Technical Note – Power Control Protocol for SolarEdge Inverters

Revision History

- Version 1.3, Oct. 2017: Storage AC Charge Policy and Storage AC Charge Limit - updated
- Version 1.2, Jan. 2017:
  - Added Export Limit and StorEdge information and appendix
  - Export control block register mapping - updated
- Version 1.1, Nov. 2014:
  - Section addition: Supported Versions
  - AdvancedPwrControlEn and ReactivePwrConfig - updated
- Version 1.0, Sept. 2014 - first release

Overview

SolarEdge inverters support the reading of inverter-level monitoring data and configuring its power control settings directly through a non-SolarEdge local device.

Direct connection to a monitoring and control system is useful when a network connection is unavailable, when extensive custom data processing is required, or when authorities require direct access to monitoring data and remote power control setting.

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

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

This document serves as a supplemental document to the *Technical Note – SunSpec Logging in SolarEdge Inverters,* and describes the register mapping of the inverter power control data (read/write MODBUS protocol).

The *Technical Note – SunSpec Logging in SolarEdge Inverters* is available on the SolarEdge website at: http://www.solaredge.com/files/pdfs/sunspec-implementation-technical-note.pdf

Supported Inverters

All inverters with CPU version 3.xxxx and above can support this feature.

To check the inverter firmware versions, short press the LCD light button until reaching the following screen:

```
ID:  ########  ##
DSP1/2:x.xxxx/x.xxxx
CPU  :0003.1400
Country:XXXXX
```

Contact SolarEdge support to upgrade the inverters to the latest FW.

Register Mapping – Power Control Data

Global Dynamic Power Control and Status Block

These registers support dynamic power control without fallback and ramp-up/ramp-down settings.

For enhanced dynamic power control with fallback and ramp-up/ramp-down settings, refer to the Enhanced Dynamic Power Control Block register map section of this document.

The base register of the dynamic-commands block is set to 0xF000:

- **RRCR State feedback** is the current state of the four RRCR input lines (0x0 – 0xF).
- **Active Power Limit** dynamic control: This register controls the active power limit of the inverter dynamically. It is set as the percentage of the inverter's maximum power. For example: when setting the register of SE5000 to 20, it will limit the inverter to 1000W which is 20% of 5000W.

> **NOTE**
> This is a dynamic command that does not require any reset. The value is not saved and when the inverter restarts, the command has to be re-entered.

- **CosPhi** dynamic control: This register controls the CosPhi of the inverter dynamically.

> **NOTE**
> This is a dynamic command that does not require any reset. The value is not saved and when the inverter restarts, the command has to be re-entered.

Address	Size	R/W	Name	Type	Value Range	Units
F000	1	R	RRCR State	Uint16	0-15	N/A
F001	1	R/W	Active Power Limit	Uint16	0-100	%
F002	2	R/W	CosPhi	Float32	-1.0 - 1.0	N/A

To enable the dynamic power control mode, set the following:

- AdvancedPwrControlEn on address 0xF142 to 1 (enable). It is disabled (0) by default.
- ReactivePwrConfig on address 0xF104 to 4 (RRCR mode). It is set by default to 0 (Fixed CosPhi mode).
- Issue a Commit Power Control Settings command on address 0xF100 in order to make this setting effective.

Global Control Block – Commit and Restore

The base register of the Global Control block is set to 0xF100 and includes two global control registers:

- **Commit Power Control Settings**: This register performs the actual writing of the power control register map (Addresses 0xF102 and further). This means that all the relevant power control settings need to be updated before executing this command.
  - Write value: 1 – Execute commit.
  - Command execution time: 5-10 seconds.
  - Read values:
    - o   0 – Commit executed successfully
    - o   0x1-0x4 – Internal error
    - o   0xF102+ – Bad value of register at address X (where X = error code)
    - o   0xFFFF – Unknown error

- **Restore Power Control Default Settings**: This register restores the power control settings to the default values of the country settings. This register does not change the county setting.
  - Write value: 1 – Execute restore defaults.
  - Command execution time: 3-6 seconds.
    - Read values:0 – Restore defaults executed successfully
    - 0xFFFF – Error

Address	Size	R/W	Name	Type	Range	Units
F100	1	R/W	Commit Power Control Settings	Int16	N/A	N/A
F101	1	R/W	Restore Power Control Default Settings	Int16	N/A	N/A

Power Control Block

This block enables the grid control functionality. The power control settings are operative only if the grid control functionality is enabled. The AdvancedPwrControlEn on address 0xF142 is disabled (=0) by default and should be enabled.

Write value: 1 – Enable grid control functionality

Address	R/W	Name	Type	Range	Units
F142	R/W	AdvancedPwrControlEn	Int32	0-1	N/A

- **Reactive Power configuration options**: The Reactive Power setting is used to select one of the several reactive power control modes listed below, and to configure the various modes. The Reactive Power values can be changed within the ranges specified in the tables for each mode:
  - *CosPhi* – sets a constant CosPhi, regardless of other parameters. CosPhi can be set to any value between (-1) and (+1) (a negative value indicates a lagging CosPhi).

Address	R/W	Name	Type	Range	Units
F10A	R/W	FixedCosPhiPhase	Float32	-1.0 - 1.0	N/A

  - *CosPhi(P)* – sets a graph of CosPhi to active power (P). CosPhi (P) has a 6-point graph setup. P can be set to any value between 0 and 100 [% of nominal active power] and CosPhi can be set to any value between (-1) and (+1) (a negative value indicates a lagging CosPhi). Each point includes the fields: < % of nominal active power, CosPhi >.

Address	R/W	Name	Type	Range	Units
F10E	R/W	ReactCosPhiVsPX[0]	Float32	0-100	P/Pmax %
F110	R/W	ReactCosPhiVsPX[1]	Float32	0-100	P/Pmax %
F112	R/W	ReactCosPhiVsPX[2]	Float32	0-100	P/Pmax %
F114	R/W	ReactCosPhiVsPX[3]	Float32	0-100	P/Pmax %
F116	R/W	ReactCosPhiVsPX[4]	Float32	0-100	P/Pmax %
F118	R/W	ReactCosPhiVsPX[5]	Float32	0-100	P/Pmax %
F11A	R/W	ReactCosPhiVsPY[0]	Float32	-1.0 - 1.0	N/A
F11C	R/W	ReactCosPhiVsPY[1]	Float32	-1.0 - 1.0	N/A
F11E	R/W	ReactCosPhiVsPY[2]	Float32	-1.0 - 1.0	N/A
F120	R/W	ReactCosPhiVsPY[3]	Float32	-1.0 - 1.0	N/A
F122	R/W	ReactCosPhiVsPY[4]	Float32	-1.0 - 1.0	N/A
F124	R/W	ReactCosPhiVsPY[5]	Float32	-1.0 - 1.0	N/A

You can set the active graph values with respect to the grid voltage, normalized to the nominal grid voltage (disabled by default- where min. =2 and max. = 0):

- o If the grid voltage is between [Max voltage lock in] and [Max voltage lock Out], then interpolate the CosPhi(P) according to the graph.
- o If the grid voltage is between [Min voltage lock in] and [Min voltage lock Out], then interpolate the CosPhi(P) according to the graph.

Address	R/W	Name	Type	Range	Units
F17A	R/W	ReactCosPhiVsPVgLockInMax	Float32	0-2	V/Vnom
F17C	R/W	ReactCosPhiVsPVgLockInMin	Float32	0-2	V/Vnom
F17E	R/W	ReactCosPhiVsPVgLockOutMax	Float32	0-2	V/Vnom
F180	R/W	ReactCosPhiVsPVgLockOutMin	Float32	0-2	V/Vnom

- *Q* – Sets the constant reactive power (Q). Q can be set to any value between 0 and max inverter power.

Address	R/W	Name	Type	Range	Units
F10C	R/W	FixedReactPwr	Float32	0-Max Power	VAR

- *Q(U)* – sets a graph of the reactive power (Q) to grid voltage (U); this mode can be used when Q(U) control is required; Q(U) has 6-point graph setups. Refer to *Appendix A – Q Configuration,* on page 24. **U** can be set to any value between 0 and 200 [% of nominal voltage].

