User Manual

Power Meter - Din Rail, No Display

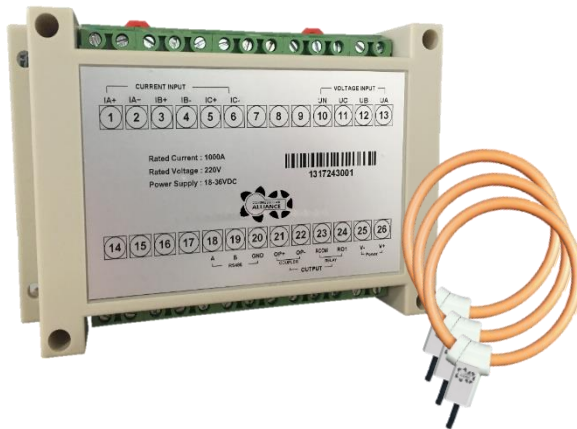## Model: POM100

Table of Contents

Notices

Please read this manual in full and carefully observe the notes and instructions before and during installation, operation and maintenance. The manufacturer cannot be held liable for any damage which occurs as a result of noncompliance with this manual.

Do not tamper with device. Should the device be tampered with in any manner other than a procedure which is described and specified in this manual, the warranty is cancelled and the manufacturer is exempt from liability.

The product is designed exclusively for the described application. Use of this product in conditions not specified in this manual or, contrary to the instructions provided by the manufacturer, is considered improper handling of the product and will void your warranty. The manufacturer will not be held liable for any damages resulting from improper use of the product.

This manual should be read carefully by relevant personnel and the end user**.** This manual should be kept with the product and be made available as needed. **Once you install or use the product, you accept that you have read, understood and complied with this manual**.

Compressed Air Alliance endeavours to make the content of this manual correct, but is not responsible for omissions or errors and the consequences caused. In case of any doubts or questions regarding this manual or the product, please contact Compressed Air Alliance.

⚠️ Warnings

Ignoring the warnings can lead to serious injury and/or cause damage!

When handling, operating or carrying out maintenance on this product, personnel must employ safe working practices and observe all local health & safety requirements and regulations.

Improper operation or maintenance of this product could be dangerous and result in an accident causing damage to machinery or injury or death.

The manufacturer cannot anticipate every possible circumstance which may represent a potential hazard. The warnings in this manual cover the most common potential hazards and are therefore not all-inclusive. If the user employs an operating procedure, an item of equipment or a method of working which is not specifically recommended by the manufacturer they must ensure that the product will not be damaged or made unsafe and that there is no risk to persons or property.

NEVER CHANGE ORIGINAL COMPONENTS WITH ALTERNATIVES.

Multi-Function Power Meter

This multi-function three phase power meter with Modbus/RTU output is simple to install and easy to configure directly into a remote display or into your data acquisition system.

The power meter can be installed on mains supply or can be used for sub metering individual equipment or sub loads.

The POM100 power meter is best suited to

- 3 phase or single phase measurements
- Where no display is required
- Permanent installations

Why should you monitor power?

Monitoring power can help you:

- Reduce operating and energy costs
- Improve understanding of energy usage (eg spikes, variation, usage)
- Identify phase and voltage issues
- Identify power factor and harmonic issues
- Compare and challenge your energy bill
- Improve efficiency and reduce waste

- Monitor your mains power supply usage and quality
- Monitor individual equipment usage or sub system loads

Key Features

- Measure voltage, amps, kilowatts, power factor, kilowatt hours, kilovolt Amps (kVa) and harmonics
- DIN rail mounting
- Modbus/RTU output
- Easy to install rogowski coil current transducers
- Can be installed on mains supply
- Can be used for sub metering individual equipment or sub loads

Installation Requirements

Installing power meters is not difficult but should be done by suitably qualified and experienced technicians. Some knowledge of MODBUS communications is required to connect the power meters to your network.

Specifications

Power Meter Specifications

Power Meter Details	
Type	Multi-function power meter
Applications	Power analysis Energy meter
Mounting	Din Rail
Poles description	3PH4W 3PH3W 1PH2W (L-N) 1PH2W (L-L) 1PH3W (L-L-N)
Display	N/A (no display)
Available clamp sensors	Rogowski coil - 500A or 1,000A or 3,000A
Sampling rate	8,000 samples per second
Harmonic	52th Max
Dimensions	122 mm L x 87 mm W x 23 mm D 4.8" L x 3.4" W x 0.9" D
Weight	125 grams
Colour	White
Installation Type	Permanent installation or temporary installation
Contractual warranty	12 months
Measurement Ranges	
Measured voltage	80V to 400V AC **or** 100V to 500V AC
Frequency	50/60Hz

Accuracy **Note**: The accuracy of the power meter is affected by the quality of installation. On-site	Current	0.5% from 1% to 120% (manufacturer doesn't ensure accuracy when <10A)
	Rated current	500A (0.5% from 10A to 600A) 3,000A (0.5% from 30A to 3600A) 10kA (0.5% from 100A to 12kA)

conditions such as oil, high humidity or other impurities can also affect the accuracy of the power meter	Rogowski coil specification	85mV/kA@50Hz±0.5%	
	Voltage	0.2% from 80V to 400V (or 100V to 500V)	
	Power factor	±0.005 from 10% to 120%	
	Active/Apparent Power	IEC62053-22 Class 0.5	
	Reactive power	IEC62053-21 Class 2	
	Frequency	0.01% from 45 to 65Hz	
	Active energy	IEC62053-22 Class 0.5s	
	Reactive energy	IEC62053-21 Class 2	

Power			
Power supply	85 to 264VAC / 100 to 370VDC, 3.5W Or 24VDC		

Input			
Input type	External CT (333mV only) **or** External Rogowski coil		
Primary current range	Adjustable from 0.1A to 9999A		
Measurement input range	$1/2^{25}$mV to 333mV		
Permissible overload	600mV for 10s/hours		

Output			
Output parameters	Voltage, Amps and Kilowatts for each phase, power factor, reactive power (kVa), total Kilowatts, Kilowatt hours and electrical system harmonics		
Connection	Screw terminals:	2.5mm^2	0.1"
	Interval:	5.08mm	0.2"
Relay	1 × digital output (2 ports) from 1pcs relay, rated 24V/800mA, 75mΩ max 2.5kVrms insulation (controlled by Modbus)		

	Maximum Switching Power: 0.5A, 125VAC 1A, 30VDC	
Optical coupler	Max voltage: 80VDC Max current: 50mA Recommend Current: 10mA	
Environmental Conditions		
Operating temperature	-25°C to +55°C	-13°F to +131°F
Storage temperature	-40℃ to +85℃	-40°F to +185°F
Humidity rating	5% to 95% RH at 50℃ (non-condensing)	
Pollution degree	2: Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.	
Overvoltage category	III, for distribution systems up to 277/480VAC	
Dielectric withstand	As per IEC61010-1, Doubled insulated front panel display	
Altitude	3000m Max	
IP degree of protection	IP20 conforming to IEC 60629	
Alarm		
Setting	Voltage and current, each phase, AVG	
Output form	Relay	
Instantaneous rms Values		
Voltage	U, UTH2, UTH3, UTH4 (Per Phase, AVG)	
Current	I, ITHD2, ITHD3, ITHD4 (Per Phase, AVG)	
Power	P, Q, S, PF (Per Phase, SUM)	
Energy	EP, EQ, ES, Freq (Per Phase, SUM) Over 1 x 109 kWh, value resets	
UTHD (%)	UTHD, THD2, THD3, THD4 (Per Phase, AVG)	
ITHD (%)	ITHD, THD2, THD3, THD4 (Per Phase, AVG)	
PF	PFa, PFb, PFc, AVG	

