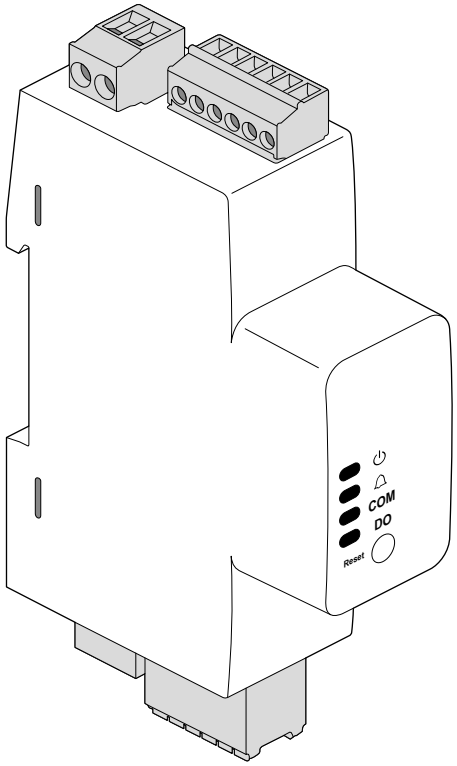
9 Series

Energy sensor, PowerTag Resi9 80A 6 circuits LN Modbus

Configuration and User Manual



R9M80X6M

02/2024

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Safety Information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a “Danger” or “Warning” safety message indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ ⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

NOTICE

NOTE is used to address practices not related to physical injury.

Electrical equipment shall only be installed, operated, serviced, and maintained by certified technicians. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this instruction. A certified technician is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Symbols

ETS settings

Additional information

The information provided must be complied with, otherwise program or data errors may occur.

Table of contents

Safety Precautions

Installation, wiring, testing, and maintenance must be performed in accordance with all local and national electrical codes.

Read carefully and follow the safety precautions below.

⚠ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Safe electrical installation must be carried out only by skilled professionals.
Skilled professionals must prove profound knowledge in the following areas:

- Connecting to installation networks.
- Connecting several electrical devices.
- Laying electrical cables.
- Safety standards, local wiring rules and regulations.

Failure to follow these instructions will result in death or serious injury.

About the Device

Energy sensor, PowerTag Resi9 80A 6 circuits LN Modbus

The Energy sensor has basic capabilities to measure current, voltage, and energy consumption, etc., which are required for monitoring single-phase electrical installations.

The Energy sensor enables various functions, some of which are listed below:

- Voltage, current, active power, active energy readings
- Power factor measurement
- Digital output
- Communication via Modbus RTU

Function summary

Parameter	R9M80X6M
Measurement method	Direct measurement
Accuracy class for Active energy Wh	Class 1
Sampling rate per cycle	128
Current: • 6-circuit current	✔
Voltage: • (Single) phase voltage	✔
Power factor: • 6-circuit power factor	✔
Frequency	✔
Power: • Active power (kW) - Per-circuit	✔
Demand parameters (kW, I): • Present demand • Peak demand	✔
Energy: kWh	Delivered, Received
RTC (real time clock)	✔
Communication	RS485 Modbus-RTU
Digital output	✔

Type of measurement

Accumulated

This Energy sensor provides bi-directional active energy measurement.

The active energy is saved in the non-volatile memory of the Energy sensor:

- kWh (delivered/consumption) per circuit
- kWh (received/producing) per circuit

Instantaneous

The Energy sensor provides highly accurate measurement data or calculated average value of a second time for the true RMS (root mean square) value for below listed items:

- Voltage (single phase)
- Current per circuit
- Active Power (W) per circuit
- Power factor per circuit
- Frequency

Cybersecurity

At Schneider Electric, we believe that cybersecurity is an essential prerequisite. We are committed to providing reliable, stable, and secure products to minimize potential network risks and protect the safety of customers, property, and the environment.

Cybersecurity aims to prevent your system, communication networks, and devices from possible attacks, data tampering, or confidential information leakage.

In addition to the direct instructions in this document, observe and follow Schneider Electric's security recommendations. For details and assistance in protecting your installation, you can also contact your local Schneider Electric Industrial Cybersecurity Services organization or visit Cybersecurity Services on the Schneider Electric website.

