

VE.Direct Protocol

BlueSolar and SmartSolar MPPT chargers

Table of Contents

1	<i>VE.Direct Protocol</i>	3
1.1	Get and Set items	7
1.2	Asynchronous items	24
1.3	Message examples	24
2	<i>Text Protocol</i>	25

1 VE.Direct Protocol

The frame format of the VE.Direct protocol has the following general format:

: [command] [data][data][...] [check]\n

Where the colon indicates the start of the frame and the newline is the end of frame. The sum of all data bytes and the check must equal 0x55. Since the normal protocol is in text values the frames are sent in their hexadecimal ASCII representation, ['0' .. '9'], ['A' .. 'F'], must be uppercase. There is no need to escape any characters.

: [command] [dataHighNibble, dataLowNibble][.....] [checkHigh, checkLow] \n

Note: The command is only send as a single nibble. Numbers are sent in Little Endian format. An error response with value 0xAAAA is sent on framing errors.

Command		Description
0	Enter boot	0x51FA51FA51FA51FA as payload will enable bootloader mode.
1	Ping	Check for presence, the response is an 'Rsp ping' containing version and firmware type. See the response ping message.
3	App version	Returns the version of the firmware as stored in the header in an 'Rsp Done' message.
4	Product Id	Returns the Product Id of the firmware as stored in the header in an 'Rsp Done' message.
6	Restart	Restarts the device, no response is sent.
7	Get	Returns a get response with the requested data or error is returned. uint16 the id of the value to get uint8 flags, should be set to zero
8	Set	Returns a set response with the requested data or error is returned. uint16 the id of the value to set uint8 flags, should be set to zero type depends on id value Asynchronous data message. Should not be replied.
A	Async	uint16 the id of the value being returned uint8 flags, defined below type depends on id value
2, 5, 9, B-F	reserved	

VE.Direct_responses are formatted in the same manner as commands, but use response codes.:

Response		Description
1	Done	Successful execution of the received command. Payload depends on command.
3	Unknown	Unknown command, data is the unknown command.
4	Error	Frame error (payload=0xAAAA), unable to enter bootloader (payload=0).
5	Ping	The version number is directly interpreted from the hex representation, e.g. 0x0101 is version 1.01. The two most significant bits indicate the firmware type: b00: bootloader b01: application b10: tester b11: release candidate In case of release candidate the lowest two bits of the highest nibble together with type indicate the release candidate number. E.g. 0xD101 represents release candidate D of version 1.01. Note that there can only be 4 release candidates per version.
7	Get	uint16 id: of the value being returned
		uint8 flags: defined below
		type depends on id value
8	Set	uint16 id of the value which was set
		uint8 flags: defined below
		type depends on id value

The following set / get flags are currently defined (reply):

Flag	Name	Meaning
0x01	Unknown Id	The specified id does not exist
0x02	Not supported	Attempting to write to a read only value
0x04	Parameter Error	The new value is out of range or inconsistent

Product id values

Id	Name	Charger	Load output	Remark (*1)
0x0300	BlueSolar MPPT 70 15 (*2 *3)	12..24V-15A	15A	-
0xA040	BlueSolar MPPT 75 50 (*3)	12..24V-50A	-	pv only
0xA041	BlueSolar MPPT 150 35 (*3)	12..48V-35A	-	pv only
0xA042	BlueSolar MPPT 75 15	12..24V-15A	15A	-
0xA043	BlueSolar MPPT 100 15	12..24V-15A	15A	-
0xA044	BlueSolar MPPT 100 30 (*3)	12..24V-30A	-	pv only
0xA045	BlueSolar MPPT 100 50 (*3)	12..24V-50A	-	pv only
0xA046	BlueSolar MPPT 150 70	12..48V-70A	-	-
0xA047	BlueSolar MPPT 150 100	12..48V-100A	-	-
0xA048	BlueSolar MPPT 75 50 rev2 (*3)	12..24V-50A	-	-
0xA049	BlueSolar MPPT 100 50 rev2	12..24V-50A	-	-
0xA04A	BlueSolar MPPT 100 30 rev2	12..24V-30A	-	-
0xA04B	BlueSolar MPPT 150 35 rev2	12..48V-35A	-	-
0xA04C	BlueSolar MPPT 75 10	12..24V-10A	10A	-
0xA04D	BlueSolar MPPT 150 45	12..48V-45A	-	-
0xA04E	BlueSolar MPPT 150 60	12..48V-60A	-	-
0xA04F	BlueSolar MPPT 150 85	12..48V-85A	-	-
0xA050	SmartSolar MPPT 250 100	12..48V-100A	-	ble
0xA051	SmartSolar MPPT 150 100 (*3 *4)	12..48V-100A	-	ble
0xA052	SmartSolar MPPT 150 85 (*3 *4)	12..48V-85A	-	ble
0xA053	SmartSolar MPPT 75 15	12..24V-15A	15A	ble net
0xA054	SmartSolar MPPT 75 10	12..24V-10A	10A	ble net
0xA055	SmartSolar MPPT 100 15	12..24V-15A	15A	ble net
0xA056	SmartSolar MPPT 100 30	12..24V-30A	-	ble net

