VE.Direct Protocol

BlueSolar and SmartSolar MPPT chargers

Victron Energy B.V. | De Paal 35 | 1351 JG Almere | The Netherlands
General phone: +31 (0)36 535 97 00 | Fax: +31 (0)36 535 97 40
E-mail: sales@victronenergy.com | **www.victronenergy.com**

Table of Contents

Victron Energy B.V. | De Paal 35 | 1351 JG Almere | The Netherlands
General phone: +31 (0)36 535 97 00 | Fax: +31 (0)36 535 97 40
E-mail: sales@victronenergy.com | **www.victronenergy.com**

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	0x51FA51FA51FA51FA51FA 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	Device Id	Returns the DeviceId 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
A	Async	Asynchronous data message. Should not be replied.	
		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.

Response		Description	
		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

Device id values

Device	Name	Charger output	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	12..48V-100A	-	ble
0xA052	SmartSolar MPPT 150|85	12..48V-85A	-	ble
0xA053	SmartSolar MPPT 75|15	12..24V-15A	15A	ble

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.
Note 2: There is a discrepancy between the labelling on the housing and the actual device 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).

1.1 Get and Set items

Product information registers

ID	Description	Scale	Type	Unit
0x0100	Product Id (1)	-	un16	-
0x0104	Group Id (3)	-	un8	-
0x0105	Device instance (3)	-	un8	-
0x0106	Device class (3)	-	un16	-
0x010A	Serial number (1)	-	string	-
0x010B	Model name (1)	-	string	-
0x0140	Capabilities (2)	-	un32	-

Note 1: Available since firmware version 1.12.
Note 2: Available since firmware version 1.16
Note 3: Available since firmware version 1.17, used for parallel charging operation

Product id (register 0x0100)

The product id register is formatted in big-endian notation (high byte first).
Please use the regular hex command :4 to get the device id, this works on all models and all software versions.

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 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	HUB-1 support (0=no, 1=yes)
16	Parallel charging support (0=no, 1=yes)
17	Alarm relay (0=no, 1=yes)
18	Alternative rx pin function (0=no, 1=yes)
19	Virtual load output (0=no, 1=yes)
20	Virtual relay (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	-

Device mode values (register 0x0200)

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

Note1: 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).
Note2: 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
252	HUB-1	Voltage controlled with remote voltage set-point
255	UNAVAILABLE	No information available

Note1: batterysafe mode will be reported as state 3 (bulk), see register 0xEDD4 to determine if batterysafe mode is active.
Note2: automatic equalization mode will be reported as state 4 (absorption), see register 0xEDD4 to determine if automatic equalization mode is active.

Remote control used bit-mask (register 0x0202)

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

Note1: 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).
Note2: 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.

Battery settings registers

ID	Description	Scale	Type	Unit
0xEDFF	Batterysafe mode (*1)	-	un8	0=off, 1=on
0xEDFD	Automatic equalization mode (*2)	-	un8	0=off, 1..250
0xEDFC	Battery bulk time limit	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	-
0xEDF0	Battery maximum current	0.1	un16	A
0xEDEF	Battery voltage (*4)	1	un8	V
0xEDEA	Battery voltage setting (*4, *7)	1	un8	V
0xEDE8	BMS present (*6)	-	un8	-

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 betweem -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 regular 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).

Battery type values (register 0xEDF1)

10A/15A Chargers (without rotary switch)

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: 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. using the mpptprefs tool or the VictronConnect app).

Charger data registers

ID	Description	Scale	Type	Unit
0xEDDF	Charger maximum current (*1)	0.01	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	-

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 (device 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.

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
33	Input voltage too high
34	Input excessive current
38	Input shutdown (due to excessive battery voltage)
67	BMS connection lost
116	Calibration data lost
117	Incompatible firmware (not for this model)
119	Settings data invalid / corrupted

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.

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

Bit	Meaning
0	Safe mode active (*1)
1	Automatic equalisation active (*2)
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.

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

Note 1: The panel current is not available in the 10A/15A chargers.
Note 2: The maximum allowed panel voltage is added in firmware version 1.16.

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

ID	Description	Scale	Type	Unit
0xEDAD	Load current	0.1	un16	A
0xEDAC	Load offset voltage	0.01	un16	V
0xEDAB	Load output control	-	un8	-
0xEDA8	Load output state	-	un8	-
0xED9D	Load switch high level (*1)	0.01	un16	V
0xED9C	Load switch low level (*1)	0.01	un16	V

Note 1: 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.

Load output control values (register 0xEDAB)

Value	Name	Meaning
0	OFF	Load output off
1	AUTO	Automatic control / batterylife (default)
2	ALT1	Alternative control 1
3	ALT2	Alternative control 2
4	ON	Load output on (use with caution, no discharge guard)
5	USER1	User defined settings 1 (off<Vlow, on>Vhigh)
6	USER2	User defined settings 2 (off<Vlow<on<Vhigh<off)

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.

Load output state values (register 0xEDA8)

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

Lighting controller timer

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

ID	Description	Scale	Type	Unit
0xEDA0 ... 0xEDA5	Event 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
0x2030	Solar activity (0=dark, 1=light)	-	un8	-
0x2031	Time-of-day (0=mid-night) (*4)	1	un16	min

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.
Note 4: 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).