Address	R/W	Name	Type	Range	Units
F126	R/W	ReactQVsVgX[0]	Float32	0-200	V/Vnom %
F128	R/W	ReactQVsVgX[1]	Float32	0-200	V/Vnom %
F12A	R/W	ReactQVsVgX[2]	Float32	0-200	V/Vnom %
F12C	R/W	ReactQVsVgX[3]	Float32	0-200	V/Vnom %
F12E	R/W	ReactQVsVgX[4]	Float32	0-200	V/Vnom %
F130	R/W	ReactQVsVgX[5]	Float32	0-200	V/Vnom %
F132	R/W	ReactQVsVgY[0]	Float32	-100 - 100	Q/Pmax %
F134	R/W	ReactQVsVgY[1]	Float32	-100 - 100	Q/Pmax %
F136	R/W	ReactQVsVgY[2]	Float32	-100 - 100	Q/Pmax %
F138	R/W	ReactQVsVgY[3]	Float32	-100 - 100	Q/Pmax %
F13A	R/W	ReactQVsVgY[4]	Float32	-100 - 100	Q/Pmax %
F13C	R/W	ReactQVsVgY[5]	Float32	-100 - 100	Q/Pmax %

You can set the active graph values with respect to the active power injected to the grid (disabled by default- where min.=2 and max. = 0):

- o If the actual produced power is between [Max P lock in] and [Max P lock Out], then interpolate the new Q according to the graph.
- o If the actual produced power is between [Min P lock in] and [Min P lock Out], then interpolate the new Q according to the graph.

Address	R/W	Name	Type	Range	Units
F182	R/W	ReactQVsVgPLockInMax	Float32	0-1	P/Pmax
F184	R/W	ReactQVsVgPLockInMin	Float32	0-1	P/Pmax
F186	R/W	ReactQVsVgPLockOutMax	Float32	0-1	P/Pmax
F188	R/W	ReactQVsVgPLockOutMin	Float32	0-1	P/Pmax

There are two types of graph configuration:

<u>Type 0</u> – Normal Q vs. V grid type. This is the default graph type (*Figure a* below) where Q = Q(U) + Q(P).

<u>Type 1</u> - Q vs. V grid type with hysteresis (*Figure b* below). In this case:

- o If the actual grid voltage > from ReactQVsVgX[5] (address F130), then Q= ReactQVsVgY[5] (address F13C)
- o Reset to ReactQVsVgY[4] (address F13A) if the actual grid voltage < from ReactQVsVgX[4] (address F12E)
- o If the actual grid voltage < from ReactQVsVgX[0] (address F126), then Q= ReactQVsVgY[0] (address F132)
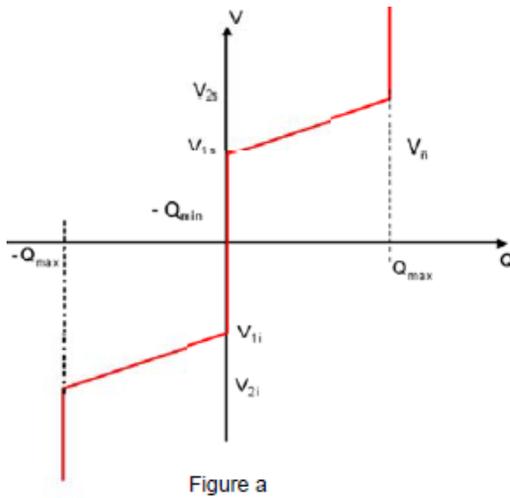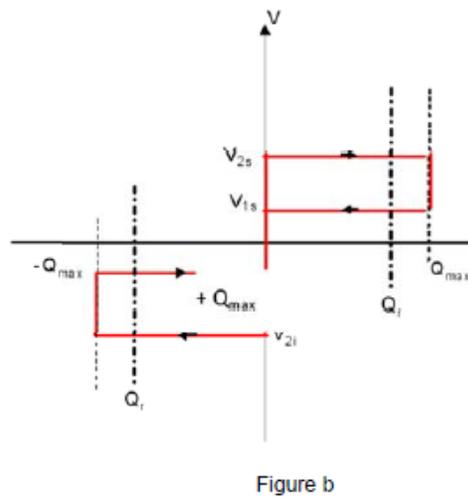- o Reset to ReactQVsVgY[1] (address F134) if the actual grid voltage < from ReactQVsVgX[1] (address F128)

Figure a   Figure b

Address	R/W	Name	Type	Range	Units
F18A	R/W	ReactQVsVgType	Uint32	0,1	N/A

- *Q(P)* – sets a graph of reactive power (Q) to grid active power (P); this mode can be used when Q(P) control is required; Q(P) has 6-point graph setups. Refer to *Appendix A – Q Configuration* on page 24 for an example. P can be set to any value between 0 and 100 [% of nominal active power].

Address	R/W	Name	Type	Range	Units
F15E	R/W	ReactQVsPX[0]	Float32	0-100	P/Pmax %
F160	R/W	ReactQVsPX[1]	Float32	0-100	P/Pmax %
F162	R/W	ReactQVsPX[2]	Float32	0-100	P/Pmax %
F164	R/W	ReactQVsPX[3]	Float32	0-100	P/Pmax %
F166	R/W	ReactQVsPX[4]	Float32	0-100	P/Pmax %
F168	R/W	ReactQVsPX[5]	Float32	0-100	P/Pmax %
F16A	R/W	ReactQVsPY[0]	Float32	0-100	Q/Pmax %
F16C	R/W	ReactQVsPY[1]	Float32	0-100	Q/Pmax %
F16E	R/W	ReactQVsPY[2]	Float32	0-100	Q/Pmax %
F170	R/W	ReactQVsPY[3]	Float32	0-100	Q/Pmax %
F172	R/W	ReactQVsPY[4]	Float32	0-100	Q/Pmax %
F174	R/W	ReactQVsPY[5]	Float32	0-100	Q/Pmax %

- *Unom* - a reference grid voltage, when required for installation testing. Unom can be set to any value between 0 and 500 [V].

Address	R/W	Name	Type	Range	Units
F14E	R/W	Vnom	Float32	0-500	V

► **To select a Reactive Power Control mode and its response time:**

Address	R/W	Name	Type	Range	Units
F104	R/W	ReactivePwrConfig	Int32	0-4	N/A
F106	R/W	ReactPwrIterTime	Uint32	10 - 600000	ms

- Write values:
  - o 0 – Fixed CosPhi mode
  - o 1 –Fixed Q mode (Fixed VAR)
  - o 2 – CosPhi(P) mode
  - o 3 – Q(U) + Q(P) mode
  - o 4 – RRCR mode
- **Reactive power response time** is used for setting the response time of the reactive power graphs.
- **Active Power configuration options**: The active power configuration is used to control the inverter's active power. The active power values can be changed in the following ranges:

- Power Limit - limits the inverter's maximum output power. The power limit can be set to any value between 0-100 [% of nominal active power].

Address	R/W	Name	Type	Range	Units
F140	R/W	PowerReduce	Float32	0-100	%

a.
- Current Limit – limits the inverter's maximum output current. The current limit can be set to any value between 0 and inverter max AC current [A] (the LCD will allow setting to a higher value but the inverter will never exceed its maximum AC current).

Address	R/W	Name	Type	Range	Units
F18E	R/W	MaxCurrent	Float32	0-256	A

- Wakeup Gradient – enables and sets the time for gradual power production when it begins operation after a fault or an inverter reset.

Address	R/W	Name	Type	Range	Units
F108	R/W	ActivePwrGradEn	Int32	0, 1	N/A
F18C	R/W	PwrSoftStartTime	Uint32	0-3600000	ms

- P(U) – sets a graph of active power (P) to grid voltage (U). P(U) has a 6-point graph setup. P can be set to any value between 0 and 100% [normalized active power (P/Pmax) in percentage] and U can be set to any value between 0 and 200% [normalized grid voltage (V/Vnom) in percentage]. Each point includes the fields <X,Y>:
< normalized grid voltage, normalized active power >.

Address	R/W	Name	Type	Range	Units
F190	R/W	PwrVsVgX[0]	Float32	0-200	V/Vnom %
F192	R/W	PwrVsVgX[1]	Float32	0-200	V/Vnom %
F194	R/W	PwrVsVgX[2]	Float32	0-200	V/Vnom %
F196	R/W	PwrVsVgX[3]	Float32	0-200	V/Vnom %
F198	R/W	PwrVsVgX[4]	Float32	0-200	V/Vnom %
F19A	R/W	PwrVsVgX[5]	Float32	0-200	V/Vnom %
F19C	R/W	PwrVsVgY[0]	Float32	0-100	P/Pmax %
F19E	R/W	PwrVsVgY[1]	Float32	0-100	P/Pmax %
F1A0	R/W	PwrVsVgY[2]	Float32	0-100	P/Pmax %
F1A2	R/W	PwrVsVgY[3]	Float32	0-100	P/Pmax %
F1A4	R/W	PwrVsVgY[4]	Float32	0-100	P/Pmax %
F1A6	R/W	PwrVsVgY[5]	Float32	0-100	P/Pmax %

- Disconnect at zero power production option – sets the AC output relays state when the inverter power production is limited to zero. The inverter cannot hold the output relays closed without minimum power production (~30 to 60W for single phase inverters and ~120 to 160W for 3 phase inverters).

b.