Id	Name	Charger	Load output	Remark (*1)
0xA057	SmartSolar MPPT 100 50	12..24V-50A	-	ble net
0xA058	SmartSolar MPPT 150 35	12..48V-35A	-	ble net
0xA059	SmartSolar MPPT 150 100 rev2	12..48V-100A	-	ble net
0xA05A	SmartSolar MPPT 150 85 rev2	12..48V-85A	-	ble net
0xA05B	SmartSolar MPPT 250 70	12..48V-70A	-	ble net
0xA05C	SmartSolar MPPT 250 85	12..48V-85A	-	ble
0xA05D	SmartSolar MPPT 250 60	12..48V-60A	-	ble net
0xA05E	SmartSolar MPPT 250 45	12..48V-45A	-	ble net
0xA05F	SmartSolar MPPT 100 20	12..24V-20A	20A	ble net
0xA060	SmartSolar MPPT 100 20 48V	12..48V-20A	100mA	ble net
0xA061	SmartSolar MPPT 150 45	12..48V-45A	-	ble net
0xA062	SmartSolar MPPT 150 60	12..48V-60A	-	ble net
0xA063	SmartSolar MPPT 150 70	12..48V-70A	-	ble net
0xA064	SmartSolar MPPT 250 85 rev2	12..48V-85A	-	ble net
0xA065	SmartSolar MPPT 250 100 rev2	12..48V-100A	-	ble net
0xA066	BlueSolar MPPT 100 20	12..24V-20A	20A	-
0xA067	BlueSolar MPPT 100 20 48V	12..48V-20A	100mA	-
0xA068	SmartSolar MPPT 250 60 rev2	12..48V-60A	-	ble net
0xA069	SmartSolar MPPT 250 70 rev2	12..48V-70A	-	ble net
0xA06A	SmartSolar MPPT 150 45 rev2	12..48V-45A	-	ble net
0xA06B	SmartSolar MPPT 150 60 rev2	12..48V-60A	-	ble net
0xA06C	SmartSolar MPPT 150 70 rev2	12..48V-70A	-	ble net
0xA06D	SmartSolar MPPT 150 85 rev2	12..48V-85A	-	ble net
0xA06E	SmartSolar MPPT 150 100 rev3	12..48V-100A	-	ble net
0xA06F	BlueSolar MPPT 150 45 rev2	12..48V-45A	-	-
0xA070	BlueSolar MPPT 150 60 rev2	12..48V-60A	-	-
0xA071	BlueSolar MPPT 150 70 rev2	12..48V-70A	-	-
0xA072	BlueSolar MPPT 150 45 rev3	12..48V-45A	-	-
0xA073	SmartSolar MPPT 150 45 rev3	12..48V-45A	-	ble net
0xA074	SmartSolar MPPT 75 10 rev2	12..24V-10A	10A	ble net
0xA075	SmartSolar MPPT 75 15 rev2	12..24V-15A	15A	ble net
0xA076	BlueSolar MPPT 100 30 rev3	12..24V-30A	-	-
0xA077	BlueSolar MPPT 100 50 rev3	12..24V-50A	-	-
0xA078	BlueSolar MPPT 150 35 rev2	12..48V-35A	-	-
0xA079	BlueSolar MPPT 75 10 rev2	12..24V-10A	10A	-
0xA07A	BlueSolar MPPT 75 15 rev2	12..24V-15A	15A	-
0xA07B	BlueSolar MPPT 100 15 rev2	12..24V-15A	15A	-
0xA102	SmartSolar MPPT VE.Can 150 70	12..48V-70A	-	ble net
0xA103	SmartSolar MPPT VE.Can 150 45	12..48V-45A	-	ble net
0xA104	SmartSolar MPPT VE.Can 150 60	12..48V-60A	-	ble net
0xA105	SmartSolar MPPT VE.Can 150 85	12..48V-85A	-	ble net
0xA106	SmartSolar MPPT VE.Can 150 100	12..48V-100A	-	ble net
0xA107	SmartSolar MPPT VE.Can 250 45	12..48V-45A	-	ble net
0xA108	SmartSolar MPPT VE.Can 250 60	12..48V-60A	-	ble net
0xA109	SmartSolar MPPT VE.Can 250 70	12..48V-70A	-	ble net
0xA10A	SmartSolar MPPT VE.Can 250 85	12..48V-85A	-	ble net
0xA10B	SmartSolar MPPT VE.Can 250 100	12..48V-100A	-	ble net
0xA10C	SmartSolar MPPT VE.Can 150 70 rev2	12..48V-70A	-	ble net
0xA10D	SmartSolar MPPT VE.Can 150 85 rev2	12..48V-85A	-	ble net
0xA10E	SmartSolar MPPT VE.Can 150 100 rev2	12..48V-100A	-	ble net
0xA10F	BlueSolar MPPT VE.Can 150 100	12..48V-100A	-	-
0xA112	BlueSolar MPPT VE.Can 250 70	12..48V-70A	-	-
0xA113	BlueSolar MPPT VE.Can 250 100	12..48V-100A	-	-
0xA114	SmartSolar MPPT VE.Can 250 70 rev2	12..48V-70A	-	ble net

Id	Name	Charger	Load output	Remark (*1)
0xA115	SmartSolar MPPT VE.Can 250 100 rev2	12..48V-7100A	-	ble net
0xA116	SmartSolar MPPT VE.Can 250 85 rev2	12..48V-85A	-	ble net
0xA117	BlueSolar MPPT VE.Can 150 100 rev2	12..48V-100A	-	-

Note 1: "pv only" indicates that the unit is only operational when the solar panel power is present, i.e. no communication is possible during the night. "ble" indicates that the unit has an internal Bluetooth low-energy module and can be monitored/configured using the [VictronConnect](#) app, additionally "net" indicates that the model supports Bluetooth VE.Smart Networking (remote sense/synchronized charging).

Note 2: There is a discrepancy between the labelling on the housing and the actual product id for the 70|15 models. A MPPT 70|15 from year/week 1308 or later is fully identical to the MPPT 75|15. This means that it is capable of history logging and the street lighting functionality is available for these models.

Note 3: These models are phased out (no longer being made/sold).

Note 4: Bluetooth communication channel multiplexed with the VE.Direct port. Once the VE.Direct port is in use the internal Bluetooth low-energy module cannot be used anymore.

1.1 Get and Set items

Product information registers

ID	Description	Scale	Type	Unit
0x0100	Product Id (1)	-	un32	-
0x0104	Group Id (3)	-	un8	-
0x010A	Serial number (1)	-	string	-
0x010B	Model name (1)	-	string	-
0x0140	Capabilities (2)	-	un32	-

Note 1: Available since firmware version 1.12 (2-bytes). Since firmware version 1.30 (4-bytes)

Note 2: Available since firmware version 1.16

Note 3: Available since firmware version 1.17, used for synchronized charging operation

Product id (register 0x0100)

Please use the regular hex command :4 to get the product id, this query works on all models and all software versions. The product id 2-byte response has incorrect endianness on some builds and should be ignored. The product id 4-byte response has consistent endianness, byte 0 = instance (0x00), byte 1+2 = product id, byte 3 = reserved (0xFF).

Capabilities (register 0x0140)

Bit	Description
0	Load output present (0=no, 1=yes)
1	Rotary encoder present (0=no, 1=yes)
2	History support (0=no, 1=yes)
3	Batterysafe mode (0=no, 1=yes)
4	Adaptive mode (0=no, 1=yes)
5	Manual equalise (0=no, 1=yes)
6	Automatic equalise (0=no, 1=yes)
7	Storage mode (0=no, 1=yes)
8	Remote on/off via rx pin (0=no, 1=yes)
9	Solar timer/streetlighting (0=no, 1=yes)
10	Alternative VE.Direct TX pin function (0=no, 1=yes)
11	User defined load switch (0=no, 1=yes)
12	Load current in TEXT protocol (0=no, 1=yes)
13	Panel current (0=no, 1=yes)
14	BMS support (0=no, 1=yes)
15	External control support (0=no, 1=yes)
16	Synchronized charging support (0=no, 1=yes)
17	Alarm relay (0=no, 1=yes)
18	Alternative VE.Direct RX pin function (0=no, 1=yes)
19	Virtual load output (0=no, 1=yes)
20	Virtual relay (0=no, 1=yes)
21	Plugin display support (0=no, 1=yes)
25	Load Automatic Energy Selector (0=no, 1=yes)
26	Battery test (0=no, 1=yes)
27	PAYGO support (0=no, 1=yes)

Generic device control registers

ID	Description	Scale	Type	Unit
0x0200	Device mode	-	un8	-
0x0201	Device state	-	un8	-
0x0202	Remote control used	-	un32	-
0x0205	Device off reason (*1)	-	un8	-
0x0207	Device off reason (*2)	-	un32	-

Note 1: firmware versions 1.29 up to 1.43. Available on SmartSolar models.

Note 2: firmware version 1.44. Available on SmartSolar models.

Device mode values (register 0x0200)

Mode	Meaning
0 or 4	Charger off (*2)
1	Charger on

Note 1: The charger will only respond to on/off commands when the remote on/off bit is set in the remote control mask (see register 0x0202).

Note 2: Firmware version 1.16 and lower report the "Charger off" state as 0, firmware version 1.17 and higher report the "Charger off" state as 4. All firmware versions will accept both 0 and 4 as a "Charger off" command. Furthermore firmware 1.16 and lower report the actual operation state of the unit (is actually charging or not). Firmware version 1.17 will report the condition of the soft on/off switch. To find out if the unit is operational or not check register 0x0201.