Update Rate	
Data acquisition rate	400ms
Calibration	
Current	Per phase, all
Voltage	Per phase, all
Power factor	Per phase, all
Energy	Reset to "0" EP, EQ, ES all phase
EMC	
Electrostatic discharge	Level IV (IEC61000-4-2)
Immunity to radiated fields	Level III (IEC61000-4-3)
Immunity to fast transients	Level IV (IEC61000-4-4)
Immunity to surge	Level IV (IEC61000-4-5)
Conducted immunity	Level III (IEC61000-4-6)
Immunity to power frequency magnetic fields	0.5mT (IEC61000-4-8)
Conducted and radiated emissions	Class B (EN55022)
Standard compliance	
EN 62052-11, EN61557-12, EN 62053-21, EN 62053-22, EN 62053-23, EN 50470-1, EN 50470-3, EN 61010-1, EN 61010-2, EN 61010-031	

Modbus RS485

Communication	
Transmission mode	RS485 port, Half duplex

RS485 link	3 wires
Communication protocol	MODBUS RTU
Settings	
Communication address	1 to 247 (default 1)
Baud rate	1200 to 57600 baud (default 19200)
Parity	Even, Odd, None (default)
Data Bit	8
Stop bit	1

Power Meter Dimensions

Rogowski Coil Specifications

	500 Amps	1,000 Amps	3,000 Amp
Coil Length	200 mm or 7.87"	350 mm or 13.78"	510 mm or 20.08"
Window Size	50 mm or 1.97"	100 mm or 3.94"	150 mm or 5.91"
Ratio	Calibrated:	85mV / kA@50Hz / 100mV / kA@50Hz	
	Uncalibrated:	110mV / kA@50Hz	
Read Accuracy	Calibrated:	<0.5% (central position, 25℃)	
	Uncalibrated:	< 5% tolerance (central position, 25℃)	
Maximum Current Measurable	100kA		
Coil Resistance	from 100 to 250 Ω		
Position Error	±1% maximum		
Phase error	≤0.5°		
Shielded	00% coil, 100% output cable		
Couplings	PA6 UL 94 V-O rated		
Voltage Insulation	Coil: 3000V Signal cable: 1000V		
Compliance	LVD EN 61010-1:2010 EMC EN 61326-1:2013		
Safety	1000V CATIII ,600V CATIV		
Materials	Coil & cable: Thermoplastic rubber, flame retardant UL 94 V-0 rated		
Lead Length	5 meters		
Operation Temperature	-20℃ to +70℃	-4°F to 158°F	
Storage Temperature	-30℃ to +90℃	-22°F to 194°F	
Installation Type	Temporary or permanent installation		
Warranty	12 months		

Rogowski Coil Position Sensitivity

Conductor Position	Typical Error (%)
● Adjacent to the center of coil	0.2%
● Adjacent to the inside coil	<1%

Rogowski Coil Dimensions

10 mm
0.4"

21 mm
0.8"

20 mm
0.8"

5 mm
0.2"
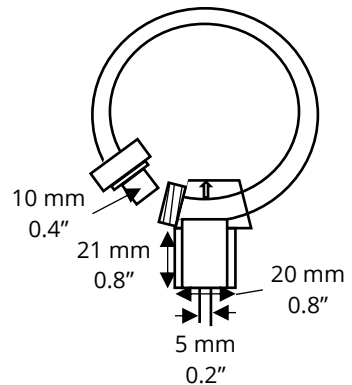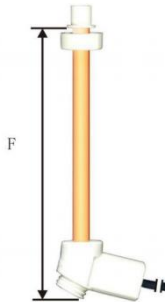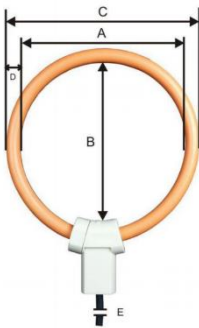
|		500 Amps	1,000 Amps	3,000 Amp
A	Windows size A	50 mm	105 mm	155 mm
B	Windows size B	60 mm	100 mm	150 mm
C	Coil Outer Diameter	66 mm	121 mm	171 mm
D	Coil section	8 mm		
E	Lead Cable Total Length	5 meters		
F	Coil length	200 mm	350 mm	510 mm

Installation – Mechanical

WARNING! Risk of electrical shock.

Any contact with energised parts of the product, may lead to an electrical shock which can lead to serious injuries or even death. The user shall take all measures necessary to protect against electrical shock.

Notes

- Users should be suitably qualified, licensed and experienced to install, operate, maintain and remove this product.
- Please observe local and national regulations before/during installation and operation.
- **Before installing the product, make sure it is rated for your system** (refer to the "Specifications" section).
  o Use of the product outside specified ranges or operating parameters can lead to malfunctions and may damage the product or system.
- The system must be disconnected from any power supply during maintenance work.
- Certain parts of the product may carry hazardous live voltage (e.g. primary conductor). The user shall take all measures necessary to protect against electrical shock. A protective enclosure or additional insulation barrier may be necessary.
- Do not use this product in explosive areas.
- Do not stress the Rogowski Coils by applying any kind of mechanical force (i.e. twisting, puncturing, excessive pressure, tight bending, etc.) as this will dramatically degrade the device's accuracy.
- Do not disassemble the product.
- The product must be installed properly, otherwise it may lead to inaccurate measurement values.
- The product should be maintained and checked for faulty wiring on a regular basis.
- Incorrect installation can damage the product, cause it to work incorrectly or result in injury or death.
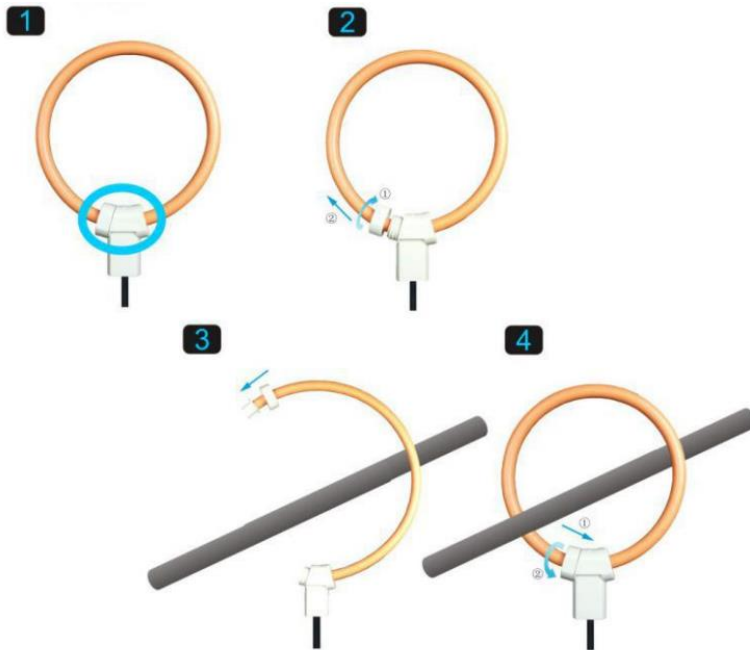
Installation and maintenance shall be done with the main power supply disconnected. Local and national regulations must be fully observed.