Address	R/W	Name	Type	Range	Units
F190	R/W	PwrVsVgX[0]	Float32	0-2	V/Vnom

- Write values:
    - o 0 – Relays are closed even at zero production (Inverter delivers small amount of power)
    - o 1 – Relays are opened (default)

■ Wakeup configuration options: The wakeup configuration is used to set the minimum and maximum grid frequencies and grid voltages between which the inverter can begin power production. It does not set the inverter disconnection values, which are pre-set, per country. The Wakeup values can be changed in the following ranges:

- The frequency can be set to any value between 0-100 [Hz].
- The voltage can be set to any value between 0-500 [V].

Address	R/W	Name	Type	Range	Units
F146	R/W	MaxWakeupFreq	Float32	0-100	Hz
F148	R/W	MinWakeupFreq	Float32	0-100	Hz
F14A	R/W	MaxWakeupVg	Float32	0-500	V
F14C	R/W	MinWakeupVg	Float32	0-500	V

■ **P(f) Configuration Options**: The P(f) setting is used when frequency-based power reduction is required. This setting defines a linear graph set by two points. The inverter de-rates the power according to the defined graph, until the frequency reaches the trip value and the inverter disconnects (the trip point does not need to be defined as one of the two points, it is pre-set per country).

Each point includes the following fields: < frequency, % of nominal active power >. The P(f) values can be changed in the following ranges:

- The frequency can be set to any value between 0 and 100 [Hz].
- P can be set to any value between 0-100 [% of nominal active power].

Address	R/W	Name	Type	Range	Units
F152	R/W	PwrVsFreqX[0]	Float32	0-100	Hz

Address	R/W	Name	Type	Range	Units
F154	R/W	PwrVsFreqX[1]	Float32	0-100	Hz
F156	R/W	PwrVsFreqY[0]	Float32	0-100	%
F158	R/W	PwrVsFreqY[1]	Float32	0-100	%

The following is a mechanism to define a graph either with or without hysteresis.

▶ **To select a Power Frequency Derating Control mode:**

Address	R/W	Name	Type	Range	Units
F102	R/W	PwrFrqDeratingConfig	Int32	0-4	N/A

- Write values for power frequency derating control mode:
  - o 0 – off
  - o 1 – Reserved
  - o 2 – Reserved
  - o 3 – Power frequency derating with hysteresis

    If the actual frequency ≥ Max Freq setting [Hz] (address F15B below) then the actual power is limited to 0.

    Hysteresis enabled: If the actual frequency ≤ Reset Freq setting [Hz] (address F15A below) for more than the defined ResetTime (address F176 below) go back to maximum power within GradTime (address F178 below).

    It is **not allowed** to go back in the graph without passing either the max frequency or reset frequency settings.
  - o 4 – Power frequency derating without hysteresis

    If the actual frequency ≥ Max Freq setting [Hz] (address F15B below) then the actual power is limited to 0.

    Hysteresis disabled: If the actual frequency ≤ Reset Freq setting [Hz] (address F15A below) for more than the defined ResetTime (address F176 below) go back to maximum power within SoftReurnTime (address F178 below).

    It is **allowed** to go back in the graph without passing either the max frequency or reset frequency settings.

    Power frequency derating control modes parameter settings:

Address	R/W	Name	Type	Range	Units
F15A	R/W	ResetFreq	Float32	0-100	Hz
F15C	R/W	MaxFreq	Float32	0-100	Hz
F176	R/W	PwrFrqDeratingResetTime	Uint32	0-MAX_UINT32	ms
F178	R/W	PwrFrqDeratingGradTime	Uint32	0-MAX_UINT33	ms

- **Advanced configuration options**: The Advanced configuration is used to configure the K-Factor for Germany MVGC. It is set to a default value of 2. The FrtEn field should be enabled (set to 1) in order to activate the FRT-K mechanism. The FRT-K value can be changed in the following ranges:
  - The K-Factor can be changed to any value between 0 and 16.

Address	R/W	Name	Type	Range	Units
F144	R/W	FrtEn	Int32	0, 1	N/A
F13E	R/W	FRT_KFactor	Float32	0-16	N/A

Power Control Block Register Map – Reference Table

The following table summarizes all the registers mentioned in the previous sections.

Address	Size	R/W	Name	Type	Range	Units
F102	2	R/W	PwrFrqDeratingConfig	Int32	0-4	N/A
F104	2	R/W	ReactivePwrConfig	Int32	0-4	N/A
F106	2	R/W	ReactPwrIterTime	Uint32	0-MAX_UINT32	ms
F108	2	R/W	ActivePwrGrad	Int32	0, 1	N/A
F10A	2	R/W	FixedCosPhiPhase	Float32	-1.0 - 1.0	N/A
F10C	2	R/W	FixedReactPwr	Float32	0-MAX_FLOAT	VAR
F10E	2	R/W	ReactCosPhiVsPX[0]	Float32	0-100	P/Pmax %
F110	2	R/W	ReactCosPhiVsPX[1]	Float32	0-100	P/Pmax %
F112	2	R/W	ReactCosPhiVsPX[2]	Float32	0-100	P/Pmax %
F114	2	R/W	ReactCosPhiVsPX[3]	Float32	0-100	P/Pmax %
F116	2	R/W	ReactCosPhiVsPX[4]	Float32	0-100	P/Pmax %
F118	2	R/W	ReactCosPhiVsPX[5]	Float32	0-100	P/Pmax %
F11A	2	R/W	ReactCosPhiVsPY[0]	Float32	-1.0 - 1.0	N/A
F11C	2	R/W	ReactCosPhiVsPY[1]	Float32	-1.0 - 1.0	N/A
F11E	2	R/W	ReactCosPhiVsPY[2]	Float32	-1.0 - 1.0	N/A
F120	2	R/W	ReactCosPhiVsPY[3]	Float32	-1.0 - 1.0	N/A
F122	2	R/W	ReactCosPhiVsPY[4]	Float32	-1.0 - 1.0	N/A
F124	2	R/W	ReactCosPhiVsPY[5]	Float32	-1.0 - 1.0	N/A
F126	2	R/W	ReactQVsVgX[0]	Float32	0-200	V/Vnom %
F128	2	R/W	ReactQVsVgX[1]	Float32	0-200	V/Vnom %
F12A	2	R/W	ReactQVsVgX[2]	Float32	0-200	V/Vnom %
F12C	2	R/W	ReactQVsVgX[3]	Float32	0-200	V/Vnom %
F12E	2	R/W	ReactQVsVgX[4]	Float32	0-200	V/Vnom %
F130	2	R/W	ReactQVsVgX[5]	Float32	0-200	V/Vnom %
F132	2	R/W	ReactQVsVgY[0]	Float32	-100 - 100	Q/Pmax %
F134	2	R/W	ReactQVsVgY[1]	Float32	-100 - 100	Q/Pmax %
F136	2	R/W	ReactQVsVgY[2]	Float32	-100 - 100	Q/Pmax %
F138	2	R/W	ReactQVsVgY[3]	Float32	-100 - 100	Q/Pmax %
F13A	2	R/W	ReactQVsVgY[4]	Float32	-100 - 100	Q/Pmax %
F13C	2	R/W	ReactQVsVgY[5]	Float32	-100 - 100	Q/Pmax %
F13E	2	R/W	FRT_KFactor	Float32	0-16	N/A
F140	2	R/W	PowerReduce	Float32	0-100	%
F142	2	R/W	AdvancedPwrControlEn	Int32	0-1	N/A
F144	2	R/W	FrtEn	Int32	0-1	N/A
F146	2	R/W	MaxWakeupFreq	Float32	0-100	Hz
F148	2	R/W	MinWakeupFreq	Float32	0-100	Hz
F14A	2	R/W	MaxWakeupVg	Float32	0-500	V
F14C	2	R/W	MinWakeupVg	Float32	0-500	V
F14E	2	R/W	Vnom	Float32	0-500	V
F150	2	R	Inom	Float32	0-100	A
F152	2	R/W	PwrVsFreqX[0]	Float32	0-100	Hz

