OPERATING MANUAL

MULTI POWER TRANSDUCER

MODEL **M50EXWTU**

CONTENTS

GENERAL DESCRIPTION

■ MEASUREMENT

Single-phase/2-wire can measure up to four circuits, single-phase/3-wire and three-phase/3-wire can measure up to two circuits, and three-phase/4-wire can measure up to one circuit at the same time.
Each line current, each phase voltage, voltage between each line, active power, reactive power, apparent power, power factor, frequency, or various energy can be measured. (Energy except for each phase active power, each phase reactive power, each phase apparent power, each phase power factor, and active energy cannot be displayed. Modbus communication only.)
THD (total harmonic distortion) of each line current, each phase voltage, and voltage between each line and harmonic from 2nd to 31st can be measured. (Harmonic cannot be displayed. Modbus communication only.)
Maximum and minimum of each measurement value can be measured. (Maximum and minimum cannot be displayed. Modbus communication only.)
Simple measurement is possible that measures power and energy by fixing voltage and power factor and by measuring only current.

■ DISPLAY

Measurement value can be displayed by organic EL.

■ COMMUNICATION

Measurement value is available by Modbus-RTU communication from high-end device such as PLC.

■ OUTPUT

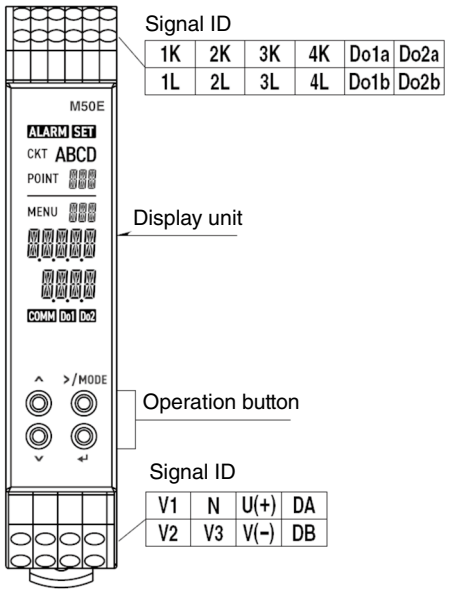
Energy count pulse can be output at Do1 and Do2.

■ SETTING

Settings can be changed by the unit operation and organic EL display.
Settings also can be changed by configurator software PMCFG that can be connected with Windows PC using configurator cable.

COMPONENT IDENTIFICATION

■ FRONT VIEW



■ DISPLAY UNIT

Segment display by organic EL.
Measurement value or setting value can be displayed.

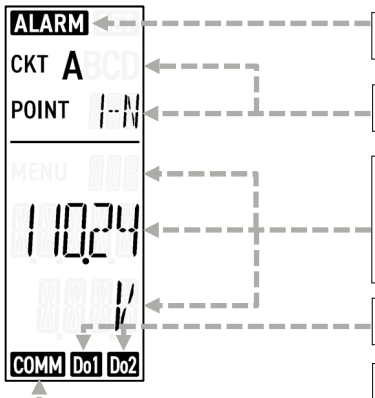
■ OPERATION BUTTON

Switch display or change settings with four buttons ∧ ∨ ↵ >/MODE .

MEASUREMENT VALUE DISPLAY

■ BUTTON OPERATION

After turning on power to the unit, all segments turn on and energy of circuit A is displayed.
The following example is voltage between 1-N of circuit A.



- Flash when some error occurs in auto-off state.
- Display circuit and measurement part of current and voltage.
- Display measurement value and unit.
  Display LOOP TEST alternately during loop test. (Refer to page 9.)
  Display ERR and error number alternately when system error occurs. (Refer to page 9.)
- Flash according to ON/OFF of integrating pulse output. (Refer to page 9.)
- Turn on when it responds to Modbus communication, and turn off when there is no response for 1 second.

Press the following buttons to switch the display.

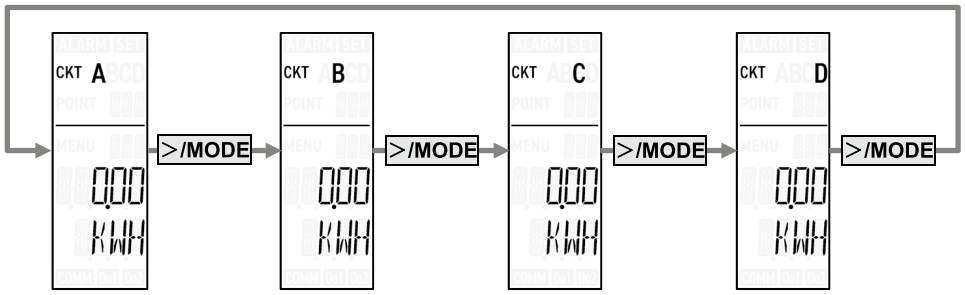
Button operation	Description
Long-press ↵	Switch to setting value display.
>/MODE	Switch circuits.
∧ ∨	Switch measurement value.
↵	Switch THD display.

■ SWITCH TO SETTING VALUE DISPLAY

Long-press ↵ button until the screen flashes twice to switch setting value display. (Refer to page 10.)

■ SWITCH CIRCUIT

Every time >/MODE button is pressed, circuit switches from circuit A to circuit B, or from circuit B to circuit C.
After circuit D, it returns to circuit A.
Whatever measurement value is displayed before switching circuit, active energy (incoming) is displayed after switching circuit.
Press >/MODE with ∧ to switch the same measurement value as the one displayed before switching circuit.



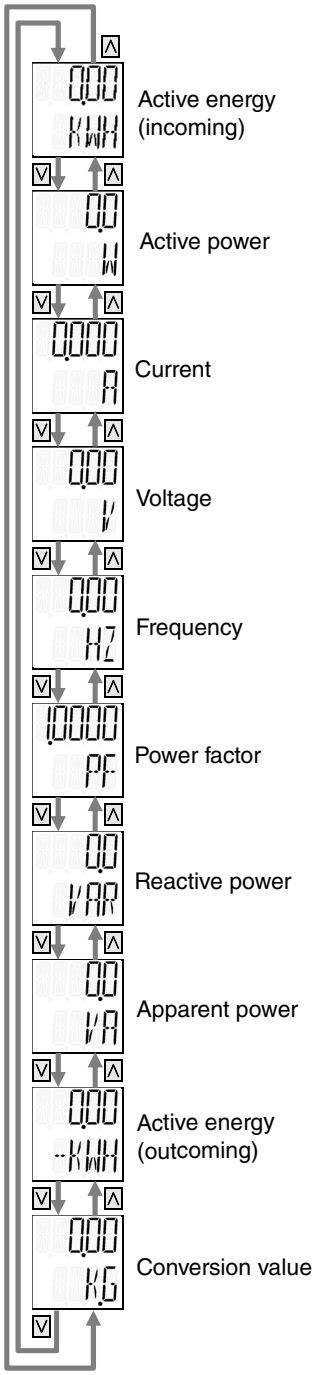
Measurable circuits are different depending on the system configuration.
For unmeasurable circuits, switch by >/MODE button is skipped.

System configuration	Circuit A	Circuit B	Circuit C	Circuit D
Single-phase/2-wire	X	X	X	X
Single-phase/3-wire	X		X	
Three-phase/3-wire	X		X	
Three-phase/4-wire	X			
Single-phase/2-wire branched from single-phase/3-wire	X	X	X	X
Single-phase/3-wire + Single-phase/2-wire	X (single-phase/3-wire)		X (single-phase/2-wire)	X (single-phase/2-wire)

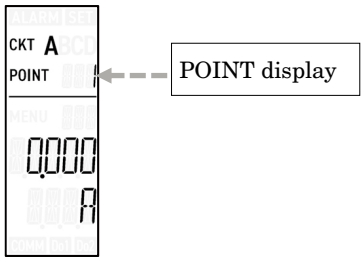
It is possible to set to skip display of unnecessary circuits by active display setting. (Refer to page 12.)

■ SWITCH MEASUREMENT VALUE

Switch to next measurement value with ▽ button, and to previous measurement value with △ button.
Press ▽ button on the last measurement value to switch the first measurement value. Press △ button on the first measurement value to switch the last measurement value.



• Display of current and voltage
The displayed type and number are different depending on system configuration.
The type can be distinguished by POINT display that shows measurement part.



The current and voltage of each system configuration are as follows.
Move to below item on the table with ▽ button, and move to upper item with △ button.

