Configuration with the TIA Portal

11.1 TIA Portal Device configuration

Drag the SM 1238 Energy Meter 480VAC module from the hardware catalog and drop it in a rack image. When you click on the SM 1238 Energy Meter 480VAC image in the rack, a blue line highlights the module and you can set parameters that appear below on the General tab > Properties tab.



11.2 General information parameters

Enter the general project, identification, and maintenance information.

11.3 Module parameters ^{模块参数}

- 11.3.1 Al configuration parameters 输入参数
- 11.3.1.1 Diagnostics (module scope parameters) ^{诊断(模块范围参数)}

Note: Bold font indicates the factory default setting for configuration parameters. 注意:粗体表示配置参数的工厂默认设置。

Diagnostics (AI configuration)

Line voltage diagnostics 线电压诊断

• Enable/disable optional line voltage diagnostics

Line voltage tolerance 线电压容许公差

Enter the percentage deviation allowed (1% ... 10% ... 50%). If enabled, deviation +/outside this value triggers the line voltage diagnostic interrupt and "No supply voltage at
L1" error message. 输入允许的百分比偏差(1%...10%......50%)。如果启用,在此值之外的偏差+/-将触发线路电压诊断
中断和 " at无电源电压 "
L1 " 错误消息。

See also

Connection examples (Page 19)

11.3.1.2 Measurement (module scope parameters) ^{测量(模块范围参数)}

11.3 Module parameters

Measurement (AI configuration) 测量(输入配置)

Connection type 连接类型

- Select the AC power connection that you want to use. For wiring details, see the Connection examples (Page 19) section.
 - Disabled
 - 1P2W 1-phase, 2-wire: Single phase measurement, two conductors, with or without voltage transformers, with one electrical current transformer
 - 3P4W 3-phase, 4-wire:
 3-phase measurement, four conductors, symmetrical and asymmetrical load, with or without voltage transformers, with three electrical current transformers
 - 3P4W1 3-phase, 4-wire, symmetrical load;
 3-phase measurement, four conductors, symmetrical load, with or without one voltage transformer, with one electrical current transformer
 - 3x1P2W 3 x 1-phase, 2-wire each:
 3x single phase measurement, two conductors, with or without voltage transformers, with three electrical current transformers
 - 2P3W 2 phase 3-wire:
 2-phase measurement, three conductors, asymmetrical load, without voltage transformers, with two electrical current transformers

Voltage measuring range

- Select the phase voltage of your AC power.
 - 100 V
 - 110 V
 - 115 V
 - 120 V
 - 127 V
 - 190 V
 - 200 V
 - 208 V
 - 220 V
 - 230 V
 - 240 V
 - 277 V

Line frequency

- Select the frequency of your AC power line.
 - 1 = 50 Hz
 - 2 = 60 Hz

Final value

- Select the full-scale watt hours value for periodic counting of the energy counter. The energy counters count up to a maximum value that you can assign, reset themselves automatically to "0", and continue counting energy usage. This behavior and the maximum (final) value are the same for all energy counters. The overflow counter counts the number of full-scale resets that occur.
 - No end value (count indefinitely)
 - Count periodically to 10³ Wh (Watt hour)
 - Count periodically to 10⁶ Wh
 - Count periodically to 109 Wh
 - Count periodically to 1012 Wh
 - Count periodically to 1015 Wh

Activate gate for energy meter ^{启动电能表闸门}

启用/禁用门电路:当启用此选项时,能量计数器只在相应的输 出数据位(DQ位)设置为1时计数。

• Enable/disable gate circuit: When this option is enabled, the energy counter only counts when the corresponding output data bit (DQ bit) is set to 1.

