal block adapter. Shown below is the correspondence with the terminal number.

CT input terminal



Terminal No.	Details
7	k terminal of CT1
8	k terminal of CT2
10	l terminal of CT1
11	l terminal of CT2

The terminal screw diameter is M3.5 (3.5 mm). Described below is recommended tightening torque.

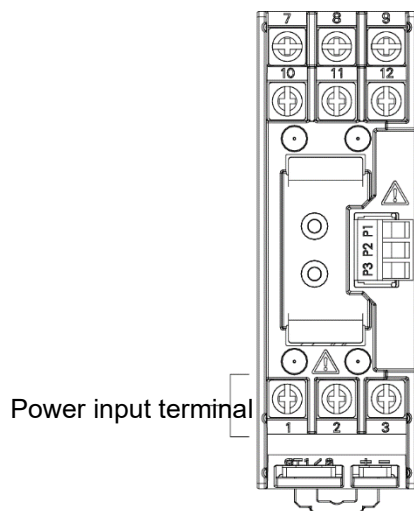
Be sure to tighten the screws in accordance with the recommended torque.

M3.5 terminal screw: 0.69 to 0.88 N · m

<Voltage wiring>

The layout of power supply input terminals is as follows. The No.1 and No.2 terminals serve as the operating power supply voltage and measurement voltage terminals for KM-N1-FLK.

Use them based on the phase-wire.



Power input terminal

Phase-Wire	Power input terminal No.		
	1	2	3
1-phase 2-wire	L	N	-
1-phase 3-wire	R	N	T
3-phase 3-wire	R	S	T

Terminal screw diameter is M3.5 (3.5 mm). Use crimp terminals suitable for M3.5.

Described below is recommended tightening torque for terminal screw.

Be sure to tighten the screws in accordance with the recommended torque.

M3.5 terminal screw: 0.69 to 0.88 N · m

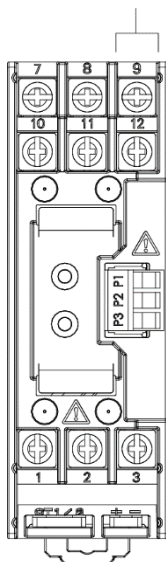
Important

- A circuit protector (CP) should be placed between the power supply input terminal and the wiring so that the power can be turned off immediately.
- For safety purposes, turn off the mains power and set the circuit protector to off to ensure there is no power supply while you are working.
- Wire correctly so the phase sequence is correct. You will be unable to measure the power and power consumption correctly if you fail to do so.
- After fixing the terminal screw with the recommended tightening torque, pull gently to confirm that the wiring is fixed firmly.

<Pulse output/RS-485 communication wiring>

The layout of pulse output/communications terminals is as follows. Either pulse output or RS-485 communications can be connected to the terminal block adapter.

Pulse output/communications terminal



Terminal No.	Pulse output	RS-485 communication
9	+	+
	(OUT1/2)	
12	COM	-

Terminal screw diameter is M3.5 (3.5 mm). Use crimp terminals suitable for M3.5.

Described below is recommended tightening torque for terminal screw.

Be sure to tighten the screws in accordance with the recommended torque.

M3.5 terminal screw: 0.69 to 0.88 N · m

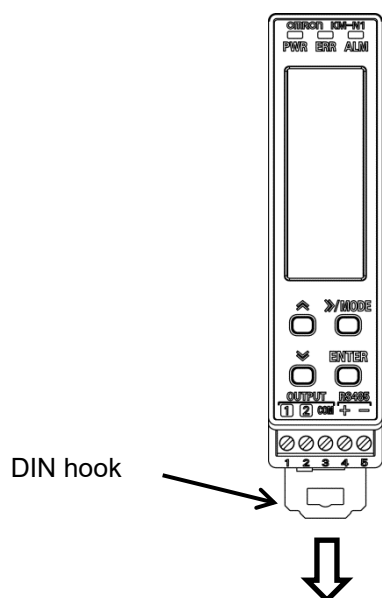
Use AWG28 or higher twisted-pair cable for hard wiring.

Important

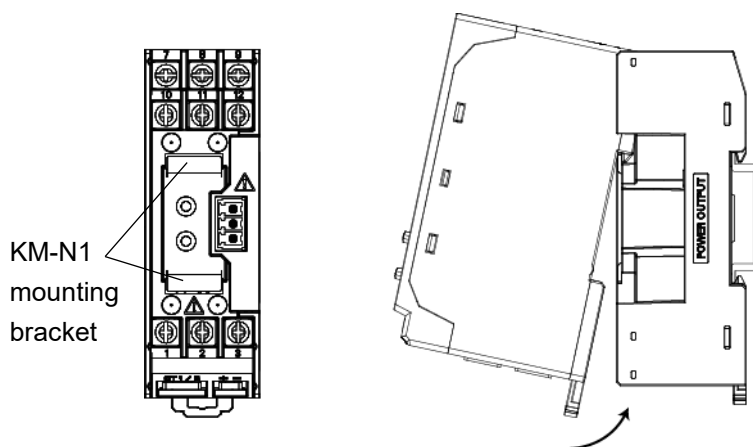
- Do not directly connect an external power source to pulse output + (OUT1/2) or COM. Make sure the load is connected.
- To avoid the influence of noise, use separate wiring for the signals and for the power.

6.4.5. Installing KM-N1-FLK

- ① Pull down the DIN hook at the lower part of KM-N1-FLK.

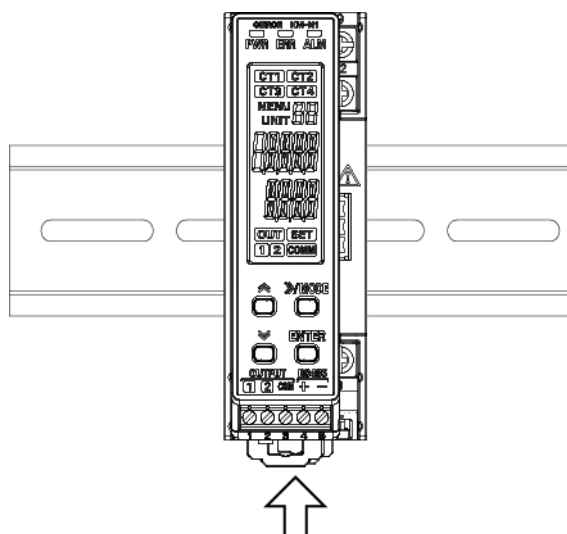


- ② Hook the upper tab of KM-N1-FLK on the KM-N1 mounting bracket of the terminal block adapter and fit in it.



③ Raise the DIN hook and fix KM-N1-FLK to the terminal block adapter.

* When removing KM-N1-FLK from the terminal block adapter, use a flathead screwdriver to flick open the DIN hook and open downwards.



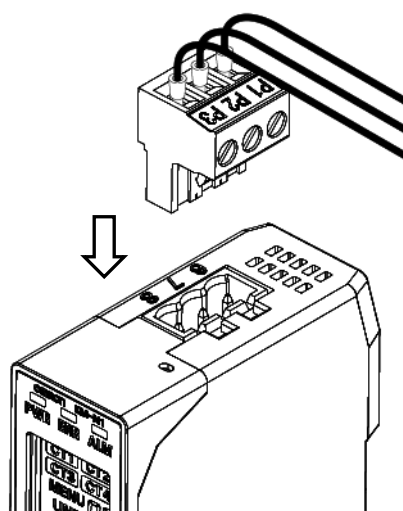
[Caution]

- Do not mount other things than KM-N1-FLK on the terminal block adapter.
- KM-N1-FLK and the terminal block adapter must be vertically oriented in order to be installed.

6.4.6. Connecting terminal block adapter and KM-N1-FLK

<Connecting power cable>

Insert the power/voltage connector of KM-N1-FLK to the connection block on KM-N1-FLK.

