SolarEdge Inverters - SunSpec Logging - Technical Note

Revision History

- Version 2.7, May 2024: Updated Appendix A and Appendix B. Removed Appendix C.
- Version 2.6, December 2023: Updated L-L voltage for SE meter via MODBUS.
- Version 2.5, November 2022: Synergy inverter updates; multiple MPPT Inverter Extension Model table: value at address 40127 changed to 0.

Contents

Overview

SolarEdge inverters support transmission of inverter-level monitoring data directly from the inverter to a local non-SolarEdge device using the SunSpec open protocol for interoperability between devices in renewable energy systems. This option can be used alongside the connection to the SolarEdge monitoring server. This document describes the connection method and the protocol and configurations needed to implement this feature.

Direct connection to a monitoring device is useful when a network connection is unavailable, when extensive custom data processing is required, or when authorities require direct access to monitoring data.

In many cases, it is possible – and recommended – to employ the direct connection alongside a SolarEdge monitoring platform connection. Connection to the monitoring platform enables all the monitoring benefits, primarily:

- Proactive installer maintenance and real time troubleshooting by SolarEdge support, using with the physical mapping available only in the monitoring platform
- Module-level monitoring

Communication Technologies

SolarEdge uses an open, industry-standard communications stack to provide efficient messaging between SolarEdge and third-party devices and applications.
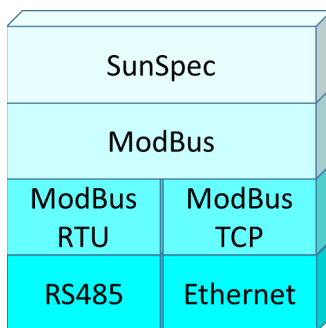
The communications stack components are briefly described below.

SunSpec

SunSpec is an application-layer communications protocol designed to achieve interoperability between Distributed Energy Resource (DER) components and smart grid applications.

Modbus

Modbus is a serial communications protocol typically used to connect data collection terminals to a centralized processing unit. SolarEdge products use Modbus to perform SunSpec messaging over two types of physical/link-layer channels:

- **Modbus RTU**: Remote Terminal Unit (RTU) Modbus over a serial RS485 connection
- **Modbus TCP**: Modbus over an Ethernet connection

SolarEdge systems support a single Modbus Leader only – either single Modbus RTU or single Modbus TCP.

SunSpec Supported Inverters

Depending on their type, SolarEdge devices may be configured in either of the two ways:

- Using SetApp
- Using the LCD

All SolarEdge inverters with SetApp configuration are SunSpec-supported.
SolarEdge inverters with the LCD that have Firmware version 3.xxxx and above only are SunSpec-supported.

To check the inverter firmware versions (for inverters with the LCD):

1. Short press the LCD light button until the following screen is displayed:

```
I D :  # # # # # # # #   # #
D S P 1 / 2 : x . x x x x / x . x x x x
C P U  : 0 0 0 2 . 0 4 9 6
C o u n t r y : X X X X X
```

2. If required, upgrade to the latest available firmware, as described in
   https://www.solaredge.com/sites/default/files/upgrading_an_inverter_using_micro_sd_card.pdf.

Use Cases for MODBUS over RS485

This section describes RS485 options to connect the inverter to a non-SolarEdge monitoring device.

Physical Connection

The connection is performed using an RS485 connector with a twisted pair cable. The transmission mode in SolarEdge inverters is set to RTU (binary).
The COM port default properties are: 115200 bps, 8 data bits, no parity, 1 stop bit, no flow control. Baud rate can be changed between 9600bps to 115200bps (supported from CPU version 2.0549).

The RS485 bus can be configured to support connection either to a non-SolarEdge monitoring device or Leader-Follower connection between SolarEdge inverters. Therefore, a Follower inverter cannot communicate simultaneously with a Leader inverter and with a non-SolarEdge monitoring device on the same RS485 bus.

All SolarEdge inverters with SetApp configuration have two built-in RS485 ports. An inverter can act as Leader on both ports simultaneously. Each port on a leader inverter can connect to up to 31 follower inverters. The two ports therefore support connectivity with 62 follower inverters.
A Commercial Gateway with LCD can act as Leader on one of the built-in RS485 ports and on the RS485 Plug-in.
For more information on the RS485 Plug-in, see:
https://www.solaredge.com/sites/default/files/RS485_expansion_kit_installation_guide.pdf

> **· · · NOTE**
>
> For connectivity purposes, the Synergy Manager is considered a single inverter.

Single Inverter Connection

Use the RS485 bus for connecting to a non-SolarEdge monitoring device.
Use the Ethernet connection or any of the optional wireless connection options to connect to the SolarEdge monitoring platform.
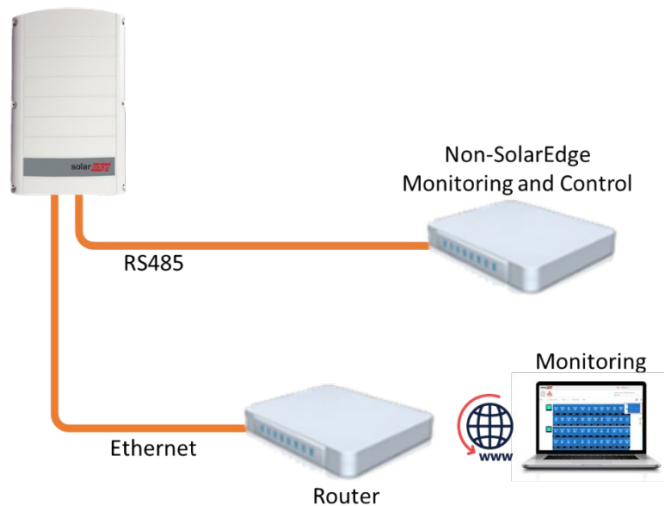
Multiple Inverter Connection

If a second RS485 port is required to establish connection, use:

- RS485-2 for inverters with SetApp configuration
- RS485-E (requires a RS485 Plug-in) for inverters with an LCD

Connection to a non-SolarEdge monitoring device only (without connection to the monitoring platform)

Option 1 (direct connection) – Use RS485-1 to connect Followers to the Leader and the Leader to a non-SolarEdge monitoring device. Every inverter in the RS485 bus should be configured to a different device ID (MODBUS ID).
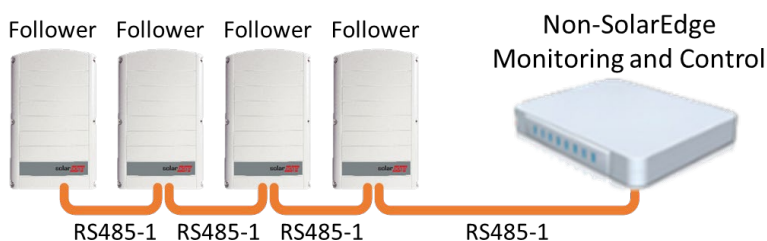
Option 2 – Use RS485-1 to connect Follower inverters to the Leader; use either RS485-2 or RS485-E to connect the Leader to a non-SolarEdge monitoring device. Every inverter in the

RS485 bus should be configured to a different device ID (MODBUS ID).
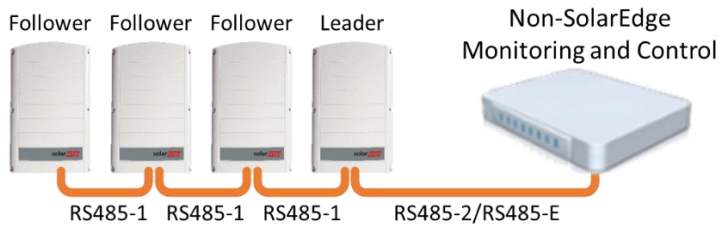
Connection to a non-SolarEdge monitoring device (with connection to the monitoring platform)

Use the RS485 bus for connection to a non-SolarEdge monitoring device. Every inverter in the RS485 bus should be configured to a different device ID (MODBUS ID).

Option 1 (direct connection) – Connect each inverter to the router via Ethernet cables.
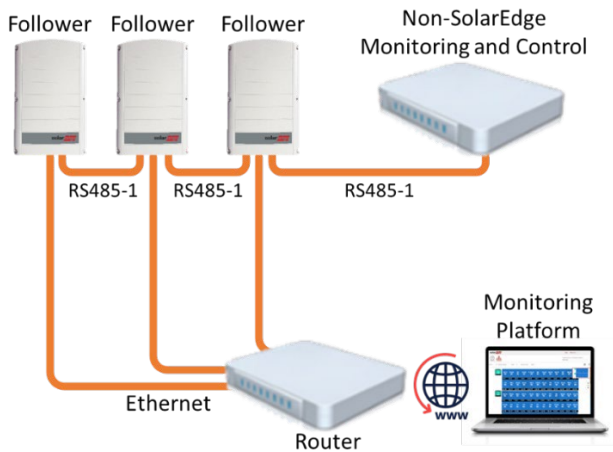
Option 2 – Connect the router to one inverter only.

Connection to the monitoring platform and to a non-SolarEdge monitoring device using a Commercial Gateway

Use the RS485-2 bus for connection to a non-SolarEdge monitoring device. Every inverter connected to the RS485 bus should be configured to a different device ID (MODBUS ID).
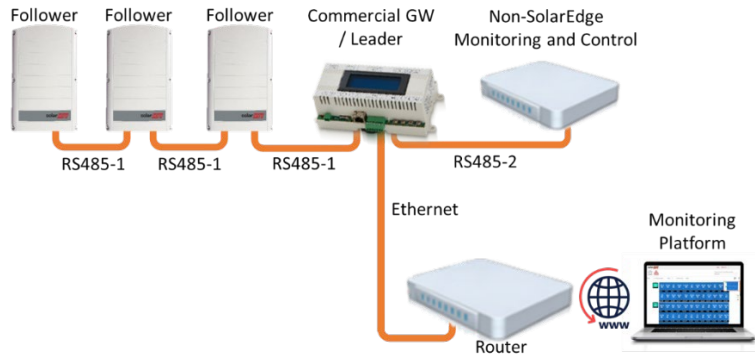
If required, use the RS485-E bus for connecting a second chain of inverters.
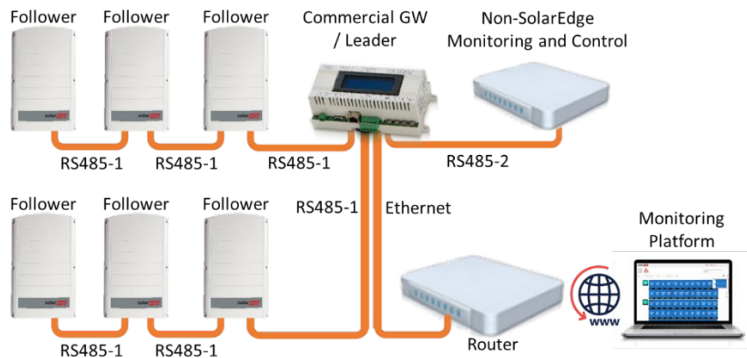
Use Cases for MODBUS over TCP

This section describes MODBUS over TCP options to connect the inverter to a non-SolarEdge monitoring device.