Step 1 – Locate clip on the Rogowski Coil base unit

Step 2 – Unscrew clip and pull out coil from base unit

Step 3 – Place coil over conductor, ensuring arrow faces toward the load

Step 4 – Insert coil back into base unit and screw clip to secure the coil

Installation – Electrical

⚠️ **WARNING!** Risk of electrical shock

Incorrect wiring or contact with energised parts of the product, may lead to an electrical shock which can lead to serious injuries or even death. The user shall take all measures necessary to protect against electrical shock.

🛈 **Notes:**

- Always check the wires to make sure they are wired correctly.
- Consider all local and national safety requirements and regulations for electrical installations.
- **The system must be disconnected from any power supply during installation and maintenance work.**
- Any electrical work on the system is only allowed by authorised and qualified personal.

Port Definition
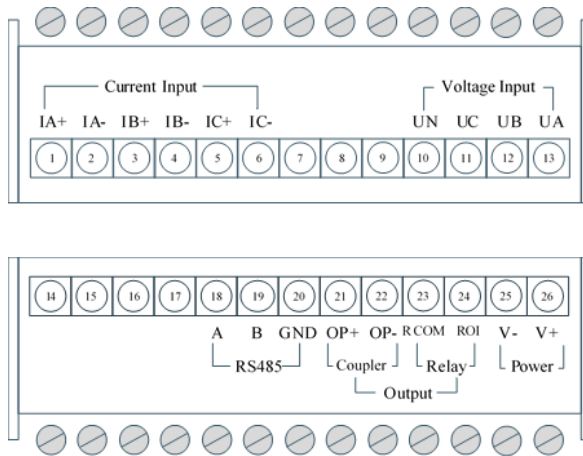
Port Number	Port Name	Port Function		Remarks
1	IA+	A-phase current input positive	A-phase current	Current (I) Input
2	IA-	A-phase current input negative		
3	IB+	B-phase current input positive	B-phase current	
4	IB-	B-phase current input negative		
5	IC+	C-phase current input positive	C-phase current	
6	IC-	C-phase current input negative		
7	N/A	Option	Option	
8	N/A	Option		
9	N/A	Option		
10	UN	N-phase voltage input	Voltage (U) Input	
11	UC	C-phase voltage input		
12	UB	B-phase voltage input		

Port Number	Port Name	Port Function	Remarks
13	UA	A-phase voltage input	
14	N/A	Option	Option
15	N/A	Option	
16	N/A	Option	
17	N/A	Option	
18	A	RS485 A (Data +)	RS485 communication
19	B	RS485 B (Data -)	
20	GND	RS485 Ground (Shield)	
21	OP+	Coupler output +	Coupler output
22	OP-	Coupler output -	
23	RCOM	Relay output -	Relay output
24	RO1	Relay output +	
25	V-	Power supply – (0V DC)	Power 85 to 265 V AC/DC **or** 24V DC
26	V+	Power supply + (24VDC)	

Wiring Diagrams

WARNING: Incorrect wiring and installation can cause an electric shock, electrocution or damage to the power meter or other equipment. It may also void the warranty.

Before installing the power meter, make sure it is rated for your system (refer to Specification section).

Notes:

Rcoil**＊**：Rogowski coil secondary output voltage can not be over 333mV rms.

CT^：CT must be voltage output, secondary output can not be over 333mV rms.

① Circuit breaker: 500mA fuses and disconnect switch

② VT primary fuses and disconnect switch

Modbus Communication Wiring Diagram
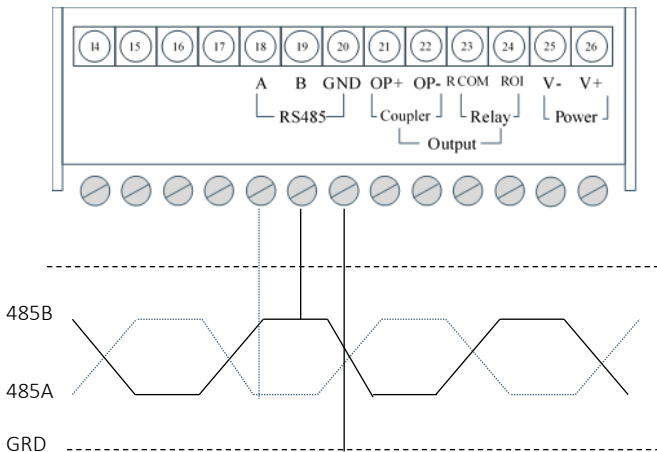
3PH4W no VT
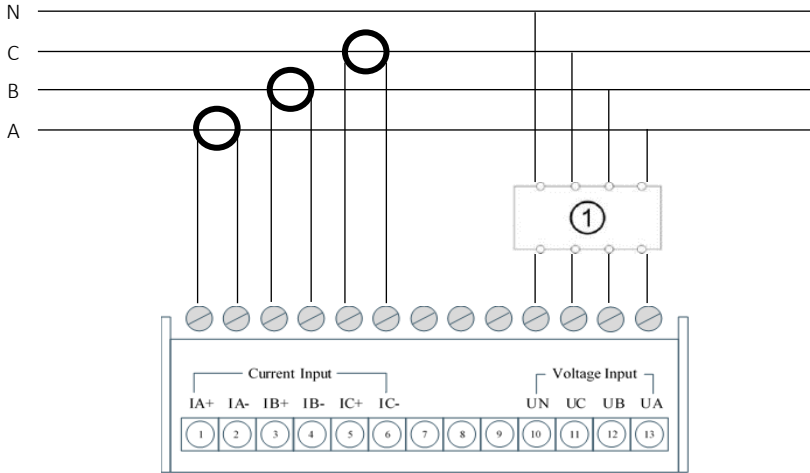
3PH3W no VT