Single-phase/2-wire	Single-phase/3-wire	Three-phase/3-wire	Three-phase/4-wire
POINT Measurement value	**POINT** Measurement value	**POINT** Measurement value	**POINT** Measurement value
Current	1 Current, Line 1	1 Current, Line 1	1 Current, Line 1
Voltage	3 Current, Line 3	2 Current, Line 2	2 Current, Line 2
	N Neutral current	3 Current, Line 3	3 Current, Line 3
	1-N Delta voltage, 1-N	1-2 Delta voltage, 1-2	N Neutral current
	3-N Delta voltage, 3-N	2-3 Delta voltage, 2-3	1-N Delta voltage, 1-N
	1-3 Delta voltage, 3-1*1	3-1 Delta voltage, 3-1	2-N Delta voltage, 2-N
			3-N Delta voltage, 3-N

Note: In single-phase/2-wire and single-phase/3-wire, voltage between 3-1 is displayed as "1-3".

Circuit A to D of single-phase/2-wire branched from single-phase/3-wire, and Circuit C and D of single-phase/3-wire + single-phase/2-wire are as follows.
For voltage, one of voltages that are set in measurement position is displayed. (Refer to page 12.)

POINT Measurement value	
	Current
1-N	Delta voltage, 1-N
or	
3-N	Delta voltage, 3-N
or	
1-3	Delta voltage, 1-3

■ DISPLAY RANGE OF MEASUREMENT VALUE

For energy value, power value, current value, and voltage value, when display range is set to AUTO, the range that the displayed value can be within is automatically selected.
It is also possible to fix display range by changing the setting except for AUTO. (Refer to page 16.)
When display range is fixed, for energy value, the digit in display range is displayed. For power value, current value, and voltage value, upper limit value is displayed when it is over the range , and lower limit value is displayed when it is lower than the range.

• Energy value display

Setting value	Range	Display example
AUTO	0.00 to 999.99 kWh	100.00 KWH
	1000.0 to 9999.9 kWh	1000.0 KWH
	10.000 to 99.999 MWh	10.000 MWH
	100.00 to 999.99 MWh	100.00 MWH
	1000.0 to 9999.9 MWh	1000.0 MWH
0.00K	0.00 to 999.99 kWh	567.89 KWH *1
0.0K	0.0 to 9999.9 kWh	4567.8 KWH *1
0K	0 to 99999 kWh	34567 KWH *1
0.000M	0.000 to 99.999 MWh	34.567 MWH *1
0.00M	0.00 to 999.99 MWh	234.56 MWH *1
0.0M	0.0 to 9999.9 MWh	1234.5 MWH *1

*1 This is a example when measurement value is 1234567.89 kWh. For energy , when measurement value is out of display range, the digit in display range is displayed.

• Power value display

Setting value	Range	Display example
AUTO	-999.9 to -100.0 MW	-100.0 MW
	-99.99 to -10.00 MW	-10.00 MW
	-9999 to -1000 kW	-1000 KW
	-999.9 to -100.0 kW	-100.0 KW
	-99.99 to -10.00 kW	-10.00 KW
	-9999 to -1000 W	-1000 W
	-999.9 to 9999.9 W	1000.0 W
	10.000 to 99.999 kW	10.000 KW
	100.00 to 999.99 kW	100.00 KW
	1000.0 to 9999.9 kW	1000.0 KW
	10.000 to 99.999 MW	10.000 MW
	100.00 to 999.99 MW	100.00 MW
0.0	-999.9 to 9999.9 W	1000.0 W
0	-9999 to 99999 W	10000 W
0.000K	-9.999 to 99.999 kW	10.000 KW
0.00K	-99.99 to 999.99 kW	100.00 KW
0.0K	-999.9 to 9999.9 kW	1000.0 KW
0K	-9999 to 99999 kW	10000 KW
0.000M	-9.999 to 99.999 MW	10.000 MW
0.00M	-99.99 to 999.99 MW	100.00 MW
0.0M	-999.9 to 999.9 MW	100.0 MW

Note: Unit is displayed as active power “W“. In case of reactive power or apparent power, replace the unit with var “VA“.

• Current value display

Setting value	Range	Display example
AUTO	0.000 to 99.999 A	10.000 A
	100.00 to 999.99 A	100.00 A
	1000.0 to 9999.9 A	1000.0 A
	10.000 to 99.999 kA	10.000 KA
0.000	0.000 to 99.999 A	10.00 A
0.00	0.00 to 999.99 A	100.00 A
0.0	0.0 to 9999.9 A	1000.0 A
0	0 to 99999 A	10000 A
0.000K	0.000 to 99.999 kA	10.000 KA
0.00K	0.00 to 99.99 kA	10.00 KA
0.0K	0.0 to 99.9 kA	10.0 KA

• Voltage value display

Setting value	Range	Display example
AUTO	0.00 to 999.99 V	100.00 V
	1000.0 to 9999.9 V	1000.0 V
	10.000 to 99.999 kV	10.000 KV
	100.00 to 999.99 kV	100.00 KV
0.00	0.00 to 999.99 V	100.00 V
0.0	0.0 to 9999.9 V	1000.0 V
0	0 to 99999 V	10000 V
0.000K	0.000 to 99.999 kV	10.000 KV
0.00K	0.00 to 999.99 kV	100.00 KV
0.0K	0.0 to 999.9 kV	100.0 KV

• Power factor value display

Setting value	Range	Display example
0.000	-1.000 to 1.000	1.000 PF
0.00	-1.00 to 1.00	1.00 PF

• Frequency value display

Setting value	Range	Display example
0.00	0.00 40.00 to 70.00 Hz	60.00 HZ
0.0	0.0 40.0 to 70.0 Hz	60.0 HZ

• Conversion value display

Setting value	Range	Display example
	0.00 to 999.99 kg	100.00 K.G
	1000.0 to 9999.9 kg	1000.0 K.G
	10.000 to 99.999 t	10.000 T
	100.00 to 999.99 t	100.00 T
	1000.0 to 9999.9 t	1000.0 T

Note 1: For conversion value, the range is automatically selected so that the displayed value falls within.
Note 2: Conversion value unit is default K.G(kg). In this case, measurement value unit more than 10000kg is displayed as t(ton).

■ ZERO DISPLAY OF EACH MEASUREMENT VALUE

Voltage value is displayed as 0V when the voltage that is input to the device (secondary voltage when it is input via voltage transformer) is less than 11V.
Current value is displayed as 0A when it is less than the result of current cutout setting value × rated current value of CT sensor (in use of CLSE-R5, current value that is set to primary rated value of CT sensor).
Frequency is displayed as 0Hz when input frequency setting value is U1N, and when frequency of ac voltage that is input between V1-N or between V1-V2 is less than 40Hz.

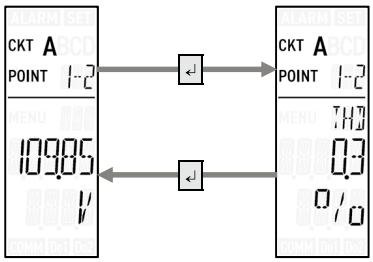
■ CONVERSION VALUE

Active energy (incoming) multiplied by coefficient is displayed as conversion value.
Set coefficient and unit to use this as carbon dioxide emission or electricity bill.
Coefficient can be set from 0.000 to 99.999, and unit can be set with any 4 letters at maximum. (Refer to page 12)

When active energy (incoming) rollovers from 9999999.99kWh to 0.00kWh, conversion value also returns to 0.00.
The upper limit of conversion value is 9999999.99. If it goes over the upper limit, it remains the upper limit value.

■ SWITCH THD DISPLAY

Press ↵ button during displaying current or voltage to switch to THD (total harmonic distortion) display of the measurement value.
Press ↵ button again to go back to original display.



■ AUTO OFF

The display turns off after 10 minutes passed with no operation.
Press any button in auto-off state to go back to original state before auto-off.
If some system error occurs or loop test starts during auto-off state, ALARM segment flashes once in 5 minutes.
Press any button and check the device state.

The time until auto-off starts can be changed. Also the setting can be changed to remaining on continually. (Refer to page 16.)

■ SIMPLE MEASUREMENT

Current, active energy, and active power can be simply measured only by connecting with current sensor, without connecting with target voltage.
Instead of connecting with voltage, there are following specification and limitation.

1) Voltage is not measured. It is calculated with the assumption that the value which was set in VT primary rated value is input. (Refer to page 13.)
2) Current frequency can be used with the setting of measurement based on the voltage that was input in V1-N, fixed 50Hz, or fixed 60Hz. (Refer to page 13.)
3) Power factor is not measured. It is calculated with the assumption of the same value as set in power factor on simple measurement.
4) Reactive power, apparent power, reactive energy, and apparent energy are not calculated.
5) Accuracy of measurement result is not guaranteed. Use it as rough estimate.
   Note: Refer to page 17 for simple measurement setting.

■ INTEGRATING PULSE OUTPUT

The device can output two types of integrating pulse, DO1 and DO2. It outputs from Do1a-Do1b and Do2a-Do2b terminal.
For DO1 and DO2 output, it is possible to set the energy type individually, or energy per 1 pulse. (Refer to page 15.)
Circuit A to D can be set individually whether to output integrating pulse to DO1 and DO2, and then output total energy of the circuits that were set to output.
Pulse is output with DO1 and DO2, and DO1 and DO2 segment flash after contact ON.