Recommended Cybersecurity Best Practices	Proven cybersecurity procedures
Cyber security service	From conception to maintenance: certified experts advise and guide you through a holistic cybersecurity program.
Cybersecurity support portal	Security notifications, reporting a vulnerability, reporting an incident

Defense in Depth Approach

Defense in Depth (DiD) is an approach to cyber security in which a series of defense mechanisms are layered on top of each other to protect valuable data and information. If one mechanism fails, another immediately springs into action to thwart an attack.

We strongly recommend following the Defense-in-Depth approach when integrating the R9M80X6M Energy sensor into your system, including the recommended access control as shown in the following content.

Access control

The R9M80X6M Energy sensor allows local access and the remote access based on Modbus-RTU. It is strongly recommended to secure the Energy sensor by authorized users.

It is advisable that the R9M80X6M Energy sensor is installed in a secure area in which access rules are implemented and managed (e.g., locked cabinet with keys). Also, always ensure physical protection on communication/connection ports and network cables.

For remote access based on Modbus RTU of the R9M80X6M Energy sensor, it is advisable that in addition to local access control, the system that is able to access the Energy sensor should deploy a defense-in-depth approach to limit such an access to authorized components in the system.

Secure disposal

If a device needs to be disposed of, perform a factory reset so that all data, project data and programming is deleted from the device.

Ensure that it is securely to prevent its redeployment into your operational system or unauthorized use.

Cybersecurity vulnerabilities/incidents

You can review the Vulnerability Management Policies on Schneider Electric's Cybersecurity Vulnerabilities Portal (https://www.se.com/ww/en/work/support/cybersecurity/vulnerability-policy.jsp) or report potential cybersecurity vulnerabilities or incidents.

Serial Modbus Configuration

Overview

After you have wired the RS485 port and powered up the Energy sensor, you could configure the serial communication port in order to communicate with it.

Each device on the same RS485 communication bus shall have a unique address and all connected devices must have the same protocol, baud rate and parity (data format).

Modbus communication

The Energy sensor supports serial communication through the RS485 port. It is recommended up to 10 devices to be connected on a single RS485 bus.

In an RS485 network, there is one server device, usually be an gateway providing bridge function between RS485 and the Ethernet. It enables communication between the upper system and multiple client devices (such as the Energy sensors). For applications that require the communication between only one dedicated computer and client devices, an RS232 to RS485 converter may serve as the master device.

RS485 wiring

In a point-to-point configuration, devices on the RS485 bus are connected by linking the (D1/+) and (D0/–) terminals of one device to the corresponding (D1/+) and (D0/–) terminals of the next device.

RS485 cable

The total distance of devices connected on the RS485 bus shall not exceed 1,000 meters (3,280 feet).

RS485 terminal

D1/+ Data positive pole. Transmits/receives non-reversal data signals.
D0/– Data negative pole. Transmits/receives reversal data signals.
0V Ground
Shielded wire

RS485 port setup

The Energy sensor is factory-configured with default serial communication settings. Before connecting the Energy sensor to the RS485 bus, you must first wire and configure each one separately.

The Energy sensor is with below default values for Modbus serial communication settings:

- Protocol = Modbus RTU
- Address = 1
- Baud rate = 19,200
- Data bit = E81 (Even checksum, 8 data bits, 1 stop bit)

You can use a communication converter (USB to RS485 or RS232 to RS485) or ethernet gateway device to connect to the Energy sensor. The corresponding RS485 port setting registers can be found in the Modbus register table, which can be downloaded from the web page: www.se.com.