Minimum and maximum value

 Enable/disable calculation of the minimum and maximum values. The minimum and maximum values are calculated from the start of the measurement. The calculated values are stored retentively and without a time stamp.
 店用/禁用最小值和最大值的计算。最小值和最大值从测量开始计算。计算值被保存,没有时间戳。 11.3 Module parameters

11.3.2 Process data parameters ^{处理数据参数}

11.3.2.1 Operating mode

Operating mode (Process data configuration)

Module version

- Select a Module version. The Module version selection affects user data interface size and process data availability. When you select module versions 32 bytes I/ 12 bytes O or 112 bytes I/ 12 bytes O, the Process data variant drop-list selector is enabled and you can select a Process data variant option. You can change to a different Process data variant in RUN mode with your program logic. The fixed format module version selections below use fixed user data and you cannot assign alternative Process data variants.
 - 2 bytes I/ 2 bytes O (fixed format)
 - 32 bytes I/ 12 bytes O (Process data variant format options enabled)
 - **112 bytes I/ 12 bytes O** (Process data variant format options enabled)
 - EE@Industry measured data e3 (fixed format)
 - EE@Industry measured data e2 (fixed format)
 - EE@Industry measured data e1 (fixed format)
 - EE@Industry measured data e0 (fixed format)

Process data variant

- Select the "Process data variant" to use with the "32 bytes I/12 bytes O" or "112 bytes I/12 bytes O" module versions. The module uses the selected Process data variant at power up. For measurement details, see the appendix D section Overview of data variant options (Page 126). The hexadecimal number following the variant name is the ID value for that variant.
 - Total power L1, L2, L3 (FE_H)
 - Active power L1, L2, L3 (FD_H)
 - Reactive power L1, L2, L3 (FCн)
 - Apparent power L1, L2, L3 (FB_H)
 - Basic measurement values L1, L2, L3 (FA_H)
 - Total energy L1, L2, L3 (F9_H)
 - Energy L1 (F8_H)
 - Energy L2 (F7_H)
 - Energy L3 (F6H)
 - Basic values 3-phase measurement L1, L2, L3 (F5_H)
 - Quality values 3-phase measurement L1, L2, L3 (F0_H)
 - Energy measurement (periodical) overage meter (EF_H)
 - EE@Industry measured data e3 (E3_H)
 - EE@Industry measured data e2 (Е2н)
 - EE@Industry measured data e1 (E1_H)
 - EE@Industry measured data e0 (E0_H)
 - Basic values single phase measurement L1 (9F_H)
 - Basic values single phase measurement L1a (9E_H)
 - Basic values single phase measurement L2 (9D_H)
 - Basic values single phase measurement L2a (9CH)
 - Basic values single phase measurement L3 (9B_H)
 - Basic values single phase measurement L3a (9A_H)

11.4 AI 3 (AC phase parameters)

11.4 AI 3 (AC phase parameters)

- 11.4.1 Inputs (phase channel parameters)
- 11.4.1.1 Line conductors 1, 2, and 3 parameters

Diagnostics (channel scope parameters)

Line conductor diagnostics configuration

Depending on your assignment of the connection type parameter, one or three line conductors are available for configuration in the Inputs parameter group.

Diagnostics (AI 3 configuration)

- Enable the Diagnostics you want, for each phase.
 - Diagnostics overflow current (enable\disable)

The measured current is monitored for "Tolerance factor × Measured current" after the "Tolerance time" elapses. A violation results in an electrical current overflow.



- ① The tolerance time starts as soon as the secondary electrical current value (1 A, 5 A) is exceeded.
- ② Overflow current diagnostic condition for the affected phase if the tolerance value of the secondary electrical current has been exceeded
- ③ After the set tolerance time has elapsed, the secondary electrical current value (1 A, 5 A) is monitored. A violation of the secondary electrical current value also returns the overflow current diagnostic condition.

Figure 11-1 Diagnostic response to an overcurrent event

- Diagnostics overflow voltage (enable\disable)
 Line voltage (measuring range) is monitored for tolerance. A violation of the overflow triggers a diagnostic interrupt.
- Diagnostics underflow voltage (enable\disable)
 Line voltage (measuring range) is monitored for tolerance. A violation of the underflow triggers a diagnostic interrupt.
- Diagnostics of low limit voltage (enable\disable)
 Select this check box if you want a diagnostic interrupt to be triggered with the low limit for voltage is reached.

11.4 AI 3 (AC phase parameters)

Diagnostics overflow cumulative values (enable\disable)
 A cumulative overflow in the calculated variables is displayed. The values stop at the high or low limit.

Tolerance factor overcurrent

• Enter the tolerable value of the secondary current of the transformer in 0.1A increments from 10 (1 A) ... **100** (10 A). Always verify that the current class of the transformer (1 A, 5A, ...) is appropriate.