■ LOOP TEST

Communication setting or readout address setting can be checked if there is error or not, by replacing the measurement value with arbitrary number and reading out from upper Modbus device.
Loop test can be performed only with configurator software PMCFG.
The following LOOP TEST display appears alternately with measurement value during loop test.

■ SYSTEM ERROR

When system error occurs in the device, the following ERR display appears alternately with measurement value.

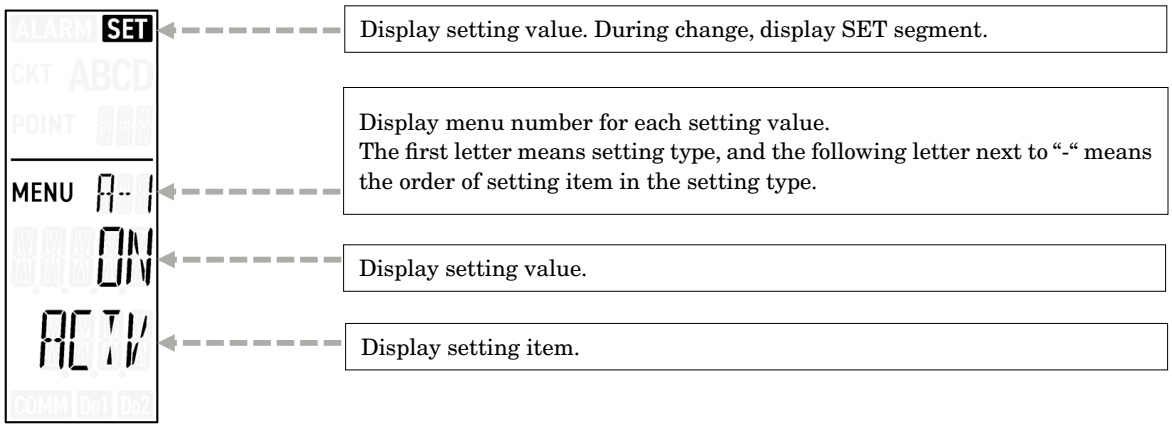
The number next to ERR shows the meaning of system error as follows.

Display	Error meaning	Action
1	Firmware corruption Firmware saved in the device is corrupted. The device is broken.	Repair is needed.
2	Calibration data corruption Calibration data saved in the device at factory setting is corrupted. The device is broken.	Repair is needed.
3	Setting value corruption Setting value saved in the device is corrupted.	Reset the setting value. (Refer to page 18.) However, setting value will be restored to initial state, so setting is needed again.
4	Energy data corruption Energy data saved in the device is corrupted.	Reset the energy. (Refer to page 18.) However, all energy and integrating time become 0.
6	Statistics data corruption Statistics data (maximum value and minimum value) saved in the device is corrupted.	Reset maximum value and minimum value using configurator software PMCFG. However, all statistics data will be reset.

SETTING VALUE DISPLAY

■ BUTTON OPERATION

Long-press ↵ button on measurement value display to show setting value.

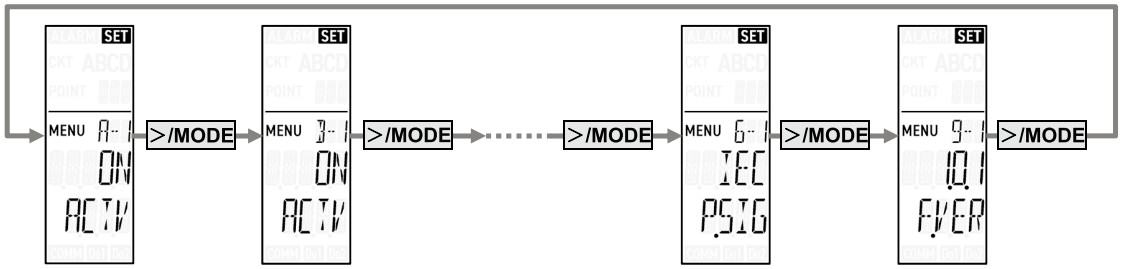


Press the following buttons to switch setting value display or change the setting value.

Button operation	Action
>/MODE	Switch setting type.
∧ ∨	Switch setting item.
Long-press ↵	Change setting value.
↵	Go back to measurement value display.

■ SWITCH SETTING TYPE

Every time >/MODE is pressed, setting type switches from A to B, B to C etc. It returns to setting type A after 9.
After switching setting type, the initial display of each setting type appears whichever menu number was displayed before switching.



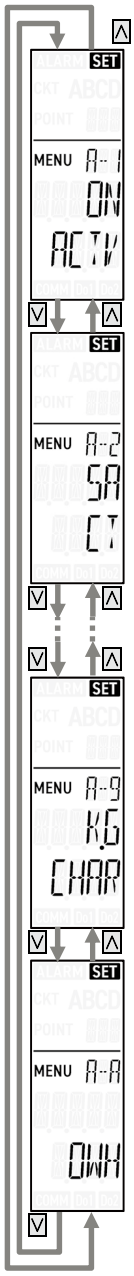
Setting type of circuits that are unmeasurable depending on system configuration is skipped, such as switching circuit on measurement value display.

There are following setting types.

Setting type	Description
A	Circuit A setting
B	Circuit B setting
C	Circuit C setting
D	Circuit D setting
1	Common setting for circuit A to D
2	Modbus communication setting
3	Energy pulse output setting
4	Display setting
5	Simple measurement setting
6	Calculation option setting
9	Maintenance setting

■ SWITCH SETTING ITEM

Switch to next setting item with ▽ button, and to previous setting item with △ button. Switch to the first setting item with ▽ button on the last setting item, and to the last setting item with △ button on the first setting item.



■ CHANGE SETTING VALUE

Long-press ↵ button until the screen flashes twice to change setting value.
There are 2 ways to change setting value, selecting setting value from menu or changing each digit.

• Select setting value from menu
Long-press ↵ button to flash the setting value, then it can be changed.

Button operation	Action
▽	Switch to next menu
△	Switch to previous menu
Long-press ↵	Confirm the change and return to setting value display
↵	Cancel the change and return to setting value display

• Change each digit
Long-press ↵ button to flash one digit of the setting value, then it can be changed.

Button operation	Action
△	Add 1 to the flashing digit or switch to next letter
▽	Subtract 1 from the flashing digit or switch to previous letter
△ while pressing >/MODE	Move the flashing digit to the left
▽ while pressing >/MODE	Move the flashing digit to the right
Long-press △	In case of number, increase the setting value by two significant figures. In case of letter, switch flashing digit to the next. Continue long-press to increase speed by three level.
Long-press ▽	In case of number, decrease the setting value by two significant figures. In case of letter, switch flashing digit to the previous. Continue long-press to increase speed by three level.
Long-press ↵	Confirm the change and return to setting value display
↵	Cancel the change and return to setting value display

Regarding to increasing two significant figures, if △ button continues to be long-pressed from 115, it increases such as 120, 130, 140…980, 990, 1000, 1100, 1200…9800, 9900, 10000, 11000…
After leaving the button, increasing stops in the state that third significant figure is flashing.

The five digits can be displayed at maximum, so setting value more than 5 digits cannot be displayed at a time.
Upper digits are preferentially displayed, so lower digits are overflowed.
During changing the setting value, the display range can be shifted in order to display overflowed digits by moving the flashing digit on the right end to the right.
In order to display the overflowed upper digits again, move the flashing digit on the left end to the left.