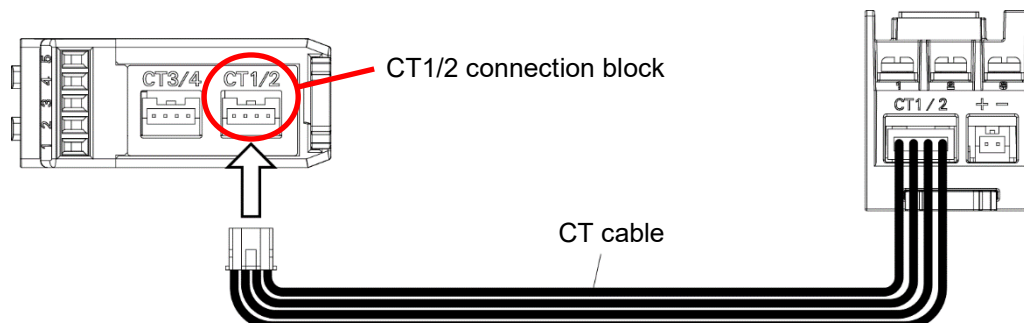


<Connecting CT cable>

Attach the other end of the CT cable, connected to the terminal block adapter, to the CT1/2 connection block of KM-N1-FLK.

When connecting to CT3/4 connector block, you cannot perform proper measurement.

<Terminal block adapter bottom>

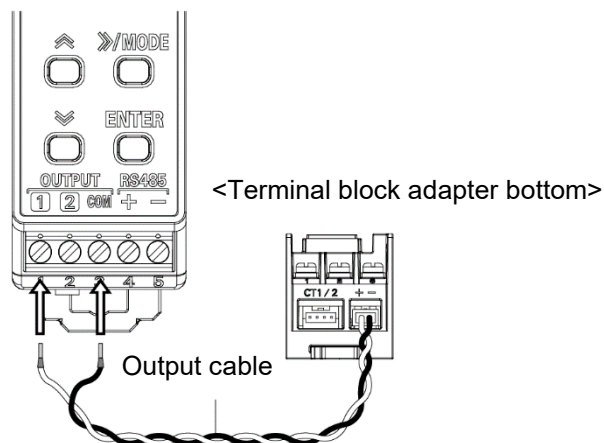
**<Connecting output cable>**

Attach the ferrule terminal end of the output cable, connected to the terminal block adapter, to either the pulse output terminal or RS-485 communications terminal of KM-N1-FLK.

To use pulse output, attach the white wire to OUTPUT1 or 2 and black to COM.

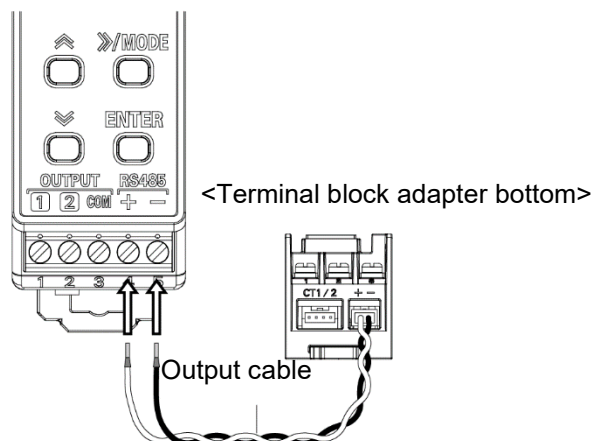
You can configure whether to use OUTPUT1 or OUTPUT2 on KM-N1-FLK main unit.

<KM-N1-FLK1 front end>



When RS-485 communication is to be used, attach the white wire to "+" and black to "-".

<KM-N1-FLK front end>



The screw diameter for KM-N1-FLK pulse output terminal and RS-485 communications terminal M2 (2 mm). Described below is recommended tightening torque.

Be sure to tighten the screws in accordance with the recommended torque.

M2 terminal screw: 0.22 to 0.25 N·m

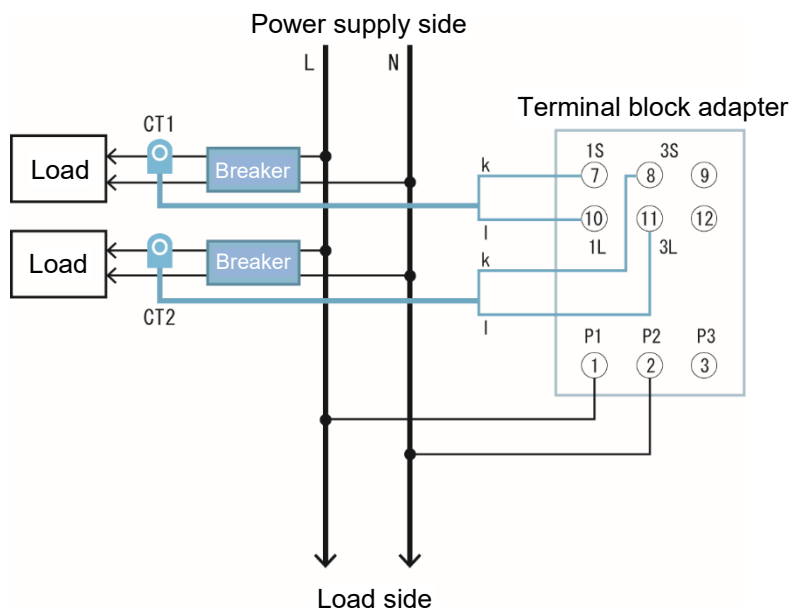
6.4.7. Wiring when using terminal block adapter

The below table shows the wiring for voltage, current, and CT by each phase and wire type.

<1-phase 2-wire>

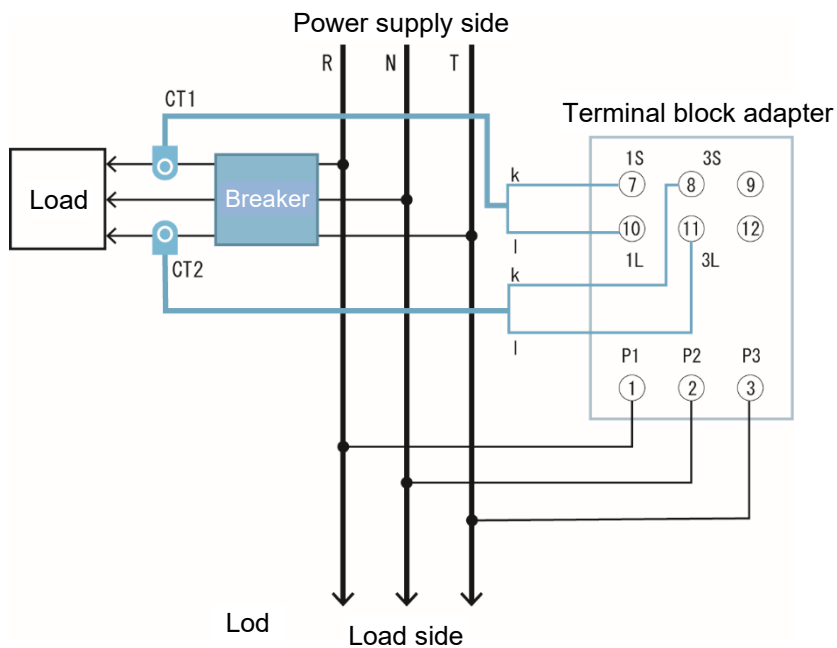
As shown below, 1-phase 2-wire can measure up to 2 circuits using a terminal block adapter.

The CT must be attached to the L-phase.