Single Inverter Connection

Use Ethernet for connecting to a non-SolarEdge monitoring device.
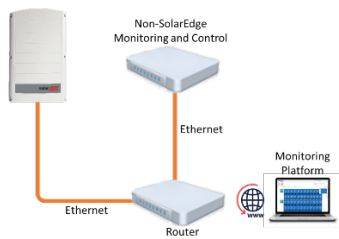
Multiple Inverter Connection

Connection to a non-SolarEdge monitoring device only (without connection to the SolarEdge monitoring platform)

Use Ethernet for connection to a non-SolarEdge monitoring device.
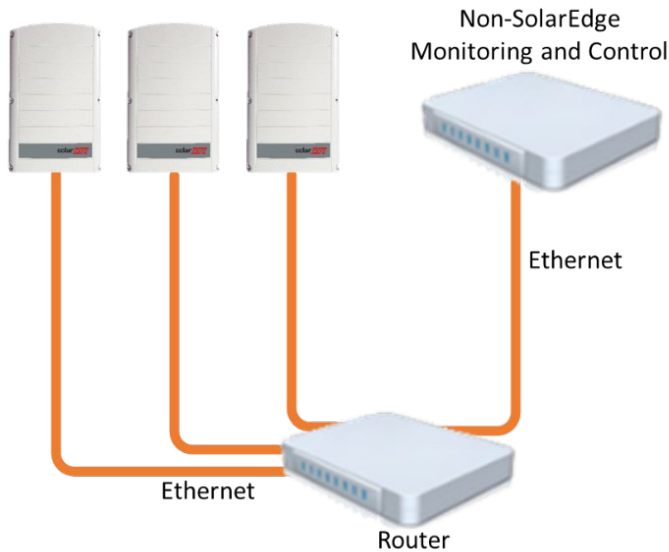
Connection to a non-SolarEdge monitoring device (with connection to the SolarEdge monitoring platform)

Use Ethernet for connection to a non-SolarEdge monitoring device.

Option 1 (direct connection) – Connect each inverter to the Ethernet router via Ethernet cables.
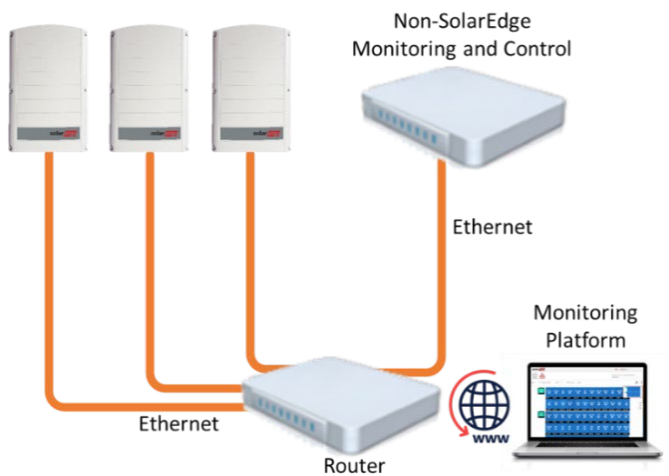
Option 2 – Connect the Leader only to the Ethernet router via Ethernet cables.
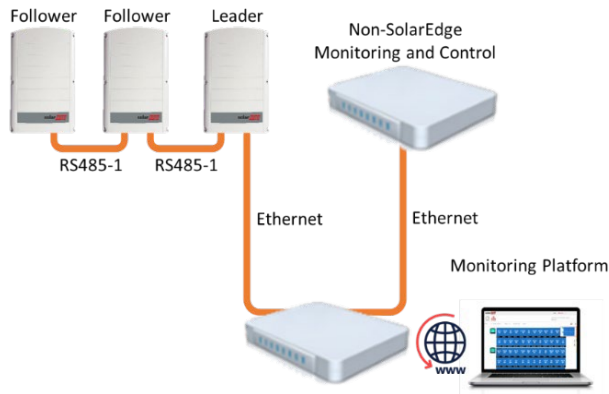
Connect a second chain of the inverters to the Leader inverter using RS485-2/RS485-E.
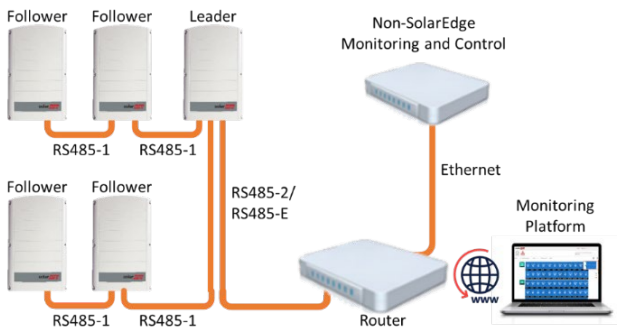
Connection to the SolarEdge monitoring platform and to a non-SolarEdge monitoring device using a Commercial Gateway

Use Ethernet for connection to a non-SolarEdge monitoring device. Every inverter connected to the RS485 bus should be configured to a different device ID (MODBUS ID).
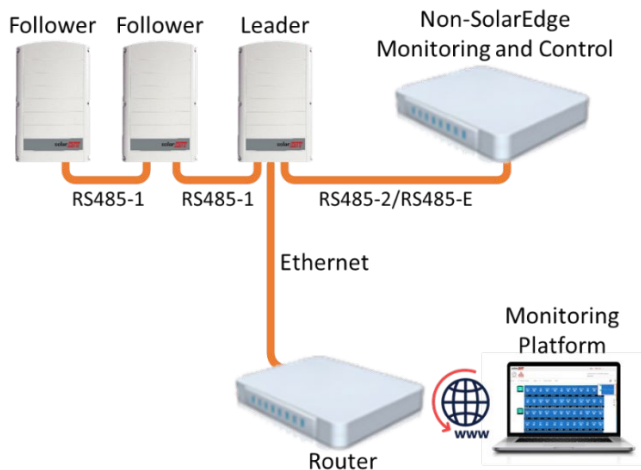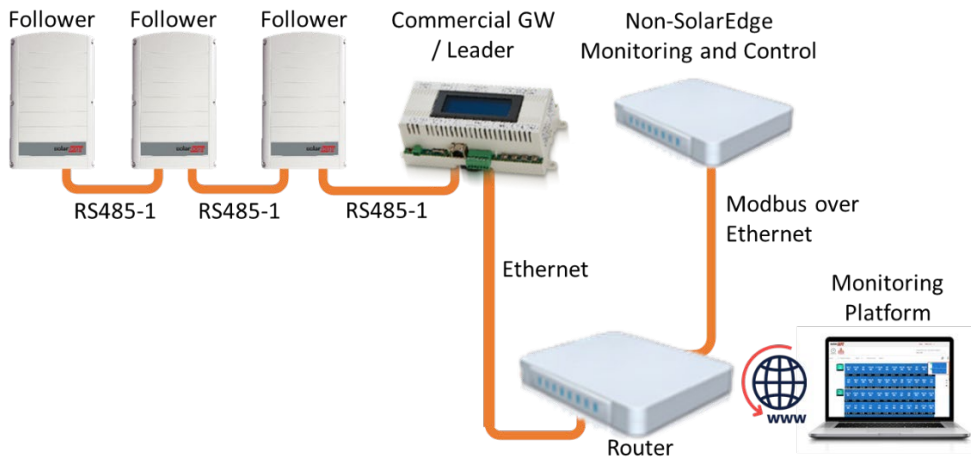
If required, use the RS485-E bus for connecting a second chain of inverters.
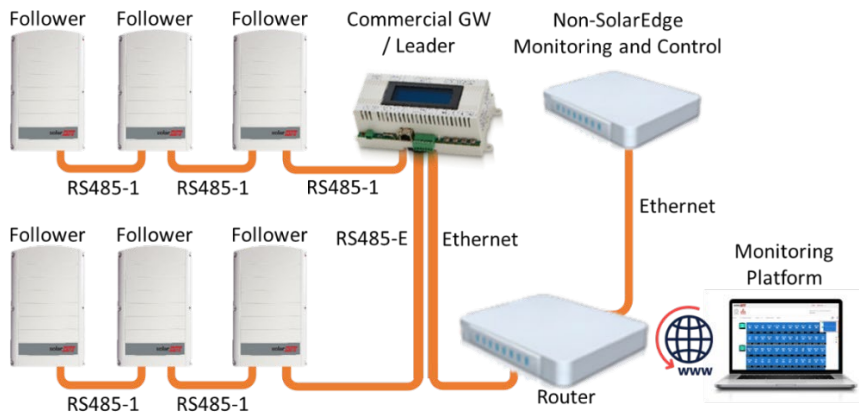
SolarEdge Device Configuration – Using SetApp

This section describes how to configure a SolarEdge device (inverter or Commercial Gateway) to be monitored by a non-SolarEdge monitoring device using SetApp.

NOTE
The actual SetApp configuration procedures may differ from the ones shown in this document.

To reach the main setup menu, access SetApp and tap Commissioning ➜ Site Communication:

Modbus over RS485 Configuration

To configure the inverters (when used without the Commercial Gateway):

1. Under the Site Communication menu, set the following:
   - RS485-1 ➜ Protocol ➜ SunSpec (Non-SE Logger)
   - RS485-1 ➜ Device ID, and enter the MODBUS address (a unique value 1...247). This will set the register C_DeviceAddress.
2. If needed, set the baud rate to a preferred value: RS485-1 ➜ Baud rate and enter the rate.