Address	Size	R/W	Name	Type	Range	Units
F154	2	R/W	PwrVsFreqX[1]	Float32	0-100	Hz
F156	2	R/W	PwrVsFreqY[0]	Float32	0-100	%
F158	2	R/W	PwrVsFreqY[1]	Float32	0-100	%
F15A	2	R/W	ResetFreq	Float32	0-100	Hz
F15C	2	R/W	MaxFreq	Float32	0-100	Hz
F15E	2	R/W	ReactQVsPX[0]	Float32	0-100	P/Pmax %
F160	2	R/W	ReactQVsPX[1]	Float32	0-100	P/Pmax %
F162	2	R/W	ReactQVsPX[2]	Float32	0-100	P/Pmax %
F164	2	R/W	ReactQVsPX[3]	Float32	0-100	P/Pmax %
F166	2	R/W	ReactQVsPX[4]	Float32	0-100	P/Pmax %
F168	2	R/W	ReactQVsPX[5]	Float32	0-100	P/Pmax %
F16A	2	R/W	ReactQVsPY[0]	Float32	0-100	Q/Pmax %
F16C	2	R/W	ReactQVsPY[1]	Float32	0-100	Q/Pmax %
F16E	2	R/W	ReactQVsPY[2]	Float32	0-100	Q/Pmax %
F170	2	R/W	ReactQVsPY[3]	Float32	0-100	Q/Pmax %
F172	2	R/W	ReactQVsPY[4]	Float32	0-100	Q/Pmax %
F174	2	R/W	ReactQVsPY[5]	Float32	0-100	Q/Pmax %
F176	2	R/W	PwrFrqDeratingResetTime	Uint32	0-MAX_UINT32	ms
F178	2	R/W	PwrFrqDeratingGradTime	Uint32	0-MAX_UINT32	ms
F17A	2	R/W	ReactCosPhiVsPVgLockInMax	Float32	0-2	V/Vnom
F17C	2	R/W	ReactCosPhiVsPVgLockInMin	Float32	0-2	V/Vnom
F17E	2	R/W	ReactCosPhiVsPVgLockOutMax	Float32	0-2	V/Vnom
F180	2	R/W	ReactCosPhiVsPVgLockOutMin	Float32	0-2	V/Vnom
F182	2	R/W	ReactQVsVgPLockInMax	Float32	0-2	P/Pmax
F184	2	R/W	ReactQVsVgPLockInMin	Float32	0-2	P/Pmax
F186	2	R/W	ReactQVsVgPLockOutMax	Float32	0-2	P/Pmax
F188	2	R/W	ReactQVsVgPLockOutMin	Float32	0-2	P/Pmax
F18A	2	R/W	ReactQVsVgType	Uint32	0-1	N/A
F18C	2	R/W	PwrSoftStartTime	Uint32	0-MAX_UINT32	ms
F18E	2	R/W	MaxCurrent	Float32	0-256	A
F190	2	R/W	PwrVsVgX[0]	Float32	0-2	V/Vnom
F192	2	R/W	PwrVsVgX[1]	Float32	0-2	V/Vnom
F194	2	R/W	PwrVsVgX[2]	Float32	0-2	V/Vnom
F196	2	R/W	PwrVsVgX[3]	Float32	0-2	V/Vnom
F198	2	R/W	PwrVsVgX[4]	Float32	0-2	V/Vnom
F19A	2	R/W	PwrVsVgX[5]	Float32	0-2	V/Vnom
F19C	2	R/W	PwrVsVgY[0]	Float32	0-1	P/Pmax
F19E	2	R/W	PwrVsVgY[1]	Float32	0-1	P/Pmax
F1A0	2	R/W	PwrVsVgY[2]	Float32	0-1	P/Pmax
F1A2	2	R/W	PwrVsVgY[3]	Float32	0-1	P/Pmax
F1A4	2	R/W	PwrVsVgY[4]	Float32	0-1	P/Pmax
F1A6	2	R/W	PwrVsVgY[5]	Float32	0-1	P/Pmax
F1A8	2	R/W	DisconnectAtZeroPwrLim	Float32	0-1	N/A

Enhanced Dynamic Power Control Block

These registers support the Enhanced Dynamic Power Control with fallback and ramp-up/ramp-down settings.

The base register of the dynamic-commands block is set to 0xF300:

- **Enable Dynamic Power Control** on address 0xF300 is disabled (=0) by default and should be enabled (1) for dynamic power control functionality
- **Max Active Power** is the inverter rated active power. This is a read only register.
- **Max Reactive Power** is the inverter rated reactive power. This is a read only register.
- All other settings described for the enhanced dynamic power control block are related to these ratings.

Address	Size	R/W	Name	Type	Value Range	Units
F300	1	R/W	Enable Dynamic Power Control	Uint16	0-1	N/A
F304	2	R	Max Active Power	Float32	Inverter rating	W
F306	2	R	Max Reactive Power	Float32	Inverter rating	VAR

To enable the enhanced dynamic power control mode, set the following:

- **AdvancedPwrControlEn** on address 0xF142 to 1 (enable). It is disabled (0) by default.
- **ReactivePwrConfig** on address 0xF104 to 4 (RRCR mode). It is set by default to 0 (Fixed CosPhi mode).
- Issue a **Commit Power Control Settings** command on address 0xF100 in order to make this setting effective.
- Initialize enhanced power control settings on address 0xF308 and onward.
- **Enable Dynamic Power Control** It is disabled (0) by default. It should be enabled only after the initialization of the enhanced power control operation.

► To initialize the Enhanced Power Control operation:

- **Active/Reactive Preference** sets the priority between active and reactive power.
  - When set to (1) the active power has higher priority on reactive power. This means that the inverter tries to reach the active power limit first and then tries to comply with the reactive power limits.
  - When set to (0) the reactive power has higher priority on reactive power.
- **CosPhi/Q Preference** sets if the reactive power is controlled by CosPhi or by Q. When set to (0) the reactive power is controlled by CosPhi.
- **Active Power Limit** sets the limits for the dynamic active power control.
- **Reactive Power Limit** sets the limits for the dynamic reactive power control.
- **Command Timeout:** this register set the timeout timer for dynamic commands. If the inverter doesn't get one of the dynamic commands within this time frame it will revert to the fallback settings described hereunder.
- **Fall-back Active Power Limit** sets the fallback limit for the dynamic active power control.
- **Fall-back Reactive Power Limit** sets the fallback limit for the dynamic reactive power control.
- **Fall-back CosPhi** sets the fallback limit for the dynamic CosPhi control.
- **Active Power Ramp-up Rate** controls the ramp-up rate of the dynamic active power change. It is set as the percentage per minute of the inverter's active power limit register setting (on address F30C).
- **Active Power Ramp-down Rate** controls the ramp-down rate of the dynamic active power change. It is set as the percentage per minute of the inverter's active power limit register setting (on address F30C).
- **Reactive Power Ramp-up Rate** controls the ramp-up rate of the dynamic reactive power change. It is set as the percentage per minute of the inverter's reactive power limit register setting (on address F30E).
- **Reactive Power Ramp-down Rate** controls the ramp-down rate of the dynamic reactive power change. It is set as the percentage per minute of the inverter's reactive power limit register setting (on address F30E).
- **Phi Change Rate** controls the change rate of the dynamic angle change. It is set in radian per minute.

Address	Size	R/W	Name	Type	Value Range	Units
F308	1	R/W	Active/Reactive Preference	Uint16	0-1	0-1
F309	1	R/W	CosPhi/Q Preference	Uint16	0-1	0-1
F30C	2	R/W	Active Power Limit	Float32	0- Max Active Power	W
F30E	2	R/W	Reactive Power Limit	Float32	0- Max Reactive Power	VAR
F310	2	R/W	Command Timeout	Uint32	0-MAX_UINT32	Sec
F312	2	R/W	Fall-back Active Power Limit	Float32	0-100	%
F314	2	R/W	Fall-back Reactive Power Limit	Float32	0-100	%
F316	2	R/W	Fall-back CosPhi	Float32	-1 to 1	N/A
F318	2	R/W	Active Power Ramp-up Rate	Float32	0-100	%/min
F31A	2	R/W	Active Power Ramp-down Rate	Float32	0-100	%/min
F31C	2	R/W	Reactive Power Ramp-up Rate	Float32	0-100	%/min
F31E	2	R/W	Reactive Power Ramp-down Rate	Float32	0-100	%/min
F320	2	R/W	Phi Change Rate	Float32	0 - pi	rad/min

► **Enhanced Power Control Dynamic Commands Operation:**

Dynamic Active Power Limit: This register controls the active power limit of the inverter dynamically. It is set as the percentage of the Active Power Limit register setting (on address F30C).