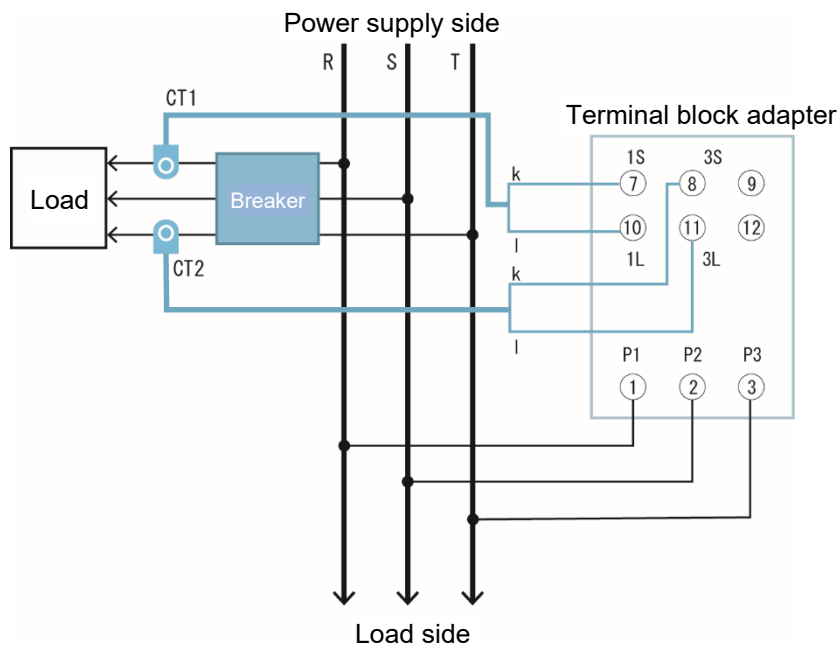


<1-phase 3-wire>

As shown below, 1-phase 3-wire can measure 1 circuit using a terminal block adapter. The CT must be attached to the R-phase and the T-phase.

**<3-phase 3-wire>**

As shown below, 3-phase 3-wire can measure 1 circuit using a terminal block adapter. The CT must be attached to the R-phase and the T-phase.



6.5. How to use KM20 mode

6.5.1. How to transition to KM20 mode

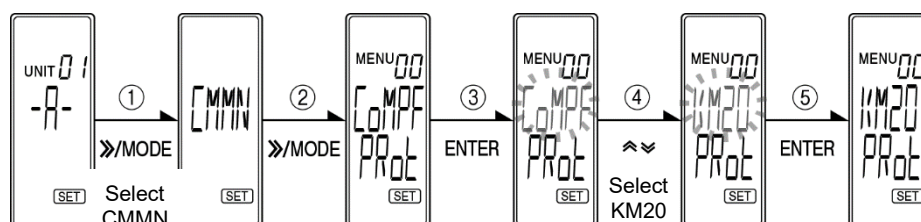
KM20 mode is entered by selecting "KM20" in the communication protocol selection.

Use the following steps for transition.

For basic operation and setting steps, refer to "Chapter 3How to Use KM-N1".

If a measured value is displayed, press and hold [>>/MODE] to enter the setting mode.

- ① Press [>>/MODE] to move to the common settings "CMMN" category display.
- ② Press [>>/MODE] again to transition to "**Protocol (MENU 00)**".
- ③ Press the [ENTER] key to enter the setting mode.
- ④ Press the Up or Down key to select "KM20".
- ⑤ Press the [ENTER] key to confirm your selection.



[Caution]

- Changing the protocol resets the unit number of each circuit to the initial value.

6.5.2. Measurement items in KM20 mode

You can perform the following measurement items in the KM20 mode. The measurement items in the table below are measured individually on a circuit-by-circuit basis, but the items measured differ depending on the phase-wire type.

Note that some items are displayed on the LCD and some can only be obtained through communication.

■ List of measurement data on a circuit basis

Type	Item	Details
Instantaneous value	Current I1	RMS current
	Current I2	RMS current (for 1P3W or 3P3W)
	Current I3	RMS current (calculated value for 1P3W or 3P3W)
	Current I1_max	Max value of I1 since the start of measurement
	Current I2_max	Max value of I2 since the start of measurement
	Current I1_min	Min value of I1 since the start of measurement
	Current I2_min	Min value of I2 since the start of measurement
	Voltage V1	RMS voltage: Between P1-P2
	Voltage V2	RMS voltage: Between P3-P2 (for 1P3W or 3P3W)
	Voltage V1_max	Max value of V1 since the start of measurement
	Voltage V2_max	Max value of V2 since the start of measurement
	Voltage V1_min	Min value of V1 since the start of measurement
	Voltage V2_min	Min value of V2 since the start of measurement
	Voltage V1-V2	RMS voltage: Between P1-P3 (for 1P3W or 3P3W)
	Frequency	Frequency obtained from voltage V1
Instantaneous power	Active power	Active power on a circuit basis
	Active power_max	Maximum value of active power on a circuit basis since the start of measurement
	Active power_min	Minimum value of active power on a circuit basis since the start of measurement
	Reactive power	Reactive power on a circuit basis
	Power factor	Power factor on a circuit basis
Integral value	Active power	Integral value if the active power is positive
	Regenerative power	Absolute integral value if the active power is negative
	Corresponding value	Value obtained by multiplying the integral active power by a specified coefficient

Shown below are measured data for each phase-wire type.

Some items are displayed on the LCD and some can only be obtained through communication.

■Phase-wire basis: Measured Data

		1P2W		1P3W		3P3W	
Type	Item	Display	Communication	Display	Communication	Display	Communication
Instantaneous value	Current I1	Yes	Yes	Yes	Yes	Yes	Yes
	Current I2			Yes	Yes	Yes	Yes
	Current I3			Yes		Yes	
	Current I1_max		Yes		Yes		Yes
	Current I2_max				Yes		Yes
	Current I1_min		Yes		Yes		Yes
	Current I2_min				Yes		Yes
	Voltage V1	Yes	Yes	Yes	Yes	Yes	Yes
	Voltage V2			Yes	Yes	Yes	Yes
	Voltage V1_max		Yes		Yes		Yes
	Voltage V2_max				Yes		Yes
	Voltage V1_min		Yes		Yes		Yes
	Voltage V2_min				Yes		Yes
	Voltage V1-V2			Yes		Yes	
	Frequency	Yes	Yes	Yes	Yes	Yes	Yes
Instantaneous power	Active power	Yes	Yes	Yes	Yes	Yes	Yes
	Active power_max		Yes		Yes		Yes
	Active power_min		Yes		Yes		Yes
	Reactive power	Yes		Yes		Yes	
	Power factor	Yes	Yes	Yes	Yes	Yes	Yes
Integral value	Active power	Yes	Yes	Yes	Yes	Yes	Yes
	Regenerative power	Yes		Yes		Yes	
	Corresponding value	Yes		Yes		Yes	

Shown below are measured data for each circuit in 1-phase 2-wire.

Some items are displayed on the LCD and some can only be obtained through communication.

■ 1-phase 2-wire (1P2W): Measured data for each circuit

		Circuit A		Circuit B	
Type	Item	Display	Communication	Display	Communication
Instantaneous value	Current I1	Yes	Yes	Yes	Yes
	Current I2				
	Current I3				
	Current I1_max		Yes		Yes
	Current I2_max				
	Current I1_min		Yes		Yes
	Current I2_min				
	Voltage V1	Yes	Yes	Yes	Yes
	Voltage V2				
	Voltage V1_max		Yes		Yes
	Voltage V2_max				
	Voltage V1_min		Yes		Yes
	Voltage V2_min				
	Voltage V1-V2				
	Frequency	Yes	Yes	Yes	Yes
Instantaneous power	Active power	Yes	Yes	Yes	Yes
	Active power_max		Yes		Yes
	Active power_min		Yes		Yes
	Reactive power	Yes		Yes	
	Power factor	Yes	Yes	Yes	Yes
Integral value	Active power	Yes	Yes	Yes	Yes
	Regenerative power	Yes		Yes	
	Corresponding value	Yes		Yes	

Shown below are measured data for each circuit in 1-phase 3-wire and 3-phase 3-wire. Some items are displayed on the LCD and some can only be obtained through communication. In KM20 mode, you can use circuit C on the KM-N1-FLK main unit by connecting a CT to the CT3/4 connector.