To configure the inverters and gateway (when used with the Commercial Gateway):

1. Inverter configuration: For all inverters, verify the following RS485 bus settings under the Site Communication menu:
   - RS485-1 ➜ Protocol ➜ SolarEdge ➜ SolarEdge Follower
   - RS485-1 ➜ Device ID ➜ [a unique value 1...247]
2. Commercial Gateway configuration *using the device display*: Use RS485-1 to connect to the inverters. RS485-1 bus configuration is as follows:
   - Communication ➜ RS485-1 Conf ➜ Device Type ➜ SolarEdge
   - Communication ➜ RS485-1 Conf ➜ Protocol ➜ Leader
   - Communication ➜ RS485-1 Conf ➜ Follower Detect

The Commercial Gateway should report the correct number of Follower inverters. If it does not, verify the connections and terminations.

3. Use RS485-2 to connect the Commercial Gateway to the non-SolarEdge monitoring device. Configure the RS485-2 bus settings as follows, *using the device display*:
   - Communication ➔ RS485-2 Conf ➔ Protocol ➔ SunSpec (Non-SE Logger)

The Commercial Gateway device ID is irrelevant for communications, but needs to be set to a different ID than the one set for the inverters.
   - Communication ➔ RS485-2 Conf ➔ Device ID ➔ [use one of the higher IDs (e.g. 247) to make sure it is out of scope]
   - The default baud rate is 115200 bps. If a different baud rate is required, select: Communication ➔ RS485-2 Conf ➔ Baud Rate

4. Make sure the device ID of the non-SolarEdge monitoring device is different from all other device IDs configured in the inverters and gateways.
5. Connect the Commercial Gateway to router via the Ethernet interface and configure the following settings *using the device display*:
   - Communication ➔ Server ➔ LAN
   - Communication ➔ LAN Conf ➔ Set DHCP ➔ [Select Enable for DHCP or Disable for static IP configuration]
   - For Static DHCP setting, configure as follows:
   - Communication ➔ LAN Conf ➔ Set IP ➔ [Set inverters' IP]
   - Communication ➔ LAN Conf ➔ Set Mask ➔ [Set inverters' subnet mask]
   - Communication ➔ LAN Conf ➔ Set Gateway ➔ [Set inverters' gateway]
   - Communication ➔ LAN Conf ➔ Set DNS ➔ [Set inverters' DNS]
6. If the router is connected to the server, select Commissioning ➔ Status and verify that "S_OK" is displayed on the Status page.

MODBUS over TCP Support

MODBUS/TCP uses the Ethernet media in physical layers to carry the MODBUS message handling structure and can support a large number of devices in one network; it is easier to integrate into the Local Area Network (LAN) of a company, so it is the choice of more and more customers.

Here, it is used for remote 3rd party monitoring and control. MODBUS TCP is agnostic of the server connection. It works only over LAN. When configured, MODBUS TCP does not initiate a connection - the server waits for a client to connect. Only one connection is supported.

💬 **NOTE**

The MODBUS TCP function is disabled by default. When enabled, it supports TCP port 1502 by default. Port number can be reconfigured.

MODBUS over TCP Configuration

To setup MODBUS TCP:

1. Select Site Communication ➔ Modbus TCP ➔ Enable. A new Port menu is added to the screen (the default port is 1502).
2. To modify the TCP port, select Port, set the port number and tap Done.

> **NOTE**
> The default device ID of the inverter connected to the Ethernet is 1.

> **NOTE**
> The TCP server idle time is 2 minutes. In order to leave the connection open, the request should be made within 2 minutes. The connection can remain open without any MODBUS requests.

SolarEdge Device Configuration – Using the Inverter/Commercial Gateway Display (LCD)

This section describes how to configure a SolarEdge device (inverter or Commercial Gateway) to be monitored by a non-SolarEdge monitoring device using the LCD. To reach the main setup menu, follow the instructions in the Installation Guide of the specific SolarEdge device.

Modbus over RS485 Configuration

To configure the inverters (when used without the Commercial Gateway):

1. In the Communication menu, set the following:
   - Communication ➔ Server ➔ Select any server connection, except for RS485 (if the inverter is not connected to the SolarEdge monitoring platform, select None.
   - Communication ➔ RS485-1 Conf
   - RS485-1 Conf ➔ Device Type ➔ Non-SE Logger
   - RS485-1 Conf ➔ Protocol ➔ SunSpec
   - RS485-1 Conf ➔ Device ID and enter the MODBUS address (a unique value 1...247). This will set the register C_DeviceAddress.
2. If necessary, set the baud rate to a preferred value: RS485-1 Conf ➔ Baud rate and enter the rate.

To configure the inverter (when used with the Commercial Gateway):

1. Inverters configuration: For all inverters, set the following RS485 bus settings:
   - Communication ➔ RS485-1 Conf ➔ Device Type ➔ SolarEdge
   - Communication ➔ RS485-1 Conf ➔ Protocol ➔Follower
   - Communication ➔ RS485-1 Conf ➔ Device ID ➔ [a unique value 1...247]

2. Commercial Gateway configuration: Use RS485-1 to connect to the inverters. RS485-1 bus configuration is as follows:
    - Communication ➜ RS485-1 Conf ➜ Device Type ➜ SolarEdge
    - Communication ➜ RS485-1 Conf ➜ Protocol ➜ Master
    - Communication ➜ RS485-1 Conf ➜ Follower Detect

The Commercial Gateway should report the correct number of followers. If it does not, verify the connections and terminations.

3. Use RS485-2 to connect to the non-SolarEdge monitoring device. RS485-2 bus configuration is as follows:
    - Communication ➜ RS485-2 Conf ➜ Device Type ➜ Non-SE Logger
    - Communication ➜ RS485-2 Conf ➜ Protocol ➜ SunSpec

The Commercial Gateway Device ID is irrelevant for communications, but needs to be set to a different ID than the one set for the inverters.
    - Communication ➜ RS485-2 Conf ➜ Device ID ➜ [use one of the higher ID's (e.g. 247) to make sure it is out of scope]
    - The default baud rate is 115200 bps. If a different baud rate is required, select: Communication ➜ RS485-2 Conf ➜ Baud Rate

4. Make sure the device ID of the non-SolarEdge monitoring device is different from all other device IDs configured in the inverters and gateways.

5. Connect the Commercial Gateway to router via the Ethernet interface and configure the following settings:
    - Communication ➜ Server ➜ LAN
    - Communication ➜ LAN Conf ➜ Set DHCP ➜ [Select Enable for DHCP or Disable for static IP configuration]
    - For Static DHCP setting, configure as follows:
    - Communication ➜ LAN Conf ➜ Set IP ➜ [Set inverters' IP]
    - Communication ➜ LAN Conf ➜ Set Mask ➜ [Set inverters' subnet mask]
    - Communication ➜ LAN Conf ➜ Set Gateway ➜ [Set inverters' gateway]
    - Communication ➜ LAN Conf ➜ Set DNS ➜ [Set inverters' DNS]

6. If the router is connected to the server, verify that the LCD panel displays <S_OK>.

7. Verify that the LCD panel of all inverters is <S_OK>.

MODBUS over TCP Support

MODBUS/TCP uses the Ethernet media in physical layers to carry the MODBUS message handling structure and can support a large number of devices in one network; it is easier to integrate into the Local Area Network (LAN) of a company, so it is the choice of more and more customers.

Here, it is used for remote 3rd party monitoring and control. MODBUS TCP is agnostic of the server connection. It works only over LAN. When configured, MODBUS TCP does not initiate a connection. The server waits for a client to connect. Only one connection is supported.

> **NOTE**
>
> The MODBUS TCP function is disabled by default. When enabled, it supports TCP port 502 by default. The port number can be reconfigured.

MODBUS over TCP Configuration

To setup MODBUS TCP:

1. Select Communication ➜ LAN Conf ➜ Modbus TCP (the default port is 502).
2. To modify the TCP port, select Modbus TCP ➜ TCP Port, set the port number and long-press Enter.

> **NOTE**
>
> The default device ID of the inverter connected to the Ethernet is 1.

When the MODBUS TCP feature is enabled, the following information is displayed: ▰ Status:

- Init – Initializing server – This state only occurs after the first configuration until it reaches the ready status. This activity lasts about 10sec.
- Ready – The server is up and waiting for a client to connect.
- Connected – The client is connected.
- Failed – The server is unable to accept clients (see error message).

▰ Error messages:

- Disconnected – The Ethernet cable is not connected
- Gateway Ping Failed – A ping to the 1st router failed
- No IP – Either no DHCP configuration or static IP configuration (no DHCP server that assigned an IP address) or need to define a static IP.

> **NOTE**
>
> The TCP server idle time is two minutes. In order to leave the connection open, the request should be made within 2 minutes. The connection can remain open without any MODBUS requests.

Register Mapping – Monitoring Data

This section describes the registers mapping for the inverter monitoring data (read-only MODBUS protocol data). The SolarEdge inverter mapping for monitoring data is based on the open protocol managed by SunSpec: SunSpec Alliance Interoperability Specification – Inverter Models v1.0. Refer to the SunSpec Alliance Interoperability Specification – Common Models (Elements) document for a detailed description of the protocol.

The register mapping can be downloaded from the SunSpec Alliance web page: http://www.sunspec.org/

SolarEdge inverters support the following mappings:

- SunSpec module ID 101, 102[1] and 103 register mappings.
- SolarEdge three phase inverters with Synergy technology also support SunSpec module ID 160 register mappings.

Common Model MODBUS Register Mappings

The base Register Common Block is set to 40001 (MODBUS PLC address [base 1]) or 40000 (MODBUS Protocol Address [base 0]).

All parameters are defined as in the SunSpec Common block definition, except for the **C_Options** register, which is set to NOT_IMPLEMENTED.

- **C_Manufacturer** is set to SolarEdge.
- **C_Model** is set to the appropriate inverter model, e.g. SE5000.
- **C_Version** contains the CPU software version with leading zeroes, e.g. 0002.0611.
- **C_SerialNumber** contains the inverter serial number.
- **C_DeviceAddress** is the device MODBUS ID.