■ **SETTING TYPE A, B, C, D (CIRCUIT A, B, C, D SETTING)**

<table>
<tr><th>MENU</th><th>Setting item</th><th>Description</th><th>Default</th></tr>
<tr><td>A-1
|
D-1</td><td>ACTV</td><td>Active display setting
Select whether to display the circuit of measurement value or skip from the following table.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>OFF</td><td>Skip the display with the operation of switching circuit on measurement value display.</td></tr><tr><td>ON</td><td>Do not skip.</td></tr></table>Circuit A setting is ON. It cannot be changed.</td><td>ON</td></tr>
<tr><td>A-2
|
D-2</td><td>CT</td><td>CT sensor
Select CT sensor to be used in circuits.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>5A</td><td>CLSE-R5</td></tr><tr><td>50A</td><td>CLSE-05</td></tr><tr><td>100A</td><td>CLSE-10</td></tr><tr><td>200A</td><td>CLSE-20</td></tr><tr><td>400A</td><td>CLSE-40</td></tr><tr><td>600A</td><td>CLSE-60</td></tr></table>Circuit B setting is common with circuit A setting, and circuit D setting is common with circuit C setting.
They cannot be changed.
Setting can be changed only in circuit A or C.</td><td>5A</td></tr>
<tr><td>A-3
|
D-3</td><td>CT1</td><td>CT sensor primary rated value
In use of CLSE-R5, set the CT sensor primary rated value of secondary 5A that is clamped with CLSE-R5 to the range of 0 to 20000(A).
This setting can be displayed and set only when CLSE-R5 is set to CT sensor.</td><td>5(A)</td></tr>
<tr><td>A-4
|
D-4</td><td>V.SET</td><td>Measurement position
Select the measurement position in single-phase/3-wire from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>1-N</td><td>Measure the load between 1-N.</td></tr><tr><td>3-N</td><td>Measure the load between 3-N.</td></tr><tr><td>1-3</td><td>Measure the load between 1-3.</td></tr></table>This can be set in circuit A, B, C, and D of single-phase/2-wire that branched from single-phase/3-wire, and in circuit C and D of single-phase/3-wire + single-phase/2-wire.</td><td>1-N</td></tr>
<tr><td>A-5
|
D-5</td><td>A.CUT</td><td>Current cutout
Current less than the setting value is recognized as 0(A) in order not to measure dark current.
Set in the range from 0.0 to 99.9(%). In CLSE-R5, threshold value is the result of CT sensor primary rated value × the setting value.
In other sensor, threshold value is the result of sensor primary rated value × the setting value.</td><td>1.0(%)</td></tr>
<tr><td>A-6
|
D-6</td><td>DO1</td><td>DO1 pulse output
Select whether to output energy pulse from DO1.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>OFF</td><td>Do not output pulse from DO1</td></tr><tr><td>ON</td><td>Output pulse from DO1</td></tr></table></td><td>ON</td></tr>
<tr><td>A-7
|
D-7</td><td>DO2</td><td>DO2 pulse output
Select whether to output energy pulse from DO2.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>OFF</td><td>Do not output pulse from DO2</td></tr><tr><td>ON</td><td>Output pulse from DO2</td></tr></table></td><td>ON</td></tr>
<tr><td>A-8
|
D-8</td><td>RATE</td><td>Conversion value coefficient
Set coefficient that multiples active energy (incoming) in calculating conversion value.
Set in the range from 0.000 to 99.999.</td><td>0.555</td></tr>
</table>

MENU	Setting item	Description	Default
A-9 | D-9	CHAR	Conversion value display unit Set the unit that displays conversion value. • 4 letters can be set at maximum combining the following letter. (space), K.(kilogram/with period), number 0 to 9, capital letter A to Z, /(slash), -(minus), +(plus), ° (superscript circle), ₀ (subscript circle). • Space or K.(kilogram/with period) needs to be set to either 1st, 2nd, or 3rd letter except for the last letter. • K.(kilogram/with period) can be set only for 1 letter. • For the last letter, space or K.(kilogram/with period) cannot be set. • When conversion value is more than 10000.00, K.(kilogram/with period) is converted to M.(mega/with period). Space (the right end one when there are some spaces) is converted to K.(kilogram/with period). With the exception, K.G is converted to T(ton), not converted to M.G.	
A-A | D-A	0WH	Reset energy Long-press ↵ button to flash RESET on the line that setting value is displayed. Next, long-press ↵ button again to reset energy of the circuit and return to setting value display. Just press ↵ button to cancel reset and return to setting value display.	-

■SETTING TYPE 1 (COMMON SETTING FOR CIRCUIT A, B, C, D)

MENU	Setting item	Description	Default
1-1	TYPE	System configuration Select system configuration from the following. Menu item: Meaning 1P2W: Single-phase/2-wire 1P3W: Single-phase/3-wire 3P3W: Three-phase/3-wire 3P4W: Three-phase/4-wire 1P2W2: Single-phase/2-wire branched from single-phase/3-wire 1P3W2: Single-phase/3-wire + Single-phase/2-wire	3P3W
1-2	VT1	VT primary rated value Set primary rated value before using voltage transformer. Set in the range of 50-400000(V). In simple measurement, this setting value is used as input voltage. When setting value is more than 100000(V), the upper 5 digits are displayed with two decimal places such as 100.00. K.(kilogram/with period) is displayed in the left of the setting item VT1.	110(V)
1-3	VT2	VT secondary rated value Set secondary rated value before using voltage transformer. Set in the range of 50-500(V).	110(V)
1-4	FREQ	Input frequency setting Select how to decide input frequency from the following. Menu item: Meaning U1N: Measure frequency of AC voltage that was input between V1-N or V1-V2 of the device. 50FIX: Operate with 50.00Hz without measuring input frequency. 60FIX: Operate with 60.00Hz without measuring input frequency.	U1N

■ **SETTING TYPE 2 (Modbus COMMUNICATION SETTING)**

<table>
<tr><th>MENU</th><th>Setting item</th><th>Description</th><th>Default</th></tr>
<tr><td>2-1</td><td>UNO</td><td>Node address
Set the Modbus node address in the range from 1 to 247.</td><td>1</td></tr>
<tr><td>2-2</td><td>BPS</td><td>Transmission speed
Select transmission speed from the following.
<table>
<tr><th>Menu item</th><th>Meaning</th></tr>
<tr><td>1200</td><td>1200(bps)</td></tr>
<tr><td>2400</td><td>2400(bps)</td></tr>
<tr><td>4800</td><td>4800(bps)</td></tr>
<tr><td>9600</td><td>9600(bps)</td></tr>
<tr><td>19200</td><td>19200(bps)</td></tr>
<tr><td>38400</td><td>38400(bps)</td></tr>
</table></td><td>38400</td></tr>
<tr><td>2-3</td><td>PRTY</td><td>Parity bit
Select parity bit from the following.
<table>
<tr><th>Menu item</th><th>Meaning</th></tr>
<tr><td>NONE</td><td>No parity bit</td></tr>
<tr><td>ODD</td><td>Parity bit of odd number</td></tr>
<tr><td>EVEN</td><td>Parity bit of even number</td></tr>
</table></td><td>ODD</td></tr>
<tr><td>2-4</td><td>S.BIT</td><td>Stop bit length
Select stop bit length from the following.
<table>
<tr><th>Menu item</th><th>Meaning</th></tr>
<tr><td>1BIT</td><td>1 bit</td></tr>
<tr><td>2BIT</td><td>2 bit</td></tr>
</table></td><td>1BIT</td></tr>
<tr><td>2-5</td><td>ORDR</td><td>Order of forwarding 32 bit word
Select order of forwarding 32 bit word (2 word) from the following.
<table>
<tr><th>Menu item</th><th>Meaning</th></tr>
<tr><td>NORML</td><td>Forward from lower to upper</td></tr>
<tr><td>SWAP</td><td>Forward from upper to lower</td></tr>
</table></td><td>NORML</td></tr>
</table>

Reboot the device to enable the change of Modbus communication setting. Refer to page 18 for rebooting the device.

■ **SETTING TYPE 3 (ENERGY OUTPUT SETTING)**

<table>
<tr><th>MENU</th><th>Setting item</th><th>Description</th><th>Default</th></tr>
<tr><td>3-1</td><td>ENE1</td><td>DO1 output energy
Select from the following the energy type that output with DO1.
<table>
<tr><th>Menu item</th><th>Meaning</th></tr>
<tr><td>EP</td><td>Active energy, incoming</td></tr>
<tr><td>EQ</td><td>Reactive energy, LAG</td></tr>
<tr><td>ES</td><td>Apparent energy</td></tr>
<tr><td>EP-</td><td>Active energy, outgoing</td></tr>
<tr><td>EQ-</td><td>Reactive energy, LEAD</td></tr>
<tr><td>EQ+LG</td><td>Reactive energy, incoming, LAG</td></tr>
<tr><td>EQ+LD</td><td>Reactive energy, incoming, LEAD</td></tr>
<tr><td>EQ-LG</td><td>Reactive energy, outgoing, LAG</td></tr>
<tr><td>EQ-LD</td><td>Reactive energy, outgoing, LEAD</td></tr>
<tr><td>EQ+P</td><td>Reactive energy, incoming</td></tr>
<tr><td>EQ-P</td><td>Reactive energy, outgoing</td></tr>
<tr><td>EQA</td><td>Reactive energy, (incoming + outgoing)</td></tr>
</table></td><td>EP</td></tr>
<tr><td>3-2</td><td>E/P1</td><td>Energy per DO1 1 pulse
Set energy pulse that is output with DO1 in the range of 0.01 to 1000.00 (kWh/pulse, kvarh/pulse, kVAh/pulse)</td><td>0.10 (kWh/pulse)</td></tr>
<tr><td>3-3</td><td>PLN1</td><td>DO1 pulse width
Set energy pulse width that is output with DO1 in the range of 100-2000 (msec) by 100 msec.
This device outputs pulse so that both ON and OFF width are more than this setting value.</td><td>100 (msec.)</td></tr>
<tr><td>3-4</td><td>MOD1</td><td>DO1 operation mode
Select DO1 operation mode from the following.
<table>
<tr><th>Menu item</th><th>Meaning</th></tr>
<tr><td>N-O</td><td>Normal open</td></tr>
<tr><td>N-C</td><td>Normal close</td></tr>
</table></td><td>N-O</td></tr>
<tr><td>3-5</td><td>ENE2</td><td>DO2 output energy
Setting method is same as DO1 output energy.</td><td>EQ+P</td></tr>
<tr><td>3-6</td><td>E/P2</td><td>Energy per DO2 1 pulse
Setting method is same as energy per DO1 1 pulse.</td><td>0.10 (kvarh/pulse)</td></tr>
<tr><td>3-7</td><td>PLN2</td><td>DO2 pulse width
Setting method is same as DO1 pulse width.</td><td>100 (msec.)</td></tr>
<tr><td>3-8</td><td>MOD2</td><td>DO2 operation mode
Setting method is same as DO1 operation mode.</td><td>N-O</td></tr>
</table>