Tolerance time overcurrent

• The monitoring time that a secondary overcurrent of the transformer is tolerated. Enter a value in millisecond units (0 ... 40000 ... 60000). A value of zero means that the monitoring time is disabled.

Measurement (channel scope parameters)

Line conductor measurement configuration

Depending on your assignment of the connection type parameter, one, two, or three line conductors are available for configuration in the Inputs parameter group. You can assign the Measurement properties for each phase that you are using.

Operating hours counter

- Assign operating hours counter properties for each AC power phase
 - Enable/disable operating hours counter
 The counting starts from a programmable minimum value. The counter can be reset or pre-defined using data record or output bit.
 - Enable/disable operating hours gate control.
 When the gate is activated, the operating hours counter only counts when the corresponding output data bit (DQ bit) is set to "1".

Primary current of electrical current transformer

• Assign a primary current in Amperes 1 ... 99999 (default value is **1 A**). The primary and secondary electrical current values that you assign identify the transfer factor of the electrical current transformer. The transfer factor is the multiplier for the measured current that is used to calculate the actual phase current.

Secondary current of electrical current transformer

- Select the electrical current transformer nominal secondary current value from the two drop-list options
 - 1A
 - 5A

Transformer primary voltage

Assign a primary voltage in volts (1 ... 230 ... 999999). The primary and secondary
voltage values that you assign identify the transfer factor of a voltage transformer. The
transfer factor is the multiplier for the measured voltage that is used to calculate the
actual phase voltage.

Transformer secondary voltage

• Assign a secondary voltage in volts (1 ... 230 ... 500).

Note

You must ensure that the actual secondary voltage applied to the module's ULx inputs does not exceed the expected 277 VAC maximum.

Lower limit electrical current measurement

• Assign an electrical current limit in milliamperes (20 ... 50 ... 250). Measured currents under this limit are not recorded.

The low limit for measuring current refers to the secondary electrical current of the transformer and is used to prevent inaccurate calculations when there are very low currents. By default, the low limit for electrical current measurement is set to 50 mA. Set the low limit for the electrical current measurement to the required value depending on your process.

Tip: If you want to find the low limit for the electrical current measurement experimentally, set it to a lower value. Then, feed in a very precise low current and determine the measurement error that you can tolerate. Afterwards, set the low limit for the electrical current measurement to the limit value that you have determined.

If current falls below the low limit for the electrical current measurement, the following measured values and derived values of the affected phase are reset.

- Effective electrical current value
- Neutral conductor current
- Active power
- Reactive power
- Apparent power
- Phase angle
- Power factor
- A moving mean value is formed from the power values and they only become "0" after a delay time. The energy meters for active, reactive and apparent energy of the reset phase stop measuring.

11.5 I/O addresses

Reverse electrical current direction

- Select whether or not to reverse the interpretation of electrical current direction, for this AC power phase. In the event of incorrect reversed connection of an electrical current transformer winding, this parameter can be used to correct the measured values and prevent rewiring to correct the wiring error. The direction of the current is only evident in the power measurement values. The electrical current measurement value is an unsigned rms value.
 - Disabled
 - Reverse electrical current direction

11.5 I/O addresses

11.5.1 I/O start addresses, Process image update and PIP partition

I/O address parameters

When you place one or more SM 1238 Energy Meter 480VAC modules in the TIA Portal Device configuration rack image, the I/O address blocks are automatically assigned. The input addresses are assigned in 32 byte maximum submodule blocks, so the 32 bytes I/ 12 bytes O module version setting uses one 32 byte input address block and the 112 bytes I/ 12 bytes O module version must use four 32 byte input address blocks.

For the 112 bytes I/ 12 bytes O module version, four address blocks appear in the configuration properties as four I/O address submodule groups (i.e. SM_1, SM_2, SM_3, and SM_4). The first block assigns addresses to 32 input bytes and 12 output bytes. The other address blocks assign the remainder of the input addresses and no output addresses.

When the address blocks are correctly assigned, multiple blocks of input addresses must not overlap and must be a contiguous block of addresses. It is possible that, for example, you could put more than one SM 1238 module in the rack and find the automatic assignment of input address has assigned non-contiguous input addresses. In this case, the hardware configuration compilation will fail. You must correct the start addresses to ensure multiple address blocks are contiguous and recompile the configuration successfully.