■ 1-phase 3-wire (1P3W), 3-phase 3-wire (3P3W): Measured data for each circuit

		Circuit A		Circuit B	
Type	Item	Display	Communication	Display	Communication
Instantaneous value	Current I1	Yes	Yes	Yes	Yes
	Current I2	Yes	Yes	Yes	Yes
	Current I3	Yes		Yes	
	Current I1_max		Yes		Yes
	Current I2_max		Yes		Yes
	Current I1_min		Yes		Yes
	Current I2_min		Yes		Yes
	Voltage V1	Yes	Yes	Yes	Yes
	Voltage V2	Yes	Yes	Yes	Yes
	Voltage V1_max		Yes		Yes
	Voltage V2_max		Yes		Yes
	Voltage V1_min		Yes		Yes
	Voltage V2_min		Yes		Yes
	Voltage V1-V2	Yes		Yes	
	Frequency	Yes	Yes	Yes	Yes
Instantaneous power	Active power	Yes	Yes	Yes	Yes
	Active power_max		Yes		Yes
	Active power_min		Yes		Yes
	Reactive power	Yes		Yes	
	Power factor	Yes	Yes	Yes	Yes
Integral value	Active power	Yes	Yes	Yes	Yes
	Regenerative power	Yes		Yes	
	Corresponding value	Yes		Yes	

Shown below are the possible ranges of each measured value in KM20 mode.

■ Measured data range in KM20 mode

Measurement item	LCD indication	Communication data
Current value	0.000 to 99999A	0 to 9999999 100x current value
Voltage value	0.000 to 9999.9V	0 to 9999999 10x voltage value
Frequency	45.0 to 65.0Hz	450 to 650 10x frequency value
Active power	-9999 to 99999kW Up to 3 decimal places	0 to 99999999 100x kW value
Reactive power		None
Power factor	-1.00 to 1.00	0 to 100; 100x power factor value
Active power	0.0 to 9999.9kWh or 0.00 to 999.99MWh	0 to 99999999 10x kWh value
Regenerative power		None
Corresponding value	0.000 to 99999M	None

6.5.3. Setting items in KM20 mode

Shown below are setting items available in KM20 mode.

Note that settings cannot be changed via communication.

■ Setting data

Category	Setting details		Attribute
Measurement	Phase-Wire	Select from 3 phase-wire types. Set at circuit A.	Individual circuit
	Circuit ON/OFF	Enable/Disable setting of measurement for circuits B and C	Individual circuit
	VT ratio	Magnification by voltage transformer	Common
	CT to use	Select the CT to be used	Individual circuit
	CT ratio	Magnification setting for 2-stage CT measurement when using 5ACT	Individual circuit
	Low-cut current	Boundary value to set the current value to 0	Individual circuit
	Simple measurement ON/OFF	Setting whether it is simple measurement or not	Individual circuit
	Simple measurement voltage	Fixed voltage value to be used for simple measurement	Individual circuit
	Simple measurement Power factor	Fixed power factor value to be used for simple measurement	Individual circuit
	Pulse terminal assignment	Set from which terminal to include in the output	Individual circuit
	Conversion rate	Coefficient used in the conversion	Common
	Conversion display unit	Characters of units to be displayed when converting	Common
	Misconnection detection	Enable/disable warning detection	Common
Display & operation	Display digits fixed	Setting to fix to the digits of the integral power consumption display	Common
	Auto LCD OFF	Disable automatic LCD off or set time to turn off	Common
Communication	Unit number	ID number to use for RS-485 communication	Individual circuit
	Protocol	Fixed to CompoWay/F if KM20 is selected	Common
	Communication speed	Select RS-485 baud rate	Common
	Data length	Select RS-485 data length	Common
	Stop bits	Select RS-485 stop bits	Common
	Parity	Select RS-485 parity	Common
	Time to wait for sending	Set time to wait for sending a response	Common
	Pulse output unit	Set the unit power consumption to output pulses	Common

Shown below are the setting items and details for each circuit.

Underlines indicate default values.

■ Individual circuit setting

Item	Type	Details
Phase-Wire	Selective	Select phase-wire 1-phase 2-wire : "1P2W" 1-phase 3-wire : "1P3W" 3-phase 3-wire : "3P3W"
Circuit ON/OFF	Selective	Available only in circuits B and C. <u>OFF</u> : "OFF" ON : "ON"
Unit number	Numerical value	CompoWay/F: 00 to 99, Disabled "---" *) Protocol is CompoWay/F in KM20 mode. Initial value: 01 for circuit A, Disabled "--" for the others
CT to use	Selective	Select the type of CT to use. 5A rated CT : "5A" 50A rated CT : "50A" <u>100A rated CT</u> : "100A" 225A rated CT : "225A" 400A rated CT : "400A" 600A rated CT : "600A" *) To use 200A CT, select "225A".
CT ratio	Numerical value	Coefficient for CT measurement when 5ACT is used <u>1.0</u> to 9999.9
Low-cut current	Numerical value	Boundary value at which the current value is set to zero, expressed as % of rated A 0.1 to 19.9%; <u>Initial value = 0.6</u>
Simple measurement ON/OFF	Selective	ON or OFF of simple measurement <u>OFF</u> : "OFF" ON : "ON"
Simple measurement voltage	Numerical value	Assumed voltage value to be used for simple measurement 0.0 to 9999.9V; <u>Initial value = 100.0</u>
Simple measurement Power factor	Numerical value	Assumed power factor value to be used for simple measurement 0.00 to <u>1.00</u>
Pulse terminal assignment	Selective	Set whether to output from OUT1 or OUT2. <u>OFF</u> : "OFF" OUT1 : "OUT1" OUT2 : "OUT2"

Shown below are the common setting items and details for the circuits.
Underlines indicate default values.

■ Common setting

Item	Type	Details
VT ratio	Numerical value	Set voltage ratio based on VT <u>1.00</u> to 99.99
Conversion rate	Numerical value	Coefficient used in the conversion 0.000 to 99.999; <u>Initial value = 10.000</u>
Conversion display unit	Character	Unit used in the conversion value display 3 alphabet characters, <u>Initial value = JPY</u>
Misconnection detection	Selective	Set ON/OFF of the misconnection warning function OFF : "OFF" ON : "ON"
Display digits fixed	Selective	Set ON/OFF of the function to fix the display digits of integral power consumption to kWh OFF : "OFF" kWh : "KWH" MWh : "MWH"
Auto LCD OFF	Selective	Set time to turn OFF LCD backlight OFF : "OFF" 1 minute : "1.0" <u>5 minutes : "5.0"</u> 10.0 minutes : "10.0"
Protocol	Selective	If KM20 is selected, the protocol is CompoWay/F
Communication speed	Selective	Select RS-485 communication baud rate 1200 bps : "1.2k" 2400 bps : "2.4k" 4800 bps : "4.8k" <u>9600 bps : "9.6k"</u> 19200 bps : "19.2k" 38400 bps : "38.4k"
Data length	Selective	Select RS-485 communication data length <u>7 bits : "7"</u> 8 bits : "8"
Stop bits	Selective	Select RS-485 communication stop bits 1 bit : "1" <u>2 bits : "2"</u>
Parity	Selective	Select RS-485 communication parity None : "NONE" Odd : "ODD" <u>Even : "EVEN"</u>
Time to wait for sending	Numerical value	Set time to wait for sending a response 0 to 99; <u>Initial value = 20</u>
Pulse output unit	Selective	Set the unit power consumption to output pulses 1Wh : "1" 10Wh : "10" <u>100Wh : "100"</u> 1kWh : "1k" 2kWh : "2k" 5kWh : "5k" 10kWh : "10k" 20kWh : "20k" 50kWh : "50k" 100kWh : "100k"

6.6. Communications specifications in KM20 mode

6.6.1. Communications overview

Shown below are communications specifications in KM20 mode. The protocol is CompoWay/F in KM20 mode.

