OPERATING MANUAL

MULTI POWER TRANSDUCER

MODEL **M50XWTU**

CONTENTS

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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 seconds
04	Read Input Resisters	0.5 seconds
16	Write Multiple Registers	2 seconds

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 Modbus setting -> long register.

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.

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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. The active energy written when 2 is written to this register address is not applied until the value of the register address is changed to something other than 2.

(*) Factory setting

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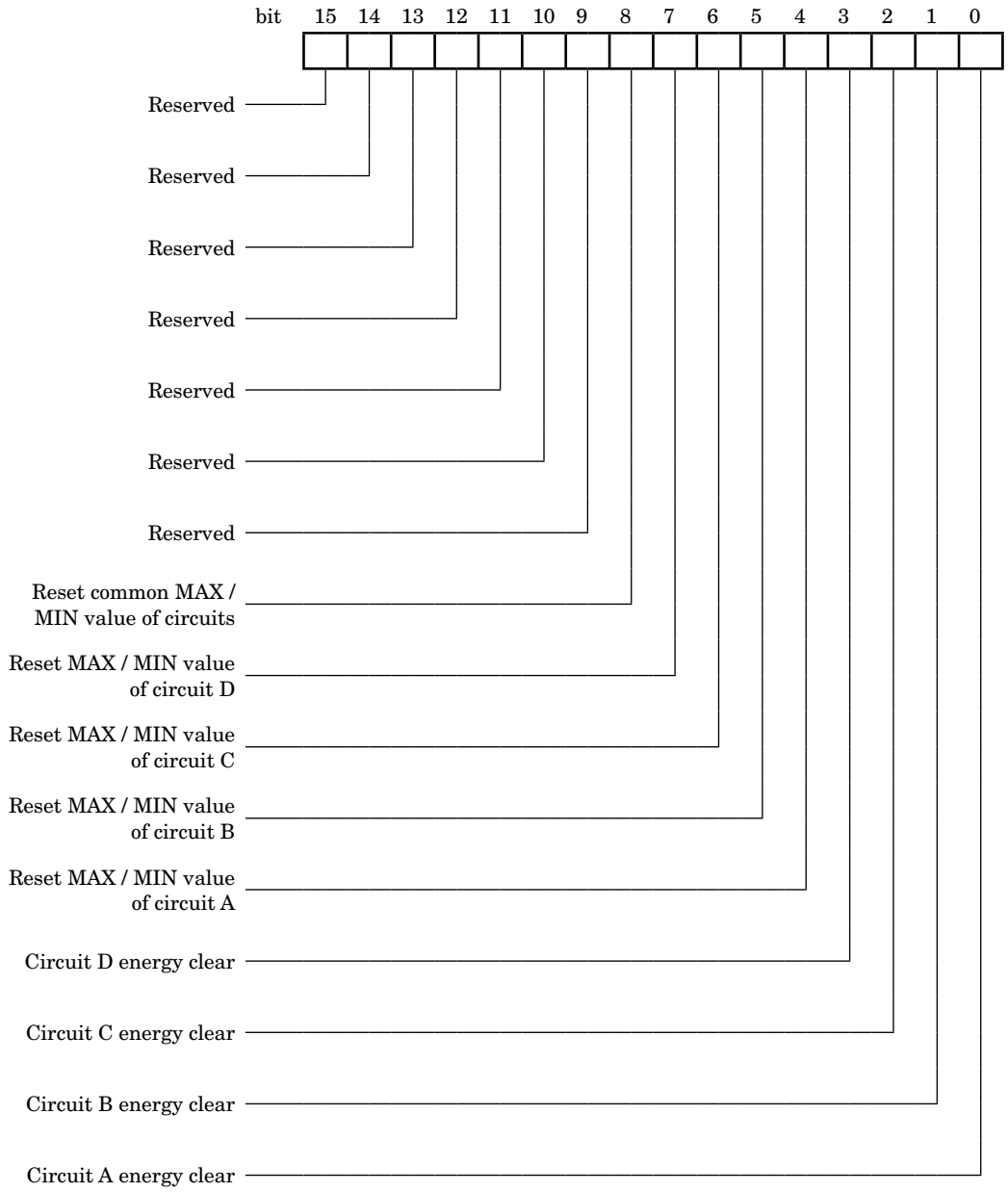
■ **SYSTEM OPERATIONS**

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.

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MODBUS - MEASURED VARIABLES

■ SIMPLIFIED MEASUREMENT MODE

Selecting simplified measurement mode by the PC configurator software PMCFG allows measuring current, active power, and active energy simply wiring the current sensor, without wiring the voltage to be measured.
Instead of eliminating the requirement of voltage wiring, following specifications and limitations are applied.

1. The voltage is not measured, but is calculated assuming the value set by the VT's primary voltage value.
2. Select frequency of current from the followings:
   - Measure based on the voltage input to the V1 - N (wiring of voltage input to V1 - N is required).
   - 50 Hz fixed
   - 60 Hz fixed
3. The power factor is not measured, but is calculated assuming the value set by power factor at simplified measurement.
4. Reactive power, apparent power, reactive energy and apparent energy are not calculated.
5. The results of calculation are not assured. Use them as reference value.

■ 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.

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■ **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).

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■ **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	Delta voltage, 1 – N	X	X	X*1	X	V/100
49	2	Delta voltage, 2 – N			X*1	X	V/100
51	2	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 HORMONIC 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

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■ 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

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■ 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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