Device state values (register 0x0201)

State	Name	Meaning
0	NOT_CHARGING	Not charging
2	FAULT	Failure
3	BULK	Full current charge with charge current set-point
4	ABSORPTION	Voltage controlled with absorption voltage set-point
5	FLOAT	Voltage controlled with float voltage set-point
7	MANUAL EQUALISE	Voltage controlled with equalisation voltage set-point
245	WAKE-UP	The device is about to start (signal to external control)
247	AUTO EQUALISE	Voltage controlled with equalisation voltage set-point
252	EXTERNAL CONTROL	Voltage controlled with remote voltage set-point
255	UNAVAILABLE	No information available

Note 1: batterysafe mode will be reported as state 3 (bulk), see register 0xEDD4 to determine if batterysafe mode is active, available until firmware version 1.13.

Note 2: automatic equalisation mode: firmware version 1.39 and lower report state 4 (absorption), see register 0xEDD4 to determine if automatic equalisation mode is active. Firmware version 1.42 and higher report state 247.

Note 3: manual equalisation mode reports as state 7. It is available on models with the plug-in display (setup menu item 10).

Remote control used bit-mask (register 0x0202)

Bit	Meaning
0	Reserved
1	Enable remote ON/OFF control
2..31	Reserved

Note 1: The mask value 0x00000002 needs to be sent at least once after power-up of the charger in order to enable remote ON/OFF control (when using register 0x0200).

Note 2: Bits can only be set to '1' in this register. The bits will only be cleared when the unit

restarts. Setting reserved bits is allowed but has no effect.

Note 3: In firmware version 1.42 and up bit 1 is set by default, so the device mode command can be used directly.

Device off reason bit-mask (registers 0x0205,0x0207)

Bit	Meaning
0	No input power (solar panels)
1	Reserved
2	Soft power switch (device mode or pluggable display)
3	Remote input (either via VE.Direct RX pin alternate function or dedicated remote input)
4	Internal reason
5	Pay-as-you-go out of credit
6	BMS shutdown
7	Reserved

Only available on SmartSolar models.

Battery settings registers

WARNING: stored in non-volatile memory. Continuous writing, for example from a control loop, will lead to early failure.

ID	Description	Scale	Type	Unit
0xEDFF	Batterysafe mode (*1,*9)	-	un8	0=off, 1=on
0xEDFE	Adaptive mode (*10)	-	un8	0=off, 1=on
0xEDFD	Automatic equalisation mode (*2)	-	un8	0=off, 1..250
0xEDFC	Battery bulk time limit (*9)	0.01	un16	hours
0xEDFB	Battery absorption time limit	0.01	un16	hours
0xEDF7	Battery absorption voltage (*5)	0.01	un16	V
0xEDF6	Battery float voltage (*5)	0.01	un16	V
0xEDF4	Battery equalisation voltage (*3,*5)	0.01	un16	V
0xEDF2	Battery temp. compensation (*5)	0.01	sn16	mV/K
0xEDF1	Battery type	1	un8	0xFF = user
0xEDF0	Battery maximum current	0.1	un16	A
0xEDEF	Battery voltage (*4)	1	un8	V
0xEDEC	Battery temperature (*8)	0.01	un16	K, 0xFFFF=N/A
0xEDEA	Battery voltage setting (*4, *7)	1	un8	V
0xEDE8	BMS present (*6)	-	un8	0=no, 1=yes
0xEDE7	Tail current (*10)	0.1	un16	
0xEDE6	Low temperature charge current (*8)	0.1	un16	A, 0xFFFF=use max
0xEDE5	Auto equalise stop on voltage (*10)	-	un8	0=no, 1=yes
0xEDE4	Equalisation current level (*10)	1	un8	% (of 0xEDF0)
0xEDE3	Equalisation duration (*10)	0.01	un16	hours
0xED2E	Re-bulk voltage offset (*10)	0.01	un16	V
0xEDE0	Battery low temperature level (*8)	0.01	sn16	°C
0xEDCA	Voltage compensation (*10)	0.01	un16	V

Note 1: Safe mode has been permanently disabled since firmware version 1.13.

Note 2: Automatic equalisation mode can be set to the values 0 (=off), 1 (=every day), 2 (=every other day) up to 250. Introduced in firmware version 1.16.

Note 3: Introduced in firmware version 1.16.

Note 4: 0xEDEF can be written to force the system into a fixed battery voltage setting. Reading 0xEDEF will always reports the operational voltage. 0xEDEA can be used to check if the battery voltage is set to AUTO (0), register 0xEDEA has been added since firmware version 1.12.

Note 5: In order to change these parameters the battery type (register 0xEDF1) must be set to user defined (0xFF). The charger checks the validity of these parameters, for a 12V system the voltage settings must be between 8V and 17.4V and the temperature compensation must be between -21mV and +21mV. If these conditions are not met an error 119 is issued. This error can only be resolved by correcting the settings (e.g. reset to factory defaults) followed by a system reset (e.g. power cycle).

Note 6: Introduced in firmware version 1.17. Set to '1' automatically when a BMS is detected. This register can be used to clear the BMS present setting in order to return the unit to stand-alone operation.

Note 7: From firmware version 1.17 the battery voltage setting register (0xEDEA) can be written as well, a write to this register has the same effect as writing to the battery voltage register (0xEDEF).

Note 8: Introduced in firmware version 1.30.

Note 9: Removed in firmware version 1.42.

Note 10: Introduced in firmware version 1.42.

Battery type values (register 0xEDF1)

10A/15A/20A Chargers (without rotary switch and load output)

Value	Name	Meaning
1	TYPE_2	GEL Victron Deep discharge
255	USER	User defined

30A/35A/45A/50A/65A/70A/85A/100A Chargers (with rotary switch)

Value	Name	Meaning
1	TYPE_1	GEL Victron Long Life (14.1V)
2	TYPE_2	GEL Victron Deep discharge (14.3V)
2	TYPE_3	GEL Victron Deep discharge (14.4V)
3	TYPE_4	AGM Victron Deep discharge (14.7V)
5	TYPE_5	Tubular plate cyclic mode 1 (14.9V)
6	TYPE_6	Tubular plate cyclic mode 2 (15.1V)
7	TYPE_7	Tubular plate cyclic mode 3 (15.3V)
8	TYPE_8	LiFePO4 (14.2V)
255	USER	User defined

These chargers have a rotary switch to select the battery type. When the battery type is written it can be set to 255 (user) so the battery parameters can be set remotely. Writing a value different from 255 will revert back to the rotary setting. A read will either return the rotary type or 255 (user). Note that the labelling on the housing is numbered from 0..7

Battery voltage setting values (register 0xEDEF and 0xEDEA)

Value	Meaning
0	Auto detection at startup
12	12V battery
24	24V battery
36	36V battery
48	48V battery

Note 1: For auto detection (setting 0) to work properly, the battery must be connected **before** the solar panel is connected. Reading the battery voltage register (0xEDEF) always returns the actual battery voltage setting (e.g. if the auto detection is active and the charger detected a 24V battery the read-back value will be 24). When this setting is written with a battery voltage (e.g. 12) the auto detection mechanism will be disabled. The 10A, 15A, 30A and 50A chargers can operate at 12 or 24V. The

35A, 45A, 60A, 70A, 85A and 100A chargers can operate at 12, 24, 36 and 48V. Note that 36V will never be auto detected, since these voltages overlap with the 24V and 48V battery range. For the charger to operate in 36V mode, it must be set to this voltage manually (e.g. by using the [VictronConnect](#) app).

Note 2: In firmware 1.26 and higher the automatic voltage detection only takes place at the first power-up. Once the voltage is detected the automatic voltage detection will be disabled. A voltage detection is considered to be successful when the battery voltage is > 7V at power-up. If the battery voltage is absent and only the panels are connected the charger will operate at 12V but auto detection remains active.