NOTE
This is a dynamic command that does not require any reset. The value is not saved and when the inverter restarts, the command has to be re-entered.

■ **Dynamic Reactive Power Limit**: This register controls the reactive power limit of the inverter dynamically. It is set as the percentage of the Reactive Power Limit register setting (on address F30E).

NOTE
This is a dynamic command that does not require any reset. The value is not saved and when the inverter restarts, the command has to be re-entered.

■ **Dynamic Cos Phi Ref**: This register controls the CosPhi of the inverter dynamically.

NOTE
This is a dynamic command that does not require any reset. The value is not saved and when the inverter restarts, the command has to be re-entered.

Address	Size	R/W	Name	Type	Value Range	Units
F322	2	R/W	Dynamic Active Power Limit	Float32	0-100	%
F324	2	R/W	Dynamic Reactive Power Ref	Float32	0-100	%
F326	2	R/W	Dynamic CosPhi Ref	Float32	-1 to 1	N/A

Enhanced Power Control Block Register Map – Reference Table

The following table summarizes all the registers mentioned in the previous section.

Address	Size	R/W	Name	Type	Value Range	Units
F300	1	R/W	Enable Dynamic Power Control	Uint16	0-1	N/A
F301	1	R	Reserved	Uint16	-	-
F302	2	R	Reserved	Float32	-	-
F304	2	R	Max Active Power	Float32	Inverter rating	W
F306	2	R	Max Reactive Power	Float32	Inverter rating	VAR
F308	1	R/W	Active/Reactive Preference	Uint16	0-1	0-1
F309	1	R/W	CosPhi/Q Preference	Uint16	0-1	0-1
F30A	2	R/W	Reserved	Float32	-	-
F30C	2	R/W	Active Power Limit	Float32	0- Max Active Power	W
F30E	2	R/W	Reactive Power Limit	Float32	0- Max Reactive Power	VAR
F310	2	R/W	Command Timeout	Uint32	0-MAX_UINT32	Sec
F312	2	R/W	Fall-back Active Power Limit	Float32	0-100	%
F314	2	R/W	Fall-back Reactive Power Limit	Float32	0-100	%
F316	2	R/W	Fall-back CosPhi	Float32	?	N/A
F318	2	R/W	Active Power Ramp-up Rate	Float32	0-100	%/min
F31A	2	R/W	Active Power Ramp-down Rate	Float32	0-100	%/min
F31C	2	R/W	Reactive Power Ramp-up Rate	Float32	0-100	%/min
F31E	2	R/W	Reactive Power Ramp-down Rate	Float32	0-100	%/min
F320	2	R/W	Phi Change Rate	Float32	0 - pi	rad/min
F322	2	R/W	Dynamic Active Power Limit	Float32	0-100	%
F324	2	R/W	Dynamic Reactive Power Ref	Float32	0-100	%
F326	2	R/W	Dynamic CosPhi Ref	Float32	0 - pi	N/A

Export Limit Control Block

These registers support export limit control settings. For export limitation, a SolarEdge device - inverter or a Control and Communication Gateway (CCG) - dynamically adjusts the PV power production in order to ensure that exported power does not exceed a preconfigured limit. To enable this functionality, an energy meter that measures export or consumption must be installed at the site. For detailed explanation on Export limitation functionality please refer to:

http://www.solaredge.com/files/pdfs/products/feed-in_limitation_application_note.pdf

The base register of the export limit control block is set to 0xE000 and also mirrored to 0xF000.

To enable the enhanced export limit control, make sure the following is set:

- **AdvancedPwrControlEn** on address 0xF142 to 1 (enable). It is disabled (0) by default.
- **ReactivePwrConfig** on address 0xF104 to 4 (RRCR mode). It is set by default to 0 (Fixed CosPhi mode).
- Issue a **Commit Power Control Settings** command on address 0xF100 to make this setting effective

■ **Export Control Mode** on address 0xE000 is disabled (=0) by default. This register controls the export control mode of operation:

Bit #	Name	Description
0	Direct Export Limitation	The meter is connected on the grid connection point and measures Export/Import power. Export limit control is performed directly by reading the export power (Site Export ≤ Site Limit). Only single selection is allowed on bits 0-2.
1	In-direct Export Limitation	The meter is connected on the load connection point and measures consumption power. Export limit control is performed indirectly by reading the consumption power and calculating the export power (Site production – Site Consumption ≤ Site Limit). Only single selection is allowed on bits 0-2.
2	Production Limitation	For this mode either the internal inverters power production measurements or external site production meter can be used. The meter measures the site production. The maximum site production will be limited to the site limit. Only single selection is allowed on bits 0-2. **Example**: site have a license for 50kW AC. The installer can install 60kW AC inverters and use less PV panels in this site to get more kWh/year from the system by limiting the site production to 50kW.
3-9	Reserved	Reserved
10	External Production	Indication that there is an additional non-SolarEdge power source (e.g. 3rd party inverter) in the system. Calculated meters will be sent only if there is a SolarEdge meter configured to measure the non-SolarEdge power source production. Bits 10-11 can be set together with bits 0-2.
11	Negative Site Limit	Allows setting of negative site limit to allow minimum import power. The system will not start production till the minimum import required is met. Bits 10-11 can be set together with bits 0-2.
12-15	Reserved	Reserved

■ Example for Direct Export Limitation with Negative site limit setting: 0000100000000001

■ **Export Control Limit Mode** is set to Total by default. There are two applicable limit modes:

0   **Total:** The Site Limit is the total export power on all the phases combined. Reverse current on one phase will count as negative power and can compensate for another phase.

1   **Per Phase:** This mode is relevant for three phase inverters only. For three phase grid connections, the inverter sets the limit on each phase to 1/3 of the total site limit. Use this mode if there is a limit on each individual phase.

- **Export Control Site Limit** sets the site limit power in watts.
- **External Production Max Power** sets the maximum power in watts of the external non-SolarEdge production for correct fallback calculation. It is needed for setting the correct fallback production limit in SolarEdge inverters when the communication between the inverters or with the meter is not working correctly. If not set, default fall back is zero (0) power.
- Export control block register mapping:

Address	Size	R/W	Name	Type	Value Range	Units
E000 / F700	1	R/W	Export Control Mode	Uint16	Bits 0 (LSB) - 11	N/A
E001 / F701	1	R/W	Export Control Limit Mode	Uint16	0-1	N/A
E002 / F702	2	R/W	Export Control Site Limit	Float32	0-Max_Site Power	W
E012	2	R/W	External Production Max Power	Float32	0-Max_External Source Power	W

StorEdge Control and Status Block

The StorEdge block supports four different control modes. The first three (Maximizing self-consumption, Profile Programming and backup only) are fully controlled by the inverter and can be configured by an external controller. The 4th control mode is remote control mode in which the StorEdge operation is fully controlled using an external controller.

- **Maximize Self Consumption** – In this mode, the battery is automatically charged and discharged to meet consumption needs and reduce the amount of electricity purchased from the grid. This mode requires installation of a SolarEdge Electricity Meter, either on the grid connection point or on the load connection point.
- **Profile Programming** (for time of use arbitrage) - In this mode, the StorEdge system operates according to a configured charge/ discharge profile, for example for time of use arbitrage (charge the battery from PV/grid when tariffs are low and discharge it when tariffs are high). This mode requires installation of a SolarEdge Electricity Meter either on the grid connection point or on the load connection point. This application is covered in the following application note: http://www.solaredge.com/files/pdfs/StorEdge_TOU_profile_programming.pdf
- **Backup only** – This mode is applicable only for inverters with backup functionality (dedicated hardware). In this mode, the battery energy is used only for electricity outage and not used for on-grid applications.
- **Remote Control** – In this mode, the battery charge/discharge operation is fully controlled using an external controller.

To enable StorEdge control, make sure the following is set:

- **AdvancedPwrControlEn** on address 0xF142 to 1 (enable). It is disabled (0) by default.
- **ReactivePwrConfig** on address 0xF104 to 4 (RRCR mode). It is set by default to 0 (Fixed CosPhi mode).
- Issue a **Commit Power Control Settings** command on address 0xF100 to make this setting effective.

This block consists of Global StorEdge Control Block and per battery Status and Information Blocks

Global StorEdge Control Block

The base register of the export limit control block is set to 0xE004 and also mirrored to 0xF704.