(Those indicated gray are initial values)

Communications protocol	CompoWay/F
Connection type	Multidrop (1:N)
Communication type	2-wire half-duplex
Sync method	Start-stop synchronization
Baud rate	2.4, 4.8, 9.6, 19.2, 38.4 kbps
Transmission code	ASCII
Data bit length	7, 8 bits
Stop bits	1, 2 bits
Error checking	Vertical parity (none even, odd) BCC
Flow control	None
Interface	RS-485
Retry function	None
Communication response Time to wait for sending	0 to 99 (ms), initial value = 20 (ms)
Communication buffer	230 (bytes)

6.6.2. CompoWay/F (KM20 mode)

The communication protocol is CompoWay/F in KM20 mode. This chapter describes details only on what is different from CompoWay/F of KM-N1-FLK (with CompoWay/F selected in the protocol) when in KM20 mode.

*) CompoWay/F of KM-N1-FLK is hereafter called "N1 mode".

6.6.3. Data format

See "5.2.1 Data format".

6.6.4. PDU (Protocol Data Unit) configuration

See "5.2.2 PDU (Protocol Data Unit) configuration".

6.6.5. Type code

In KM20 mode, the variable area type code differs from that in N1 mode.
The parameter area type code is the same.

■ Variable area in KM20 mode

Variable type code	Details
C0	Present value of measurement
C2	Maximum value of voltage, current, and active power
C3	Minimum value of voltage, current, and active power

6.6.6. List of services

Supported services are the same as in N1 mode. (See "5.2.4 List of services")
However, since the details of Read unit properties, Read controller status, and Operation commands are different, they are described in the "6.6.8 Service details" section.

6.6.7. End code list

Same as in N1 mode in case of normal end.
Shown below are codes when an error occurs.

■ On error occurrence

Code	Name	Details	Priority
0F	FINS command error	Non-executable FINS command	3
14	Format error	Other than 0 to 9 or A to F used The format is invalid	2
16	Sub-address error	Sub-address is illegal	1

6.6.8. Service details

Basically the same as in N1 mode. See "5.2.6 Service details" for details.
However, since the details of Read unit properties, Read controller status, and Operation commands are different, they are described in this section.

■ Read unit properties (0503)

In KM20 mode, the service response PDU differs from that in N1 mode as shown below.
The response code is the same as that in N1 mode.

Service response PDU in KM20 mode

MRC		SRC		Response code				Model										Buffer size			
0	5	0	3	*	*	*	*	K	M	2	0	-	B	4	0			0	0	E	6

■ Read controller status (0601)

In KM20 mode, the related information differs from that in N1 mode.

The response code is the same as that in N1 mode.

Service response PDU in KM20 mode

MRC		SRC		Response code				(1) Operational state		(2) Related information	
0	6	0	1	*	*	*	*	*	*	*	*

(1) Operational state

Operational state	Details
00	Measuring without error
01	Error occurred and measuring stopped

(2) Related information

Bit position	Meaning	Details
B0	None	0 (fixed)
B1	None	0 (fixed)
B2	None	0 (fixed)
B3	None	0 (fixed)
B4	None	0 (fixed)
B5	None	0 (fixed)
B6	Voltage input insufficient	0: No warning, 1: Warning
B7	None	0 (fixed)

*) In KM20 mode, a warning is issued if the voltage V1 falls below 85V, even in 1-phase 2-wire.

■ Operation command (3005)

Shown below are operation commands available in KM20 mode.

"Move to measuring mode", "Move to setting mode", and "Reset to factory defaults" in N1 mode are not supported.

Also, "Reset maximum measured value" and "Reset minimum measured value" are not accepted in N1 mode.

Service request PDU and response PDU are the same as in N1 mode.

List of KM20 mode-supported commands

Command code	Related information	Command details
03	00	Reset integral power (individual)
12	00	Reset maximum measured value
13	00	Reset minimum measured value
99	00	Reset software

<Reset maximum/minimum measured value>

Voltage, current, and active power values are reset.

- Reset maximum value

On reset, the maximum value is set to 0, respectively.

- Reset minimum value

When reset, each measured value is reset to the maximum value that the measurement can take.

6.6.9. Response code

The following response codes, which were supported by KM20-B40-FLK, are not supported in KM20 mode.

- 1104: End address out of range

As with KM20-B40-FLK, if the response length exceeds 120 bytes, "110B: Response too long" is returned.

6.6.10. Address map (KM20 mode)

Shown below are the address maps of measured values in KM20 mode. Address values are hexadecimal.

■ Address map of measured values

Variable type	Address	Type	Item	R/W
C0	0000	Measured value (Instantaneous value)	Voltage V1 (10x V value)	R
	0001		Voltage V2 (10x V value)	R
	0002		Current I1 (100x A value)	R
	0003		Current I2 (100x A value)	R
	0004		Active power (100x kW value)	R
	0006		Power factor (100x value)	R
	0007		Frequency (10x Hz value)	R
	0008	Measured value (integral)	Integral power consumption (10x kWh value)	R
	000A	Set value	Status information	R
	000B		Software version (e.g.) "00000100"H > ver.1.00	R
C2	0000	Measured value (maximum)	Voltage V1 (10x V value)	R
	0001		Voltage V2 (10x V value)	R
	0002		Current I1 (100x A value)	R
	0003		Current I2 (100x A value)	R
	0004		Active power (100x kW value)	R
C3	0000	Measured value (minimum)	Voltage V1 (10x V value)	R
	0001		Voltage V2 (10x V value)	R
	0002		Current I1 (100x A value)	R
	0003		Current I2 (100x A value)	R
	0004		Active power (100x kW value)	R

Shown below is the relationship between phase-wire of V1, V2, I1, as well as I2 and data.

Item	1P2W	1P3W	3P3W	Meaning
V1	Yes	Yes	Yes	1P2W, 1P3W: R-phase voltage, 3P3W: R-S voltage) Equivalent to P1-P2 voltage in KM20
V2	-	Yes	Yes	1P3W: T-phase voltage, 3P3W: S-T voltage) Equivalent to P2-P3 voltage in KM20
I1	Yes	Yes	Yes	R-phase current
I2	-	Yes	Yes	T-phase current

Shown below are the address maps of setting values in KM20 mode.

■ Address map of setting values

Address	Type	Item	R/W
0004	Unit (individual)	CT ratio 10 to 99999 (10x ratio of primary current and secondary current)	R
0005		Low-cut current 1 to 199 (10x percentage to CT rating)	R
0019		CT to use H'00000000: 5A H'00000001: 50A H'00000002: 100A H'00000003: 200A *) H'00000004: 400A H'00000005: 600A *) Display on main unit is 225A.	R
0003	Unit common	VT ratio 100 to 99999 (100x VT ratio value)	R
0012		Node number 00 to 99	R
0013		Communication speed 0 : 1200 bps 1 : 2400 bps 2 : 4800 bps 3 : 9600 bps 4 : 19200 bps 5 : 38400 bps	R
0014		Data length 0 : 7 bits 1 : 8 bits	R
0015		Stop bits 0 : 1 bit 1 : 2 bits	R
0016		Parity 0 : NONE 1 : ODD 2 : EVEN	R
0017		Time to wait for sending (0 to 99) Waiting time in ms	R
001A		Priority type 1 : Software enabled *) Fixed to "1" due to absence of DIP switch	R

6.7. Communication with host device in KM20 mode

As the address map in KM20 is the same as that for KM-N1-FLK, there is no need to change the address to acquire measurement values in a host device, and the system can continue to be used as is.