Note 3: The MPPT 100|20 48V operates at 48V by default, it will never perform an automatic voltage detection, it can be set manually to 12,24 or 36V.

Charger data registers

ID	Description	Scale	Type	Unit
0xEDEC	Battery temperature (*7)	0.01	un16	K
0xEDDF	Charger maximum current (*1)	0.1	un16	A
0xEDDD	System yield (*2)	0.01	un32	kWh
0xEDDC	User yield (resettable) (*2)	0.01	un32	kWh
0xEDDB	Charger internal temperature	0.01	sn16	°C
0xEDDA	Charger error code	-	un8	-
0xEDD7	Charger current (*3)	0.1	un16	A
0xEDD5	Charger voltage (*3)	0.01	un16	V
0xEDD4	Additional charger state info	-	un8	-
0xEDD3	Yield today (*2)	0.01	(*4)	kWh
0xEDD2	Maximum power today (*2)	1	un16	W
0xEDD1	Yield yesterday (*2)	0.01	(*4)	kWh
0xEDD0	Maximum power yesterday (*2)	1	un16	W
0xEDCE	Voltage settings range (*5)	-	un16	-
0xEDCD	History version (*1)	-	un8	-
0xEDCC	Streetlight version (*1)	-	un8	-
0x2211	Adjustable voltage minimum (*6)	0.01	un16	V
0x2212	Adjustable voltage maximum (*6)	0.01	un16	V

Note 1: Available in firmware version 1.16 and higher.

Note 2: Historical data is available on all models except the BlueSolar MPPT 70|15 charger (product id 0x0300)

Note 3: The charger voltage is the voltage across the battery terminals of the charger. The charger current is the sum of the current flowing to the battery and the load output. To report the battery current the load current (0xEDAD) must be subtracted manually.

Note 4: The type is an un32 up to and including v1.12, in higher versions it is an un16.

Note 5: The low-byte is the minimum system voltage and the high byte is maximum system voltage (both in 1V units). Available in firmware version 1.16 and higher.

Note 6: Available in firmware version 1.30. These indicate the allowed voltage adjustment range for absorption, float and equalisation settings.

Note 7: Available in firmware version 1.42. This shows the battery temperature if a BMV or a Smart Battery Sense is connected via VE.Smart networking.

Additional charger state info bit-mask (register 0xEDD4)

Bit	Meaning
0	Safe mode active (*1,*3)
1	Automatic equalisation active (*2,*3)
4	Temperature dimming active
6	Input current dimming active

Note 1: Safe mode has been permanently disabled since firmware version 1.13.

Note 2: Automatic equalisation is introduced in firmware version 1.16.

Note 3: Since firmware version 1.42 this information is moved to register 0x0201, these bits are no longer used.

Charger error code values (register 0xEDDA)

Error	Meaning
0	No error
2	Battery voltage too high
17	Charger internal temperature too high
18	Charger excessive output current
19	Charger current polarity reversed
20	Charger bulk time expired (when 10 hour bulk time protection active)
21	Charger current sensor issue (bias not within expected limits during off state)
26	Charger terminals overheated
28	Converter issue (dual converter models, one of the converters is not working)
33	Input voltage too high
34	Input excessive current
38	Input shutdown (due to excessive battery voltage)
39	Input shutdown (current flowing while the converter is switched off)
66	Incompatible device in the network (for synchronized charging)
67	BMS connection lost
68	Network misconfigured (e.g. combining ESS with ve.smart networking)
116	Calibration data lost
117	Incompatible firmware (i.e. not for this model)
119	Settings data invalid / corrupted (use restore to defaults and reset to recover)

Notes: Error 19 is disabled since firmware version 1.15, it can be safely ignored in older versions.

Error 21 can occur at start-up/shutdown it can be ignored for 5 minutes, this is resolved in firmware version 1.16. Errors 26 and 38 are added in firmware version 1.16. Error 34 is removed in firmware version 1.29. Error 116 also occurs if the firmware on a SmartSolar unit is downgraded from v1.40 or higher to v1.39 or lower.

Solar panel data registers

ID	Description	Scale	Type	Unit
0xEDBC	Panel power	0.01	un32	W
0xEDBB	Panel voltage	0.01	un16	V
0xEDBD	Panel current (*1)	0.1	un16	A
0xEDB8	Panel maximum voltage (*2)	0.01	un16	V
0xEDB3	Tracker mode (*3)	-	un8	-

Note 1: The panel current is not available in the 10A/15A/20A chargers.

Note 2: The maximum allowed panel voltage is added in firmware version 1.16.

Note 3: Added in firmware version 1.42. 0 = off, 1 = voltage/current limited, 2 = MPP tracker.

Load output data/settings registers

These registers are only available on the models that have a load output (10A/15A/20A models).

ID	Description	Scale	Type	Unit
0xEDAD	Load current	0.1	un16	A
0xEDAC	Load offset voltage	0.01	un8	V
0xEDAB	Load output control	-	un8	-
0xEDA9	Load output voltage (*1)	0.01	un16	V
0xEDA8	Load output state	-	un8	-
0xED9D	Load switch high level (*2)	0.01	un16	V
0xED9C	Load switch low level (*2)	0.01	un16	V
0xED91	Load output off reason (*3)	-	un8	-
0xED90	Load AES timer (*4)	1	un16	minute

Note 1: The load output voltage is only available on smart solar 10A/15A/20A chargers.

Note 2: The user defined load switch mode is introduced in firmware version 1.15. Note that this function does not work in combination with 24V operation, please use firmware version 1.16 if this functionality is required. The user defined load switch is not available on the MPPT 70|15.

Note 3: Added in firmware version 1.20. Available on SmartSolar models.

Note 4: Added in firmware version 1.26. Available on SmartSolar models with a load output.

Load output state values (register 0xEDA8)

State	Name	Meaning
0	OFF	Load output is off
1	ON	Load output is on

Load output control values (register 0xEDAB)

Value	Name	Meaning
0	OFF	Load output off
1	AUTO	Automatic control / battery life (default)
2	ALT1	Alternative control 1 (off<11.1V, on>13.1V)
3	ALT2	Alternative control 2 (off<11.8V, on>14.0V)
4	ON	Load output on (use with caution, no discharge guard)
5	USER1	User defined settings 1 (off<Vlow, on>Vhigh) (*2)
6	USER2	User defined settings 2 (off<Vlow<on<Vhigh<off) (*2)
7	AES	Automatic Energy Selector (*3)

Bit	Description
7	Lighting controller timer (1=active)

Note 1: Make sure to mask the lower 4 bits when using the load output control values, the upper 4 bits are reserved for other purposes.

Note 2: The user defined settings make use of the load switch high and low level registers. This feature is introduced in firmware version 1.15.

Note 3: The automatic energy selector can be customized by the load switch high (switch on level), load switch low level (switch off level) and AES timer (on duration when between the on and off levels) registers. This feature is introduced in firmware version 1.26 and is available on SmartSolar models with a load output.

Load output off reason bit-mask (register 0xED91)

Bit	Meaning
0	Battery low
1	Short circuit
2	Timer program
3	Remote input (VE.Direct RX pin alternate function)
4	Pay-as-you-go out of credit
5	Reserved
6	Reserved
7	Device starting up

Note: added in firmware version 1.20. Available on SmartSolar models.

Relay settings registers

These registers are only available on the models that have a relay output.