Storage Control Mode is used to set the StorEdge system operating mode:

    0 – Disabled

    1 – Maximize Self Consumption – requires a SolarEdge Electricity meter on the grid or load connection point

    2 – Time of Use (Profile programming) – requires a SolarEdge Electricity meter on the grid or load connection point

    3 – Backup Only (applicable only for systems support backup functionality)

    4 – Remote Control – the battery charge/discharge state is controlled by an external controller

> **NOTE**
> Advanced power control such as power limits or gradients run in parallel and have higher priority.

Storage AC Charge Policy is used to enable charging for AC and the limit of yearly AC charge (if applicable).

    0 – Disable

    1 – Always allowed – needed for AC coupling operation. Allows unlimited charging from the AC. When used with Maximize self-consumption, only excess power is used for charging (charging from the grid is not allowed).

    2 – Fixed Energy Limit – allows AC charging with a fixed yearly (Jan 1 to Dec 31) limit (needed for meeting ITC regulation in the US)

    3 – Percent of Production - allows AC charging with a % of system production year to date limit (needed for meeting ITC regulation in the US)

Storage AC Charge Limit is used to set the AC charge limit according to the policy set in the previous register. Either fixed in kWh or percentage is set (e.g. 100KWh or 70%). Relevant only for **Storage AC Charge Policy =** 2 or 3.

Storage Backup Reserved Setting sets the percentage of reserved battery SOE to be used for backup purposes. Relevant only for inverters with backup functionality.

The following registers are applicable only for **remote control** mode (0xE004 = 4):

Storage Charge/Discharge default Mode sets the default mode of operation when **Remote Control Command Timeout** has expired. The supported Charge/Discharge Modes are as follows:

    0 – Off

    1 – Charge excess PV power only.

        Only PV excess power not going to AC is used for charging the battery. Inverter NominalActivePowerLimit (or the inverter rated power whichever is lower) sets how much power the inverter is producing to the AC. In this mode, the battery cannot be discharged. If the PV power is lower than NominalActivePowerLimit the AC production will be equal to the PV power.

    2 – Charge from PV first, before producing power to the AC.

        The Battery charge has higher priority than AC production. First charge the battery then produce AC. If *StorageRemoteCtrl_ChargeLimit* is lower than PV excess power goes to AC according to *NominalActivePowerLimit*. If *NominalActivePowerLimit* is reached and battery *StorageRemoteCtrl_ChargeLimit* is reached, PV power is curtailed.

    3 – Charge from PV+AC according to the max battery power.

        Charge from both PV and AC with priority on PV power. If PV production is lower than StorageRemoteCtrl_ChargeLimit, the battery will be charged from AC up to NominalActivePow-erLimit. In this case AC power = StorageRemoteCtrl_ChargeLimit- PVpower. If PV power is larger than StorageRemoteCtrl_ChargeLimit the excess PV power will be directed to the AC up to the Nominal-ActivePowerLimit beyond which the PV is curtailed.

    4 – Maximize export – discharge battery to meet max inverter AC limit.

        AC power is maintained to NominalActivePowerLimit, using PV power and/or battery power. If the PV power is not sufficient, battery power is used to complement AC power up to StorageRemoteCtrl_DishargeLimit. In this mode, charging excess power will occur if there is more PV than the AC limit.

    5 – Discharge to meet loads consumption. Discharging to the grid is not allowed.

    7 – Maximize self-consumption

> **NOTE**
> Modes 5 and 7 require an external consumption/export meter.

Remote Control Command Timeout sets the operating timeframe for the charge/discharge command sets in **Remote Control Command Mode** register. When expired, it reverts to the default mode defined in **Storage Charge/Discharge default Mode** register.

Remote Control Command Mode sets the operating mode during the defined time frame according to the selected Storage Charge/Discharge Mode (see **Storage Charge/Discharge default Mode** above for the different modes**)**

Remote Control Charge Limit sets the maximum charge limit. The default is the maximum battery charge power.

Remote Control Charge Limit sets the maximum discharge limit. The default is the maximum battery discharge power.

- ■ **StorEdge Control Block register mapping:**

Address	Size	R/W	Name	Type	Range	Units
E004 (F704)	1	R/W	Storage Control Mode	Uint16	0-4	N/A
E005 (F705)	1	R/W	Storage AC Charge Policy	Uint16	0-3	N/A
E006 (F706)	2	R/W	Storage AC Charge Limit	Float32	0-Max_Float	KWh or %
E008 (F708)	2	R/W	Storage Backup Reserved Setting	Float32	0-100	%
E00A (F70A)	1	R/W	Storage Charge/Discharge Default Mode	Uint16	0-7	N/A
E00B (F70B)	2	R/W	Remote Control Command Timeout	Uint32	0-86400(24h)	Sec
E00D (F70D)	1	R/W	Remote Control Command Mode	Uint16	0-7	N/A
E00E (F70E)	2	R/W	Remote Control Charge Limit	Float32	0- Battery Max Power	W
E010 (F710)	2	R/W	Remote Control Command Discharge Limit	Float32	0- Battery Max Power	W

NOTE

When two batteries are connected, the Global StorEdge Control Block operation depends on the system functionality and hardware limitation. If double batteries are used for double capacity, each battery will be controlled one after the other, meaning first battery 1 is discharged and then battery 2, following this battery 1 is charged and afterwards battery 2. In this way the system tries to balance the cycles between the batteries.

For double power (requires different hardware), the inverter will treat the two batteries as a single entity.

For configuration examples, see Appendix B – Configuration Examples.

Battery Status and Information Block

This block supports up to two batteries.

The base register of the Battery 1 Status and Information is set to 0xE100 and mirrored to 0xF500.

The base register of the Battery 2 Status and Information is set to 0xE200.

The following per battery nameplate information is available:

- Battery Manufacturer Name
- Battery Model
- Battery Firmware Version
- Battery Serial Number
- Battery Device ID (MODBUS address)
- Battery Rated Energy
- Battery Max Charge Continues Power
- Battery Max Discharge Continues Power
- Battery Max Charge Peak Power
- Battery Max Discharge Peak Power

The following per battery statuses are available (if supported by the battery vendor):

- Battery Average Temperature
- Battery Max Temperature
- Battery Instantaneous Voltage
- Battery Instantaneous Current
- Battery Instantaneous Power
- Battery Lifetime Export Energy counter
- Battery Lifetime Import Energy counter
- Battery Max Energy – updated according to the battery aging
- Battery Available Energy (Instantaneous)
- Battery State of Health (SOH) calculated as Battery Max Energy \ Battery Rated Energy
- Battery State of Energy (SOE) calculated as Battery Available Energy \ Battery Max Energy
- Battery Status – Battery operating state: 0 – Off; 1 – Standby; 2 – Init; 3 – Charge; 4 – Discharge; 5 – Fault; 7 - Idle
- Status Internal – internal battery vendor status
- Events Log – EventsLog[0] has the last error; EventsLog[1..7] are not implemented
- Events Log Internal – reserved

StorEdge Battery 1 Status and Information Block register mapping:

Address	Size	R/W	Name	Type	Units
E100 (F500)	16	R	Battery 1 Manufacturer Name	String[32]	-
E110 (F510)	16	R	Battery 1 Model	String[32]	-
E120 (F520)	16	R	Battery 1 Firmware Version	String[32]	-
E130 (F530)	16	R	Battery 1 Serial Number	String[32]	-
E140 (F540)	1	R	Battery 1 Device ID	Uint16	-
E141 (F541)	1	R	Reserved	Uint16	-
E142 (F542)	2	R	Battery 1 Rated Energy	Float32	W*H
E144 (F544)	2	R	Battery 1 Max Charge Continues Power	Float32	W
E146 (F546)	2	R	Battery 1 Max Discharge Continues Power	Float32	W
E148 (F548)	2	R	Battery 1 Max Charge Peak Power	Float32	W
E14A (F54A)	2	R	Battery 1 Max Discharge Peak Power	Float32	W
E14C (F54C)	32	R	Reserved	Uint16	-
E16C (F56C)	2	R	Battery 1 Average Temperature	Float32	°C
E16E (F56E)	2	R	Battery 1 Max Temperature	Float32	°C
E170 (F570)	2	R	Battery 1 Instantaneous Voltage	Float32	V
E172 (F572)	2	R	Battery 1 Instantaneous Current	Float32	A
E174 (F574)	2	R	Battery 1 Instantaneous Power	Float32	W
E176 (F576)	4	R	Battery 1 Lifetime Export Energy Counter	Uint64	W*H
E17A (F57A)	4	R	Battery 1 Lifetime Import Energy Counter	Uint64	W*H
E17E (F57E)	2	R	Battery 1 Max Energy	Float32	W*H
E180 (F580)	2	R	Battery 1 Available Energy	Float32	W*H
E182 (F582)	2	R	Battery 1 State of Health (SOH)	Float32	N/A
E184 (F584)	2	R	Battery 1 State of Energy (SOE)	Float32	N/A
E186 (F586)	2	R	Battery 1 Status	Uint32	0-7
E188 (F588)	2	R	Battery 1 Status Internal	Uint32	Vendor-defined status codes.
E18A (F58A)	8	R	Battery 1 Events Log	Uint16[8]	Battery vendor's last fault ID
E192 (F592)	8	R	Battery 1 Events Log Internal	Uint16[8]	-
E19A (F59A)	32	R	Reserved	Uint16	N/A