Address (base 0)	(base 1)	Size	Name	Type	Description
40000	40001	2	C_SunSpec_ID	uint32	Value = "SunS" (0x53756e53). Uniquely identifies this as a SunSpec MODBUS Map
40002	40003	1	C_SunSpec_DID	uint16	Value = 0x0001. Uniquely identifies this as a SunSpec Common Model Block
40003	40004	1	C_SunSpec_Length	uint16	65 = Length of block in 16-bit registers
40004	40005	16	C_Manufacturer	String(32)	Value Registered with SunSpec = "SolarEdge "
40020	40021	16	C_Model	String(32)	SolarEdge Specific Value
40044	40045	8	C_Version	String(16)	SolarEdge Specific Value
40052	40053	16	C_SerialNumber	String(32)	SolarEdge Unique Value
40068	40069	1	C_DeviceAddress	uint16	MODBUS Unit ID

Inverter Device Status Values

The following I_Status_* values are supported:

Parameter	Value	Description
I_STATUS_OFF	1	Off
I_STATUS_SLEEPING	2	Sleeping (auto-shutdown) – Night mode
I_STATUS_STARTING	3	Grid Monitoring/wake-up
I_STATUS_MPPT	4	Inverter is ON and producing power
I_STATUS_THROTTLED	5	Production (curtailed)
I_STATUS_SHUTTING_DOWN	6	Shutting down
I_STATUS_FAULT	7	Fault
I_STATUS_STANDBY	8	Maintenance/setup

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[1] Supported only in split-phase configurations (Japanese grid and 240V grid in North America)

Inverter Model MODBUS Register Mappings

The following table lists the supported MODBUS register values. Unsupported values are indicated by the NOT_IMPLEMENTED value. The base register of the Device Specific block is set to 40070 (MODBUS PLC address [base 1]), or 40069 (MODBUS Protocol Address [base 0]).

- **acc32** is a uint32 accumulator that should always increase. Its value is in the range of 0...4294967295.
- **Scale Factors.** As an alternative to floating point format, values are represented by Integer values with a signed scale factor applied. The scale factor explicitly shifts the decimal point to left (negative value) or to the right (positive value).

For example, a value "Value" may have an associated value "Value_SF"

Value = "Value" * 10^ Value_SF for example:

- For "Value" = 2071 and "Value_SF" = -2 Value = $2071 * 10^{-2}$ = 20.71
- For "Value" = 2071 and "Value_SF" = 2 Value = $2071 * 10^2$ = 207100

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40069	40070	1	C_SunSpec_DID	uint16		101 = single phase 102 = split phase 103 = three phase
40070	40071	1	C_SunSpec_Length	uint16	Registers	50 = Length of model block
40071	40072	1	I_AC_Current	uint16	Amps	AC Total Current value
40072	40073	1	I_AC_CurrentA	uint16	Amps	AC Phase A Current value
40073	40074	1	I_AC_CurrentB	uint16	Amps	AC Phase B Current value
40074	40075	1	I_AC_CurrentC	uint16	Amps	AC Phase C Current value
40075	40076	1	I_AC_Current_SF	int16		AC Current scale factor
40076	40077	1	I_AC_VoltageAB	uint16	Volts	AC Voltage Phase AB value
40077	40078	1	I_AC_VoltageBC	uint16	Volts	AC Voltage Phase BC value
40078	40079	1	I_AC_VoltageCA	uint16	Volts	AC Voltage Phase CA value
40079	40080	1	I_AC_VoltageAN [1]	uint16	Volts	AC Voltage Phase A to N value
40080	40081	1	I_AC_VoltageBN [1]	uint16	Volts	AC Voltage Phase B to N value
40081	40082	1	I_AC_VoltageCN [1]	uint16	Volts	AC Voltage Phase C to N value
40082	40083	1	I_AC_Voltage_SF	int16		AC Voltage scale factor
40083	40084	1	I_AC_Power	int16	Watts	AC Power value
40084	40085	1	I_AC_Power_SF	int16		AC Power scale factor
40085	40086	1	I_AC_Frequency	uint16	Hertz	AC Frequency value
40086	40087	1	I_AC_Frequency_SF	int16		Scale factor
40087	40088	1	I_AC_VA	int16	VA	Apparent Power
40088	40089	1	I_AC_VA_SF	int16		Scale factor
40089	40090	1	I_AC_VAR[2]	int16	VAR	Reactive Power
40090	40091	1	I_AC_VAR_SF[2]	int16		Scale factor

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[1] Supported only in split-phase configurations (Japanese grid and 240V grid in North America).

[2] For details, see the Power Configurations and Correlated Outcomes under Reactive Power Configuration in SolarEdge Inverters, Power Control Options.

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40091	40092	1	I_AC_PF[1]	int16	%	Power Factor
40092	40093	1	I_AC_PF_SF[1]	int16		Scale factor
40093	40094	2	I_AC_Energy_WH	acc32	WattHours	AC Lifetime Energy production
40095	40096	1	I_AC_Energy_WH_SF	uint16		Scale factor
40096	40097	1	I_DC_Current	uint16	Amps	DC Current value
40097	40098	1	I_DC_Current_SF	int16		Scale factor
40098	40099	1	I_DC_Voltage	uint16	Volts	DC Voltage value
40099	40100	1	I_DC_Voltage_SF	int16		Scale factor
40100	40101	1	I_DC_Power	int16	Watts	DC Power value
40101	40102	1	I_DC_Power_SF	int16		Scale factor
40103	40104	1	I_Temp_Sink	int16	Degrees C	Heat Sink Temperature
40106	40107	1	I_Temp_SF	int16		Scale factor
40107	40108	1	I_Status	uint16		Operating State
40108	40109	1	I_Status_Vendor	uint16		Vendor-defined operating state and error codes. For error description, meaning and troubleshooting, refer to the SolarEdge Installation Guide.

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[1] For details, see the Power Configurations and Correlated Outcomes under Reactive Power Configuration in SolarEdge Inverters, Power Control Options.

Multiple MPPT Inverter Extension Model

The Multiple MPPT (Maximum Power Point Tracker) Inverter Extension Model (160) is supported for SolarEdge Synergy Inverters with firmware version 4.13.xx or later. The fixed block data below refers to an entire Synergy Manager system (and not to individual blocks within the system).

Address		Name	Size	Type	Units	Description
(base 0)	(base 1)					
Header (Size: 2 words)						
40121	40122	ID	1	uint16	N/A	Value = 160 Multiple MPPT Inverter Extension Model
40122	40123	L	1	uint16	N/A	Model length
Fixed Block (Size: 8 words)						
40123	40124	DCA_SF	1	sunssf	N/A	Current Scale Factor
40124	40125	DCV_SF	1	sunssf		Voltage Scale Factor
40125	40126	DCW_SF	1	sunssf		Power Scale Factor
40126	40127	DCWH_SF	1	sunssf		0 (not supported)
40127	40128	Evt	2	bitfield32		0 (not supported)
40129	40130	N	1	count		Number of Synergy units (2 or 3)
40130	40131	TmsPer	1	uint16		0 (not supported)
Synergy Unit 0 Block (Size: 20 words)						
40131	40132	ID	1	uint16		Synergy Unit #0
40132	40133	IDStr	8	string		Input ID String
40140	40141	DCA	1	uint16		DC Current (A)
40141	40142	DCV	1	uint16		DC Voltage (V)
40142	40143	DCW	1	uint16		DC Power (W)
40143	40144	DCWH	2	acc32		0 (not supported)
40145	40146	Tms	2	uint32		0 (not supported)
40147	40148	Tmp	1	int16		Temperature (ºC)
40148	40149	DCSt	1	enum16		0 (not supported)
40149	40150	DCEvt	2	bitfield32		0 (not supported)
Synergy Unit 1 Block (Size: 20 words)						
40151	40152	ID	1	uint16		Synergy Unit #1
40152	40153	IDStr	8	string		Input ID String
40160	40161	DCA	1	uint16		DC Current (A)
40161	40162	DCV	1	uint16		DC Voltage (V)
40162	40163	DCW	1	uint16		DC Power (W)
40163	40164	DCWH	2	acc32		0 (not supported)
40165	40166	Tms	2	uint32		0 (not supported)
40167	40168	Tmp	1	int16		Temperature (ºC)
40168	40169	DCSt	1	enum16		0 (not supported)
40169	40170	DCEvt	2	bitfield32		0 (not supported)

Address		Name	Size	Type	Units	Description
(base 0)	(base 1)					
Synergy Unit 2 Block (Size: 20 words)						
40171	40172	ID	1	uint16		Synergy Unit #2
40172	40173	IDStr	8	string		Input ID String
40180	40181	DCA	1	uint16		DC Current (A)
40181	40182	DCV	1	uint16		DC Voltage (V)
40182	40183	DCW	1	uint16		DC Power (W)
40183	40184	DCWH	2	acc32		0 (not supported)
40185	40186	Tms	2	uint32		0 (not supported)
40187	40188	Tmp	1	int16		Temperature (ºC)
40188	40189	DCSt	1	enum16		0 (not supported)
40189	40190	DCEvt	2	bitfield32		0 (not supported)

Meter Models

The SunSpec Alliance Interoperability Specification describes the data models and MODBUS register mappings for meter devices used in Renewable Energy systems. This section defines the models for:

- Single Phase Meter
- Split Phase Meter
- WYE (4-wire) Meter
- Delta (3-wire)Meter

Meter Device Block

- The following data elements are provided to describe meters.
- C_SunSpec_DID – A well-known value that uniquely identifies this block as a meter
- block. (4) for single phase meters and (5) for three phase meter types.
- C_SunSpec_Length – The length of the meter block in registers.
- M_AC_xxxx – Meter AC values.
- M_Exported_xxxx – Meter Exported Energy values
- M_Imported_xxxx – Meter Imported Energy values

Energy Value

The energy value is represented by a 32-bit unsigned integer accumulator with a scale factor. Values for import and export are provided. Unsupported or invalid accumulators may return 0x00000000. Power signs and Energy quadrants are per IEEE 1459-2000.

Meter Event Flag Values

The SunSpec Common Elements defines a C_Event value. The meter specific flags are defined here.

C_Event Value	Flag	Description
M_EVENT_Power_Failure	0x00000004	Loss of power or phase
M_EVENT_Under_Voltage	0x00000008	Voltage below threshold (Phase Loss)
M_EVENT_Low_PF	0x00000010	Power Factor below threshold (can indicate miss-associated voltage and current inputs in three phase systems)
M_EVENT_Over_Current	0x00000020	Current Input over threshold (out of measurement range)
M_EVENT_Over_Voltage	0x00000040	Voltage Input over threshold (out of measurement range)
M_EVENT_Missing_Sensor	0x00000080	Sensor not connected
M_EVENT_Reserved1	0x00000100	Reserved for future use
M_EVENT_Reserved2	0x00000200	Reserved for future use
M_EVENT_Reserved3	0x00000400	Reserved for future use
M_EVENT_Reserved4	0x00000800	Reserved for future use
M_EVENT_Reserved5	0x00001000	Reserved for future use
M_EVENT_Reserved6	0x00002000	Reserved for future use
M_EVENT_Reserved7	0x00004000	Reserved for future use
M_EVENT_Reserved8	0x00008000	Reserved for future use
M_EVENT_OEM1-15	0x7FFF000	Reserved for OEMs

MODBUS Register Mappings

Meter Model – MODBUS Mapping

This map supports single, split, wye, and delta meter connections in a single map as proper subsets. The connection type is distinguished by the C_SunSpec_DID. Registers that are not applicable to a meter class return the unsupported value (for example, Single Phase meters will support only summary and phase A values).