Change Modbus address using reset button

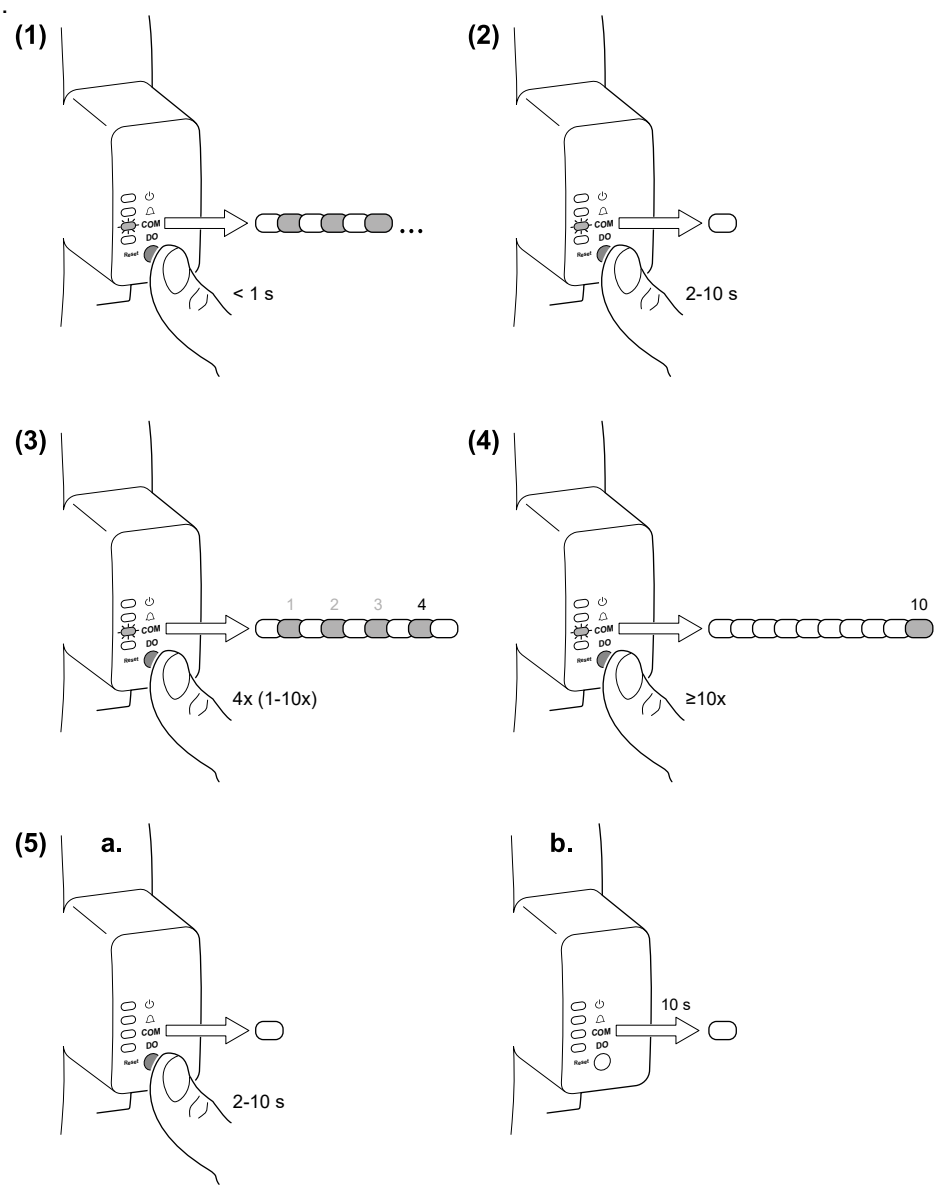
1. You can check the current Modbus address by short press on the reset button, the number of times the COM LED blinks represents the current address.

2. By long press (press and hold) the reset button (2 sec < T <10 sec), the COM LED will turn off, which means that the address setting mode is activated.

3. Modbus address will be defined by the number of short press, (it has nothing to do with the Modbus address previously configured).

4. When pressing more than 10 times in Modbus address setting mode, the address will be always set as 10

5. You can quit the Modbus setting mode
   a. by long press the reset button (2 sec < T < 10 sec) again, or
   b. let it quit automatically after 10 seconds' timeout.
   You can check out the Modbus address by step 1.



Get Energy sensor Data

Check Energy sensor data via software

You may access to or display the Energy sensor data using different software systems and methods. This includes employing a simple Modbus register interface to read values saved in the Energy sensor registers, as well as using energy management systems to view intelligent information in the Energy sensor.

Digital Output

The digital output may be configured for digital applications, such as generating ON/OFF control signals for capacitor banks, generators, and external devices and appliances.

Digital output configuration

Parameters	Value	Remarks
Control mode	Level mode or pulse mode	Level mode: The relay outputs a level signal Pulse Mode: The relay outputs a pulse signal
Pulse width	Range from 0 to 9999	In the settings, the pulse width (ON time) is defined in unit of 0.1 second. Note: It is effective only when the control mode is set to pulse mode.

Digital output as alarm

It can be output to drive external buzzer or light to alert users by following steps:

1. Set the corresponding bit of the alarm to 1 (Enable) of “SOE mask bit” Modbus register.

2. Set alarm through “SOE alarm Set” for specific type of alarm/event via “Pickup Setpoint” register for threshold value, and the time delay via “Pickup Time Delay” to avoid false alarm reporting.