StorEdge Battery 2 Status and Information Block register mapping:

Address	Size	R/W	Name	Type	Units
E200	16	R	Battery 2 Manufacturer Name	String[32]	-
E210	16	R	Battery 2 Model	String[32]	-
E220	16	R	Battery 2 Firmware Version	String[32]	-
E230	16	R	Battery 2 Serial Number	String[32]	-
E240	1	R	Battery 2 Device ID	Uint16	-
E241	1	R	Reserved	Uint16	-
E242	2	R	Battery 2 Rated Energy	Float32	W*H
E244	2	R	Battery 2 Max Charge Continues Power	Float32	W
E246	2	R	Battery 2 Max Discharge Continues Power	Float32	W
E248	2	R	Battery 2 Max Charge Peak Power	Float32	W
E24A	2	R	Battery 2 Max Discharge Peak Power	Float32	W
E24C	32	R	Reserved	Uint16	-
E26C	2	R	Battery 2 Average Temperature	Float32	°C
E26E	2	R	Battery 2 Max Temperature	Float32	°C
E270	2	R	Battery 2 Instantaneous Voltage	Float32	V
E272	2	R	Battery 2 Instantaneous Current	Float32	A
E274	2	R	Battery 2 Instantaneous Power	Float32	W
E276	4	R	Battery 2 Lifetime Export Energy Counter	Uint64	W*H
E27A	4	R	Battery 2 Lifetime Import Energy Counter	Uint64	W*H
E27E	2	R	Battery 2 Max Energy	Float32	W*H
E280	2	R	Battery 2 Available Energy	Float32	W*H
E282	2	R	Battery 2 State of Health (SOH)	Float32	N/A
E284	2	R	Battery 2 State of Energy (SOE)	Float32	N/A
E286	2	R	Battery 2 Status	Uint32	0-7
E288	2	R	Battery 2 Status Internal	Uint32	Vendor-defined status codes
E28A	8	R	Battery 2 Events Log	Uint16[8]	Battery vendor's last fault ID
E292	8	R	Battery 2 Events Log Internal	Uint16[8]	-
E29A	32	R	Reserved	Uint16	N/A

Register Mapping – Grid Protection Limits

Global Grid Protection Block – Commit and Restore

The base register of the Grid Protection block is set to 0xF600 and includes two global control registers:

- **Commit Grid Limits Settings**: This register performs the actual writing of the grid protection trip limits register map (Addresses 0xF602 and further). This means that all the relevant grid protection trip-limit settings need to be updated before executing this command.
  - Write value: 1 – Execute commit.
  - Command execution time: 5-10 seconds.
  - Read values:
    - o   0 – Commit executed successfully
    - o   0x1 – Internal error
    - o   0xFFFF – Unknown error
- **Restore Grid Limits Default Settings**: This register restores the grid protection trip-limit settings to the default values of the country settings. This register does not change the county setting.
  - Write value: 1 – Execute restore defaults.
  - Command execution time: 3-6 seconds.
  - Read values:
    - o   0 – Restore defaults executed successfully
    - o   0xFFFF – Error

Address	Size	R/W	Name	Type	Range	Units
F600	1	R/W	Commit Grid Limits Settings	Int16	N/A	N/A
F601	1	R/W	Restore Grid Limits Settings Defaults	Int16	N/A	N/A

Grid Protection Trip Limits Block

This block sets the grid protection trip limits.

The user can set the following grid protection limits:

Vg<min, max> <1-5>: The minimum and maximum grid voltage thresholds (Volts).

Vg<min, max><1-5>_HoldTime: The minimum and maximum grid voltage thresholds trip time in milliseconds. The trip time indicates the time after which the inverter should disconnect from the grid if the grid voltage is out of range.

Fg<min, max> <1-5>: The minimum and maximum grid frequency thresholds (Hz).

Fg<min, max> <1-5>_HoldTime: The minimum and maximum grid frequency thresholds trip time in milliseconds. The trip time indicates the time after which the inverter should disconnect from the grid if the grid voltage is out of range.

GRM Time: Grid monitoring time - the duration (milliseconds) that the grid voltage and frequency have to be within the range (min. and max. thresholds) before the inverter can reconnect to the grid. For example, if the GRM time is set to 60 seconds, the inverter checks that the grid is within the voltage and frequency ranges for 60 seconds before reconnecting to the grid.

Grid Protection Trip Limits Block – Register Map

The following table summarizes all the grid protection trip limits registers:

Address	Size	R/W	Name	Type	Range	Units
F602	2	R/W	VgMax1	Float32	0-MAX_FLOAT	V
F604	2	R/W	VgMax1_HoldTime	Uint32	0-MAX_UINT32	msec
F606	2	R/W	VgMax2	Float32	0-MAX_FLOAT	V
F608	2	R/W	VgMax2_HoldTime	Uint32	0-MAX_UINT32	msec
F60A	2	R/W	VgMax3	Float32	0-MAX_FLOAT	V
F60C	2	R/W	VgMax3_HoldTime	Uint32	0-MAX_UINT32	msec
F60E	2	R/W	VgMax4	Float32	0-MAX_FLOAT	V
F610	2	R/W	VgMax4_HoldTime	Uint32	0-MAX_UINT32	msec
F612	2	R/W	VgMax5	Float32	0-MAX_FLOAT	V
F614	2	R/W	VgMax5_HoldTime	Uint32	0-MAX_UINT32	msec
F616	2	R/W	VgMin1	Float32	0-MAX_FLOAT	V
F618	2	R/W	VgMin1_HoldTime	Uint32	0-MAX_UINT32	msec
F61A	2	R/W	VgMin2	Float32	0-MAX_FLOAT	V
F61C	2	R/W	VgMin2_HoldTime	Uint32	0-MAX_UINT32	msec
F61E	2	R/W	VgMin3	Float32	0-MAX_FLOAT	V
F620	2	R/W	VgMin3_HoldTime	Uint32	0-MAX_UINT32	msec
F622	2	R/W	VgMin4	Float32	0-MAX_FLOAT	V
F624	2	R/W	VgMin4_HoldTime	Uint32	0-MAX_UINT32	msec
F626	2	R/W	VgMin5	Float32	0-MAX_FLOAT	V
F628	2	R/W	VgMin5_HoldTime	Uint32	0-MAX_UINT32	msec
F62A	2	R/W	FgMax1	Float32	0-MAX_FLOAT	Hz
F62C	2	R/W	FgMax1_HoldTime	Uint32	0-MAX_UINT32	msec
F62E	2	R/W	FgMax2	Float32	0-MAX_FLOAT	Hz
F630	2	R/W	FgMax2_HoldTime	Uint32	0-MAX_UINT32	msec
F632	2	R/W	FgMax3	Float32	0-MAX_FLOAT	Hz
F634	2	R/W	FgMax3_HoldTime	Uint32	0-MAX_UINT32	msec
F636	2	R/W	FgMax4	Float32	0-MAX_FLOAT	Hz
F638	2	R/W	FgMax4_HoldTime	Uint32	0-MAX_UINT32	msec
F63A	2	R/W	FgMax5	Float32	0-MAX_FLOAT	Hz
F63C	2	R/W	FgMax5_HoldTime	Uint32	0-MAX_UINT32	msec
F63E	2	R/W	FgMin1	Float32	0-MAX_FLOAT	Hz
F640	2	R/W	FgMin1_HoldTime	Uint32	0-MAX_UINT32	msec
F642	2	R/W	FgMin2	Float32	0-MAX_FLOAT	Hz
F644	2	R/W	FgMin2_HoldTime	Uint32	0-MAX_UINT32	msec
F646	2	R/W	FgMin3	Float32	0-MAX_FLOAT	Hz
F648	2	R/W	FgMin3_HoldTime	Uint32	0-MAX_UINT32	msec
F64A	2	R/W	FgMin4	Float32	0-MAX_FLOAT	Hz
F64C	2	R/W	FgMin4_HoldTime	Uint32	0-MAX_UINT32	msec
F64E	2	R/W	FgMin5	Float32	0-MAX_FLOAT	Hz
F650	2	R/W	FgMin5_HoldTime	Uint32	0-MAX_UINT32	msec
F652	2	R/W	GRM_Time	Uint32	0-MAX_UINT32	msec

Appendix A – Q Configuration

If the utility requires a Q(U) control of the inverter, it usually provides a linear graph, with Umin, Umax, Q(Umin) and Q(Umax).