■ **SETTING TYPE 4 (DISPLAY SETTING)**

<table>
<tr><th>MENU</th><th>Setting item</th><th>Description</th><th>Default</th></tr>
<tr><td>4-1</td><td>DISP</td><td>Auto off setting
Select time until the display automatically turns off from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>OFF</td><td>Remain on continually. (Display does not turn off automatically.)</td></tr><tr><td>1.0</td><td>Turn off with no operation for more than 1 minute.</td></tr><tr><td>5.0</td><td>Turn off with no operation for more than 5 minutes.</td></tr><tr><td>10.0</td><td>Turn off with no operation for more than 10 minutes.</td></tr></table></td><td>10.0
(min)</td></tr>
<tr><td>4-2</td><td>D.BRT</td><td>Display brightness
Select display brightness from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>LOW</td><td>Display with low brightness.</td></tr><tr><td>NORML</td><td>Display with standard brightness.</td></tr></table></td><td>NORML</td></tr>
<tr><td>4-3</td><td>UKWH</td><td>Energy volume display range
Select energy volume display range from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>AUTO</td><td>Switch display range automatically according to measurement value.</td></tr><tr><td>0.00K</td><td>Display the digit of range from 000.00k to 999.99k.</td></tr><tr><td>0.0K</td><td>Display the digit of range from 0000.0k to 9999.9k.</td></tr><tr><td>0K</td><td>Display the digit of range from 00000k to 99999k.</td></tr><tr><td>0.000M</td><td>Display the digit of range from 00.000M to 99.999M.</td></tr><tr><td>0.00M</td><td>Display the digit of range from 000.00M to 999.99M.</td></tr><tr><td>0.0M</td><td>Display the digit of range from 0000.0M to 9999.9M.</td></tr></table>When energy value is out of display range, the upper limit value is not displayed. The digit in display range will be displayed.</td><td>AUTO</td></tr>
<tr><td>4-4</td><td>UPOW</td><td>Power display range
Select power display range from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>AUTO</td><td>Switch display range automatically according to measurement value.</td></tr><tr><td>0.0</td><td>Display the range from -999.9 to 9999.9 with first decimal digit.</td></tr><tr><td>0</td><td>Display the range from -9999 to 99999 with no decimal digit.</td></tr><tr><td>0.000K</td><td>Display the range from -9.999k to 99.999k with three decimal digits.</td></tr><tr><td>0.00K</td><td>Display the range from -99.99k to 999.99k with two decimal digits.</td></tr><tr><td>0.0K</td><td>Display the range from -999.9k to 9999.9k with first decimal digit.</td></tr><tr><td>0K</td><td>Display the range from -9999k to 99999k with no decimal digit.</td></tr><tr><td>0.000M</td><td>Display the range from -9.999M to 99.999M with three decimal digits.</td></tr><tr><td>0.00M</td><td>Display the range from -99.99M to 999.99M with two decimal digits.</td></tr><tr><td>0.0M</td><td>Display the range from -999.9M to 999.9M with first decimal digit.</td></tr></table>When power value is out of display range, upper limit value or lower limit value in display range is displayed.</td><td>AUTO</td></tr>
</table>

<table>
<tr><td>4-5</td><td>UAMP</td><td>Current display range
Select current display range from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>AUTO</td><td>Switch display range automatically accoding to measurement value.</td></tr><tr><td>0.000</td><td>Display the range from 0.000 to 99.999 with three decimal digits.</td></tr><tr><td>0.00</td><td>Display the range from 0.00 to 999.99 with two decimal digits.</td></tr><tr><td>0.0</td><td>Display the range from 0.0 to 9999.9 with first decimal digit.</td></tr><tr><td>0</td><td>Display the range from 0 to 99999 with no decimal digit.</td></tr><tr><td>0.000K</td><td>Display the range from 0.000k to 99.999k with three decimal digits.</td></tr><tr><td>0.00K</td><td>Display the range from 0.00k to 99.99k with two decimal digits.</td></tr><tr><td>0.0K</td><td>Display the range from 0.0k to 99.9k with first decimal digit.</td></tr></table>When current value is out of display range, upper limit value of display range is displayed.</td><td>AUTO</td></tr>
<tr><td>4-6</td><td>UVOL</td><td>Voltage display range
Select voltage display range from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>AUTO</td><td>Switch display range automatically accoding to measurement value.</td></tr><tr><td>0.00</td><td>Display the range from 0.00 to 999.99 with two decimal digits.</td></tr><tr><td>0.0</td><td>Display the range from 0.0 to 9999.9 with first decimal digit.</td></tr><tr><td>0</td><td>Display the range from 0 to 99999 with no decimal digit.</td></tr><tr><td>0.000K</td><td>Display the range from 0.000k to 99.999k with three decimal digits.</td></tr><tr><td>0.00K</td><td>Display the range from 0.00k to 999.99k with two decimal digits.</td></tr><tr><td>0.0K</td><td>Display the range from 0.0k to 999.9k with first decimal digit.</td></tr></table>When voltage value is out of display range, upper limit value of display range is displayed.</td><td>AUTO</td></tr>
<tr><td>4-7</td><td>UPF</td><td>Power factor display range
Select power factor display range from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>0.000</td><td>Display the range from -1.000 to 1.000 with three decimal digits.</td></tr><tr><td>0.00</td><td>Display the range from -1.00 to 1.00 with two decimal digits.</td></tr></table></td><td>0.000</td></tr>
<tr><td>4-8</td><td>UHZ</td><td>Frequency display range
Select frequency display range from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>0.00</td><td>Display the range from 0.00 / 40.00 to 70.00 with two decimal digits.</td></tr><tr><td>0.0</td><td>Display the range from 0.0 / 40.0 to 70.0 with first decimal digit.</td></tr></table></td><td>0.00</td></tr>
</table>

■ SETTING TYPE 5 (SIMPLE MEASUREMENT SETTING)

<table>
<tr><th>MENU</th><th>Setting item</th><th>Description</th><th>Default</th></tr>
<tr><td>5-1</td><td>SMPL</td><td>Simple measurement setting
Select whether to perform simple measurement or not from the following.<table><tr><th>Menu item</th><th>Meaning</th></tr><tr><td>OFF</td><td>Do not perform simple measurement. (normal measurement)</td></tr><tr><td>ON</td><td>Perform simple measurement.</td></tr></table></td><td>OFF</td></tr>
<tr><td>5-2</td><td>S-PF</td><td>Power factor at simple measurement.
Set power factor at simple measurement in the range of 0.0000 to 1.0000.
It can be displayed and set only when the simple measurement setting is ON.</td><td>1.0000</td></tr>
</table>

■ SETTING TYPE 6 (CALCULATION OPTION SETTING)

MENU	Setting item	Description	Default
6-1	P.SIG	Power factor PF sign Select how to decide power factor PF sign from the following. Menu item: IEC — Positive in incoming active power, Negative in outgoing active power. Menu item: IEEE — Positive in LAG (inductive), Negative in LEAD (capacitive).	IEC
6-2	Q.SIG	Reactive power Q sign Select how to decide reactive power Q sign from the following. Menu item: IEC — Positive from [PF = 1.0] to 180° in LAG direction; Negative for the other direction. Menu item: SPC — Identical to IEC method in incoming power; Positive-negative inverted in outgoing power.	IEC
6-3	QN.CL	Phase reactive power Qn Select how to calculate phase reactive power (Qn) from the following. Menu item: VECT — Calculate using vector method. $Qn = \sqrt{Sn^2 - Pn^2}$, $Sn = In \cdot Un$ Menu item: SIGMA — Calculate using reactive power method. $Qn = \frac{1}{Nsmp} \sum_{i=1}^{Nsmp} (Un_i - UN_i) \cdot In_{i+(Nsmp/4)}$, $Sn = \sqrt{Pn^2 + Qn^2}$ In conjuction with calculating phase reactive power, how to calculate each phase apparent power switches.	SIGMA
6-4	S.CAL	Apparent power S Select how to calculate apparent power from the following. Menu item: VECT — Calculate using active power and reactive power. $Sn = \sqrt{P^2 - Q^2}$ Menu item: SIGMA — Add each phase apparent power. S = S1 + S2 + S3	VECT

■ SETTING TYPE 9 (MAINTENANCE SETTING)

MENU	Setting item	Description	Default
9-1	F.VER	Firmware version Firmware version is displayed on the line that displays setting value. This setting can only be displayed, and cannot be changed.	–
9-2	A.0WH	Reset energy for all circuits Long-press ↵ button to flash RESET on the line that displays setting value. Next, long-press ↵ button to reset energy of all circuits and return to setting value display. Just press ↵ button to cancel reset and return to setting value display.	–
9-3	INIT	Initialize settings Long-press ↵ button to flash RESET on the line that displays setting value. Next, long-press ↵ button to reset all settings and return to setting value display. Just press ↵ button to cancel initializing and return to setting value display.	–
9-4	DEV	Reboot the device Long-press ↵ button to flash RESET on the line that displays setting value. Next, long-press ↵ button to reboot the device. Just press ↵ button to cancel rebooting the device and return to setting value display.	–

MODBUS - BASICS

■ COMMUNICATION PROPERTY

This device conforms with Modbus-RTU protocol (MODBUS APPLICATION PROTOCOL V1.1a / Modbus over Serial Line Specification & Implementation Guide V1.0).
The following communication parameters are selectable.