3PH3W with VT

1PH3W LL-N

N

L

L

Current Input

IA+   IA-   IB+   IB-   IC+   IC-

Voltage Input

UN   UC   UB   UA

1 2 3 4 5 6 7 8 9 10 11 12 13

1PH2W L-N

N

L

Current Input

IA+   IA-   IB+   IB-   IC+   IC-

Voltage Input

UN   UC   UB   UA

1 2 3 4 5 6 7 8 9 10 11 12 13
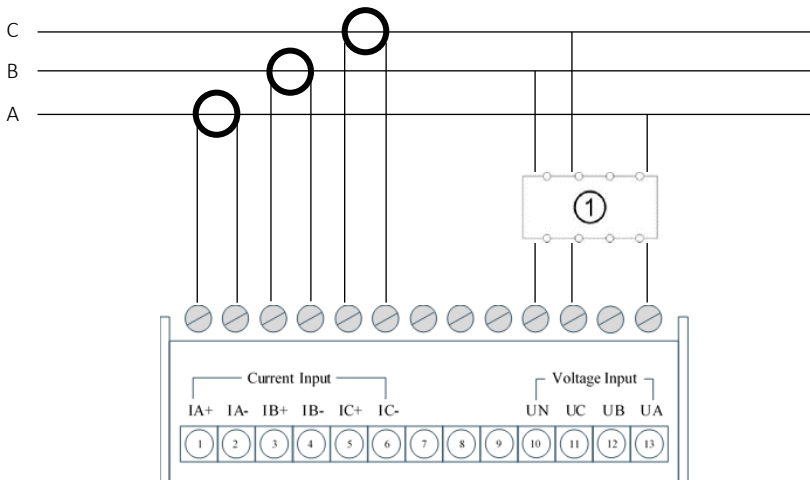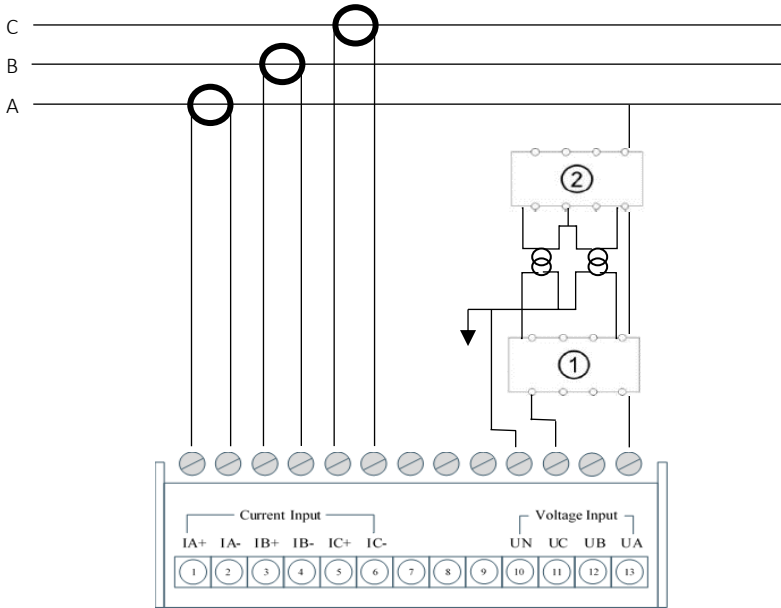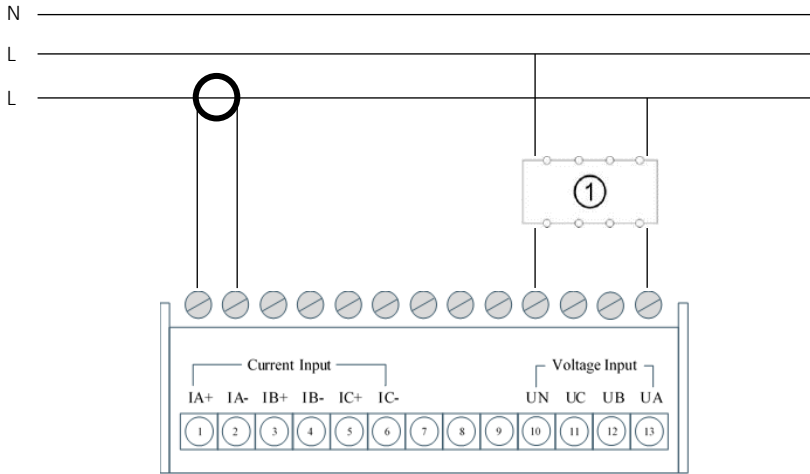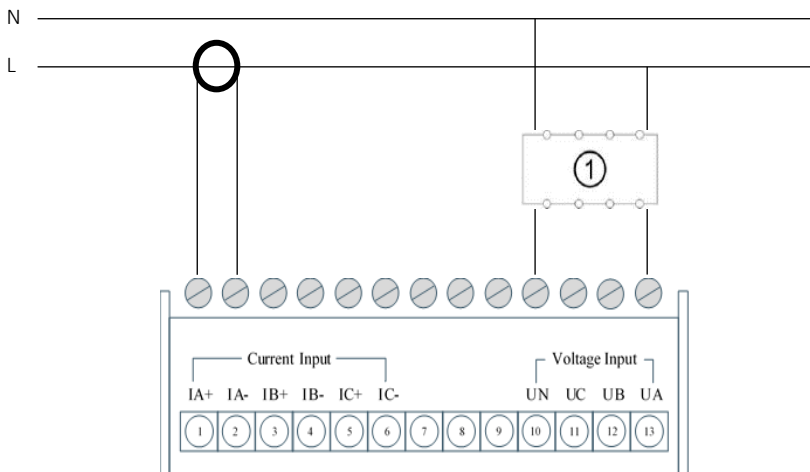
1PH2W L-L
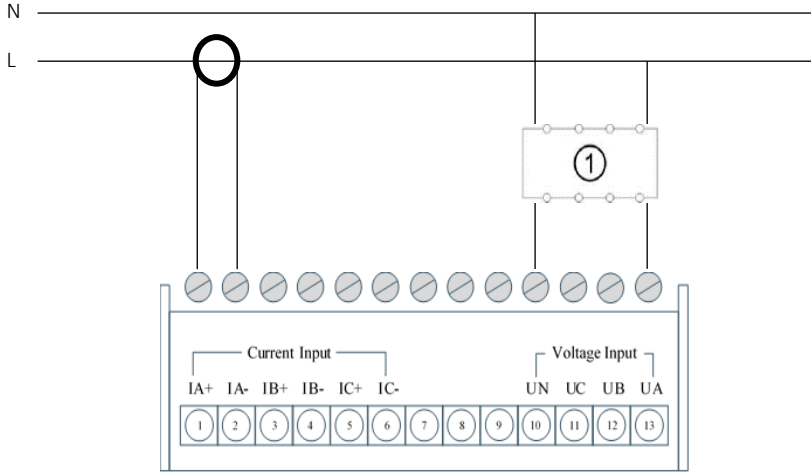
Warranty

Compressed Air Alliance provides a 12-month warranty for all Power Meters. The warranty covers materials and workmanship under the stated operating conditions from the date of delivery. Please report any findings immediately and within the warranty time.

If faults occur during the warranty period Compressed Air Alliance will repair or replace the defective unit, without charge for repair labour and material costs but there is a charge for other services such as labour to remove or reinstall the instrument, transport and packing. Warranty repairs do not extend the period of warranty.

The following damage is excluded from this warranty:

- Improper use and non-adherence to the user manual.
- Use of unsuitable accessories.
- External influences (e.g. damage caused by vibration, damage during transportation, excess heat or moisture).

The warranty is cancelled when one of the following situations occurs:

- The user opens the measurement instrument without a direct request written in this manual.
- Repairs or modifications are undertaken by third parties or unauthorised persons.
- The serial number has been changed, damaged or removed.

Other claims, especially damage occurring on the outside of the instrument (eg dents, marks), are not included unless responsibility is legally binding.

Need help?

You can contact Compressed Air Alliance via:
- Phone (Australia): 1300 558 526
- E-mail: sales@compressedairalliance.com
- Website: www.compressedairalliance.com

Appendix – Modbus Communication Protocol

Modbus communications overview

This power meter adopts standard protocol — **Modbus-RTU**.