NOTE

Modbus registers store data in Big-Endian format. Most-significant values are stored first, at the lowest storage address.

The meters' base address is calculated as shown in the table below:

- For 2-unit three phase inverters with Synergy technology, add 50 to the default addresses.
- For 3-unit three phase inverters with Synergy technology, add 70 to the default addresses.

Meter #	Address (Default) (base 0)	(base 1)	Address (using 2-unit Synergy) (base 0)	(base 1)	Address (using 3-unit Synergy) (base 0)	(base 1)
1st meter	40000 + 121	40000 + 122	40000 + 171	40000 + 172	40000 + 191	40000 + 192
2nd meter	40000 + 295	40000 + 296	40000 + 345	40000 + 346	40000 + 365	40000 + 366
3rd meter	40000 + 469	40000 + 470	40000 + 519	40000 + 520	40000 + 539	40000 + 540

NOTE

Only enabled meters are readable, i.e. if meter 1 and 3 are enabled, they are readable as 1st meter and 2nd meter (and the 3rd meter isn't readable). The meter type can be read from the Common block Options field (the same strings that we use in the menus).

Meter 1

Address (base 0)	(base 1)	Size	Name	Type	Units	Description
Common Block						
40121	40122	1	C_SunSpec_DID	uint16	N/A	Value = 0x0001. Uniquely identifies this as a SunSpec Common Model Block
40122	40123	1	C_SunSpec_Length	uint16	N/A	65 = Length of block in 16-bit registers
40123	40124	16	C_Manufacturer	String(32)	N/A	Meter manufacturer
40139	40140	16	C_Model	String(32)	N/A	Meter model
40155	40156	8	C_Option	String(16)	N/A	Export + Import, Production, consumption,
40163	40164	8	C_Version	String(16)	N/A	Meter version
40171	40172	16	C_SerialNumber	String(32)	N/A	Meter SN
40187	40188	1	C_DeviceAddress	uint16	N/A	Inverter Modbus ID

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
Identification						
40188	40189	1	C_SunSpec_DID	uint16	N/A	Well-known value. Uniquely identifies this as a SunSpec MODBUS Map: Single Phase (AN or AB) Meter (201) Split Single Phase (ABN) Meter (202) Wye-Connect Three Phase (ABCN) Meter (203) Delta-Connect Three Phase (ABC) Meter(204)
40189	40190	1	C_SunSpec_Length	uint16	Registers	Length of meter model block
Current						
40190	40191	1	M_AC_Current	int16	Amps	AC Current (sum of active phases)
40191	40192	1	M_AC_Current_A	int16	Amps	Phase A AC Current
40192	40193	1	M_AC_Current_B	int16	Amps	Phase B AC Current
40193	40194	1	M_AC_Current_C	int16	Amps	Phase C AC Current
40194	40195	1	M_AC_Current_S F	int16	SF	AC Current Scale Factor
Voltage						
Line to Neutral Voltage						
40195	40196	1	M_AC_Voltage_L N	int16	Volts	Line to Neutral AC Voltage (average of active phases)
40196	40197	1	M_AC_Voltage_A N	int16	Volts	Phase A to Neutral AC Voltage
40197	40198	1	M_AC_Voltage_B N	int16	Volts	Phase B to Neutral AC Voltage
40198	40199	1	M_AC_Voltage_C N	int16	Volts	Phase C to Neutral AC Voltage
Line to Line Voltage[1]						
40199	40200	1	M_AC_Voltage_L L	int16	Volts	Line to Line AC Voltage (average of active phases)
40200	40201	1	M_AC_Voltage_A B	int16	Volts	Phase A to Phase B AC Voltage
40201	40202	1	M_AC_Voltage_B C	int16	Volts	Phase B to Phase C AC Voltage
40202	40203	1	M_AC_Voltage_C A	int16	Volts	Phase C to Phase A AC Voltage
40203	40204	1	M_AC_Voltage_S F	int16	SF	AC Voltage Scale Factor
Frequency						
40204	40205	1	M_AC_Freq	int16	Herts	AC Frequency
40205	40206	1	M_AC_Freq_SF	int16	SF	AC Frequency Scale Factor
Power						
Real Power						
40206	40207	1	M_AC_Power	int16	Watts	Total Real Power (sum of active phases)

[1] The SolarEdge (SE) Meter does not support reading Line-to-Line (L-L) voltages via MODBUS Sunspec.

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40207	40208	1	M_AC_Power_A	int16	Watts	Phase A AC Real Power
40208	40209	1	M_AC_Power_B	int16	Watts	Phase B AC Real Power
40209	40210	1	M_AC_Power_C	int16	Watts	Phase C AC Real Power
40210	40211	1	M_AC_Power_SF	int16	SF	AC Real Power Scale Factor
Apparent Power						
40211	40212	1	M_AC_VA	int16	Volt- Amps	Total AC Apparent Power (sum of active phases)
40212	40213	1	M_AC_VA_A	int16	Volt- Amps	Phase A AC Apparent Power
40213	40214	1	M_AC_VA_B	int16	Volt- Amps	Phase B AC Apparent Power
40214	40215	1	M_AC_VA_C	int16	Volt- Amps	Phase C AC Apparent Power
40215	40216	1	M_AC_VA_SF	int16	SF	AC Apparent Power Scale Factor
Reactive Power						
40216	40217	1	M_AC_VAR	int16	VAR	Total AC Reactive Power (sum of active phases)
40217	40218	1	M_AC_VAR_A	int16	VAR	Phase A AC Reactive Power
40218	40219	1	M_AC_VAR_B	int16	VAR	Phase B AC Reactive Power
40219	40220	1	M_AC_VAR_C	int16	VAR	Phase C AC Reactive Power
40220	40221	1	M_AC_VAR_SF	int16	SF	AC Reactive Power Scale Factor
Power Factor						
40221	40222	1	M_AC_PF	int16	%	Average Power Factor (average of active phases)
40222	40223	1	M_AC_PF_A	int16	%	Phase A Power Factor
40223	40224	1	M_AC_PF_B	int16	%	Phase B Power Factor
40224	40225	1	M_AC_PF_C	int16	%	Phase C Power Factor
40225	40226	1	M_AC_PF_SF	int16	SF	AC Power Factor Scale Factor
Accumulated Energy						
Real Energy						
40226	40227	2	M_Exported	uint32	Watt- hours	Total Exported Real Energy
40228	40229	2	M_Exported_A	uint32	Watt- hours	Phase A Exported Real Energy
40230	40231	2	M_Exported_B	uint32	Watt- hours	Phase B Exported Real Energy
40232	40233	2	M_Exported_C	uint32	Watt- hours	Phase C Exported Real Energy
40234	40235	2	M_Imported	uint32	Watt- hours	Total Imported Real Energy
40236	40237	2	M_Imported_A	uint32	Watt- hours	Phase A Imported Real Energy
40238	40239	2	M_Imported_B	uint32	Watt- hours	Phase B Imported Real Energy
40240	40241	2	M_Imported_C	uint32	Watt- hours	Phase C Imported Real Energy
40242	40243	1	M_Energy_W_SF	int16	SF	Real Energy Scale Factor
Apparent Energy						
40243	40244	2	M_Exported_VA	uint32	VA-hours	Total Exported Apparent Energy
40245	40246	2	M_Exported_VA_ A	uint32	VA-hours	Phase A Exported Apparent Energy
40247	40248	2	M_Exported_VA_ B	uint32	VA-hours	Phase B Exported Apparent Energy
40249	40250	2	M_Exported_VA_ C	uint32	VA-hours	Phase C Exported Apparent Energy

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40251	40252	2	M_Imported_VA	uint32	VA-hours	Total Imported Apparent Energy
40253	40254	2	M_Imported_VA_ A	uint32	VA-hours	Phase A Imported Apparent Energy
40255	40256	2	M_Imported_VA_ B	uint32	VA-hours	Phase B Imported Apparent Energy
40257	40258	2	M_Imported_VA_ C	uint32	VA-hours	Phase C Imported Apparent Energy
40259	40260	1	M_Energy_VA_S F	int16	SF	Apparent Energy Scale Factor
Reactive Energy						
40260	40261	2	M_Import_VARh_ Q1	uint32	VAR-hours	Quadrant 1: Total Imported Reactive Energy
40262	40263	2	M_Import_VARh_ Q1A	uint32	VAR-hours	Phase A - Quadrant 1: Imported Reactive Energy
40264	40265	2	M_Import_VARh_ Q1B	uint32	VAR-hours	Phase B- Quadrant 1: Imported Reactive Energy
40266	40267	2	M_Import_VARh_ Q1C	uint32	VAR-hours	Phase C- Quadrant 1: Imported Reactive Energy
40268	40269	2	M_Import_VARh_ Q2	uint32	VAR-hours	Quadrant 2: Total Imported Reactive Energy
40270	40271	2	M_Import_VARh_ Q2A	uint32	VAR-hours	Phase A - Quadrant 2: Imported Reactive Energy
40272	40273	2	M_Import_VARh_ Q2B	uint32	VAR-hours	Phase B- Quadrant 2: Imported Reactive Energy
40274	40275	2	M_Import_VARh_ Q2C	uint32	VAR-hours	Phase C- Quadrant 2: Imported Reactive Energy
40276	40277	2	M_Export_VARh_ Q3	uint32	VAR-hours	Quadrant 3: Total Exported Reactive Energy
40278	40279	2	M_Export_VARh_ Q3A	uint32	VAR-hours	Phase A - Quadrant 3: Exported Reactive Energy
40280	40281	2	M_Export_VARh_ Q3B	uint32	VAR-hours	Phase B- Quadrant 3: Exported Reactive Energy
40282	40283	2	M_Export_VARh_ Q3C	uint32	VAR-hours	Phase C- Quadrant 3: Exported Reactive Energy
40284	40285	2	M_Export_VARh_ Q4	uint32	VAR-hours	Quadrant 4: Total Exported Reactive Energy
40286	40287	2	M_Export_VARh_ Q4A	uint32	VAR-hours	Phase A - Quadrant 4: Exported Reactive Energy
40288	40289	2	M_Export_VARh_ Q4B	uint32	VAR-hours	Phase B- Quadrant 4: Exported Reactive Energy
40290	40291	2	M_Export_VARh_ Q4C	uint32	VAR-hours	Phase C- Quadrant 4: Exported Reactive Energy
40292	40293	1	M_Energy_VAR_ SF	int16	SF	Reactive Energy Scale Factor
Events						
40293	40294	2	M_Events	uint32	Flags	See M_EVENT_ flags. 0 = nts.