Event description (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	%

Event anchor points (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 models since firmware version 1.17.

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.

RX Port operation modes (register 0xED98)

Value	Description
0	Remote on/off
1	Load output configuration (default)

Note 1: Available since firmware version 1.17.

History data

Historical data is available on all models except the BlueSolar MPPT 70|15 charger (device 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	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	-
19	Battery voltage minimum	0.01	un16	V
21	13 reserved bytes (0xFF)	-	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 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.

Restore factory defaults

ID	Description	Scale	Type	Unit
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.

Remote control registers - firmware v1.17 or higher

ID	Description	Scale	Type	Unit
0x2000	Charge algorithm version (*1)	-	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	-
0x2005	Switch bank status	-	un8	-
0x2006	Switch bank mask	-	un8	-
0x2007	Charge state elapsed time (*4)	1	un32	ms
0x2008	Absorption time left (*4)	0.01	un16	hours
0x200E	Network mode	-	un8	-
0x2014	Charge current percentage (*5)	1	un8	%
0x2015	Charge current limit (*6)	0.1	un16	A

Note 1: The charge algorithm version in combination with registers 0x0104..0x0106 is used for identification and grouping of chargers specifically intended for parallel 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.
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 and the charger switches back to internal behavior. These values must be written frequently, the timeout is set to 1 minute after which the unit switches back to internal behavior.
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: Firmware version 1.17 only.
Note 6: Firmware version 1.19 and higher.

Remote commands (register 0x2004)

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

Note 1: Only available on models that support equalization
Note 2: Synchronize blinking leds / icons (on a display)
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.

Switch bank bit definitions (registers 0x2005 and 0x2006)

Bit	Description
0	Relay (0=off, 1=on)
1	Error (0=no error, 1=error)
2	Under voltage (0=no, 1=yes)
3	Over voltage (0=no, 1=yes)
4	Panel irradiated (0=dark, 1=light)
5..7	Reserved

Network mode bit definitions (register 0x200E)

Bit	Description
0	Unit operates in networked environment
1	Remote charge control
2	Remote HUB-1 control
3	Remote BMS control
4	Charge group master
5	Charge instance master
6..7	Reserved

Use cases	Description
Stand-alone	Set 0x200E to 0x00 (=default behavior, charger uses internal charge profile)
Charge master	Set 0x200E to 0x21 (charger uses internal charge profile)
Remote slave	Set 0x200E to 0x03, write to registers 0x0201 and 0x2001 periodically
Remote HUB-1	Set 0x200E to 0x05, write to register 0x2001 periodically
Remote BMS	Set 0x200E to 0x09, write to register 0x2014 or 0x2015 periodically

When a unit operates in slave or remote controlled mode, the charge voltage and/or current percentage registers must be updated periodically. A timeout mechanism will set the unit back to stand-alone mode after 1 minute otherwise (e.g. if the communication cable is removed).
The remote charge control and remote HUB-1 control modes behave identically (i.e. the charge voltage set-point is controlled remotely), the difference being that a unit with a display shows HUB-1 on the display when the HUB-1 mode is active.
When a charger is controlled in remote BMS mode the BMS present register (0xEDE8) is set automatically. An effect of this setting is that the charger will no longer operate in stand-alone mode, it requires communication from the BMS (a timeout leads to error 67).
When a unit is set to charge instance master mode it will periodically send the registers 0x2001, 0x2007 and 0x2008 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. Currently the ve.direct chargers are unable to perform data gathering (i.e. reporting the condition of the complete charger group).

Network status (register 0x200F)

This register gives feedback about the charge algorithm, it indicates if the charger operates stand-alone or if it is controlled remotely.

Value	Description
0x00	Unit in slave mode (e.g. BMS or HUB-1 controlled)
0x01	Unit is group master
0x02	Unit is instance master (e.g. parallel charging)
0x03	Unit is both group and instance master
0x04	Unit operates stand-alone (default behavior)

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 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.

1.3 Message examples

\n at the end of the message is implied.

Ping
:154
:51641F9
0x4116 = talking to application version 1.16

Application version
:352
:11641FD
Like ping, application version 1.16

Device Id
:451
:1000351
`0x300` = BlueSolar MPPT 70|15

Restart
:64F
No response, restarted

Get Battery Maximum Current
:7F0ED0071
:7F0ED009600DB
Value = 0x0096 = 15.0A

Set Battery Maximum Current
Set to 10.0A = 0x0064
:8F0ED0064000C
:8F0ED0064000C
Acknowledged with the new value returned.

Unsupported command
:253
:3020050
Unknown response

Invalid frame (checksum wrong)
:452
:4AAAAFD
Error response

Asynchronous message
:A0102000543
The unit reports register 0x0201 (device state) with value 0x05 (float).

2 Text Protocol

When no VE.Direct queries are sent to the device, the charger periodically sends human readable (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 device id overview (added new types)
Updated the battery table for the 50A/35A chargers

27-11-2013
Updated device 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 device id overview (added new type 85A MINI)

7-11-2014
Updated notes (error 21) in the charger error codes section

13-02-2015
Updated device 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 batterysafe and automatic equalization
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 parallel 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 device id table (added new SmartSolar models)

10-08-2016
Added vreg 0x200F (network status)