COMM. PROPERTY	SELECTION
Modbus address (Node address)	1 to 247
Baud rate	1200 bps 2400 bps 4800 bps 9600 bps 19200 bps 38400 bps (*)
Parity bit	None Odd (*) Even
Stop bit	1 bit (*) 2 bits
Protocol	Modbus-RTU

(*) Factory setting

■ SUPPORTED COMMANDS

When appropriately set, the host PC connected via RS-485 can read measurands from and write configurations (setting) to the device.
All registers are assigned to Read Holding Registers, can be read out using this command. If reading an address with no assigned register is attempted, '0' is given.
Write Multiple Registers command is used to write registers. If writing an address with no assigned register is attempted, 'Exception' is given.

FUNCTION CODE	COMMAND	RECOMMENDED TIME OUT VALUE
03	Read Holding Registers	0.5 sec.
04	Read Input Resisters	0.5 sec.
16	Write Multiple Registers	2 sec.

These commands enable reading measurands and writing configurations.
One (1) word registers are represented in 16-bit integers, while two (2) word registers are in 32-bit. All registers are in the form of integer unless specifically given in the explanations.
The lower digit word in a 32-bit register is assigned to the lower address (n), while the upper digit word is assigned to the higher address (n+1).
The 32-bit register must be read out and written in single command sequence.

This order can be changed from setting -> long register. (Refer to page 14.)

It is recommended to wait for a time period indicated under 'recommended time out value' in the above table to receive a response for a command. If no response is received for these time periods, take appropriate error processing such as retrying.

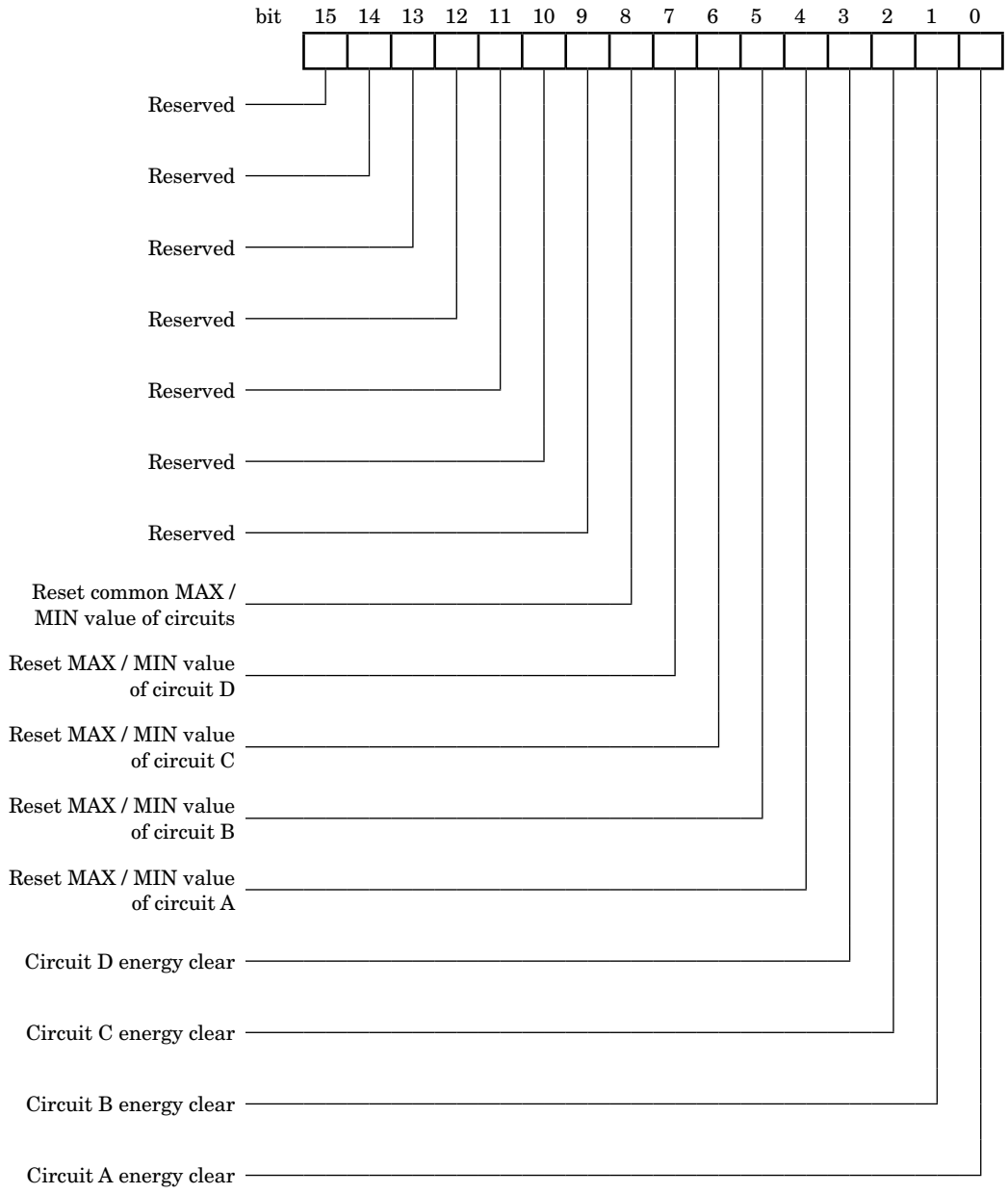
MODBUS - OPERATIONS

■ MODBUS REGISTER ACCESS SETTING

ADDR.	WORD	PARAMETER
4945	1	Modbus register access setting 0 : Write disable (*) 1 : Write enable 2 : Write enable the count values Other : Write disable This setting is erased when the power supply to the unit is removed. It always starts with '0' (Write disable) when the power supply is turned on. Set '1' or '2' before starting writing at other registers. In order to write a count value (e.g. active energy), set '2' at this register address. When it is set, the unit stops counting so that a new count value can be written in the register address. Be careful to use '2' setting because no counting will be performed if the unit remains with this setting.

(*) Factory setting

■ **SYSTEM OPERATIONS**

ADDR.	WORD	PARAMETER
5330	1	Reset energy count Specify the extent of count resetting. The register is automatically set to '0' when the resetting procedure is complete after one of these values is written at this address. If another value is written before '0' has been set, the former resetting procedure ends indefinitely. Specific values can be preset to each register by writing at this address from the host.  Ex.) 304 (130H): Resets common MAX / MIN value and MAX / MIN value of circuit A, B.

MODBUS - MEASURED VARIABLES

■ UNITS OF MEASURED VARIABLES

Measured variables, except for the nth harmonic distortion, are read out as signed 32-bit integer.
Each variable has different engineering unit (Refer to the table below). For example, when 40000 is read at the address 41 for the 1 – N delta voltage, the actual voltage value equals to 400.0V = 40000 × 0.01, as the engineering unit for this item is V/100 (0.01V).
Readable range for each parameter depends upon the parameter type, as shown in the table below. For example, Current unit is applied to Line current or Neutral current, and Voltage unit is applied to the 1 – N delta voltage or the minimum value voltage.