6.7.1. List of supported host devices

Shown below are the host devices and software supported in KM20 mode and other modes than KM20 mode.

For how to use those host devices and software, refer to respective user's manual.

Host device (software)	KM20 mode	Other than KM20 mode
EQ100	Yes	Yes
EW700 series	Yes	No
ZN-KMX21	Yes	Yes
CJ series	Yes	Yes
Easy KM Manager	Yes	No
KM-N Setting Tool	No	Yes

6.7.2. Cautions for communication with host device in KM20 mode

①Select "KM20-B40" as the power monitor model

When selecting a model when creating a project, such as EQ100, select "KM20-B40" in KM20 mode.

To select a model in other mode than KM20 mode, select "KM-N1-FLK".

②Setting values cannot be changed by host devices

In KM20 mode, the address map of the setting values is Read Only and you cannot change the setting values via communication.

③Display of CT ratio and VT ratio

In KM20 mode, the CT ratio and VT ratio settings differ from those of KM20-B40.

Therefore, when the set values are loaded in software such as Easy KM Manager, the CT and VT ratios may not be displayed in the software.

Chapter 7. Troubleshooting

7.1. Alert list.....	7-2
7.2. Troubleshooting.....	7-3

7.1. Alert list

Warnings come as errors and alarms. The types of errors and alarms are described below.

Warning type		Details	Output		Action to take
			LCD	LED	
Error	Set value error	Internal memory corrupted	E-M1	ERR LED flashing	Repair is necessary. Contact the place of purchase or the manufacturer.
	Measured value error	Internal memory corrupted	E-M2		
	Calibration value error	Calibration value corrupted	E-M3		
Alarm	Input frequency warning	Frequency is outside the range of the rated value.	A-F1	ALM LED flashing	Input the power supply voltage of the frequency within the rating
	Misconnection warning	• P3 voltage of less than the rated value. • The phase order is reversed.	A-W1		Check the set phase-wire and voltage input.
	Pulse 1 output warning	• Pulse 1 is output again while pulse 1 is being output. • Pulse 1 is output during the pulse 1 OFF retention period	A-P1		Change the pulse output unit so that pulses are not output while other pulses are being output nor during OFF retention period.
	Pulse 2 output warning	• Pulse 2 is output again while pulse 2 is being output. • Pulse 2 is output during the pulse 2 OFF retention period	A-P2		

* To cancel the alarm, take the actions described to remove the cause, then reset the main unit.

Ref: 4.13 Reset (P4-16)

7.2. Troubleshooting

Check if an issue is covered by the following items if KM-N1 doesn't seem to be working correctly.

Phenomena	Details	Action to take	Refer to P.
The main unit doesn't start.	The power LED is off.	Power is not supplied. Check that the hard wiring is done to the power supply/voltage connector and that the supplied voltage is within the rating.	2-5
	Power LED is lit but LCD is OFF.	The power saving mode is working. Pressing any key turns on the LCD again.	4-11
Cannot measure voltage	Are voltage connection and phase sequence correct?	Check that the voltage connection is correct for the selected phase-wire.	2-11
	In the phase-wire, is 1P3W2 (1-phase 3-wire composite) or 1P2W2 (1-phase 2-wire voltage option) selected?	If you selected 1P3W2 or 1P2W2 phase-wire, set the voltage assignment of branched 1-phase 2-wire properly.	4-4
Cannot measure current	Is a dedicated CT connected?	Connect the dedicated CT to the main unit. Also, make sure that the CT is attached to the wire.	2-4
	Are you measuring a microcurrent (current close to 0A)?	To measure a very small current compared to the rated value of the dedicated CT, check the current low cut value. It may be forcibly set to 0.	4-3
	Does the circuit to measure match the dedicated CT connector?	The circuits A and B use CT1/2 while C and D use CT 3/4. Properly connect them based on the connection diagram.	2-4
Voltage and current can be measured but power cannot be.	Isn't the dedicated CT installed in a reversed direction?	If you are measuring negative power, all the dedicated CTs installed may be installed in reverse. Or, if you are measuring power close to 0, the dedicated CT on one side may be installed in reverse.	2-10
	Is the voltage phase sequence correct?	If the voltage phase sequence is not correct, power cannot be measured. If the function for warning about miss-wiring is on, "A-W1VR" is displayed. Wire all connections correctly.	2-11, 4-12
	In the phase-wire, is 1P3W2 (1-phase 3-wire composite) or 1P2W2 (1-phase 2-wire voltage option) selected?	If you selected 1P3W2 or 1P2W2 phase-wire, set the voltage assignment of branched 1-phase 2-wire properly.	4-4

There is a large discrepancy in measured values	Is the wiring proper for the phase-wire?	Wire all connections correctly.	2-11
	Does the rating of the dedicated CT match that of the configured CT?	Check the rating of the dedicated CT to use and set the proper rating.	1-4
		If you perform multipoint measurement, you must set CT rating for each circuit.	3-16
		In multipoint measurement, CT1/2 corresponds to the circuits A and B while CT 3/4 to C and D. Make sure that the rating of connected CT matches that of the CT configured for each circuit.	3-16
	Is the specified rating within that of the dedicated CT?	Check the rating of the dedicated CT. The dedicated CT must be suitable for the rated current of the circuit to measure.	1-4
	Is the phase-wire setting correct?	Check the phase-wire of the circuit to measure and set it properly if not.	3-13
The unit cannot transition to the setting mode.	Isn't the mode lock enabled?	Press and hold the UP and ENTER keys simultaneously to cancel the mode lock.	4-16
Pulse is not output	Is the pulse output wiring correct?	Wire all connections correctly.	2-7
	Is the pulse output assignment set for each circuit?	You need to set each circuit to which pulse output (1 or 2). The initial value is OFF (no pulse output). Check if it is set.	3-15
	Is the pulse output unit too large for the integral active power?	If the pulse output units are too large for the increases in integral power consumption, the interval between pulse outputs will be wide. Reduce the pulse output units.	3-22
RS-485 communications not possible	Are all connections wired correctly?	Wire all connections correctly.	2-9
	Are the communications settings correct?	Check that the communications settings of the KM-N1 main unit match those of the host system.	3-18
	Is a terminating resistor installed?	Attach a terminal resistor of 120Ω (1/2 W) to the end of KM-N1.	2-9
	Have you not connected the units beyond the maximum number of units you can connect on the same line?	The maximum number of units you can connect when the protocol is CompoWay/F the maximum is 31 and when the protocol is Modbus is 99 units (the parent device is not included in either of these numbers).	2-9
	Have you set separate unit number for each circuit?	Make sure the unit numbers do not duplicate across circuits when using multipoint measurement. Also, if you connect two (2) or more KM-N1 units, assign separate unit number to each circuit.	3-14, 3-16
Voltage cannot be measured when using terminal block adapter	Are the connections to the power cable and voltage connectors correct?	Connect the voltage connectors P1, P2, and P3 on KM-N1-FLK to those on the terminal block adapter.	6-16
	Are voltage connection and phase sequence to the terminal block adapter correct?	Check that the voltage connection is correct for the selected phase-wire.	6-20

Current cannot be measured when using terminal block adapter	Are current connection to the terminal block adapter correct?	Check that the dedicated CT connection is correct for the selected phase-wire.	6-20, 6-24
	For the connection to KM-N1-FLK, is the CT cable connected to the CT1/2 connector block?	When a terminal block adapter is used, circuits A and B are used.	6-23
Communications not available in KM20 mode	Are the communication wires correctly connected to the terminal block adapter?	Wire all connections correctly.	6-20
	Are the communications settings correct?	The protocol is CompoWay/F in KM20 mode. Check that other communication conditions also match those of the host system.	6-35
Unable to change setting values via communication when in KM20 mode	You cannot change setting values via communication in KM20 mode.	Operate the KM-N1-FLK main unit directly to change the settings.	3-13