Meter 2

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
Common Block						
40295	40296	1	C_SunSpec_DID	uint16	N/A	Value = 0x0001. Uniquely identifies this as a SunSpec Common Model Block
40296	40297	1	C_SunSpec_Length	uint16	N/A	65 = Length of block in 16-bit registers
40297	40298	16	C_Manufacturer	String(32)	N/A	Meter manufacturer
40313	40314	16	C_Model	String(32)	N/A	Meter model
40329	40330	8	C_Option	String(16)	N/A	Export+Import, Production, Consumption,
40337	40338	8	C_Version	String(16)	N/A	Meter version
40345	40346	16	C_SerialNumber	String(32)	N/A	Meter SN
40361	40362	1	C_DeviceAddress	uint16	N/A	Inverter Modbus ID
Identification						
40362	40363	1	C_SunSpec_DID	uint16	N/A	Well-known value. Uniquely identifies this as a SunSpec MODBUS Map: Single Phase (AN or AB) Meter (201) Split Single Phase (ABN) Meter (202) Wye-Connect Three Phase (ABCN) Meter (203) Delta-Connect Three Phase (ABC) Meter(204)
40363	40364	1	C_SunSpec_Length	uint16	Registers	Length of meter model block
Current						
40364	40365	1	M_AC_Current	int16	Amps	AC Current (sum of active phases)
40365	40366	1	M_AC_Current_A	int16	Amps	Phase A AC Current
40366	40367	1	M_AC_Current_B	int16	Amps	Phase B AC Current
40367	40368	1	M_AC_Current_C	int16	Amps	Phase C AC Current
40368	40369	1	M_AC_Current_S F	int16	SF	AC Current Scale Factor
Voltage						
Line to Neutral Voltage						
40369	40370	1	M_AC_Voltage_LN	int16	Volts	Line to Neutral AC Voltage (average of active phases)
40370	40371	1	M_AC_Voltage_AN	int16	Volts	Phase A to Neutral AC Voltage
40371	40372	1	M_AC_Voltage_BN	int16	Volts	Phase B to Neutral AC Voltage
40372	40373	1	M_AC_Voltage_CN	int16	Volts	Phase C to Neutral AC Voltage

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
Line to Line Voltage¹						
40373	40374	1	M_AC_Voltage_L L	int16	Volts	Line to Line AC Voltage (average of active phases)
40374	40375	1	M_AC_Voltage_A B	int16	Volts	Phase A to Phase B AC Voltage
40375	40376	1	M_AC_Voltage_B C	int16	Volts	Phase B to Phase C AC Voltage
40376	40377	1	M_AC_Voltage_C A	int16	Volts	Phase C to Phase A AC Voltage
40377	40378	1	M_AC_Voltage_S F	int16	SF	AC Voltage Scale Factor
Frequency						
40378	40379	1	M_AC_Freq	int16	Herts	AC Frequency
40379	40380	1	M_AC_Freq_SF	int16	SF	AC Frequency Scale Factor
Power						
Real Power						
40380	40381	1	M_AC_Power	int16	Watts	Total Real Power (sum of active phases)
40381	40382	1	M_AC_Power_A	int16	Watts	Phase A AC Real Power
40382	40383	1	M_AC_Power_B	int16	Watts	Phase B AC Real Power
40383	40384	1	M_AC_Power_C	int16	Watts	Phase C AC Real Power
40384	40385	1	M_AC_Power_SF	int16	SF	AC Real Power Scale Factor
Apparent Power						
40385	40386	1	M_AC_VA	int16	Volt- Amps	Total AC Apparent Power (sum of active phases)
40386	40387	1	M_AC_VA_A	int16	Volt- Amps	Phase A AC Apparent Power
40387	40388	1	M_AC_VA_B	int16	Volt- Amps	Phase B AC Apparent Power
40388	40389	1	M_AC_VA_C	int16	Volt- Amps	Phase C AC Apparent Power
40389	40390	1	M_AC_VA_SF	int16	SF	AC Apparent Power Scale Factor
Reactive Power						
40390	40391	1	M_AC_VAR	int16	VAR	Total AC Reactive Power(sum of active phases)
40391	40392	1	M_AC_VAR_A	int16	VAR	Phase A AC Reactive Power
40392	40393	1	M_AC_VAR_B	int16	VAR	Phase B AC Reactive Power
40393	40394	1	M_AC_VAR_C	int16	VAR	Phase C AC Reactive Power
40394	40395	1	M_AC_VAR_SF	int16	SF	AC Reactive Power Scale Factor
Power Factor						
40395	40396	1	M_AC_PF	int16	%	Average Power Factor (average of active phases)
40396	40397	1	M_AC_PF_A	int16	%	Phase A Power Factor
40397	40398	1	M_AC_PF_B	int16	%	Phase B Power Factor
40398	40399	1	M_AC_PF_C	int16	%	Phase C Power Factor
40399	40400	1	M_AC_PF_SF	int16	SF	AC Power Factor Scale Factor
Accumulated Energy						
Real Energy						

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¹ The SolarEdge (SE) Meter does not support reading Line-to-Line (L-L) voltages via MODBUS Sunspec.

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40400	40401	2	M_Exported	uint32	Watt- hours	Total Exported Real Energy
40402	40403	2	M_Exported_A	uint32	Watt- hours	Phase A Exported Real Energy
40404	40405	2	M_Exported_B	uint32	Watt- hours	Phase B Exported Real Energy
40406	40407	2	M_Exported_C	uint32	Watt- hours	Phase C Exported Real Energy
40408	40409	2	M_Imported	uint32	Watt- hours	Total Imported Real Energy
40410	40411	2	M_Imported_A	uint32	Watt- hours	Phase A Imported Real Energy
40412	40413	2	M_Imported_B	uint32	Watt- hours	Phase B Imported Real Energy
40414	40415	2	M_Imported_C	uint32	Watt- hours	Phase C Imported Real Energy
40416	40417	1	M_Energy_W_SF	int16	SF	Real Energy Scale Factor
Apparent Energy						
40417	40418	2	M_Exported_VA	uint32	VA-hours	Total Exported Apparent Energy
40419	40420	2	M_Exported_VA_ A	uint32	VA-hours	Phase A Exported Apparent Energy
40421	40422	2	M_Exported_VA_ B	uint32	VA-hours	Phase B Exported Apparent Energy
40423	40424	2	M_Exported_VA_ C	uint32	VA-hours	Phase C Exported Apparent Energy
40425	40426	2	M_Imported_VA	uint32	VA-hours	Total Imported Apparent Energy
40427	40428	2	M_Imported_VA_ A	uint32	VA-hours	Phase A Imported Apparent Energy
40429	40430	2	M_Imported_VA_ B	uint32	VA-hours	Phase B Imported Apparent Energy
40431	40432	2	M_Imported_VA_ C	uint32	VA-hours	Phase C Imported Apparent Energy
40433	40434	1	M_Energy_VA_S F	int16	SF	Apparent Energy Scale Factor
Reactive Energy						
40434	40435	2	M_Import_VARh_ Q1	uint32	VAR-hours	Quadrant 1: Total Imported Reactive Energy
40436	40437	2	M_Import_VARh_ Q1A	uint32	VAR-hours	Phase A - Quadrant 1: Imported Reactive Energy
40438	40439	2	M_Import_VARh_ Q1B	uint32	VAR-hours	Phase B- Quadrant 1: Imported Reactive Energy
40440	40441	2	M_Import_VARh_ Q1C	uint32	VAR-hours	Phase C- Quadrant 1: Imported Reactive Energy
40442	40443	2	M_Import_VARh_ Q2	uint32	VAR-hours	Quadrant 2: Total Imported Reactive Energy
40444	40445	2	M_Import_VARh_ Q2A	uint32	VAR-hours	Phase A - Quadrant 2: Imported Reactive Energy
40446	40447	2	M_Import_VARh_ Q2B	uint32	VAR-hours	Phase B- Quadrant 2: Imported Reactive Energy
40448	40449	2	M_Import_VARh_ Q2C	uint32	VAR-hours	Phase C- Quadrant 2: Imported Reactive Energy
40450	40451	2	M_Export_VARh_ Q3	uint32	VAR-hours	Quadrant 3: Total Exported Reactive Energy
40452	40453	2	M_Export_VARh_ Q3A	uint32	VAR-hours	Phase A - Quadrant 3: Exported Reactive Energy
40454	40455	2	M_Export_VARh_ Q3B	uint32	VAR-hours	Phase B- Quadrant 3: Exported Reactive Energy
40456	40457	2	M_Export_VARh_	uint32	VAR-hours	Phase C- Quadrant 3: Exported Reactive

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
			Q3C			Energy
40458	40459	2	M_Export_VARh_Q4	uint32	VAR-hours	Quadrant 4: Total Exported Reactive Energy
40460	40461	2	M_Export_VARh_Q4A	uint32	VAR-hours	Phase A - Quadrant 4: Exported Reactive Energy
40462	40463	2	M_Export_VARh_Q4B	uint32	VAR-hours	Phase B- Quadrant 4: Exported Reactive Energy
40464	40465	2	M_Export_VARh_Q4C	uint32	VAR-hours	Phase C- Quadrant 4: Exported Reactive Energy
40466	40467	1	M_Energy_VAR_ SF	int16	SF	Reactive Energy Scale Factor
Events						
40467	40468	2	M_Events	uint32	Flags	See M_EVENT_ flags. 0 = nts.