3. Alarm will be trigged and output the pulse or level signal when the threshold is exceeded, and the latest alarm/event record can be read out through register “Last 1” to “Last 128” as well, supporting up to 128 records.

Factory Reset

Long press reset button more than 10 seconds will let the Energy sensor reset to factory default. Modbus configuration are set back to the factory value (for the default values, refer to that is in the section “RS485 port setup”, see page -> 10).

NOTE: Reset to factory settings resets the following parameters:

- Communication settings: Device modbus address, RS-485 port baud rate and parity
- Digital output: Digital alarm output settings, Digital alarm bit mask

Measurement and Calculation

Real-time readings

The Energy sensor measures current and voltage and reports in the real-time RMS (Root Mean Squared) values for all six circuits.

The voltage and current inputs are continuously monitored at a sampling rate of 128 samples per cycle. The amount of resolution enables the Energy sensor to provide reliable measurements and calculated electrical values for various commercial, building, and industrial applications.

The Energy sensor's registers refresh readings in such frequency as in below table:

Parameters	Refresh frequency
Voltage, Current, Active power, Power factor	250 msec
Frequency	Around 500 msec
Active energy	1 sec

Energy measurements

The Energy sensor offers fully bidirectional active energy measurement. The Energy sensor calculates and stores all accumulated active energy data in the non-volatile memory.

Power demand

Power demand is a measure of average power consumption over a fixed time interval.

If not specified, references to demand are assumed to mean power demand.

The Energy sensor measures instantaneous power consumption and can calculate demand using block interval demand method.

Power demand calculation methods

Power demand is calculated by dividing the energy accumulated during a specified period by the length of that period.

How the Energy sensor performs this calculation depends on the method and time parameters (for example, timed rolling block demand with a 15-minute interval and a 5-minute sub-range).

The Energy sensor provides calculation method for power demand based on the block interval demand.

Block interval demand

For block interval demand method types, specify a period of time interval (or block) that the Energy sensor uses for the demand calculation.

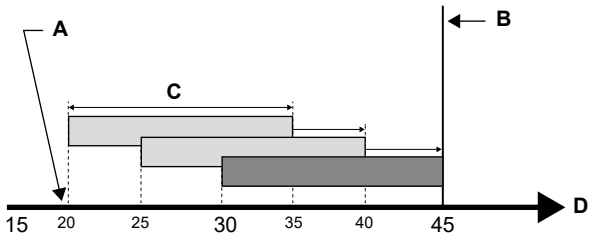
The Energy sensor provides the timed rolling block method as below:

Type	Description
Timed rolling block	Select an interval and a subinterval. The subinterval must divide evenly into the interval (for example, three 5-minute subintervals for a 15-minute interval). Demand value is updated at the end of each subinterval. The Energy sensor provides the demand value for the last completed interval in the register.

Block interval demand example

Below diagram shows how power demand is calculated with timed rolling block method. In this example, the interval is set to 15 minutes and subinterval is set to 5 minutes.

Timed rolling block



A Calculation updates at the end of the subinterval (5 minutes)
B Demand value is the average for the last completed interval
C 15-minute interval
D Time (min)

Present demand

The present demand is calculated by the Energy sensor based on the block interval method. You can set the demand interval from 1 to 60 minutes in increments of 1 minute (for example, 15 minutes).

Peak demand

The Energy sensor records the peak (or maximum) values of active power. The peak for each value is the highest average reading since the Energy sensor was last reset. These values are saved in the non-volatile memory of the Energy sensor. The Energy sensor also stores the date and time when the peak demand occurred.

SOE event record

When events such as digital input changes, the power-on, power-off, and alarms of the Energy sensor occur, the Energy sensor will save these events in the non-volatile memory, which can be viewed through communication.