Chapter 8. Appendix

8.1. Specifications	8-2
8.2. ASCII code table.....	8-6
8.3. 11-segment display.....	8-8

8.1. Specifications

■ Main unit specifications

Item	Details
Rated input voltage (Common for power supply voltage)	1-phase 2-wire: 100 to 240 VAC : Line voltage 1-phase 3-wire: 100/200 VAC : Phase voltage/Line voltage 3-phase 3-wire: 100 to 240 VAC : Line voltage
Rated frequency	50/60 Hz
Allowable power supply voltage range	85 to 110% of rated supply voltage
Power consumption	5 VA max.
Ambient operating temperature	-10 to 55°C (with no icing or condensation)
Ambient operating humidity	25 to 85%RH
Storage temperature	-25 to 65°C (with no icing or condensation)
Storage humidity	25 to 85%RH
Withstand voltage	1) Between electric circuit and case: 1500 VAC for 1 minute 2) Between power supply & voltage input and RS-485 & OUTPUT1/2 & OUTPUT common: 1500 VAC for 1 minute
Insulation resistance	1) Between electronic circuitry and case: 20 MΩ max. (at 500 VDC megger) 2) Between the set of power and voltage inputs and the set of communication terminals and pulse output terminals: 20 MΩ max. (at 500 VDC megger)
Vibration resistance	Single amplitude: 0.1 mm, Acceleration: 15 m/s ² Frequency: 10 to 150 Hz, 10 sweeps for 8 minutes along the three axes
Shock resistance	150 m/s ² , 3 times each in the up, down, left, right, forward, and back directions
Electromagnetic environment	Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)
Display & operation	LED, LCD indication, Operation button (Main unit front end: Up, Down, >>/MODE, ENTER) Reset switch (main unit top)
Weight	Approx. 130 g (packaged), Approx. 80 g (main body only)
Mounting	Attaching the DIN rail
Altitude	2000 m max.
Installation environment	Overvoltage category and measurement category: II, Pollution level: 2
Applicable standards	EN/IEC 61010-1, EN/IEC 61010-2-030, EN/IEC 61326-1
Accessories	User's Manual, terminating resistor

■ Measurement specifications

Item		Details
Accuracy (Note 1) (Note 2)	Voltage (Note 3)	$\pm 0.5\% \text{F.S.} \pm 1 \text{ digit}$
	Current (Note 4)	$\pm 0.5\% \text{F.S.} \pm 1 \text{ digit}$
	Power consumption	$\pm \pm 1.0\% \text{F.S.} \pm 1 \text{ digit}$ (Power factor=1)
	Frequency	$\pm 0.2 \text{ Hz} \pm 1 \text{ digit}$
Temperature effect (Note 5)		$\pm 1.0\% \text{F.S.}$
Frequency effect (Note 6)		$\pm 1.0\% \text{F.S.}$
Harmonic wave effect (Note 7)		$\pm 0.5\% \text{F.S.}$
Measurement frequency		80 ms (at 50 Hz), 66.7 ms (at 60 Hz)
Function		Simple measurement, Current low-cut value (0.1 to 19.9%), Conversion

Note 1. Not including of error of dedicated CT.

Note 2. Value at ambient temperature of 23°C, rated input, rated frequency

Note 3. R-T voltage in the same condition: $\pm 1.0\% \text{F.S.} \pm 1 \text{ digit}$

Note 4. S-phase current of 3-phase 3-wire and N-phase current of 1-phase 3-wire in the same condition: $\pm 1.0\% \pm 1 \text{ digit}$

Note 5. Measured value ratio at ambient temperature of 23°C, rated input, rated frequency, power factor of 1 within the range of operating temperature

Note 6. Measured value ratio at ambient temperature of 23°C, rated input, rated frequency, power factor of 1 within $\pm 5 \text{ Hz}$ of the rated frequency

Note 7. Error when superimposing harmonic wave of 2nd, 3rd, 5th, 7th, 9th, 11th and 13th orders with the content rate of 30% in current and 5% in voltage on fundamental wave at ambient temperature of 23°C

■ Input specifications

Item	Details
Applicable circuit type	1-phase 2-wire, 1-phase 3-wire, 3-phase 3-wire
Number of measuring circuits	1-phase 2-wire: 4 circuits max., 1-phase 3-wire, 3-phase 3-wire: 2 circuits max.
Rated input voltage	100 to 240 VAC [1-phase 2-wire] : Line voltage 100/200 VAC [1-phase 3-wire] : Phase voltage/Line voltage 100 to 240 VAC [3-phase 3-wire] : Line voltage
VT ratio	1.00 to 99.99 (can be set in setting mode) * When the measurement of the load more than 240VAC (allowable measurement voltage), an external transformer (VT) is necessary.
CT ratio	1.0 to 9999.9 (can be set in setting mode) * It is possible to set when "5A" in selected for the CT to use. Set the ratio of the primary current and the secondary current.
Rated input current	Dedicated CT (5/50A, 100A, 225A, 400A, 600A)
Allowable input current	120% of rated input current (110% for 225A only)
Rated input power	2/20kW at 5/50ACT, 40kW at 100ACT, 90kW at 225ACT, 160kW at 400ACT, 240kW at 600ACT * The values are for 3-phase 3-wire. The rated input power according to the phase-wire can be calculated by the following formula. 1-phase 2-wire: 240 (V) x CT-to-use rated current (A) 1-phase 3-wire: 100 (V) x CT-to-use rated current (A) x 2 3-phase 3-wire: 240 (V) x CT-to-use rated current (A) x $\sqrt{3}$

■ Terminal block adapter specifications

Item	Details
Rated input voltage	100 to 240 VAC
Allowable input voltage range	85 to 110% of rated input voltage
Ambient operating temperature	-10 to 55°C (with no icing or condensation)
Ambient operating humidity	25 to 65%RH
Storage temperature	-25 to 65°C (with no icing or condensation)
Withstand voltage	Between electric circuit and case: 1500 VAC for 1 minute Between voltage input terminal and pulse/communication terminal: 1500 VAC for 1 minute
Insulation resistance	Between total electronic circuitry and case: 20M Ω max. (at 500 VDC megger) Between voltage input terminals and pulse/communication terminal: 20M Ω max. (at 500 VDC megger)
Vibration resistance	Single amplitude: 0.1 mm, Acceleration: 15 m/s ² , Frequency: 10 to 150 Hz 10 sweeps for 8 minutes along the 3 axes
Shock resistance	150 m/s ² , 3 times each in the up, down, left, right, forward, and back directions
Weight	Approx. 105 g (packaged), Approx. 60 g (terminal block and adapter only)
Mounting	Attaching the DIN rail
Applicable standards (Note)	None
Altitude	2000 m max.
Installation environment	Overvoltage category and measurement category: II, Pollution level: 2
Accessories	User's Manual (this document), power cable for terminal block adapter, CT cable for terminal block adapter, output cable for terminal block adapter

Note. Although KM-N1-□□□ is a CE marked product, it is not subject to CE marking when used with this product.