Meter 3

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
Common Block						
40469	40470	1	C_SunSpec_DID	uint16	N/A	Value = 0x0001. Uniquely identifies this as a SunSpec Common Model Block
40470	40471	1	C_SunSpec_Length	uint16	N/A	65 = Length of block in 16-bit registers
40472	40473	16	C_Manufacturer	String(32)	N/A	Meter manufacturer
40488	40489	16	C_Model	String(32)	N/A	Meter model
40504	40505	8	C_Option	String(16)	N/A	Export+Import, Production, Consumption,
40512	40513	8	C_Version	String(16)	N/A	Meter version
40520	40521	16	C_SerialNumber	String(32)	N/A	Meter SN
40536	40537	1	C_DeviceAddress	uint16	N/A	Inverter Modbus ID
Identification						
40537	40538	1	C_SunSpec_DID	uint16	N/A	Well-known value. Uniquely identifies this as a SunSpec MODBUS Map: Single Phase (AN or AB) Meter (201) Split Single Phase (ABN) Meter (202) Wye-Connect Three Phase (ABCN) Meter (203) Delta-Connect Three Phase (ABC) Meter(204)
40538	40539	1	C_SunSpec_Length	uint16	Registers	Length of meter model block
Current						
40539	40540	1	M_AC_Current	int16	Amps	AC Current (sum of active phases)
40540	40541	1	M_AC_Current_A	int16	Amps	Phase A AC Current
40541	40542	1	M_AC_Current_B	int16	Amps	Phase B AC Current
40542	40543	1	M_AC_Current_C	int16	Amps	Phase C AC Current

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40543	40544	1	M_AC_Current_S F	int16	SF	AC Current Scale Factor
Voltage						
Line to Neutral Voltage						
40544	40545	1	M_AC_Voltage_L N	int16	Volts	Line to Neutral AC Voltage (average of active phases)
40545	40546	1	M_AC_Voltage_A N	int16	Volts	Phase A to Neutral AC Voltage
40546	40547	1	M_AC_Voltage_B N	int16	Volts	Phase B to Neutral AC Voltage
40547	40548	1	M_AC_Voltage_C N	int16	Volts	Phase C to Neutral AC Voltage
Line to Line Voltage[1]						
40548	40549	1	M_AC_Voltage_L L	int16	Volts	Line to Line AC Voltage (average of active phases)
40549	40550	1	M_AC_Voltage_A B	int16	Volts	Phase A to Phase B AC Voltage
40550	40551	1	M_AC_Voltage_B C	int16	Volts	Phase B to Phase C AC Voltage
40551	40552	1	M_AC_Voltage_C A	int16	Volts	Phase C to Phase A AC Voltage
40552	40553	1	M_AC_Voltage_S F	int16	SF	AC Voltage Scale Factor
Frequency						
40553	40554	1	M_AC_Freq	int16	Herts	AC Frequency
40554	40555	1	M_AC_Freq_SF	int16	SF	AC Frequency Scale Factor
Power						
Real Power						
40555	40556	1	M_AC_Power	int16	Watts	Total Real Power (sum of active phases)
40556	40557	1	M_AC_Power_A	int16	Watts	Phase A AC Real Power
40557	40558	1	M_AC_Power_B	int16	Watts	Phase B AC Real Power
40558	40559	1	M_AC_Power_C	int16	Watts	Phase C AC Real Power
40559	40560	1	M_AC_Power_SF	int16	SF	AC Real Power Scale Factor
Apparent Power						
40560	40561	1	M_AC_VA	int16	Volt-Amps	Total AC Apparent Power (sum of active phases)
40561	40562	1	M_AC_VA_A	int16	Volt-Amps	Phase A AC Apparent Power
40562	40563	1	M_AC_VA_B	int16	Volt-Amps	Phase B AC Apparent Power
40563	40564	1	M_AC_VA_C	int16	Volt-Amps	Phase C AC Apparent Power
40564	40565	1	M_AC_VA_SF	int16	SF	AC Apparent Power Scale Factor
Reactive Power						
40565	40566	1	M_AC_VAR	int16	VAR	Total AC Reactive Power (sum of active phases)
40566	40567	1	M_AC_VAR_A	int16	VAR	Phase A AC Reactive Power
40567	40568	1	M_AC_VAR_B	int16	VAR	Phase B AC Reactive Power
40568	40569	1	M_AC_VAR_C	int16	VAR	Phase C AC Reactive Power

[1] The SolarEdge (SE) Meter does not support reading Line-to-Line (L-L) voltages via MODBUS Sunspec.

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40569	40570	1	M_AC_VAR_SF	int16	SF	AC Reactive Power Scale Factor
Power Factor						
40570	40571	1	M_AC_PF	int16	%	Average Power Factor (average of active phases)
40571	40572	1	M_AC_PF_A	int16	%	Phase A Power Factor
40572	40573	1	M_AC_PF_B	int16	%	Phase B Power Factor
40573	40574	1	M_AC_PF_C	int16	%	Phase C Power Factor
40574	40575	1	M_AC_PF_SF	int16	SF	AC Power Factor Scale Factor
Accumulated Energy						
Real Energy						
40575	40576	2	M_Exported	uint32	Watt-hours	Total Exported Real Energy
40577	40578	2	M_Exported_A	uint32	Watt-hours	Phase A Exported Real Energy
40579	40580	2	M_Exported_B	uint32	Watt-hours	Phase B Exported Real Energy
40581	40582	2	M_Exported_C	uint32	Watt-hours	Phase C Exported Real Energy
40583	40584	2	M_Imported	uint32	Watt-hours	Total Imported Real Energy
40585	40586	2	M_Imported_A	uint32	Watt-hours	Phase A Imported Real Energy
40587	40588	2	M_Imported_B	uint32	Watt-hours	Phase B Imported Real Energy
40589	40590	2	M_Imported_C	uint32	Watt-hours	Phase C Imported Real Energy
40591	40592	1	M_Energy_W_SF	int16	SF	Real Energy Scale Factor
Apparent Energy						
40592	40593	2	M_Exported_VA	uint32	VA-hours	Total Exported Apparent Energy
40594	40595	2	M_Exported_VA_ A	uint32	VA-hours	Phase A Exported Apparent Energy
40596	40597	2	M_Exported_VA_ B	uint32	VA-hours	Phase B Exported Apparent Energy
40598	40599	2	M_Exported_VA_ C	uint32	VA-hours	Phase C Exported Apparent Energy
40600	40601	2	M_Imported_VA	uint32	VA-hours	Total Imported Apparent Energy
40602	40603	2	M_Imported_VA_ A	uint32	VA-hours	Phase A Imported Apparent Energy
40604	40605	2	M_Imported_VA_ B	uint32	VA-hours	Phase B Imported Apparent Energy
40606	40607	2	M_Imported_VA_ C	uint32	VA-hours	Phase C Imported Apparent Energy
40608	40609	1	M_Energy_VA_S F	int16	SF	Apparent Energy Scale Factor
Reactive Energy						
40610	40611	2	M_Import_VARh_ Q1	uint32	VAR-hours	Quadrant 1: Total Imported Reactive Energy
40612	40613	2	M_Import_VARh_ Q1A	uint32	VAR-hours	Phase A - Quadrant 1: Imported Reactive Energy
40614	40615	2	M_Import_VARh_ Q1B	uint32	VAR-hours	Phase B- Quadrant 1: Imported Reactive Energy
40616	40617	2	M_Import_VARh_ Q1C	uint32	VAR-hours	Phase C- Quadrant 1: Imported Reactive Energy

Address		Size	Name	Type	Units	Description
(base 0)	(base 1)					
40618	40619	2	M_Import_VARh_ Q2	uint32	VAR-hours	Quadrant 2: Total Imported Reactive Energy
40620	40621	2	M_Import_VARh_ Q2A	uint32	VAR-hours	Phase A - Quadrant 2: Imported Reactive Energy
40622	40623	2	M_Import_VARh_ Q2B	uint32	VAR-hours	Phase B- Quadrant 2: Imported Reactive Energy
40624	40625	2	M_Import_VARh_ Q2C	uint32	VAR-hours	Phase C- Quadrant 2: Imported Reactive Energy
40626	40627	2	M_Export_VARh_ Q3	uint32	VAR-hours	Quadrant 3: Total Exported Reactive Energy
40628	40629	2	M_Export_VARh_ Q3A	uint32	VAR-hours	Phase A - Quadrant 3: Exported Reactive Energy
40630	40631	2	M_Export_VARh_ Q3B	uint32	VAR-hours	Phase B- Quadrant 3: Exported Reactive Energy
40632	40633	2	M_Export_VARh_ Q3C	uint32	VAR-hours	Phase C- Quadrant 3: Exported Reactive Energy
40634	40635	2	M_Export_VARh_ Q4	uint32	VAR-hours	Quadrant 4: Total Exported Reactive Energy
40636	40637	2	M_Export_VARh_ Q4A	uint32	VAR-hours	Phase A - Quadrant 4: Exported Reactive Energy
40638	40639	2	M_Export_VARh_ Q4B	uint32	VAR-hours	Phase B- Quadrant 4: Exported Reactive Energy
40640	40641	2	M_Export_VARh_ Q4C	uint32	VAR-hours	Phase C- Quadrant 4: Exported Reactive Energy
40642	40643	1	M_Energy_VAR_ SF	int16	SF	Reactive Energy Scale Factor
Events						
40643	40644	2	M_Events	uint32	Flags	See M_EVENT_ flags. 0 = nts.

Appendix A – Encoding and Decoding Examples

This appendix explains how to create Modbus commands to communicate with SolarEdge devices and parse their responses.

Client Request/Server Response Register Structure

Use the table's mandatory fields to structure and parse your Modbus command according to the following order.

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the client.	XXXX
Length of the following fields	sizeof (modbusID) + SizeOf(functionCode) + SizeOf(Data)	0x0000
Modbus ID	Identifies a device in a network	0x00
Function code	Executes commands from the leader device to follower devices Main functions: ◢ 0x03 – Read holding register ◢ 0x06 – Preset single register ◢ 0x10 – Preset multiple registers	0x00
Data	Numerical value	0x000000

⋯ NOTE

◢ When Modbus connection is over UDP, the Server Response Register has two extra bytes for CRC.

◢ When encoding the registers, note the following:

- Some commands require two registers. You must write the two registers together using Modbus function 16.
- Each register contains two bytes in Big-Endian order from the most significant byte to the least significant byte (MSB-LSB).
- Each 32-bit value spans over two registers in the Little-Endian word order from the least significant byte to the most significant byte (MSB-LSB).
- If the controller does not support the Little-Endian word order, there is another linked map using the Big-Endian word order at an offset of 0x800.