The events that can be documented are as follows:

Serial number	Event type	Remarks
01	Power-on	Power changes
02	Power-off	
03	Set parameters	Commands
04	Clear Energy	
05	Clear SOE record	
07	Overvoltage	Alarms
08	Undervoltage	
09	Overcurrent L1	
10	Undercurrent L1	
11	Overcurrent L2	
12	Undercurrent L2	
13	Overcurrent L3	
14	Undercurrent L3	
15	Overcurrent L4	
16	Undercurrent L4	
17	Overcurrent L5	
18	Undercurrent L5	
19	Overcurrent L6	
20	Undercurrent L6	
21	Active power overload L1	
22	Active power underload L1	
23	Active power overload L2	
24	Active power underload L2	
25	Active power overload L3	
26	Active power underload L3	
27	Active power overload L4	
28	Active power underload L4	
29	Active power overload L5	
30	Active power underload L5	
31	Active power overload L6	
32	Active power underload L6	
57	Low true power factor L1	
58	Low true power factor L2	
59	Low true power factor L3	

60	Low true power factor L4	
61	Low true power factor L5	
62	Low true power factor L6	
63	Over frequency	
64	Under frequency	

Maintenance

Maintenance overview

This Energy sensor contains no user-serviceable parts. If a Energy sensor requires service, contact the local representative of Schneider Electric Technical Support.

NOTICE

ENERGY SENSOR DAMAGE

- Do not open the Energy sensor case.
- Do not attempt to repair any part of the Energy sensor.

Failure to follow these instructions may result in equipment damage.

Opening the Energy sensor voids the warranty.

Troubleshooting via COM LED

Abnormal serial communications LED behavior could mean potential problems with the Energy sensor.

Problem	Probable causes	Possible solutions
COM LED remains lit and does not flash	Internal hardware problem	Perform a hard reset: turn off control power to the Energy sensor, then re-apply power. If the problem persists, contact Technical Support.

If the problem is not fixed after troubleshooting, contact Technical Support for help. Make sure you have your meter's firmware version, model, and serial number information available.

Energy sensor memory

The Energy sensor uses its non-volatile memory to retain data and configuration values.

Viewing firmware version

You can find the Energy sensor’s firmware version from the Modbus communication:

In the corresponding register address, you can view the following items:

Device information	Device name, version number

Technical assistance

If you have technical questions, or you need support and assistance, please contact the Customer Care Centre in your country:
se/com/contact

Make sure to provide the model number, serial number, and firmware version of your Energy sensor in your email or have such information available when seeking technical support.

Power, Energy and Power factor

The sampled measurements taken at the voltage and current inputs provide data for calculation of power, energy and PF.

Power flow

Positive active power P (+) flows from the source to the load. Negative active power P (–) flows from the load to the source.

Energy delivered (imported) /energy received (exported)

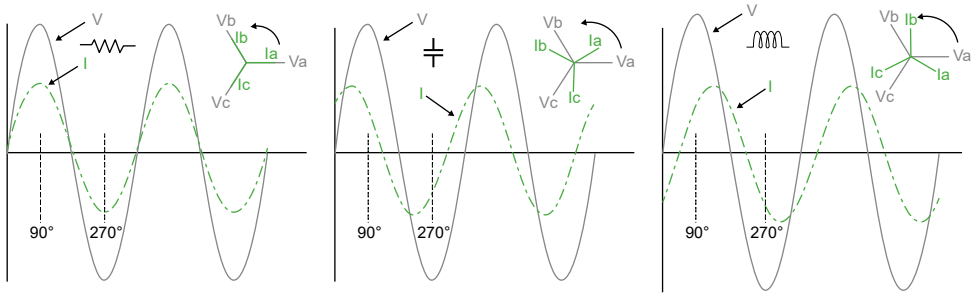
The Energy sensor interprets energy delivered (imported) or received (exported) according to the direction of active power flow. Energy delivered (imported) means positive active power (+P) and energy received (exported) means negative active power flow (–P).

Current phase shift from voltage

Electrical current can lag, lead, or be in phase with the AC voltage waveform and is typically associated with the type of load – inductive, capacitive, or resistive.

For purely resistive loads, the current waveform is in phase with the voltage waveform. For capacitive loads, current leads voltage. For inductive loads, current lags voltage.

The following diagrams show how voltage and current waveforms shift based on load type under ideal (laboratory) conditions.



Current and voltage in phase (resistive)	Current leads voltage (capacitive)	Current lags voltage (inductive)

Power factor (PF)

Power factor (PF) is the ratio of active power (P) to apparent power (S).

PF is provided as a number between –1 and +1 or as a percentage from –100% to +100%, where the sign is determined by the convention.