You can change the **baud rate** of communication to 1200, 2400, 4800, 9600 etc.

Error detection: CRC16 (cyclic redundancy check).

Modbus communications settings

Before communicating with the device using Modbus-RTU protocol, use the HMI to configure the following settings:

Parameters	Available Values	Default Value
Baud rate	1200 Baud 2400 Baud 4800 Baud 9600 Baud 19200 Baud 38400 Baud 57600 Baud	19200 Baud
Data bits	8	8
Parity	Odd Even None	None
Stop bits	1	1
Address	1–247	1

Command Request

Slave Address	Function Code	Command Block	CRC
8-Bits	8-Bits	N×8-Bits	16-Bits Checking

Functional code

Functional code tells what function addressed terminal equipment can execute. The following table lists the functional code that used by this power meter, as well as their significance and function.

Function Code		Function Name	Behaviour
Decimal	Hexa-decimal		
3	03H	Read Holding Registers	Read present HEX from one or more registers.
16	10H	Write Multiple Registers	Write present HEX on multiple registers.

Register table

Register tables have the following columns:

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description

Where

- **Register Alias**: The meaning of the register
- **Register Address**: Modbus address of register encoded in the Modbus frame, in decimal (dec)
- **Action**: The read/write by command register
- **Size**: The data size in Int16
- **Type**: The encoding data type
- **Units**: The unit of the register value

- **Range**: The permitted values for this variable, usually a subset of what the format allows
- **Description**: Provides information about the register and the values that apply

Unit Table

The following data types appear in the Modbus register list:

Type	Description	Range
UInt16	16-bit unsigned integer	0 to 65535
Int16	16-bit signed integer	-32768 to +32767
UInt32	32-bit unsigned integer	0 to 4 294 967 295
UInt64	64 bit unsigned integer	0 to 18 446 744 073 709 551 615
UTF8	8-bit field	multibyte character encoding for Unicode
Float32	32-bit value	Standard representation IEEE for floating number (with single precision)
Bitmap	–	–
Date Time	–	-

Date Time Format

Units															
Word	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	Reserved (0)								Year (0–99, year from 2000)							
2	Month (1–12)								Day (1–31)							
3	Hour (0–23)								Minute (0–59)							
4	Millisecond (0–59999)															

Configure Meter

You can configure the power meter by writing command and command parameters to corresponding command registers using Modbus function 16.

Command request

The following table describes a Modbus command request:

Slave Address	Function Code	Command Register Address	Command Register Number	Data Length	Command Register Value	CRC
1-247	16	300 (up to 423)	N	N x 2		

Command Result

The command result can be obtained by reading registers 424 and 425.

The following table describes the command result:

Register Address	Content	Size (Int16)	Data (example)
424	Requested Command Number	1	1001(set Date Time)
425	Result	1	0 = Valid Operation 80 = Invalid Command 81 = Invalid Parameter 82 = Invalid Number of Parameters 83 = Operation Not Performed

Command Request Example

Slave Address (8 bits)	Function Code (8 bits)	Command Register Address (16 bits)		Command Register Number (16 bits)		Data Length (8 bits) N x 2	Command Register Value (16 bits) X N				CRC (16 bits)	
		High 8 bits	Low 8 bits	High 8 bits	Low 8 bits		Command		Parameter		High 8 bits	Low 8 bits
							High 8 bits	Low 8 bits	High 8 bits	Low 8 bits		

Function code (0x10=16) Operation

Function code (0x10=16) is used to configure the meter.

Request data format:

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	16	
3	Registers Start address	UInt16	-	Big-Endian (Sending order)
4	Registers Numbers	UInt16	1-123	Big-Endian (Sending order)
5	Bytes of Registers Values	UInt8		Registers Numbers x 2
6	Value of Register 1	UInt16	-	Big-Endian (Sending order)
7	...	UInt16	-	Big-Endian (Sending order)
8	Value of Register n	UInt16	-	Big-Endian (Sending order)

No.	Alias	Type	Range (decimal)	Description
9	CRC-16 Check	UInt16	-	Little-Endian (Sending order)

Response data format:

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	16	
3	Registers Start address	UInt16	300	Big-Endian
4	Registers Numbers	UInt16	1-123	Big-Endian
5	CRC-16 Check	UInt16	-	Little-Endian

⚠️ **Attention:** Function code (0x10=16) can only write data to "Command Register，That is, only registers starting from 300 can be written data.

For example: Configure "Digital Outputs" (command=1005)

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	1	01	
2	Function code	UInt8	16	10	
3	Registers Start address	UInt16	300	012C	Big-Endian (Sending order)
4	Registers Numbers	UInt16	2	0002	Big-Endian (Sending order)
5	Bytes of Registers Values	UInt8	4	04	

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
6	Value of Register 300	UInt16	1005	03ED	Big-Endian (Sending order)
7	Value of Register 301	UInt16	1	0001	Big-Endian (Sending order)
9	CRC-16 Check	UInt16	50093	C3AD	Little-Endian (Sending order)

Request data send as follows: 01 10 01 2C 00 02 04 03 ED 00 01 AD C3

If the configured data is right, the meter will response data as follows: 01 10 01 2C 00 02 81 FD

No.	Alias	Type	Range (hexadecimal)	Range (decimal)
1	Salve ID	UInt8	01	1
2	Function code	UInt8	10	16
3	Registers Start address	UInt16	012C	300
4	Registers Numbers	UInt16	0002	2
7	CRC-16 Check	UInt16	81FD	

Function code (0x03=3) Operation

Function code (0x03=3) is used to read registers values

Request data format

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	3	
3	Registers Start address	UInt16	-	Big-Endian (Sending order)
4	Registers Numbers	UInt16	1-125	Big-Endian (Sending order)
5	CRC-16 Check	UInt16	-	Little-Endian (Sending order)

Response data format

No.	Alias	Type	Range (decimal)	Description
1	Salve ID	UInt8	1-247	
2	Function code	UInt8	3	
3	Bytes of Registers Values	UInt8	-	Registers Numbers *2
4	Value of Register 1		-	Big-Endian
5	…		-	Big-Endian
6	Value of Register n		-	Big-Endian
7	CRC-16 Check	UInt16	-	Little-Endian

For example: Read Voltage A, B, C value (Address starts 2147)

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	1	0x01	
2	Function code	UInt8	3	0x03	
3	Registers Start address	UInt16	2147	0x0863	
4	Registers Numbers	UInt16	6	0x0006	
5	CRC-16 Check	UInt16	46647	0xB637	

Request data send as follows: 01 03 08 63 00 06 37 B6

Response data as follows: 01 03 0C 43 5C 00 00 43 5D 00 00 43 5E 00 00 14 AC

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	01	1	
2	Function code	UInt8	03	3	
3	Bytes of Registers Values	UInt8	0C	12	
4	Voltage A	float32	435C0000	220V	
5	Voltage B	float32	435D0000	221V	
6	Voltage C	float32	435E0000	222V	
7	CRC-16 Check	UInt16	14AC		

Exception response

Exception response frame format

No.	Alias	Type	Range (decimal)	Range (hexadecimal)	Description
1	Salve ID	UInt8	1-247	0x01-0xF7	
2	Function code	UInt8	(128+3) (128+16)	(0x80+0x03) (0x80+0x10)	
3	Exception code	UInt8			
4	CRC-16 Check	UInt16			Little-Endian

Exception code of MODBUS

Code (hexadecimal)	Name	Meaning
0x01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the meter
0x02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the meter
0x03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the meter
0x04	DEVICE FAILURE	An unrecoverable error occurred while the server was attempting to perform the requested action.