Input addresses

- Assign properties to the input I addresses that are read by your program logic.
 - Start address: Automatic or manual entry
 - End address: Automatically calculated and entry field disabled
 - Organization block: Accept the "Automatic update" default assignment or select a different OB for a time critical I/O process image update.
 - Process image: Accept the "Automatic update" default assignment or assign a Process Image Partition for the I/O data.

Output addresses

- Assign properties to the output Q addresses that are written by your program logic.
 - Start address: Automatic or manual entry
 - End address: Automatically calculated and entry field disabled
 - Organization block: Accept the "Automatic update" default assignment or select a different OB for time critical I/O process image update.
 - Process image: Accept the "Automatic update" default assignment or assign a Process Image Partition for the I/O data.

11.5.2 Hardware identifier

The hardware identifier is automatically assigned and the entry field is disabled.

Status LEDs and diagnostic interrupt alarms

12.1 Status and error LED display

DIAG and L1, L2, L3 LED displays

In the following diagram, the DIAG LED and the three phase status LEDs are colored in green. The other LED positions are not used.



Figure 12-1 LED display

Meaning of the LED displays

The following table explains the meaning of the DIAG and phase status LED displays.

Corrective measures for diagnostic alarms can be found in the Diagnostic alarms (Page 84) section.

DIAG LED

Table 12- 1	Meaning	of the	DIAG	LED
-------------	---------	--------	------	-----

DIAG	Meaning
Off	Supply voltage of the S7-1200 not OK
Green flashing	Module not ready for operation (no parameters assigned)
浂	
Green On	Module parameters assigned and module running properly
•	
Red flashing	Module parameters assigned and module diagnostic error detected
栄	

L 1, 2, 3 phase status LEDs

Table 12-2 Meaning of the Status LED

Status	Meaning
Green On	Channel configured and no fault has been detected.
•	
Red flashing	There is an error with this phase or no voltage is applied.
栄	
Red flashing on all phase I EDs	SM 1238 Energy Meter 480VAC firmware loader is active.
来	tempt, see the Firmware updates and S7-1200 CPU version compatibility (Page 14) topic.

12.2 Diagnostic alarms

12.2 Diagnostic alarms

Diagnostic alarms

The SM 1238 Energy Meter 480VAC module supports diagnostic error interrupt events shown in the following table.

Note

Assignment channel in diagnostic message ⇔ Phase

In the diagnostic messages the channels are counted from "Channel "0" on, in the SM 1238 Energy Meter 480VAC from Phase "1" on.

Note the following assignment:

- Channel "0" ⇔ Phase "1"
- Channel "1" ⇔ Phase "2"
- Channel "2" ⇔ Phase "3"

12.2 Diagnostic alarms

Diagnostic alarm	Error code	Meaning	Remedy	
Undervoltage ¹	2н	Line voltage (measurement range) is moni-	Observe the line voltage range	
Overvoltage	3н	tored for tolerance. Violation leads to volt- age overflow/underflow error.		
Overload	4 _H	The measured current is monitored after expiration of the "Tolerance time", for "Tol- erance factor × Measured current". Ex- ceeding this results in an overflow electrical current error.	Observe the electrical current range	
		The maximum value of the secondary current (12 A) is exceeded.		
Overflow cumulative values	7 _Н	Cumulative overflow error in the calculated values	-	
Low limit ¹	8н	Violation of the low limit for voltage meas- urement. This error is generated when the voltage falls below 80VAC.	Observe the voltage range	
Error	9н	Internal module error (diagnostic alarm on channel 0 applies to the entire module).	Replace the module	
Parameter assignment error	10н	 The module cannot evaluate parameters for the channel. Incorrect parameter assignment 	Correct the parameter assignment.	
Load voltage	11 _H	Missing or insufficient line voltage on phase L1 for F-stand 1 only.	Check supply	
Channel is temporarily unavailable	1F _H	Firmware upgrade is being performed. Channel 0 applies to the entire module. The module is currently not performing any measurements.		