PF= P/S

A purely resistive load has no reactive components, so its power factor is 1 (PF = 1, or unity power factor). Inductive or capacitive loads introduce a reactive power (Q) component to the circuit which causes the PF to become closer to zero.

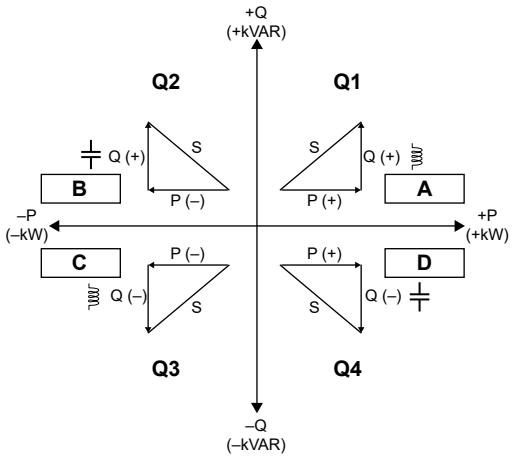
True PF

The Energy sensor supports true power factor values:

- True PF includes harmonic content.

The PF displayed by the Energy sensor is the true PF.

Power and PF lead/lag



Q1 Quadrant 1
Q2 Quadrant 2
Q3 Quadrant 3
Q4 Quadrant 4
A PF lag
B PF lead
C PF lag
D PF lead

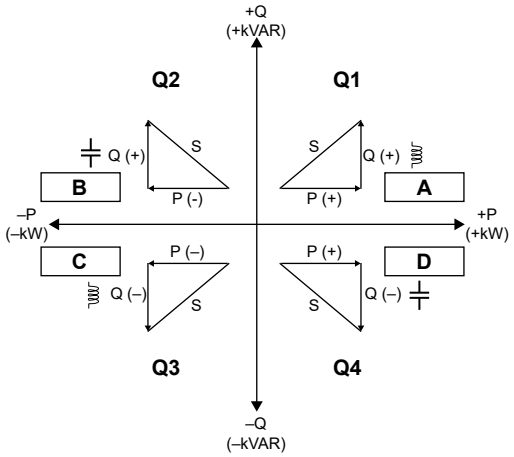
PF sign convention

Power factor sign (PF sign) can be positive or negative according to IEC standards.

PF sign convention: IEC

PF sign correlates with the direction of active power (kW) flow:

- Quadrant 1 and 4: Positive active power (+kW), the PF sign is positive (+).
- Quadrant 2 and 3: Negative active power (–kW), the PF sign is negative (–).



Q1 Quadrant 1
Q2 Quadrant 2
Q3 Quadrant 3
Q4 Quadrant 4
A PF sign +
B PF sign –
C PF sign –
D PF sign +

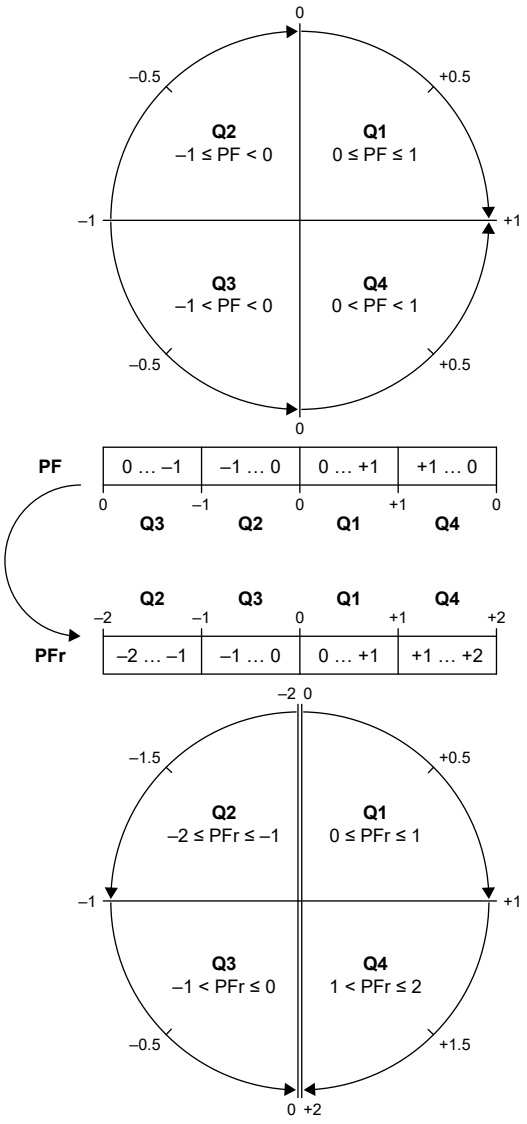
Power factor register format

The meter performs a simple algorithm to the PF value then stores it in the PF register.