If the utility requires a Q(U)+Q(P) control of the inverter, it usually provides a linear Q(U) graph for P=0 and for P=Pnom.

To translate this graph to the values that need to be configured in the inverter, use the following definitions and instructions; **Q** and **U** (bold font) refer to the values that should be set in the inverter:

1 $Q_{max} = 0.6 * S_{max}$

> **NOTE:**
> $Q_{max} = sin\varphi * S_{max} = \sin(\cos^{-1}\frac{P}{S}) * S_{max}$; optimally CosPhi is set to a min/max value of -0.8/0.8 and therefore $\sin(\cos^{-1} 0.8) = 0.6$.

2 $\boldsymbol{U}_{min} = {U_{min}}/{U_{nom}}$; $\boldsymbol{U}_{max} = {U_{max}}/{U_{nom}}$ (between 0 and 200)

3 $\boldsymbol{Q}(\boldsymbol{U}_{min}) = - {Q(U_{min})}/{Q_{nom}}$; $\boldsymbol{Q}(\boldsymbol{U}_{max}) = - {Q(U_{max})}/{Q_{nom}}$

> **NOTE:**
> SolarEdge inverters use the convention of inductive power being positive and capacitive power being negative; since most graphs are supplied with the opposite convention, i.e. with Q decreasing as U increases, the minus sign was inserted into the above definitions. When supplied with a graph where Q increases as U increases, the minus sign should be ignored.

4 The 6 points that set the linear Q(U) graph should be the following:

P0	**U**min	**Q**(**U**min)
P1	**U**min	**Q**(**U**min)
P2	**U**min	**Q**(**U**min)
P3	**U**max	**Q**(**U**max)
P4	**U**max	**Q**(**U**max)
P5	**U**max	**Q**(**U**max)

> **NOTE:**
> Do not enter identical $\boldsymbol{Q}(\boldsymbol{U}_{min})$ or $\boldsymbol{Q}(\boldsymbol{U}_{max})$ values for different U points.
> If the graph comprises several linear sections, use points 1-4 for the Q(U) values of the break points in the graph.
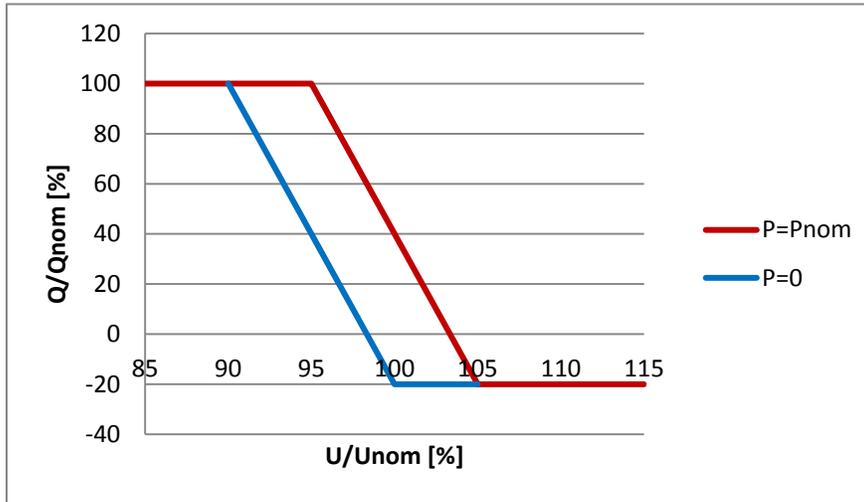
5 $dQ = -[Q(U, P = P_{nom}) - Q(U, P = 0)]$ (See above note regarding the minus sign.)

6 The 6 points that set the Q(P) graph should be the following:

P0	0	0
P1	0	0
P2	0	0
P3	100	dQ/Qmax
P4	100	dQ/Qmax
P5	100	dQ/Qmax

Example

The following Q(U,P) graph has been provided by the utility:

The inverter being configured is SE10k, which has a maximum AC power of 10kVA. The following values are the result of the above steps:

1 $Q_{max} = 0.6 * 10 = 6kVAR$

2 $U_{min} = 90\% ; \quad U_{max} = 100\%$

      [if U is provided in Volts, divide by Unom to get the percentage value]

3 $Q(U_{min}) = -100\% ; \quad Q(U_{max}) = 20\%$
   c.   [if Q is provided in kVAR, divide by Qnom to get the percentage value]

4 The 6 points that set the Q(U) graph should be the following:

P0	90	-100
P1	90	-100
P2	90	-100
P3	100	20
P4	100	20
P5	100	20

5 $dQ = -[40 - (-20)] = -60\%$

6 In this case, dQ is already normalized by Qmax. Therefore, the 6 points that set the Q(P) graph should be the following:

P0	0	0
P1	0	0
P2	0	0
P3	100	-60
P4	100	-60
P5	100	-60

Appendix B – Configuration Examples

Enable Dynamic Power Control Mode

- Set *AdvancedPwrControlEn* (0xF142) to 1 (enable). It is disabled (0) by default.
- Set *ReactivePwrConfig* (0xF104) to 4 (RRCR mode). It is set by default to 0 (Fixed CosPhi mode).
- Issue a *CommitPowerControlSettings* command on address 0xF100 in order to make this setting effective. This command executes in 5 to 10 seconds.

Use the following registers for dynamic commands:

- The Inverter maximum active power can be controlled dynamically with *NominalActivePowerLimit* (0xF001).
- The inverter reactive power can be controlled with *CosPhi* (0xF002).

NOTE:
This is effective only for exporting power to the AC. When importing power from the AC, the inverter power is defined by the Battery power limit and PV production (within the static maximum limits set for the Inverter).

Configuration of the Storage Control for Remote Control mode

Initial configuration

- Set *ExportConf_Ctrl* (0xE000) to 0 to disable Export Configuration //This is used only when the inverter manages the power control. It is not applicable to Remote Control mode hence need to be disabled
- Set *StorageConf_CtrlMode* (0xE004) to 4 "Remote"
- Set *StorageConf_AcChargePolicy* (0xE005) to 1 "Always Allowed" // Applicable if AC charge is needed.
- *StorageConf_AcChargeLimit* (0xE006) //This is relevant only if *StorageConf_AcChargePolicy* (0xF705) is set to 2 or 3
- *StorageConf_BackupReserved* (0xE008) // only applicable to inverters that support backup hardware functionality
- Set *StorageConf_DefaultMode* (0xE00A) recommend to set to 1 "Charge excess PV" //default fallback mode in case of communication interruption.

Use the following registers for dynamic commands:

- StorageRemoteCtrl_CommandTimeout (0xE00B): Sets the time duration in seconds for the new command (e.g. can be renewed at each write cycle for a few seconds).
- StorageRemoteCtrl_CommandMode (0xE00D): Sets the operating mode during the defined time frame according to the selected Storage Charge/Discharge Mode
- StorageRemoteCtrl_ChargeLimit (0xE00E): Battery charge power limit in watts up to the battery max power
- StorageRemoteCtrl_*DischargeLimit* (0xE010): Battery discharge power limit in watts up to the battery max power

Configurations examples for dynamic commands:

Discharge 1500W for 15 minutes:

- StorageRemoteCtrl_CommandTimeout = 900   // Seconds. Inverter reverts to the defaults set in the initial configuration after the time out.
- StorageRemoteCtrl_CommandMode = 4   // 'Discharge' mode
- StorageRemoteCtrl_DischargeLimit = 1500   // W

Charge 2000W from the AC for 15 minutes:

- StorageRemoteCtrl_CommandTimeout = 900   // Seconds
- StorageRemoteCtrl_CommandMode = 3   // 'Charge full from AC+PV' mode
- StorageRemoteCtrl_ChargeLimit = 2000   // W