ID	Description	Scale	Type	Unit
0xEDD9	Relay operation mode	-	un8	-
0x0350	Relay battery low voltage set	0.01	un16	V
0x0351	Relay battery low voltage clear	0.01	un16	V
0x0352	Relay battery high voltage set	0.01	un16	V
0x0353	Relay battery high voltage clear	0.01	un16	V
0xEDBA	Relay panel high voltage set	0.01	un16	V
0xEDB9	Relay panel high voltage clear	0.01	un16	V
0x100A	Relay minimum enabled time	1	un16	minute

Relay operation modes (register 0xEDD9)

Value	Description
0	Relay always off
1	Panel voltage high (uses 0xEDBA,0xEDB9)
2	Internal temperature high (> 85°C / 185F)
3	Battery voltage too low (uses 0x0350,0x0351)
4	Equalisation active
5	Error condition present
6	Internal temperature low (< -20°C / -4F)
7	Battery voltage too high (uses 0x0352,0x0353)
8	Charger in float or storage
9	Day detection (panels irradiated)
10	Load control (relay switches according to the load control mode)

Lighting controller timer

The lighting controller (timer) functionality is available from firmware version 1.15 and higher on the 10/15/20A models with a load output, except the BlueSolar MPPT 70/15 charger (product id 0x0300).

ID	Description	Scale	Type	Unit
0xEDA0 ... 0xEDA5	Timer events 0..5	-	un32	-
0xEDA7	Mid-point shift (*1)	1	sn16	min
0xED9B	Gradual dim speed (*2)	1	un8	s
0xED9A	Panel voltage night (*3)	0.01	un16	V
0xED99	Panel voltage day (*3)	0.01	un16	V
0xED96	Sunset delay (*4)	1	un16	min
0xED97	Sunrise delay (*4)	1	un16	min
0xED90	AES Timer	1	un16	min
0x2030	Solar activity	-	un8	0=dark, 1=light
0x2031	Time-of-day (*5)	1	un16	min, 0=mid-night

Note 1: The mid-point shift can be used to compensate the difference between the solar mid-night (halfway between sunset and sunrise) and the actual mid-night (clock wise).

Note 2: The gradual dimming option can be used to mask differences in day/night detection between individual units that are located in each other's proximity. A value of 0 (=default) means that gradual dimming is disabled, i.e. immediate response. Another value is interpreted as 1% change per x seconds, e.g. when using a value of 9 it takes 15 minutes to dim from 0 to 100%. Introduced in firmware version 1.16.

Note 3: The day/night panel voltage settings can be useful to tweak the behaviour of the system, so it matches with the actual panel configuration. The day detection voltage must be higher than the night detection voltage level. The lowest detectable voltage is 11.4V. Set this option to 0 to use the built-in defaults. Introduced in firmware version 1.16. Since firmware version 1.26 it is possible to use voltage settings below 11.4V.

Note 4: The sunset and sunrise delays can be used to make the system less sensitive for clouds passing over the solar panels. Introduced in firmware version 1.26.

Note 5: The time-of-day can be read to verify the synchronization of the solar clock. It can also be written with the current time (the charger will use this time for 5 days before falling back to the solar activity). The value is the number of minutes since mid-night. A value of 0xFFFF indicates that the time is unknown (e.g. when the charger is not yet synchronized).

Timer events (registers 0xEDA0..0xEDA5)

A timer event consists of a 32-bit word with the following content

Bits	Description	Scale	Type	Unit
0..15	Time offset	1	sn16	min
16..23	Anchor point	-	un8	-
24..31	Dim action (0..100)	1	un8	%

Anchor points (bits 16..23 in registers 0xEDA0..0xEDA5)

Value	Description
1	Sunset
2	Mid-night
3	Sunrise

Note: The sunset and sunrise moments are absolute; using the mid-night point requires synchronization of the charger with the solar activity.

VE.Direct port functions

ID	Description	Scale	Type	Unit
0xED9E	TX Port operation mode	-	un8	-
0xED98	RX Port operation mode (*1)	-	un8	-

Note 1: The RX Port operation mode is only available on the 10A/15A/20A models since firmware version 1.17.

VE.Direct TX Port operation modes (register 0xED9E)

Value	Description
0	Normal VE.Direct communication (default)
1	Pulse for every 0.01kWh harvested (100ms low)
2	Lighting control pwm normal (f=160Hz, 0%=0V) (*2)
3	Lighting control pwm inverted (f=160Hz, 0%=5V) (*2)
4	Virtual load output (*3)

Note 1: Any mode other than 0 effectively disables communication. In these modes the TEXT protocol broadcasts will be disabled. When the charger receives a valid HEX frame, it will send a response before falling back to mode as defined by this register.

Note 2: Modes 2 and 3 are only available in combination with the lighting controller timer.

Note 3: Mode 4 is only available on selected models without a real load output (typically product id 0xA046 and higher). A VE.Direct TX digital output cable can be used to connect to a Battery Protect or DC/DC solid state relay. Available since firmware version 1.17.

VE.Direct RX Port operation modes (register 0xED98)

Value	Description
0	Remote on/off (*2)
1	Load output configuration (*2)
2	Load output on/off remote control (inverted)
3	Load output on/off remote control (normal) (*1)

Note 1: Added in firmware version 1.26.

Note 2: "Load output configuration" is the default behaviour for models with a load output. "Remote on/off" is the default behaviour for models without a load output.

Restore factory defaults

ID	Description
0x0004	Restore default

When a write message is addressed to register Id 0x0004, all settings of the device, with the exception of the factory calibration data, will be restored to the factory default values. The data part of this message is ignored.

History data

Historical data is available on all models except the BlueSolar MPPT 70|15 charger (product id 0x0300). The history registers are introduced in firmware version 1.16.

ID	Description
0x1030	Clear history
0x104F	Total history
0x1050 ... 0x106E	Daily history (0x1050=today, 0x1051=yesterday, ...) (*1)

Note 1: When reading a daily history register that does not (yet) contain data the response will be an empty record with its flag position set to 0x04.

History total record (register 0x104F) - firmware version 1.16 - 19 bytes payload

Bytes	Description	Scale	Type	Unit
0	Reserved (=0)	-	un8	-
1	Error database (=0)	-	un8	-
2	Error 0 (most recent) (*1)	-	un8	-
3	Error 1 (*1)	-	un8	-
4	Error 2 (*1)	-	un8	-
5	Error 3 (oldest) (*1)	-	un8	-
6	Total yield (user resettable)	0.01	un32	kWh
10	Total yield (system)	0.01	un32	kWh
14	Panel voltage maximum	0.01	un16	V
16	Battery voltage maximum	0.01	un16	V
18	Number of days available (*2)	-	un8	-

Note 1: For the error meanings see the description of register 0xEDDA.

Note 2: When the charger starts for the first time or after a history reset the 30 day backlog buffer will be empty. This field can be used to know in advance how many days of history are available without having to query all the individual daily registers.

History total record (register 0x104F) - firmware version 1.17 and higher - 34 bytes payload

Bytes	Description	Scale	Type	Unit
0	Reserved (=1)	-	un8	-
1..18	See table above (*1)			
19	Battery voltage minimum	0.01	un16	V
21	13 reserved bytes (=0xFF)	-	un8	-

Note 1: Bytes 1 to 18 are identical to firmware 1.16.