PARAMETER	UNIT	RANGE
Current	mA	0 to 2 000 000 000 mA
Voltage	V/100	0 to 20 000 000.00 V
Active power	W/10	-200 000 000.0 to 200 000 000.0 W
Reactive power	var/10	-200 000 000.0 to 200 000 000.0 var
Apparent power	VA/10	0 to 200 000 000.0 VA
Power factor	1/10 000	-1.0000 to 1.0000
Frequency	Hz/100	0 or 40.00 Hz to 70.00 Hz
Active energy	kWh/100	0 to 9 999 999.99 kWh*1
Reactive energy	kvarh/100	0 to 9 999 999.99 kvarh*1
Apparent energy	kVAh/100	0 to 9 999 999.99 kVAh*1
Energy count time	h/100	0 to 9 999 999.99 hours*1
Converted value	1/100	0 to 9 999 999.99*2 A value multiplied active energy by coefficient set by PMCFG. By setting the converted CO_2 value and the unit price of electricity as coefficients, the desired value can be aggregated.

*1. Reset to 0 when exceeding the max. value, count is continued.

*2. A value multiplied active energy by coefficient. Reset to 0 at the same time when active energy resets to 0.

■ RELATION BETWEEN WIRING AND CIRCUIT

WIRING	COMMON	CIRCUIT A	CIRCUIT B	CIRCUIT C	CIRCUIT D
Single-phase/2-wire 4-circuit	Single-phase/ 2-wire	Single-phase/ 2-wire	Single-phase/ 2-wire	Single-phase/ 2-wire	Single-phase/ 2-wire
Single-phase/two-wire branched from single-phase/three-wire 4-circuit	Single-phase/ 3-wire	Single-phase/ 2-wire	Single-phase/ 2-wire	Single-phase/ 2-wire	Single-phase/ 2-wire
Single-phase/3-wire + Single-phase/2-wire 2-circuit	Single-phase/ 3-wire	Single-phase/ 3-wire	–	Single-phase/ 2-wire	Single-phase/ 2-wire
Single-phase/3-wire 2-circuit	Single-phase/ 3-wire	Single-phase/ 3-wire	–	Single-phase/ 3-wire	–
Three-phase/3-wire 2-circuit	Three-phase/ 3-wire	Three-phase/ 3-wire	–	Three-phase/ 3-wire	–
Three-phase/4-wire	Three-phase/ 4-wire	Three-phase/ 4-wire	–	–	–

For example, when “single-phase/three-wire x 1 + single-phase/two-wire 2-circuit” is set for the wiring, to read the momentary value common for circuits, the value can be read from addresses with X in the column of single-phase/3-wire of the table of momentary value common for circuits.
To read the momentary value of circuit D, the value can be read from addresses with X in the column of circuit D of the table of momentary value of momentary value of each circuit (single-phase/2-wire).

■ **MOMENTARY VALUE COMMON FOR CIRCUITS**

ADDRESS	WORD LENGTH	PARAMETER	WIRING				UNIT
			Single-phase/ 2-wire	Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
13	2	Frequency	X	X	X	X	Hz/100
41	2	Delta voltage, 1 – 2			X	X	V/100
43	2	Delta voltage, 2 – 3			X	X	V/100
45	2	Delta voltage, 3 – 1		X	X	X	V/100
47	2	Phase voltage, Phase 1 (Delta voltage, 1 – N)	X	X	X*1	X	V/100
49	2	Phase voltage, Phase 2 (Delta voltage, 2 – N)			X*1	X	V/100
51	2	Phase voltage, Phase 3 (Delta voltage, 3 – N)		X	X*1	X	V/100

*1. The phase voltages from the virtual N line, which is the center of lines 1, 2, and 3, can be read out.
N line is not connected, it may differ from the actual phase voltage.

■ **MOMENTARY VALUE OF EACH CIRCUIT (Single-phase/3-wire, three-phase/3-wire, and three-phase/4-wire)**

ADDRESS		WORD LENGTH	PARAMETER	WIRING			UNIT
Circuit A	Circuit C			Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
33	4033	2	Current, Line 1	X	X	X	mA
35	4035	2	Current, Line 2		X*1	X	mA
37	4037	2	Current, Line 3	X	X	X	mA
39	4039	2	Neutral current	X*1		X*3	mA
5	4005	2	Active power	X	X	X	W/10
7	4007	2	Reactive power	X	X	X	var/10
9	4009	2	Apparent power	X	X	X	VA/10
11	4011	2	Power factor	X	X	X	1/10 000
53	4053	2	Active power, Phase 1	X	X*2	X	W/10
55	4055	2	Active power, Phase 2		X*2	X	W/10
57	4057	2	Active power, Phase 3	X	X*2	X	W/10
59	4059	2	Reactive power, Phase 1	X	X*2	X	var/10
61	4061	2	Reactive power, Phase 2		X*2	X	var/10
63	4063	2	Reactive power, Phase 3	X	X*2	X	var/10
65	4065	2	Apparent power, Phase 1	X	X*2	X	VA/10
67	4067	2	Apparent power, Phase 2		X*2	X	VA/10
69	4069	2	Apparent power, Phase 3	X	X*2	X	VA/10
71	4071	2	Power factor, Phase 1	X	X*2	X	1/10 000
73	4073	2	Power factor, Phase 2		X*2	X	1/10 000
75	4075	2	Power factor, Phase 3	X	X*2	X	1/10 000

*1. The value calculated based on the input of 1-wire current and 3-wire current. It may differ from the actual current value.
*2. The calculation process of three phase energy can be read out.
Each operation result has no meaning.
*3. The value calculated based on the input of 1-wire current, 2-wire current and 3-wire current. It may differ from the actual current value.

■ **MOMENTARY VALUE OF EACH CIRCUIT (Single-phase/2-wire)**

ADDRESS				WORD LENGTH	PARAMETER	UNIT
Circuit A	Circuit B	Circuit C	Circuit D			
33	35	4033	4035	2	Current	mA
53	55	4053	4055	2	Active power	W/10
59	61	4059	4061	2	Reactive power	var/10
65	67	4065	4067	2	Apparent power	VA/10
71	73	4071	4073	2	Power factor	1/10 000

■ ENERGY OF EACH CIRCUIT

Writing the following registers enables energy presetting.
Set Modbus Register Access in order to write in the energy and fractions.

ADDRESS				WORD LENGTH	PARAMETER	UNIT
Circuit A	Circuit B	Circuit C	Circuit D			
129	161	4129	4161	2	Active energy, incoming	kWh/100
131	163	4131	4163	2	Reactive energy, LAG	kvarh/100
133	165	4133	4165	2	Apparent energy	kVAh/100
135	167	4135	4167	2	Active energy, outgoing	kWh/100
137	169	4137	4169	2	Reactive energy, LEAD	kvarh/100
139	171	4139	4171	2	Reactive energy, incoming, LAG	kvarh/100
141	173	4141	4173	2	Reactive energy, incoming, LEAD	kvarh/100
143	175	4143	4175	2	Reactive energy, outgoing, LAG	kvarh/100
145	177	4145	4177	2	Reactive energy, outgoing, LEAD	kvarh/100
147	179	4147	4179	2	Energy count time	h/100
149	181	4149	4181	2	Reactive energy, incoming	kvarh/100
151	183	4151	4183	2	Reactive energy, outgoing	kvarh/100
153	185	4153	4185	2	Converted value	Specified unit/100
155	187	4155	4187	2	Reactive energy, (incoming + outgoing)	kvarh/100

■ TOTAL HARMONIC DISTORTION COMMON FOR CIRCUITS

ADDRESS	WORD LENGTH	PARAMETER	WIRING				UNIT
			Single-phase/ 2-wire	Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
1289	2	Delta voltage total harmonic distortion, 1 – 2			X	X	%/10
1291	2	Delta voltage total harmonic distortion, 2 – 3			X	X	%/10
1293	2	Delta voltage total harmonic distortion, 3 – 1		X	X	X	%/10
1295	2	Phase voltage total harmonic distortion, Phase 1	X	X		X	%/10
1297	2	Phase voltage total harmonic distortion, Phase 2				X	%/10
1299	2	Phase voltage total harmonic distortion, Phase 3		X		X	%/10

■ TOTAL HARMONIC DISTORTION OF EACH CIRCUIT (Single-phase/3-wire, three-phase/3-wire, and three-phase/4-wire)

ADDRESS		WORD LENGTH	PARAMETER	WIRING			UNIT
Circuit A	Circuit C			Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
1281	8281	2	Current total harmonic distortion, Line 1	X	X	X	%/10
1283	8283	2	Current total harmonic distortion, Line 2		X	X	%/10
1285	8285	2	Current total harmonic distortion, Line 3	X	X	X	%/10
1287	8287	2	Neutral current total harmonic distortion	X		X	%/10

■ TOTAL HARMONIC DISTORTION OF EACH CIRCUIT (Single-phase/2-wire)

ADDRESS				WORD LENGTH	PARAMETER	UNIT
Circuit A	Circuit B	Circuit C	Circuit D			
1281	1283	8281	8283	2	Current total harmonic distortion	%/10