The Energy sensor provides two groups of registers for Power Factor values. In the register table, “Power Factor, Alternate Formate” is a set of Power Factor values for each of the 6 circuits, which provides value in range from –1 to +1. It follows the IEC standard and provides the true Power Factor value with positive value (0 to +1) meaning active power is positive, and with negative value (–1 to 0) meaning active power is negative.

Another group of registers under “Power Factor” in the register table is a set of Power Factor values for each of the 6 circuits that provides true Power Factor value in range from –2 to +2. It follows below convention to provide Power Factor values in the 4-quadrant system.

The Energy sensor and software interpret the PF register for all reporting or data entry fields according to the following diagram:



Q1 Quadrant 1
Q2 Quadrant 2
Q3 Quadrant 3
Q4 Quadrant 4
PF Power factor
PFr PF register

The PF value is calculated from the PF register value using the following formula:

Quadrant	PF range	PF register range	PF formula
Quadrant 1	0 to +1	0 to +1	PF value = PF register value
Quadrant 2	-1 to 0	–2 to –1	PF value =(-2) -(PF register value)
Quadrant 3	0 to -1	–1 to 0	PF value = PF register value
Quadrant 4	+1 to 0	+1 to +2	PF value =(+2) -(PF register value)

Specification

The specifications contained in this section are subject to change without notice. For installation and wiring information, refer to the Energy sensor's instruction sheet.

Mechanical characteristics

IP degree of protection (IEC60529)	Enclosure: IP20 Front section: IP40
Installation method	DIN rail installation (width of 35 mm)
Mounting position	Vertical
Weight	110 g
Dimensions W x L x H	27x70x113.6 mm

Electrical characteristics

Auxiliary power supply

Item	R9M80X6M
Voltage	AC: 100-240 V, 50/60 Hz, DC: 80-265 V
Overvoltage category (auxiliary power)	CAT III
Power consumption	< 3 W at DC input; < 5 VA at AC input

Measurement accuracy

Item	R9M80X6M
Current	± 0.5%
Voltage L-N	± 0.5%
Power factor	± 1%
Active Power	± 1%
Frequency	± 0.02 Hz
Active energy	Cl.1 (Class 1 as per IEC61557-12)

Voltage inputs

Rated voltage	230 V L-N
Impedance	≥ 1.7 MΩ
Frequency	50 Hz, ± 5 Hz

Current inputs

Measured current	20 mA to 80 A; The current ranges correlate with the CT, CR number R9MCT80
Withstand	Continuous at 80 A The current ranges correlate with the CT, CR number R9MCT80
Impedance	≤ 20 mΩ
Frequency	50 Hz, ± 5 Hz

Environmental characteristics

Operating temperature	-25 °C to +60 °C
Storage temperature	-40 °C to +85 °C
Humidity rating	5% to 95% relative humidity at 50 °C (non-condensing)
Operating temperature	5% to 95% (non-condensing)
Storage humidity	10% to 100% (non-condensing)
Pollution degree	2
Altitude	≤ 2000 m (6562 ft)

Safety, EMC, Certification and Standards

Protective class	II Double insulated for user accessible parts
Certification	CE, UKCA
Safety Standards	*BS/EN/IEC 61010-1*
Standards compliance	*BS/EN/IEC 62052-11* *BS/EN/IEC 62053-21* *BS/EN/IEC 61557-12*

RS485 communications

Number of ports	1
Maximum cable length	1000 meters
Maximum number of devices (unit load)	Up to 10 devices on the same bus
Parity check	Even, odd, or none, Even by default
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, Default 19200
Insulation	2.5 kV AC real RMS, double insulated

DO terminal

Relay output drive capability	24 VDC (max) / 0.05 A
Isolation voltage	Between contact and coil: 2 kV rms
Pulse output	400 imp/kWh

Schneider Electric Industries SAS
35 rue Joseph Monier
92500 Rueil-Malmaison France

UK Representative
Schneider Electric Limited
Stafford Park 5
Telford, TF3 3BL
United Kingdom

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