History day record (registers 0x1050..0x106E) - 34 bytes payload

Bytes	Description	Scale	Type	Unit
0	Reserved (=0)	-	un8	-
1	Yield	0.01	un32	kWh
5	Consumed (*1)	0.01	un32	kWh
9	Battery voltage maximum	0.01	un16	V
11	Battery voltage minimum	0.01	un16	V
13	Error database (=0)	-	un8	-
14	Error 0 (most recent) (*2)	-	un8	-
15	Error 1 (*2)	-	un8	-
16	Error 2 (*2)	-	un8	-
17	Error 3 (oldest) (*2)	-	un8	-
18	Time bulk	1	un16	min
20	Time absorption	1	un16	min
22	Time float	1	un16	min
24	Power maximum	1	un32	W
28	Battery current maximum	0.1	un16	A
30	Panel voltage maximum	0.01	un16	V
32	Day sequence number (*3)	-	un16	-

Note 1: Consumed is not available on models without load output (reads as 0xFFFFFFFF).

Note 2: For the error meanings see the description of register 0xEDDA.

Note 3: The sequence number can be used to uniquely identify a day. This number will stay the same while data traverses through the 30 day backlog buffer. For each new day added the sequence number will be increased by 1, at the count of 365 it will be wrapped to 0.

Pluggable display settings

ID	Description	Type
0x0400	Display backlight mode (0 = keypress, 1 = on, 2 = auto)	un8
0x0401	Display backlight intensity (0 = always off, 1 = on)	un8
0x0402	Display scroll text speed (1 = slow, 5 = fast)	un8
0x0403	Display setup lock (0 = unlocked, 1 = locked) (*2)	un8
0x0404	Display temperature unit (0 = Celsius, 1 = Fahrenheit) (*2)	un8

Note 1: Only available on models with the pluggable LCD display. These registers are primarily intended for settings migration to be used by the firmware updater.

Note 2: Since firmware v1.30.

Remote control registers - firmware v1.29 or higher (v1.02 or higher for VE.Can MPPTs)

Note: the remote control registers were already present since firmware version 1.17 for experimental purposes. Remote control is officially supported since firmware version 1.29 (v1.02 for VE.Can MPPTs). Synchronized charging is available for firmware version 1.44 or higher (v1.02 or higher for VE.Can MPPTs) on SmartSolar chargers with an integrated Bluetooth device that is VE.Smart network capable (see the product id table page 5, look for 'ble net').

ID	Description	Scale	Type	Unit
0x2000	Charge algorithm version (*1, *8)	-	un8	-
0x2001	Charge voltage set-point (*2)	0.01	un16	V
0x2002	Battery voltage sense (*3)	0.01	un16	V
0x2003	Battery temperature sense (*3)	0.01	sn16	°C
0x2004	Remote command	-	un8	-
0x2007	Charge state elapsed time (*4, *8)	1	un32	ms
0x2008	Absorption time (*4, *8)	0.01	un16	hours
0x2009	Error code (*8)	-	un8	-
0x200A	Battery charge current (*8)	0.001	sn32	A
0x200B	Battery idle voltage (*8)	0.01	un16	V
0x200C	Device state (*8)	-	un8	-
0x200D	Network info (*7)	-	un8	-
0x200E	Network mode	-	un8	-
0x200F	Network status register	-	un8	-
0x2013	Total charge current (*8)	0.001	sn32	A
0x2014	Charge current percentage (*5)	1	un8	%
0x2015	Charge current limit (*6)	0.1	un16	A
0x2018	Manual equalisation pending (*8)	-	un8	-
0x2027	Total DC input power (*8)	0.01	un32	W

Note 1: The charge algorithm version in combination with register 0x0104 is used for identification and grouping of chargers specifically intended for synchronized charging.

Note 2: The charge voltage set-point can be read from the master unit and written to the slave units so the group will behave as one unit. See network mode register 0x200E.

Note 3: Remote sensor data can be written to a charger, it will adapt its charge profile accordingly. Reserved values 0xFFFF (voltage) and 0x7FFF (temperature) can be written to indicate that the data is no longer available so the charger switches back to internal behaviour. These values must be written frequently, the timeout is set to 1 minute after which the unit switches back to internal behaviour.

Note 4: The time data must be copied from the master unit to the slave units. This ensures that the slaves have the information required to take over the master role if needed (e.g. when the master is switched off).

Note 5: Deprecated, replaced by 0x2015 (was present in firmware version 1.17 only).

Note 6: Firmware version 1.19 and higher (v1.02 or higher on VE.Can MPPTs). See network mode register 0x200E.

Note 7: Added in firmware version 1.42 (v1.02 on VE.Can MPPTs).

Note 8: Implemented in firmware version 1.44 or higher (v1.02 or higher on VE.Can MPPTs) only on SmartSolar models that support synchronised charging.

Remote commands (register 0x2004)

Value	Description
1	Start equalise (*1)

Value	Description
2	Stop equalise (*1)
3	Synchronize user interface (*2)
4	Synchronize day event (*3)

Note 1: Only available on models that support manual equalisation (check register 0x0140).

Note 2: Synchronize blinking leds / icons (on a display), not used on VE.Direct.

Note 3: First unit to detect a new day sends this message so all grouped units will update their daily history at the same time, not used on VE.Direct.

Network mode bit definitions (register 0x200E)

Bit	Name	Description
0	Networked	Visual indication that the unit is controlled remotely
1	Slave mode	Remote control of vset / iset / charge state
2	External control mode	Remote control of vset / iset
3	BMS controlled	Remote control of vset / iset & bms protection active
4	Charge group master	Not used
5	Charge instance master	Unit is the charge master
6	Standby	Keep unit in standby
7	Reserved	

Use cases	Description
Stand-alone	Set 0x200E to b0000000, default behavior, charger uses internal charge profile
Charge master	Set 0x200E to b0100001, charger uses internal charge profile
Slave mode	Set 0x200E to b0000011, write to registers 0x0201 and 0x200x
External control mode	Set 0x200E to b0000101, write to registers 0x2001 and/or 0x2015
BMS mode	Set 0x200E to b0001001, write to registers 0x2001 and/or 0x2015

Networked environment

The only effect of setting bit 0 is that the charger indicates that it operates in a networked environment, this is done by blinking a symbol on the LCD display and/or a blinking state led..

Slave mode

Use this mode when the charger is to be a slave of another charger. In this mode, provide the following values to the charger:

- Charge voltage set-point 0x2001
- Charge state (bulk/abs/...) 0x200C
- Charge state elapsed time 0x2007
- Absorption time 0x2008
- Battery idle voltage 0x200B
- Battery charge current 0x200A

The charger will automatically fall back to stand-alone mode after not receiving voltage data for 1 minute (e.g. if the communication cable is removed).

External control mode (e.g. ESS or DVCC)

Set the charger in this mode to remotely control the charge voltage and/or current setpoint(s).

Firmware versions up to and including 1.39: when in this mode, the device state always reports as EXTERNAL CONTROL (252). It is not showing Bulk, Absorption or anything else.

Firmware versions 1.42 and higher: depending on the content received, if the unit receives a charge voltage set-point it reports EXTERNAL CONTROL (252). If the unit only receives a current set-point, it still uses its internal charger algorithm and it will keep reporting Bulk, Absorption, etc.

The charger will automatically fall back to stand-alone mode after not receiving data for 1 minute (e.g. if the communication cable is removed).

BMS Controlled

Setting the remote BMS mode bit indicates the Solar Charger that it is controlled by a BMS.

These remote control combinations are allowed:

- Control only the current limit, the charger uses its own bulk-absorption-float state machine to determine the voltage setpoint.
- Control only the voltage setpoint, the charger estimates the appropriate charge state based on the voltage. The current limit is set to the battery maximum current (0xEDF0).
- Control both the current limit and voltage setpoint.