Command List

Set System Date Time

Command Number	Action R/W	Size	Type	Units	Range	Description
1001	Write (W)	1	UInt16	-	2000-2099	Year
	Write (W)	1	UInt16	-	1-12	Month
	Write (W)	1	UInt16	-	1-31	Day
	Write (W)	1	UInt16	-	0-23	Hour
	Write (W)	1	UInt16	-	0-59	Minute
	Write (W)	1	UInt16	-	0-59	Second

Set Communications

Command Number	Action R/W	Size	Type	Units	Range	Description
1002	Write (W)	1	UInt16	-	1-247	Slave Address
	Write (W)	1	UInt16	-	0,1,2,3,4,5,6	Baud Rate 0=1200 1=2400 2=4800 3=9600 4=19200 5=38400 6=57600
	Write (W)	R/WC	UInt16	-	0,1,2	Parity 0 = Odd 1 = Even 2 = None

Set Power System

Command Number	Action R/W	Size	Type	Units	Range	Description
1003	Write (W)	1	UInt16	-	0,1,2,3,4	Wiring 0 = 1PH2W L–N 1 = 1PH2W L–L 2 = 3PH4W 3 = 3PH3W 4 = 1PH3W_LLN
	Write (W)	1	UInt16	Hz	50,60	Nominal Frequency
	Write (W)	2	UInt32	V	-	VT Primary
	Write (W)	1	UInt16	V	100,110,115,120	VT Secondary
	Write (W)	2	UInt32	A	-	CT Primary
	Write (W)	1	UInt16	mV	Max value: 333mV	CT Secondary
	Write (W)	2	UInt32	-	Reserved	Reserved
	Write (W)	1	UInt16	-	1,2,3,4	Rcoil Rate Current 1 = 100A (50mV/kA@50Hz) 2 = 600A (50mV/kA@50Hz) 3 = 1,000A (85mV/kA@50Hz) 4 = 3,000A (85mV/kA@50Hz) 5 = 6,000A (50mV/kA@50Hz)
	Write (W)	1	UInt16	-	0,1	Voltage Connection 0 = Direct Connect

Command Number	Action R/W	Size	Type	Units	Range	Description
						1 = VT
	Write (W)	1	UInt16	-	0,1	Current Connection 0 = Rogowski coil 1 = CT

Set Harmonic Times

Command Number	Action R/W	Size	Type	Units	Range	Description
1004	Write (W)	1	UInt16	-	2-52	HX harmonic times
	Write (W)	1	UInt16	-	2-52	HY harmonic times
	Write (W)	1	UInt16	-	2-52	HZ harmonic times

Set Digital Output

Command Number	Action R/W	Size	Type	Units	Range	Description
1005	Write (W)	1	UInt16	-	0,1	1= Relay Open 0 = Relay Closed

Reset Energy

Command Number	Action R/W	Size	Type	Units	Range	Description
1006	Write (W)	1	UInt16	-	2050 to 2053	2050: Reset Phase 1 205120: Reset Phase 2 102: Reset Phase 3 103: Reset Phase 1, 2, 3

Modbus Register List

Meter

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Meter Model	50	R	20	UTF8	-	
Serial Number	70	R	2	UInt32	-	
Firmware Version	72	R	1	UInt16	-	DLF format: X.Y.ZTT
Date Time	73	R/WC	4	Data Time	-	Date/Time Reg.73: Year 00-99 (year from 2000 to 2099) Reg.74: Month (b15:b8), Day (b7:b0) Reg.75: Hour (b15:b8), Minute (b7:b0) Reg. 76: Millisecond

Communications

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Address	80	R/WC	1	UInt16	-	1 to 247
Baud Rate	81	R/WC	1	UInt16	-	0 = 1200 1 = 2400 2 = 4800 3 = 9600 4 = 19200

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
						5 = 38400 6 = 57600
Parity	82	R/WC	1	UInt16	-	0 = ODD 1 = EVEN 2 = None

Power System

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Wiring Type	90	R/WC	1	UInt16	-	0 = 1PH2W L–N 1 = 1PH2W L–L 2 = 3PH4W 3 = 3PH3W 4 = 1PH3W_LLN
Nominal Frequency	91	R/WC	1	UInt16	Hz	
VT Primary	92	R/WC	2	UInt32	V	
VT Secondary	94	R/WC	2	UInt32	V	RealValue=ReadValue/1000
CT Primary	96	R/WC	2	UInt32	A	
CT Secondary	98	R/WC	2	UInt32	mV	RealValue=ReadValue/1000
-	100	R/WC	2	UInt32	A	
Rcoil Secondary	102	R/WC	2	UInt32	mV	RealValue=ReadValue/1000
Voltage Connection	104	R/WC	1	UInt16	-	0 = Direct Connect 1 = 3 VT
Current Connection	105	R/WC	1	UInt16	-	0 = Rogowski coil 1 = CT

Digital Output Status

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Digital Output Status	150	R/WC	1	-	-	1 = Relay output on 0 = Relay output off

Tariff Status

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Tariff Status	160	R/WC	1	-	-	1 = Tariff 1 2 = Tariff 2 3 = Tariff 3 4 = Tariff 4

Command Register

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Command Code	300	R/W	1	UInt16	-	
Parameter 001	301	R/W	1	UInt16	-	
Parameter 002	302	R/W	1	UInt16	-	
…	…	R/W	1	UInt16	-	
Parameter 123	423	R/W	1	UInt16	-	
Requested Command	424	R	1	UInt16	-	
Command Result	425	R	1	UInt16	-	0 = Valid Operation 80 = Invalid Command 81 = Invalid Parameter

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
						82 = Invalid Number of Parameters 83 = Operation Not Performed

Basic Data - Power factor, frequency, harmonics, Current, voltage, power

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Power Factor						
PF1	2000	R	2	Float32	-	Phase 1 Power Factor
PF2	2002	R	2	Float32	-	Phase 2 Power Factor
PF3	2004	R	2	Float32	-	Phase 3 Power Factor
PF Avg	2006	R	2	Float32	-	Average of PF1, PF2, PF3
DPF1	2008	R	2	Float32	-	Phase 1 Displacement Power Factor
DPF2	2010	R	2	Float32	-	Phase 2 Displacement Power Factor
DPF3	2012	R	2	Float32	-	Phase 3 Displacement Power Factor
DPF Avg	2014	R	2	Float32	-	Average Of DPF1, DPF2, DPF3
Frequency						
Freq1	2016	R	2	Float32	Hz	Phase 1 Frequency
Freq2	2018	R	2	Float32	Hz	Phase 2 Frequency