Table 12-3 Error codes

¹ If the "Underflow voltage" and "Low limit voltage" diagnostics are active at the same time, the "Low limit voltage" diagnostics has the higher priority and deletes the "Underflow voltage" diagnostics.

12.3 Diagnostics response

12.3 Diagnostics response

Diagnostics response

This section describes the response of the SM 1238 Energy Meter 480VAC when a diagnostic error is reported.

Measured values in the case of diagnostics

After a diagnostic error occurs, measured values continue to be displayed as long as they can still be acquired. If measured values cannot be measured or calculated, "0" is displayed.

Zero suppression

If the current fed in is lower than the configured low limit for current, the measured value of the current and all dependent variables are suppressed or set to "0".

Overload limitation

If the secondary current fed in at the channel is higher than 12 A, the module limits the current and the measured value of the current and all dependent variables are set to "0".

Value falls below "Low limit electrical current measurement"

If current falls below the low limit for the electrical current measurement, the following measured values and derived variables of the affected phase are reset.

- Effective electrical current value
- Active power
- Reactive power
- Apparent power
- Phase angle
- Power factor

A moving mean value is formed from the power values and they only become "0" after a corresponding time. The energy meters for active, reactive and apparent energy of the reset phase stop measuring.

12.3 Diagnostics response

Loss of the supply voltage

At a loss of supply voltage at U_{L1} (phase 1) for F-stand 1, all measurements are interrupted.

After the supply voltage is restored, the SM 1238 Energy Meter 480VAC operates again with the configuration / parameter assignment stored in the CPU. The retentively stored values are used for the following counters and calculations:

- Energy and overflow counters
- Operating hours counters
- Counters for limit violation
- Minimum values
- Maximum values

Input data to "0"

Note

If the SM 1238 Energy Meter 480VAC is no longer recognized by the S7-1200 (for example, because it is defective or not plugged in), all input data is set to "0".

Technical specifications

13

Article number	6ES7238-5XA32-0XB0
General information	
Product type designation	SM 1238, AI energy meter 480 V AC
HW functional status	From FS02
Firmware version	V2.0.1
Product function	
Voltage measurement	Yes
 with voltage transformer 	Yes
Current measurement	Yes
 without current transformer 	No
 with current transformer 	Yes
Energy measurement	Yes
Frequency measurement	Yes
Power measurement	Yes
Active power measurement	Yes
Reactive power measurement	Yes
I&M data	Yes; I&M 0
Isochronous mode	No
Engineering with	
 STEP 7 TIA Portal configurable/integrated as of version 	V13 SP1
Operating mode	
cyclic measurement	Yes
acyclic measurement	Yes
Acyclic measured value access	Yes
Fixed measured value sets	Yes
Freely definable measured value sets	No
CiR – Configuration in RUN	
Reparameterization possible in RUN	Yes
Calibration possible in RUN	Yes
Installation type/mounting	
Mounting position	Horizontal, vertical

Article number	6ES7238-5XA32-0XB0
Supply voltage	
Design of the power supply	from CPU
Type of supply voltage	DC
Input current	
Current consumption, max.	180 mA
Power loss	
Power loss, typ.	0.75 W
Address area	
Address space per module	
Address space per module, max.	124 byte; 112 byte input / 12 byte output
Time of day	
Operating hours counter	
present	Yes
Analog inputs	
Cycle time (all channels), typ.	50 ms; Time for consistent update of all meas- ured and calculated values (cyclic und acyclic data)
Interrupts/diagnostics/status information	
Alarms	
Diagnostic alarm	Yes
Limit value alarm	Yes
Hardware interrupt	No
Diagnostics indication LED	
 Monitoring of the supply voltage (PWR- LED) 	Yes
Channel status display	Yes; Green LED
for channel diagnostics	Yes; red Fn LED
for module diagnostics	Yes; green/red DIAG LED
Integrated Functions	
Measuring functions	
 Measuring procedure for voltage meas- urement 	TRMS
Measuring procedure for current measure- ment	TRMS
Type of measured value acquisition	seamless
Curve shape of voltage	Sinusoidal or distorted
Buffering of measured variables	Yes
Parameter length	74 byte
Bandwidth of measured value acquisition	2 kHz; Harmonics: 39 / 50 Hz, 32 / 60 Hz