■ HARMONIC COMMON FOR CIRCUITS

ADDRESS	WORD LENGTH	PARAMETER	WIRING				UNIT
			Single-phase/ 2-wire	Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
1793	1	Delta voltage harmonic, 1 – 2, 2nd			X	X	%/10
:	:	:			:	:	:
1822	1	Delta voltage harmonic, 1 – 2, 31st			X	X	%/10
1857	1	Delta voltage harmonic, 2 – 3, 2nd			X	X	%/10
:	:	:			:	:	:
1886	1	Delta voltage harmonic, 2 – 3, 31st			X	X	%/10
1821	1	Delta voltage harmonic, 3 – 1, 2nd		X	X	X	%/10
:	:	:		:	:	:	:
1950	1	Delta voltage harmonic, 3 – 1, 31st		X	X	X	%/10
1985	1	Phase voltage harmonic, Phase 1, 2nd	X	X		X	%/10
:	:	:	:	:		:	:
2014	1	Phase voltage harmonic, Phase 1, 31st	X	X		X	%/10
2049	1	Phase voltage harmonic, Phase 2, 2nd				X	%/10
:	:	:				:	:
2078	1	Phase voltage harmonic, Phase 2, 31st				X	%/10
2113	1	Phase voltage harmonic, Phase 3, 2nd		X		X	%/10
:	:	:		:		:	:
2142	1	Phase voltage harmonic, Phase 3, 31st		X		X	%/10

■ HARMONIC OF EACH CIRCUIT (Single-phase/3-wire, three-phase/3-wire, and three-phase/4-wire)

ADDRESS		WORD LENGTH	PARAMETER	WIRING			UNIT
Circuit A	Circuit C			Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
1537	8537	1	Current harmonic, Line 1, 2nd	X	X	X	%/10
:	:	:	:	:	:	:	:
1566	8566	1	Current harmonic, Line 1, 31st	X	X	X	%/10
1601	8601	1	Current harmonic, Line 2, 2nd		X	X	%/10
:	:	:	:		:	:	:
1630	8630	1	Current harmonic, Line 2, 31st		X	X	%/10
1665	8665	1	Current harmonic, Line 3, 2nd	X	X	X	%/10
:	:	:	:	:	:	:	:
1694	8694	1	Current harmonic, Line 3, 31st	X	X	X	%/10
1729	8729	1	Neutral current harmonic, 2nd	X		X	%/10
:	:	:	:	:		:	:
1758	8758	1	Neutral current harmonic, 31st	X		X	%/10

■ TOTAL HARMONIC DISTORTION OF EACH CIRCUIT (Single-phase/2-wire)

ADDRESS				WORD LENGTH	PARAMETER	UNIT
Circuit A	Circuit B	Circuit C	Circuit D			
1537	1601	8537	8601	1	Current harmonic, 2nd	%/10
:	:	:	:	:	:	:
1566	1630	8566	8630	1	Current harmonic, 31st	%/10

■ MAXIMUM / MINIMUM VALUE COMMON FOR CIRCUITS

ADDRESS	WORD LENGTH	PARAMETER	WIRING				UNIT
			Single-phase/ 2-wire	Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
781	2	Frequency MAX	X	X	X	X	Hz/100
809	2	Delta voltage MAX, 1 – 2			X	X	V/100
811	2	Delta voltage MAX, 2 – 3			X	X	V/100
813	2	Delta voltage MAX, 3 – 1		X	X	X	V/100
815	2	Phase voltage MAX, Phase 1	X	X	X	X	V/100
817	2	Phase voltage MAX, Phase 2			X	X	V/100
819	2	Phase voltage MAX, Phase 3		X	X	X	V/100
873	2	Delta voltage total harmonic distortion MAX, 1 – 2			X	X	%/10
875	2	Delta voltage total harmonic distortion MAX, 2 – 3			X	X	%/10
877	2	Delta voltage total harmonic distortion MAX, 3 – 1		X	X	X	%/10
879	2	Phase voltage total harmonic distortion MAX, Phase 1	X	X		X	%/10
881	2	Phase voltage total harmonic distortion MAX, Phase 2				X	%/10
883	2	Phase voltage total harmonic distortion MAX, Phase 3		X		X	%/10
941	2	Frequency MIN	X	X	X	X	Hz/100
969	2	Delta voltage MIN, 1 – 2			X	X	V/100
971	2	Delta voltage MIN, 2 – 3			X	X	V/100
973	2	Delta voltage MIN, 3 – 1		X	X	X	V/100
975	2	Phase voltage MIN, Phase 1	X	X	X	X	V/100
977	2	Phase voltage MIN, Phase 2			X	X	V/100
979	2	Phase voltage MIN, Phase 3		X	X	X	V/100

■ MAX / MIN VALUE OF EACH CIRCUIT (Single-phase/3-wire, three-phase/3-wire, and three-phase/4-wire)

ADDRESS		WORD LENGTH	PARAMETER	WIRING			UNIT
Circuit A	Circuit C			Single-phase/ 3-wire	Three-phase/ 3-wire	Three-phase/ 4-wire	
801	2801	2	Current MAX, Line 1	X	X	X	mA
803	2803	2	Current MAX, Line 2		X	X	mA
805	2805	2	Current MAX, Line 3	X	X	X	mA
807	2807	2	Neutral current MAX	X		X	mA
773	2773	2	Active power MAX	X	X	X	W/10
775	2775	2	Reactive power MAX	X	X	X	var/10
777	2777	2	Apparent power MAX	X	X	X	VA/10
779	2779	2	Power factor MAX	X	X	X	1/10 000
821	2821	2	Active power MAX, Phase 1	X	X	X	W/10
823	2823	2	Active power MAX, Phase 2		X	X	W/10
825	2825	2	Active power MAX, Phase 3	X	X	X	W/10
827	2827	2	Reactive power MAX, Phase 1	X	X	X	var/10
829	2829	2	Reactive power MAX, Phase 2		X	X	var/10
831	2831	2	Reactive power MAX, Phase 3	X	X	X	var/10
833	2833	2	Apparent power MAX, Phase 1	X	X	X	VA/10
835	2835	2	Apparent power MAX, Phase 2		X	X	VA/10
837	2837	2	Apparent power MAX, Phase 3	X	X	X	VA/10
839	2839	2	Power factor MAX, Phase 1	X	X	X	1/10 000
841	2841	2	Power factor MAX, Phase 2		X	X	1/10 000
843	2843	2	Power factor MAX, Phase 3	X	X	X	1/10 000
865	2865	2	Current total harmonic distortion MAX, Line 1	X	X	X	%/10
867	2867	2	Current total harmonic distortion MAX, Line 2		X	X	%/10
869	2869	2	Current total harmonic distortion MAX, Line 3	X	X	X	%/10
871	2871	2	Neutral current total harmonic distortion MAX	X		X	%/10
961	2961	2	Current MIN, Line 1	X	X	X	mA
963	2963	2	Current MIN, Line 2		X	X	mA
965	2965	2	Current MIN, Line 3	X	X	X	mA
967	2967	2	Neutral current MIN	X		X	mA
933	2933	2	Active power MIN	X	X	X	W/10
935	2935	2	Reactive power MIN	X	X	X	var/10
937	2937	2	Apparent power MIN	X	X	X	VA/10
939	2939	2	Power factor MIN	X	X	X	1/10 000
981	2981	2	Active power MIN, Phase 1	X	X	X	W/10
983	2983	2	Active power MIN, Phase 2		X	X	W/10
985	2985	2	Active power MIN, Phase 3	X	X	X	W/10
987	2987	2	Reactive power MIN, Phase 1	X	X	X	var/10
989	2989	2	Reactive power MIN, Phase 2		X	X	var/10
991	2991	2	Reactive power MIN, Phase 3	X	X	X	var/10
993	2993	2	Apparent power MIN, Phase 1	X	X	X	VA/10
995	2995	2	Apparent power MIN, Phase 2		X	X	VA/10
997	2997	2	Apparent power MIN, Phase 3	X	X	X	VA/10
999	2999	2	Power factor MIN, Phase 1	X	X	X	1/10 000
1001	3001	2	Power factor MIN, Phase 2		X	X	1/10 000
1003	3003	2	Power factor MIN, Phase 3	X	X	X	1/10 000

■ **MAX / MIN VALUE OF EACH CIRCUIT (Single-phase/2-wire)**

ADDRESS				WORD LENGTH	PARAMETER	UNIT
Circuit A	Circuit B	Circuit C	Circuit D			
801	803	2801	2803	2	Voltage MAX	mA
821	823	2821	2823	2	Active power MAX	W/10
827	829	2827	2829	2	Reactive power MAX	var/10
833	835	2833	2835	2	Apparent power MAX	VA/10
839	841	2839	2841	2	Power factor MAX	1/10 000
865	867	2865	2867	2	Current total harmonic distortion MAX	%/10
961	963	2961	2963	2	Current MIN	mA
981	983	2981	2983	2	Active power MIN	W/10
987	989	2987	2989	2	Reactive power MIN	var/10
993	995	2993	2995	2	Apparent power MIN	VA/10
999	1001	2999	3001	2	Power factor MIN	1/10 000

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