■Output specifications

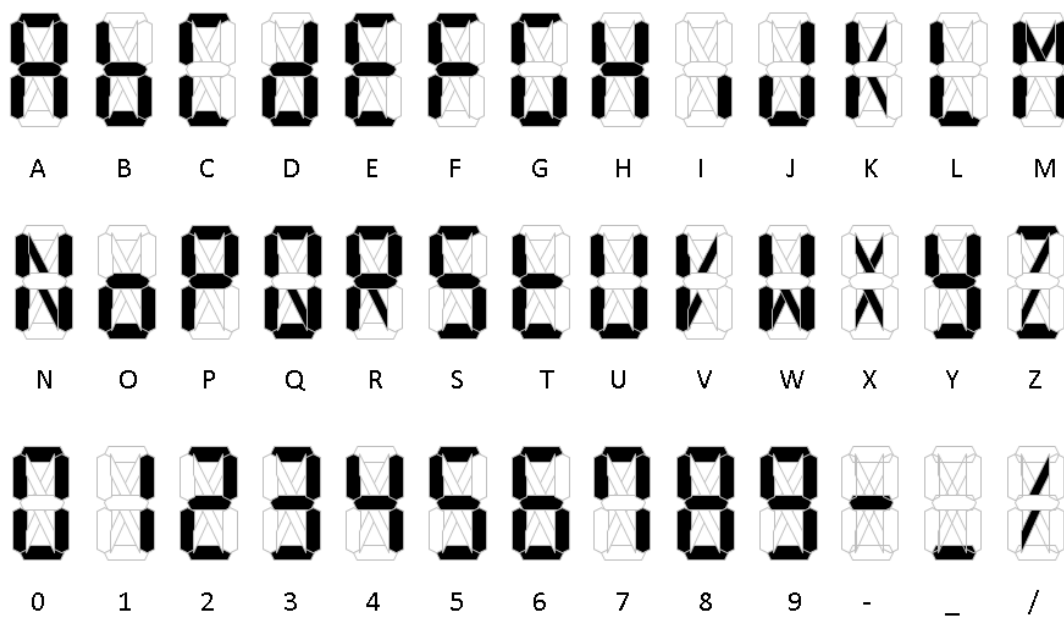
Item	Details	
Pulse output (Integral active power)	Number of output points	: 2 points (NPN open collector output)
	Output capacity	: 30 VDC, 30 mA max.
	Residual voltage when ON	: 1.2 V max.
	Current leakage when OFF	: 0.1 mA max.
	Output units	: 1, 10, 100, 1k, 2K, 5k, 10k, 20k, 50k, 100k (Wh)
	Pulse ON time	: 500 ms fixed
RS-485	Protocol	: CompoWay/F, Modbus (RTU) (KM-N1-FLK) BACnet MS/TP, Modbus (RTU) (KM-N1-BAC)
	Sync method	: Start-stop synchronization
	Communication speed	: 1.2, 2.4, 4.8, 9.6, 19.2, 38.4 kbps (CompoWay/F, Modbus) 9.6, 19.2, 38.4 kbps (BACnet MS/TP)
	Data bit length	: 7, 8 bits (CompoWay/F) 8 bits fixed (BACnet MS/TP, Modbus)
	Stop bits	: 1, 2 bits (CompoWay/F, Modbus) * Depending on parity in case of Modbus 1 bit (fixed)(BACnet MS/TP)
	Parity	: None, even, odd (CompoWay/F, Modbus) None (fixed)(BACnet MS/TP)
	Time to wait for sending	: Valid setting range 0 to 99 ms (all protocols) KM-N1-FLK initial value = 20 ms KM-N1-BAC initial value = 1 ms
	Max. transmission distance	: 1200 m
	Maximum number of units to connect	: 31 units (CompoWay/F), 99 units (BACnet MS/TP, Modbus) When measuring more than one circuit with one unit, the number of circuits is treated as the number of connected units.
LED indication	Green: Power Red: Error Orange: Alarm	
LCD indication	Numerical/character: 11-segment 2-line display Other symbols: CT number, unit No./menu No., status display Measured value display: Refreshing in 500 ms	

8.2. ASCII code table

Binary	Decimal	Hexadecimal	Character	Binary	Decimal	Hexadecimal	Character
0000000	0	0	NUL	0100000	32	20	SP
0000001	1	1	SOH	0100001	33	21	!
0000010	2	2	STX	0100010	34	22	"
0000011	3	3	ETX	0100011	35	23	#
0000100	4	4	EOT	0100100	36	24	\$
0000101	5	5	ENQ	0100101	37	25	%
0000110	6	6	ACK	0100110	38	26	&
0000111	7	7	BEL	0100111	39	27	'
0001000	8	8	BS	0101000	40	28	(
0001001	9	9	HT	0101001	41	29	)
0001010	10	A	LF	0101010	42	2A	*
0001011	11	B	VT	0101011	43	2B	+
0001100	12	C	FF	0101100	44	2C	,
0001101	13	D	CR	0101101	45	2D	-
0001110	14	E	SO	0101110	46	2E	.
0001111	15	F	SI	0101111	47	2F	/
0010000	16	10	DLE	0110000	48	30	0
0010001	17	11	DC1	0110001	49	31	1
0010010	18	12	DC2	0110010	50	32	2
0010011	19	13	DC3	0110011	51	33	3
0010100	20	14	DC4	0110100	52	34	4
0010101	21	15	NAK	0110101	53	35	5
0010110	22	16	SYN	0110110	54	36	6
0010111	23	17	ETB	0110111	55	37	7
0011000	24	18	CAN	0111000	56	38	8
0011001	25	19	EM	0111001	57	39	9
0011010	26	1A	SUB	0111010	58	3A	:
0011011	27	1B	ESC	0111011	59	3B	;
0011100	28	1C	FS	0111100	60	3C	<
0011101	29	1D	GS	0111101	61	3D	=
0011110	30	1E	RS	0111110	62	3E	>
0011111	31	1F	US	0111111	63	3F	?

Binary	Decimal	Hexadecimal	Character	Binary	Decimal	Hexadecimal	Character
1000000	64	40	@	1100000	96	60	`
1000001	65	41	A	1100001	97	61	a
1000010	66	42	B	1100010	98	62	b
1000011	67	43	C	1100011	99	63	c
1000100	68	44	D	1100100	100	64	d
1000101	69	45	E	1100101	101	65	e
1000110	70	46	F	1100110	102	66	f
1000111	71	47	G	1100111	103	67	g
1001000	72	48	H	1101000	104	68	h
1001001	73	49	I	1101001	105	69	i
1001010	74	4A	J	1101010	106	6A	j
1001011	75	4B	K	1101011	107	6B	k
1001100	76	4C	L	1101100	108	6C	l
1001101	77	4D	M	1101101	109	6D	m
1001110	78	4E	N	1101110	110	6E	n
1001111	79	4F	O	1101111	111	6F	o
1010000	80	50	P	1110000	112	70	p
1010001	81	51	Q	1110001	113	71	q
1010010	82	52	R	1110010	114	72	r
1010011	83	53	S	1110011	115	73	s
1010100	84	54	T	1110100	116	74	t
1010101	85	55	U	1110101	117	75	u
1010110	86	56	V	1110110	118	76	v
1010111	87	57	W	1110111	119	77	w
1011000	88	58	X	1111000	120	78	x
1011001	89	59	Y	1111001	121	79	y
1011010	90	5A	Z	1111010	122	7A	z
1011011	91	5B	[	1111011	123	7B	{
1011100	92	5C	¥(¥)	1111100	124	7C	
1011101	93	5D	]	1111101	125	7D	}
1011110	94	5E	^	1111110	126	7E	~
1011111	95	5F	_	1111111	127	7F	DEL

8.3. 11-segment display



(MEMO)

OMRON Corporation Industrial Automation Company

Kyoto, JAPAN

Contact : www.ia.omron.com

Regional Headquarters

OMRON EUROPE B.V.

Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands

Tel: (31) 2356-81-300 Fax: (31) 2356-81-388

OMRON ASIA PACIFIC PTE. LTD.

438B Alexandra Road, #08-01/02 Alexandra
Technopark, Singapore 119968

Tel: (65) 6835-3011 Fax: (65) 6835-3011

OMRON ELECTRONICS LLC

2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A.

Tel: (1) 847-843-7900 Fax: (1) 847-843-7787

OMRON (CHINA) CO., LTD.

Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China

Tel: (86) 21-6023-0333 Fax: (86) 21-5037-2388

Authorized Distributor:

©OMRON Corporation 2025 All Rights Reserved.
In the interest of product improvement,
specifications are subject to change without notice.

Cat. No. N244-E1-01

0725