Technical specifications

Article number		6ES7238-5XA32-0XB0	
Measuring range			
-	Frequency measurement, min.	45 Hz	
_	Frequency measurement, max.	65 Hz	
Measuring inputs for voltage			
-	Measurable line voltage between phase and neutral conductor	277 V	
-	Measurable line voltage between the line conductors	480 V	
-	Measurable line voltage between phase and neutral conductor, min.	0 V	
-	Measurable line voltage between phase and neutral conductor, max.	293 V	
-	Measurable line voltage between the line conductors, min.	0 V	
-	Measurable line voltage between the line conductors, max.	508 V	
-	Measurement category for voltage measurement in accordance with IEC 61010-2-030	CAT II; CAT III in case of guaranteed protection level of 1.5 kV	
-	Internal resistance line conductor and neutral conductor	3.4 ΜΩ	
-	Power consumption per phase	20 mW	
-	Impulse voltage resistance 1,2/50µs	1 kV	
Measuring inputs for current			
-	measurable relative current (AC), min.	1 %; Relative to the secondary rated current 5 A	
-	measurable relative current (AC), max.	100 %; Relative to the secondary rated current 5 A	
-	Continuous current with AC, maximum permissible	5 A	
-	Apparent power consumption per phase for measuring range 5 A	0.6 V·A	
-	Rated value short-time withstand cur- rent restricted to 1 s	100 A	
-	Input resistance measuring range 0 to 5 A	25 m Ω ; At the terminal	
-	Zero point suppression	Parameterizable: 2 250 mA, default 50 mA	
-	Surge strength	10 A; for 1 minute	

Article number	6ES7238-5XA32-0XB0	
Accuracy class according to IEC 61557-12		
 Measured variable voltage 	0,2	
 Measured variable current 	0,2	
 Measured variable apparent power 	0.5	
 Measured variable active power 	0.5	
 Measured variable reactive power 	1	
 Measured variable power factor 	0.5	
 Measured variable active energy 	0.5	
 Measured variable reactive energy 	1	
 Measured variable neutral current 	0.5; calculated	
 Measured variable phase angle 	±1 °; not covered by IEC 61557-12	
 Measured variable frequency 	0.05	
Potential separation		
Potential separation channels		
between the channels and backplane bus	Yes; 3 700V AC (type test) CAT III	
Isolation		
Isolation tested with	2 300V AC for 1 min. (type test)	
Ambient conditions		
Ambient temperature during operation		
horizontal installation, min.	-20 °C	
horizontal installation, max.	00 °C	
• vertical installation, min.	-20 °C	
• vertical installation, max.	50 °C	
Dimensions		
Width	45 mm	
Height	100 mm	
Depth	75 mm	
Weights		
Weight (without packaging)	165 g	
Data for selecting a current transformer		
 Burden power current transformer x/1A, min. 	As a function of cable length and cross section, see device manual	
 Burden power current transformer x/5A, min. 	As a function of cable length and cross section, see device manual	

13.1 Technical specifications

Agency approvals

The SM 1238 Energy Meter 480 VAC meets the standards and agency approvals for S7-1200 PLC system components. The approvals are listed in the General technical specifications section of the S7-1200 System Manual. You can find the S7-1200 system manual on the Internet (https://support.industry.siemens.com/cs/ww/en/view/91696622).

Agency approvals are also marked on the side of the module.

模块配置数据记录

Module configuration data record (DS 128)

A.1 Configuration by parameter data record

Parameter assignment in the user program

You can reassign the module parameters in RUN mode. For example, you can change the diagnostics alarm behavior. 您可以更改诊断警报行为。

Changing parameters in RUN

The "WRREC" instruction in your program can transfer parameters to the module via the respective data record. The device configuration parameters set in STEP 7 do not change in the CPU, which means the parameters set in STEP 7 are still valid after a restart.

If you reconfigure a module (so that the user data size changes) and diagnostics are pending prior to the reconfiguration, these diagnostics are not signaled as "outgoing".

STATUS output parameter

If errors occur during the transfer of parameters with the WRREC instruction, the module continues operation with the previous parameter assignment. However, a corresponding error code is written to the STATUS output parameter.

The description of the WRREC instruction and the error codes is available in the STEP 7 online help.