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Freq3	2020	R	2	Float32	Hz	Phase 3 Frequency
FreqAvg	2022	R	2	Float32	Hz	Average of Freq1, Freq2, Freq3
Harmonics Configuration						
HX harmonic times	2024	R/WC	1	UInt16	-	Range:2-52
HY harmonic times	2025	R/WC	1	UInt16	-	Range:2-52
HZ harmonic times	2026	R/WC	1	UInt16	-	Range:2-52
Current Harmonics						
I1THDx	2027	R	2	Float32	%	Phase 1 X times harmonics current distortion
I2THDx	2029	R	2	Float32	%	Phase 2 X times harmonics current distortion
I3THDx	2031	R	2	Float32	%	Phase 3 X times harmonics current distortion
ITHDx Avg	2033	R	2	Float32	%	Average of I1THDx, I2THDx, I3THDx
I1THDy	2035	R	2	Float32	%	Phase 1 y times harmonics current distortion
I2THDy	2037	R	2	Float32	%	Phase 2 y times harmonics current distortion
I3THDy	2039	R	2	Float32	%	Phase 3 y times harmonics current distortion

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
ITHDy Avg	2041	R	2	Float32	%	Average of U1THDy, U2THDy, U3THDy
I1THDz	2043	R	2	Float32	%	Phase 1 z times harmonics current distortion
I2THDz	2045	R	2	Float32	%	Phase 2 z times harmonics current distortion
I3THDz	2047	R	2	Float32	%	Phase 3 z times harmonics current distortion
ITHDz Avg	2049	R	2	Float32	%	Average of U1THDz, U2THDz, U3THDz
I1THD	2051	R	2	Float32	%	Phase 1 total harmonics current distortion
I2THD	2053	R	2	Float32	%	Phase 2 total harmonics current distortion
I3THD	2055	R	2	Float32	%	Phase 3 total harmonics current distortion
ITHD Avg	2057	R	2	Float32	%	Average of U1THD, U2THD, U3THD
I1THx	2059	R	2	Float32	V	Phase 1 x times harmonics current
I2THx	2061	R	2	Float32	V	Phase 2 x times harmonics current
I3THx	2063	R	2	Float32	V	Phase 3 x times harmonics current

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
ITHx Avg	2065	R	2	Float32	V	Average of U1THx, U2THx, U3THx
I1THy	2067	R	2	Float32	V	Phase 1 y times harmonics current
I2THy	2069	R	2	Float32	V	Phase 2 y times harmonics current
I3THy	2071	R	2	Float32	V	Phase 3 y times harmonics current
ITHy Avg	2073	R	2	Float32	V	Average of U1THy, U2THy, U3THy
I1THz	2075	R	2	Float32	V	Phase 1 z times harmonics current
I2THz	2077	R	2	Float32	V	Phase 2 z times harmonics current
I3THz	2079	R	2	Float32	V	Phase 3 z times harmonics current
ITHz Avg	2081	R	2	Float32	V	Average of U1THz, U2THz, U3THz
Voltage Harmonics						
U1THDx	2083	R	2	Float32	%	Phase 1 X times harmonics voltage distortion
U2THDx	2085	R	2	Float32	%	Phase 2 X times harmonics voltage distortion
U3THDx	2087	R	2	Float32	%	Phase 3 X times harmonics voltage distortion
UTHDx Avg	2089	R	2	Float32	%	Average of U1THDx, U2THDx, U3THDx

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
U1THDy	2091	R	2	Float32	%	Phase 1 y times harmonics voltage distortion
U2THDy	2093	R	2	Float32	%	Phase 2 y times harmonics voltage distortion
U3THDy	2095	R	2	Float32	%	Phase 3 y times harmonics voltage distortion
UTHDy Avg	2097	R	2	Float32	%	Average of U1THDy, U2THDy, U3THDy
U1THDz	2099	R	2	Float32	%	Phase 1 z times harmonics voltage distortion
U2THDz	2101	R	2	Float32	%	Phase 2 z times harmonics voltage distortion
U3THDz	2103	R	2	Float32	%	Phase 3 z times harmonics voltage distortion
UTHDz Avg	2105	R	2	Float32	%	Average of U1THDz, U2THDz, U3THDz
U1THD	2107	R	2	Float32	%	Phase 1 total harmonics voltage distortion
U2THD	2109	R	2	Float32	%	Phase 2 total harmonics voltage distortion
U3THD	2111	R	2	Float32	%	Phase 3 total harmonics voltage distortion

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
UTHD Avg	2113	R	2	Float32	%	Average of U1THD, U2THD, U3THD
U1THx	2115	R	2	Float32	V	Phase 1 x times harmonics voltage
U2THx	2117	R	2	Float32	V	Phase 2 x times harmonics voltage
U3THx	2119	R	2	Float32	V	Phase 3 x times harmonics voltage
UTHx Avg	2121	R	2	Float32	V	Average of U1THx, U2THx, U3THx
U1THy	2123	R	2	Float32	V	Phase 1 y times harmonics voltage
U2THy	2125	R	2	Float32	V	Phase 2 y times harmonics voltage
U3THy	2127	R	2	Float32	V	Phase 3 y times harmonics voltage
UTHy Avg	2129	R	2	Float32	V	Average of U1THy, U2THy, U3THy
U1THz	2131	R	2	Float32	V	Phase 1 z times harmonics voltage
U2THz	2133	R	2	Float32	V	Phase 2 z times harmonics voltage
U3THz	2135	R	2	Float32	V	Phase 3 z times harmonics voltage
UTHz Avg	2137	R	2	Float32	V	Average of U1THz, U2THz, U3THz
Current						
I1	2139	R	2	Float32	A	Phase 1 Current
I2	2141	R	2	Float32	A	Phase 2 Current

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
I3	2143	R	2	Float32	A	Phase 3 Current
Current Avg	2145	R	2	Float32	A	Average of I1, I2, I3
Voltage						
U1	2147	R	2	Float32	V	Phase 1 Voltage
U2	2149	R	2	Float32	V	Phase 2 Voltage
U3	2151	R	2	Float32	V	Phase 3 Voltage
Voltage Avg	2153	R	2	Float32	V	Average of U1, U2, U3
Power						
P1	2155	R	2	Float32	kW	Active Power Phase 1
P2	2157	R	2	Float32	kW	Active Power Phase 1
P3	2159	R	2	Float32	kW	Active Power Phase 1
PTotal	2161	R	2	Float32	kW	Total Active Power
FQ1	2163	R	2	Float32	kVAR	Fundamental Reactive Power Phase 1
FQ2	2165	R	2	Float32	kVAR	Fundamental Reactive Power Phase 2
FQ3	2167	R	2	Float32	kVAR	Fundamental Reactive Power Phase 3
FQTotal	2169	R	2	Float32	kVAR	Total Fundamental Reactive Power
S1	2171	R	2	Float32	kVA	Apparent Power Phase 1
S2	2173	R	2	Float32	kVA	Apparent Power Phase 2

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
S3	2175	R	2	Float32	kVA	Apparent Power Phase 3
STotal	2177	R	2	Float32	kVA	Total Apparent Power

Energy

The energy values automatically reset to 0 when total energy reaches the limit of 1.0 x 10^9 kWh, 1.0 x 10^9 kVarh, or 1.0 x 10^9 kVah