BMS Protection mechanism:

- Setting the Remote BMS mode bit and sending a current limit or voltage setpoint makes the Solar Charger automatically enable the BMS present setting (0xEDE8), and store that to flash.
- The effect of this setting is that the charger will no longer operate in stand-alone mode, it requires communication from the BMS: when no data is received, it stops charging and shows error #67.
- To allow for a 'black start', ie. starting up from an empty battery, in the morning, the charger will charge in "Float" mode for 45 seconds, so the BMS can power-up. When after 45 seconds there is still no data received from the BMS, it will switch off and show error #67.

Charge master mode

When a unit is set to charge instance master mode it will periodically send the registers 0x2001, 0x2007, 0x2008 and 0x200B using asynchronous hex-messages (:A). These messages must be forwarded to the slave chargers. The internal charge profile remains active in the instance master mode.

The group master role is only present for compatibility with the VE.Can chargers. The VE.Direct chargers are unable to perform data gathering (i.e. reporting the condition of the complete charger group).

Remote sensor data (voltage and/or temperature)

Write the battery temperature data periodically to register 0x2003 and the battery voltage data to register 0x2002. Both have a timeout of 60s, after which the charger will stop using the remote information. The voltage information has to be within $\pm 5V$ with respect to the voltage on the charger terminals. The charger can adapt its charging voltage up to $\pm 2V$ to compensate for cable losses.

Adding nodes to the network

When a node is about to start it reports state 245 (wake-up) briefly before starting, this is the trigger for the network master to determine the role of the new unit. If the network master needs time to gather data, it can force the unit into standby by setting bit 6 in register 0x200E. The network master can preset link data into the unit before clearing bit 6 and allowing the unit to start-up.

Network info (register 0x200D)

This register gives an overview of the active network components, it combines the statuses of multiple interfaces.

Bit	Description
0	Unit is controlled by a BMS
1	Unit voltage set-point is controlled remotely
2	Unit operates as charge slave
3	Unit operates as charge master
4	Unit is using ICHARGE information (battery current estimate)
5	Unit is using ISENSE information (actual battery current)
6	Unit is using TSENSE information
7	Unit is using VSENSE information
8	Unit is held in STANDBY while the network initialises

Network status (register 0x200F)

The low nibble part of this register gives feedback about the charge algorithm, it indicates if the charger operates stand-alone or if it is controlled remotely. This register is maintained per interface.

Value	Description
0x00	Unit in slave mode (e.g. BMS or ESS controlled)
0x01	Unit is group master
0x02	Unit is instance master (e.g. synchronized charging)
0x03	Unit is both group and instance master
0x04	Unit operates stand-alone (default behavior)

Bit	Description
4	Unit is using ICHARGE information
5	Unit is using ISENSE information
6	Unit is using TSENSE information
7	Unit is using VSENSE information

Note: bits 6+7 are added in firmware version 1.26, bits 4+5 in firmware version 1.44.

Device state (register 0x200C)

State	Name	Meaning
0	NOT_CHARGING	Not charging
2	FAULT	Failure
3	BULK	Full current charge with charge current set-point
4	ABSORPTION	Voltage controlled with absorption voltage set-point
5	FLOAT	Voltage controlled with float voltage set-point
6	STORAGE (*1)	Voltage controlled with set-point sent by the master
7	MANUAL EQUALISE	Voltage controlled with equalisation voltage set-point
11	POWER SUPPLY (*1)	Voltage controlled with set-point sent by the master
245	WAKE-UP	The device is about to start (signal to external control)
246	REPEATED ABSORPTION (*1)	Voltage controlled with set-point sent by the master
247	AUTO EQUALISE	Voltage controlled with equalisation voltage set-point
248	BATTERY SAFE (*1)	Voltage controlled with set-point sent by the master
249	LOAD DETECT (*1)	Voltage controlled with set-point sent by the master

State	Name	Meaning
252	EXTERNAL CONTROL (*1)	Voltage controlled with remote voltage set-point
255	UNAVAILABLE	No information available

Note 1: These states are only possible when in slave mode. The voltage set-point will be the one sent by the master.

Absorption time (register 0x2008)

Firmware versions up to and including 1.39: use the available absorption time (updated when the unit starts or when the unit switches from absorption to float).

Firmware versions 1.42 and higher: use the time spent in absorption (counting up when the unit is in absorption), the available absorption time is determined by the user configuration (adaptive mode, maximum absorption time). The time spent is reset if the unit is off for more than 1 hour or if the configuration is changed (different battery type).

Battery idle voltage (register 0x200B)

The battery voltage measured before the charge process starts, in a networked environment, this should only be measured by the first device that is about to start. Units that start later should use the information from the first unit.

Battery charge current (register 0x200A)

The actual battery current: used to check if the tail current condition is met (switch from absorption to float). This comes from a battery monitor (e.g. BMV).

Total charge current (register 0x2013)

The estimated battery current: used to check if the tail current condition is met (switch from absorption to float). This is determined by to summing up all the known DC battery currents in the system.

Error code (register 0x2009)

The network master uses this register to inject an error code into a unit. Example: if the network master determines that there is a configuration issue, it can inject error code 66, so the error code will be visible on the pluggable display and in VictronConnect.

Total DC input power (register 0x2027)

The total dc input power produced by the synchronized charging system. This is determined by to summing up all the known DC input power in the system. The network master needs to take care of this, on VE.CAN the MPPT chargers do this themselves, on the ve.direct interface the external network master needs to do this by summing up all the individual powers by reading VE_REG_DC_INPUT_POWER (0xEDBC) and write the sum to register 0x2027 on all the units. This information is used by VictronConnect and/or Venus devices so they can show a power indication in the device list.

Charge current limit (register 0x2015)

The charge current limit of the charger. This register could be used to limit/control the charge current of a charger on a network. It must be written to the charger regularly (more than once a minute) together with register 0x200E (see network mode register 0x200E for more information). Charger charge current limit will be the minimum value between register 0x2015 (charge current limit) and register 0xEDF0 (maximum battery current setting). When register 0x2015 is not used, charger will use the maximum battery current setting (register 0xEFF0) as charge limit.

1.2 Asynchronous items

The charger can send hex messages asynchronously (without prior request). This is done using :A messages, the format is identical to a Get response. The table below shows the MPPT firmware versions and the support of asynchronous messages.

Firmware	Asynchronous messages
1.15 and lower	Not supported
1.16	Only the history messages for totals and today (0x104F/0x1050) are sent asynchronously when their contents are changed.
1.17	Like 1.16 the history messages are always sent asynchronously. Furthermore when hex messages are detected by the charger it will send most registers asynchronously when their contents change. If no incoming hex messages are detected for 2 minutes it will cease to send these messages.
1.26	Added the following registers to be transmitted asynchronously: <ul style="list-style-type: none">- register 0xEDD5 (charger output voltage)- register 0x2030 (solar rtc state)- register 0x2002 (vsense): transmit 0xFFFF @ timeout- register 0x2003 (tsense): transmit 0x7FFF @ timeout
1.53	Text messages not suppressed/delayed anymore due to hex requests. Now the text messages will always be sent every 2 seconds. Furthermore, a response to a hex message will always wait until the text message finishes to be sent (will not be interrupted in the middle of it as it was before).

1.3 Message examples

\n at the end of the message is implied.