Modbus Broadcast

Modbus Broadcast write command sends the data to all devices on the bus; the client does not receive a response.

Example of *Modbus Broadcast* command:

Broadcast write 1 to address 0xF300 in all slaves.

Client Request Register

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the installer.	XXXX
Length of the following fields	(sizeof(modbusID) = 1 + SizeOf(functionCode) = 1 + SizeOf(Data) = 4) = 06	0x06
Modbus ID	Identifies a device in a network.	0x00
Function code	Preset single register	0x06
Data	Numerical values	F3 00 00 01 (F300 address of starting point, with additional 1)

Read Single or Multiple Register Data

Create a Read Single or Multiple Register Data command to read data from the inverter using Modbus.

Example of *Read Single or Multiple Register Data* command:

From Inverter with Modbus ID 1 requested to read Dynamic Reactive Power Limit Float) two registers: 0xF324, 0xF325.

Client Request Register

Use the following fields to structure your command:

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the installer.	XXXX
Length of the following fields	(sizeof (modbusID) = 1 + SizeOf(functionCode) = 1 + SizeOf(Data) = 4) = 06	0x06
Modbus ID	Identifies a device in a network	0x01
Function code	Read holding register	0x03
Data	Numerical values	F3 24 00 01 (F324 address of starting point, with additional 1)

Server Response Register

Use the following fields to parse your command:

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the installer.	XXXX
Length of the following fields	(sizeof(modbusID) = 1 + SizeOf(functionCode) = 1 + SizeOf(Data) = 5) = 07	0x07
Modbus ID	Identifies a device in a network	0x01
Function code	Read holding register	0x03
Data	Numerical values	04 00 00 00 32 (04 is the data length – 00 32 response for F324, 00 00 response for F325)

Write Single Register Data

Modbus write command sends to a single register. The server sends a response after it finishes processing the command.

Enable the Dynamic Power Control Mode

This procedure explains how to execute *multiple write to single register* commands consecutively.

1. Set the following:
   - **AdvancedPwrControlEn** on address 0xF142 to 1 (enable). It is 0 (disabled) by default.
   - **ReactivePwrConfig** on address 0xF104 to 4 for either Q or CosPhi control. The default value is 0 (Fixed CosPhi mode).

   > **• • • NOTE**
   >
   > If the registers are already set to the correct value, do not re-write them.

2. Issue a **Commit Power Control Settings** command on address 0xF100 (set to 1) to put the settings into effect. This command stops production and restarts the inverter.
3. Update the enhanced power control settings to addresses 0xF308–0xF320.
4. Enable **Dynamic Power Control** (set to 1). It is 0 (disabled) by default. See the example below.

> **• • • NOTE**
>
> Dynamic Power Control should be enabled only after the initialization of the enhanced power control operation in the previous step.

Example of *Write to Single Register* command:

Inverter with Modbus ID 1, Enable Dynamic Power Control. Write 1 to F300.

Client Request Register

Use the following fields to structure your command:

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the installer.	XXXX
Length of the following fields	(sizeof(modbusID) = 1 + SizeOf(functionCode) = 1 + SizeOf(Data) = 4) = 06	0x06
Modbus ID	Identifies a device in a network	0x01
Function code	Preset single rigester	0x06
Data	Numerical values	0xF3 00 00 01. (write 1 to F300)

Write Multiple Register Data

Modbus write command sends to a range of registers. The server sends a response after it finishes processing the command.

Example of *Write Multiple Register Data* command:

Inverter with Modbus ID 1, Set Dynamic Reactive Power Limit to 100. Write 0x64 to F324.

Client Request Register

Use the following fields to structure your command:

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the installer.	XXXX
Length of the following fields	(sizeof(modbusID) = 1 + SizeOf(functionCode) = 1 + SizeOf(Data) = 4) = 08	0x08
Modbus ID	Identifies a device in a network	0x01
Function code	Preset multiple registers = 0x10	0X10
Data	Numerical values	F3 24 00 00 00 64

Example of *Write Multiple Register to Modify Q Filter* command:
Inverter with Modbus ID 1, Write 600ms to Q filter time in register D21E.

 Use the following fields to structure your command:

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the installer.	XXXX
Length of the following fields	(sizeof(modbusID) = 1 + SizeOf(functionCode) = 1 + SizeOf(Data) = 4) = 06	0x06
Modbus ID	Identifies a device in a network	0x01
Function code	Preset multiple rigester	0x10
Data	Numerical values	0xD2 1E 00 02 04 00 00 02 58. (write 600 to 0xD21E)

Write Multiple Register Data – Big-Endian

To use Big-Endian notation, add an offset of 0x800 to the register address.
Example of *Write Multiple Register Data — Big Endian* command:
Inverter with Modbus ID 1, Set Dynamic Reactive Power Limit to 100. Write 0x64 FB24.

Client Request Register

Use the following fields to structure your command:

Field	Description	Range (Hexadecimal)
Transaction processing identifiers	Client identifier. This parameter cannot be changed by the installer.	XXXX
Length of the following fields	(sizeof(modbusID) = 1 + SizeOf(functionCode) = 1 + SizeOf(Data) = 4) = 08	0x08
Modbus ID	Identifies a device in a network	0x01
Function code	Preset multiple registers = 0x10	0X10
Data	Numerical values	FB 24 64 00 00 00

Abnormal Response Data

If you input abnormal data in the Modbus, the leader/follower device returns the following errors and messages:

Error	Message
Wrong address in Read/Write command	Illegal data address
Incorrect value	Follower/leader device failure

NOTE

The adjustable parameters in Modbus registers are intended for long-term storage. Periodic changes in this parameter can possibly damage the flash memory.

Appendix B – Response Time Information

This appendix displays typical and max data processing and reaction time of the Modbus interface.
This table list the products which follow the response time measurements:

Product	Part Number	Firmware Versions
Three Phase Commercial Inverter	SExxK-xxxxIxxxx	Inverters with SetApp configuration –4.13.5xx and above

Timing Definitions
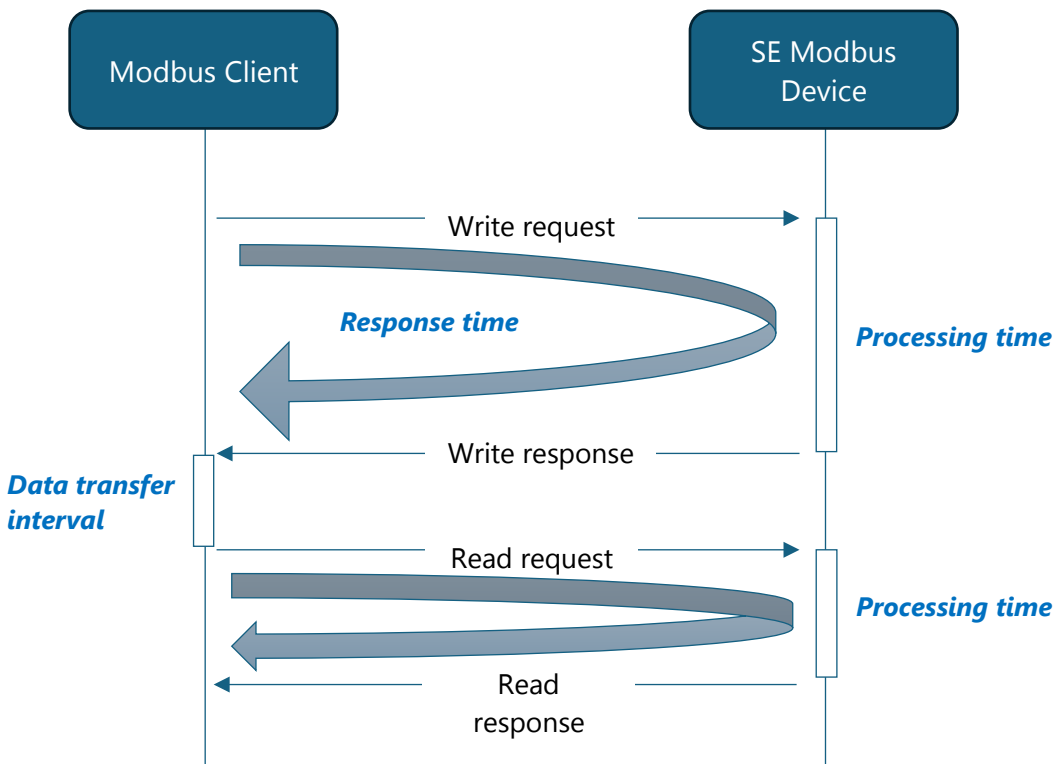
Type of Time	Definition
Processing time of setpoint	This is the time required by SolarEdge products to process the incoming setpoint Modbus command.
Reaction time of setpoint	This is the time between the changing of the setpoint until it's come into effect.
Response time	The is the time between the query and its acknowledgement.
Data transfer interval	For system stability, this is the time separation period between data transfers.

Modbus External Interface

Indirect (Daisy-Chain)

You can connect the follower devices to leader using RS485 interface. You can connect the leader to the controller using RS485 or ethernet.

Direct/Single Inverter Connection

You can connect all inverters to the controller through individual Modbus TCP connection. This provides better timing performance.

SolarEdge timing performance

Type of Command	Timing Definitions		Time [s]
Read	Response time (includes Processing time)		< 0.5 s
Write	Response time (includes Processing time)		< 0.5 s
	Reaction time of setpoint (dynamic)	Active Power (P)	< 1 s
		Reactive Power (P)	< 5 s[1]
	Commit		< 1.5 s[2]
Read/Write	Data transfer interval		< 0.1 s

> **NOTE**
>
> 🔹 The effect on the response time is minor, according to the following:
> - Number of follower devices
> - Single or multiple read/write commands
>
> 🔹 When you add CCG as an interface, it results in a longer response time

---

[1] To optimize the reaction time, set the **Example of Write Single Register to Modify Q Filter command**:. You must follow this command with a commit.

[2] You need to follow static write commands with a commit. This can cause a longer response time.

Support Contact Information

If you have technical problems concerning SolarEdge products, please contact us:

https://www.solaredge.com/service/support

Before contacting us, make sure to have the following information at hand:

- Model and serial number of the product in question.
- The error indicated on the product SetApp mobile application LCD screen or on the monitoring platform or by the LEDs, if there is such an indication.
- System configuration information, including the type and number of modules connected and the number and length of strings.
- The communication method to the SolarEdge server, if the site is connected.
- The product's software version as it appears in the ID status screen.