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Active Energy						
EP1Imp	4000	R	2	UInt32	kWh	Active Energy Import Phase 1
EP2Imp	4002	R	2	UInt32	kWh	Active Energy Import Phase 2
EP3Imp	4004	R	2	UInt32	kWh	Active Energy Import Phase 3
EPsumImp	4006	R	2	UInt32	kWh	Total Active Energy Import Phase All
EP1Exp	4008	R	2	UInt32	kWh	Active Energy Export Phase 1
EP2Exp	4010	R	2	UInt32	kWh	Active Energy Export Phase 2
EP3Exp	4012	R	2	UInt32	kWh	Active Energy Export Phase 3
EPsumExp	4014	R	2	UInt32	kWh	Total Active Energy Export Phase All

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
Reactive Energy						
EQ1Imp	4024	R	2	UInt32	kVarh	Reactive Energy Import Phase 1
EQ2Imp	4026	R	2	UInt32	kVarh	Reactive Energy Import Phase 2
EQ3Imp	4028	R	2	UInt32	kVarh	Reactive Energy Import Phase 3
EQsumImp	4030	R	2	UInt32	kVarh	Total Reactive Energy Import Phase All
EQ1Exp	4032	R	2	UInt32	kVarh	Reactive Energy Export Phase 1
EQ2Exp	4034	R	2	UInt32	kVarh	Reactive Energy Export Phase 2
EQ3Exp	4036	R	2	UInt32	kVarh	Reactive Energy Export Phase 3
EQsumExp	4038	R	2	UInt32	kVarh	Total Reactive Energy Export Phase All
Apparent Energy						
ES1Imp	4048	R	2	UInt32	kVAh	Apparent Energy Import Phase 1
ES2Imp	4050	R	2	UInt32	kVAh	Apparent Energy Import Phase 2
ES3Imp	4052	R	2	UInt32	kVAh	Apparent Energy Import Phase 3
ESsumImp	4054	R	2	UInt32	kVAh	Total Apparent Energy Import Phase All
ES1Exp	4056	R	2	UInt32	kVAh	Apparent Energy Export Phase 1

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
ES2Exp	4058	R	2	UInt32	kVAh	Apparent Energy Export Phase 2
ES3Exp	4060	R	2	UInt32	kVAh	Apparent Energy Export Phase 3
ESsumExp	4062	R	2	UInt32	kVAh	Total Apparent Energy Export Phase All
Energy by Tariff Import						
ETF1	4072	R	2	UInt32	kWh	Rate 1 Active Energy Import
ETF2	4074	R	2	UInt32	kWh	Rate 2 Active Energy Import
ETF3	4076	R	2	UInt32	kWh	Rate 3 Active Energy Import
ETF4	4078	R	2	UInt32	kWh	Rate 4 Active Energy Import
Power / Current Demand						
PDemand	5000	R	2	Float32	kW	Active Power Present Demand
PPeakDemand	5002	R	2	Float32	kW	Active Power Peak Demand
PPeakDemandDate	5004	R	4	Date time	-	Active Power Peak Demand Date/Time
QDemand	5008	R	2	Float32	kW	Reactive Power Present Demand
QPeakDemand	5010	R	2	Float32	kW	Reactive Power Peak Demand
QPeakDemandDate	5012	R	4	Date time	-	Reactive Power Peak Demand Date/Time

Register Alias	Register Address	Action R/WC	Size	Type	Units	Description
SDemand	5016	R	2	Float32	kW	Apparent Power Present Demand
SPeakDemand	5018	R	2	Float32	kW	Apparent Power Peak Demand
SPeakDemandDate	5020	R	4	Date time	-	Apparent Power Peak Demand Date/Time
I1Demand	5024	R	2	Float32	kW	Current I1 Present Demand
I1PeakDemand	5026	R	2	Float32	kW	Current I1 Peak Demand
I1PeakDemandDate	5028	R	4	Date time	-	Current I1 Peak Demand Date/Time
I2Demand	5032	R	2	Float32	kW	Current I2 Present Demand
I2PeakDemand	5034	R	2	Float32	kW	Current I2 Peak Demand
I2PeakDemandDate	5036	R	4	Date time	-	Current I2 Peak Demand Date/Time
I3Demand	5040	R	2	Float32	kW	Current I3 Present Demand
I3PeakDemand	5042	R	2	Float32	kW	Current I3 Peak Demand
I3PeakDemandDate	5044	R	4	Date time	-	Current I3 Peak Demand Date/Time
IAvgDemand	5048	R	2	Float32	kW	Current IAvg Present Demand
IAvgPeakDemand	5050	R	2	Float32	kW	Current IAvg Peak Demand
IAvgPeakDemand Date	5052	R	4	Date time	-	Current IAvg Peak Demand Date/Time

Harmonics calculations

The power quality analysis values use the following abbreviations:

- Fundamental phase current rms: I1
- Fundamental phase voltage rms: V1
- Total harmonic distortion of the phase current

$$(\text{THD})_I = \frac{\sqrt{I^2 - I_1^2}}{I_1}$$

- Total harmonic distortion of the phase voltage

$$(\text{THD})_V = \frac{\sqrt{V^2 - V_1^2}}{V_1}$$

- Harmonic distortion on the phase current

$$HD_{I_x} = \frac{I_x}{I_1} \text{ , } x = 2, 3, \ldots, N$$

$$HD_{I_y} = \frac{I_y}{I_1} \text{ , } y = 2, 3, \ldots, N$$

$$HD_{I_z} = \frac{I_z}{I_1} \text{ , } z = 2, 3, \ldots, N$$

- Harmonic distortion on the phase voltage

$$HD_{V_x} = \frac{V_x}{V_1} \text{ , } x = 2, 3, \ldots, N$$

$$HD_{V_y} = \frac{V_y}{V_1} \text{ , } y = 2, 3, \ldots, N$$

$$HD_{V_z} = \frac{V_z}{V_1} \text{ , } z = 2, 3, \ldots, N$$

Power, energy and power factor

Power and the PQ coordinate system

The meter uses the values of real power (P) and reactive power (Q) on the PQ coordinate system to calculate apparent power

Power flow

Positive power flow P(+) and Q(+) means power is flowing from the power source towards the load. Negative power flow P(-) and Q(-) means power is flowing from the load towards the power source.

Energy delivered (imported) / energy received (exported)

The meter interprets energy delivered (imported) or received (exported) according to the direction of real power (P) flow. Energy delivered (imported) means positive real power flow (+P) and energy received (exported) means negative real power flow (-P).

Power factor (PF)

Power factor (PF) is the ratio of real power (P) to apparent power (S), and is a number between 0 and 1. An ideal, purely resistive load has no reactive components, so its power factor is one (PF = 1, or unity power factor). A purely inductive or capacitive load no resistive components, so its power factor is zero (PF = 0).

True PF and displacement PF

The meter supports true power factor and displacement power factor values:

- True power factor includes harmonic content (PF).
- Displacement power factor only considers the fundamental frequency (DPF).

PF sign convention

The meter shows positive or negative power factor according to IEC standards.

PF sign in IEC mode

The meter correlates power factor sign (PF sign) with the direction of real power (P) flow.

- For positive real power (+P), the PF sign is positive (+).
- For negative real power (-P), the PF sign is negative (-).

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