<p>Ping :154 :51641F9 0x4116 = talking to application version 1.16</p> <p>Application version :352 :11641FD Like ping, application version 1.16</p> <p>Product Id :451 :1000351 0x300 = BlueSolar MPPT 70 15</p> <p>Restart :64F No response, restarted</p> <p>Get Battery Maximum Current :7F0ED0071 :7F0ED009600DB Value = 0x0096 = 15.0A</p>	<p>Set Battery Maximum Current Set to 10.0A = 0x0064 :8F0ED0064000C :8F0ED0064000C Acknowledged with the new value returned.</p> <p>Unsupported command :253 :3020050 Unknown response</p> <p>Invalid frame (checksum wrong) :452 :4AAAAFD Error response</p> <p>Asynchronous message :A0102000543 The unit reports register 0x0201 (device state) with value 0x05 (float).</p>
--	---

2 Text Protocol

For firmware version v1.52 and below, when no VE.Direct queries are sent to the device, the charger periodically sends human readable (TEXT) data to the serial port. For firmware versions v1.53 and above, the charger always periodically sends TEXT data to the serial port. See the ["VE.Direct Protocol"](#) document for a detailed description of the contents and availability of the information.

Changes:

12-09-2012

Added text protocol description

02-01-2013

Updated chapter 2.1 (register overview)

Name change HEX protocol => VE.Direct protocol

04-06-2013

Updated product id overview (added new types)

Updated the battery table for the 50A/35A chargers

27-11-2013

Updated product id overview (added new types)

Updated description regarding the battery voltages (about 35A charger and register 0xEDEA)

TEXT protocol part now refers to a separate document

01-08-2014

Split document into 3 parts: bootloader, private and public protocol parts

22-09-2014

Added Async message in the hex protocol definition

Updated document to match with firmware version 1.15 (new load output related features)

24-09-2014

Updated history section, added descriptions for the history totals and daily records

29-09-2014

Fixed panel current (wrong register number). Daily history changed yield/consumed un16->un32.

14-10-2014

vreg 0x0100 (product id): updated comment and set type to un16

vregs 0xEDD3/0xEDD1 (yield today/yesterday): update types (depends on firmware version)

22-10-2014

vreg 0xEDDB charger *internal* temperature

moved day sequence number from the total record to the day record

23-10-2014

Updated product id overview (added new type 85A MINI)

7-11-2014

Updated notes (error 21) in the charger error codes section

13-02-2015

Updated product id overview (added new types rev2 devices and the 75|10)

Updated history total record: added number of days field

23-03-2015

Updated street lighting related registers (gradual dim and panel voltage tweaks)

Added automatic equalisation registers

14-04-2015

Added remark: the user defined load switch modes are introduced in firmware version 1.15

21-04-2015

Product id 0xA047 changed from 85A to 100A charge current

Added capability query registers (useful for tooling/displays)

1-05-2015

Battery settings registers: added note 5 explaining parameter validity checks.

6-05-2015

Added new mppt types 150/45 and 150/60

20-05-2015

History total record, added new frame definition to include the minimum battery voltage

29-05-2015

Register 0x0201 (device state), added notes about the special modes battery safe and automatic equalisation

Removed product id 0xA048, the MPPT 75/50 is replaced by the MPPT 100/50

12-06-2015

Updated response code description

08-09-2015

Product id register (0x0100): added recommendation to use the :4 hex command instead

Capabilities register (0x0140): added BMS/HUB-1 and synchronized charging definitions

03-11-2015

Added product id 0xA04F: MPPT 150/85

08-01-2016 – rev 4

Updated product id table, added new models

Capabilities register (0x0140): added alarm relay and alternate rx pin definitions

Added register (0xED98): RX port configuration

26-02-2016

Update examples (replaced BMV examples)

Updated description of register 0x0200 and 0x0202

Timer event description bit order fixed (vregs 0xEDA0..0xEDA5)

Added virtual load output to register 0xED9E

Capabilities register (0x0140): added virtual load output and virtual relay

Added remote control registers section

Added asynchronous message section

25-03-2016

Updated description of register 0x0200: v1.17 will report the on/off switch condition

Added 'error response' description, updated message examples

Added 10A to the relevant sections that were applicable to the 15A only.

29-03-2016

Added remark in the battery parameters section: these parameters can only be written when the user defined battery type is selected.

08-04-2016 – rev 5

Change in register (0xEDEA): in firmware v1.17 this register is writeable; a write has the same effect as writing to register (0xEDEF).

12-05-2016

BMS current setting changed from percentage to absolute current value; vreg 0x2014 (firmware v1.17) will be replaced by vreg 0x2015 (firmware v1.19).

21-06-2016

HUB-1 operation: dropped the requirement to set the state remotely in firmware v1.19. Added state 252 (HUB-1) to vreg 0x0201, this state will be reported when the charger operates in HUB-1 mode.

22-07-2016

Updated product id table (added new SmartSolar models)

10-08-2016

Added register 0x200F (network status)

31-10-2016

Updated load output section (add load output voltage for the SmartSolar models)

Updated product id table (added new SmartSolar models)

12-12-2016

Update load output section (add load output off reason, update in rx operation modes)

15-12-2016

Updated product id table (added new SmartSolar models)

21-06-2017 – rev 6

Updated registers 0xEDEF and 0xEDEA: automatic voltage detection mechanism changed

Updated register 0x0140 (capabilities): added new values 21 and 25

Add registers 0xED96 and 0xED97 (sunrise/sunset delays)

Add register 0xED91 (load output off reason)

Add register 0xED90 (aes timer)

Updated register 0xEDAB (load output control): added option 7

Updated register 0xED98 (rx port): added option 3

Updated register 0x200F (network status): added tsense/vsense feedback

Updated register 0x0201 (device state): added manual equalisation.

Updated description of asynchronous items: added changes in firmware version 1.26

30-06-2017

Updated product id table (added new SmartSolar model 100/20 rev2)

06-12-2017

Updated section about remote controlling the charger (BMS/ESS)

Add register 0x0205 (device off reason)

Updated product id table

19-02-2018 – rev 7

Update document to match with firmware 1.30

Rename HUB-1 to ESS

Updated product id table

13-09-2018

Replaced device id with product id

Update description of the product id vreg (0x0100)

11-09-2019

Update document to match with firmware versions 1.42 and 1.44

Rename ESS to External control

Add registers for the charger algorithm (more customization options)

Add/update registers for the synchronized charger operation

03-10-2019 – rev8

Add SmartSolar VE.Can models to the product id values table

Update the remote control registers table (update data formats and add 0x2027)

Update description of Error code (register 0x2009)

02-12-2019 – rev9

Add Link Device state (register 0x200C) description

03-12-2019 – rev10

Add scale, type and unit for the Adaptive mode register (0xEDFE) on the battery settings registers table.

15-06-2020 – rev11

Fixed standby and instance master bits in network mode use cases .

16-06-2020 – rev12

Added VE_REG_LINK_BATTERY_IDLE_VOLTAGE (0x200B) and VE_REG_LINK_DEVICE_STATE (0x200C) on the list of VREGs that are periodically sent by the charge master.

17-06-2020 – rev13

Remove VE_REG_LINK_DEVICE_STATE (0x200C) on the list of VREGs that are periodically sent by the charge master.

08-10-2020 – rev14

Update asynchronous items table with the new changes to the text messages done on v1.53 fw.

01-02-2021 – rev15

Update text protocol short description.

01-03-2021 – rev16

Fix Load offset voltage (0xEDAC) data type, from un16 to un8.

Fix Charger maximum current (0xEDDF) data scale, from 0.01 to 0.1.

05-11-2021 – rev17

Add description to the charge current limit register (0x2015).

Add warning to the battery settings to inform user that those should not be changed too often.

Update product id list (add products 0xA066 to 0xA07B and 0xA10C to 0xA117).

Changed references to “parallel charging” to “synchronized charging”.