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# Introduction

Victron products which feature the VE.Direct serial communications interface allow simple access to detailed information of that product. This document describes how to receive and interpret this information.

See our Data communication whitepaper for more information on other protocols and products available: [Whitepaper-Data-communication-with-Victron-Energy-products\\_EN.pdf](#).

The VE.Direct interface includes two modes: Text-mode and the HEX-mode. The purpose of the Text-mode is to make retrieving information extremely simple. The product will periodically transmit all run-time fields. The HEX-mode allows not only to read data but also write data, for example, change settings.

There are two different implementations of the Text-mode and HEX-mode:

## Older implementations

- On power up, a VE.Direct interface will always be in Text-mode, and continuously transmits all run-time fields. As soon as it receives a valid HEX-message, it will switch to HEX-mode. It will stay in HEX-mode as long as HEX-messages are frequently received. After a product has not received any valid HEX-messages for several seconds, it will switch back to Text-mode and start to auto transmit the run-time fields periodically again. Some products will send Asynchronous HEX-messages, starting with “:A” and ending with a newline ‘\n’, on their own. These messages can interrupt a regular Text-mode frame.

## Newer implementations

- Always have the Text-mode active, regardless of the HEX-messages.

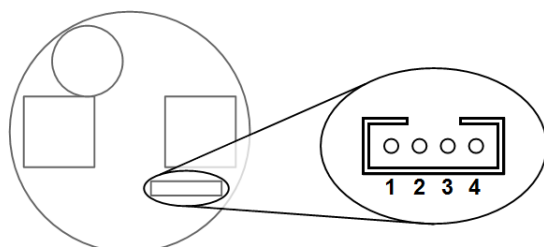
To know more which implementation is applied to your product, please check its specific VE.Direct protocol document.

This document only describes the Text-mode.

Make sure to also read our [VE.Direct protocol FAQ](#), and the [Open source page on Victron Live](#) which lists projects from other people using our VE.Direct protocol

# Physical interface

The VE.Direct interface is accessed via a 4-pin connector. The picture below shows where the VE.Direct connector is located on a BMV-700.



| Pin | Producer     | Consumer     |
|-----|--------------|--------------|
| 1   | GND          | GND          |
| 2   | VE.Direct-RX | VE.Direct-RX |
| 3   | VE.Direct-TX | VE.Direct-TX |
| 4   | Power +      | Power +      |

Producers are products, such as the BMV battery monitor and the MPPT solar chargers. Consumers are products reading the data, such as the [Color Control GX](#). When connecting a Producer to a Consumer, the Producer's VE.Direct-TX must be connected to Consumer VE.Direct-RX. The same goes to the Producer VE.Direct-RX, which must be connected to Consumer's VE.Direct-TX. Note that the pins on the MPPT can have alternative functions. Its VE.Direct-RX pin can be used to switch the charger on and off. Its VE.Direct-TX pin can be configured to send a PWM signal, to dim (street-)lights. For details about the connector type see the information at the end of this document.

A VE.Direct to USB interface cable can be purchased from Victron Energy ("VE.Direct to USB", part number ASS030530000). This interface cable provides a virtual comport through USB as well as galvanic isolation.

A VE.Direct to RS232 interface cable can also be purchased from Victron Energy ("VE.Direct to RS232 interface", part number ASS030520500).

## Serial port configuration

|               |       |
|---------------|-------|
| Baud rate:    | 19200 |
| Data bits:    | 8     |
| Parity:       | None  |
| Stop bits:    | 1     |
| Flow control: | None  |

## Pins to use when using the VE.Direct to RS232 interface

For the communication use the GND, RX and TX pins: pin 5, 2 and 3 on the DB9 connector.

Also the DTR signal (pin 4 on the DB9 connector) and/or the RTS signal (pin 7 on the DB9 connector) must be driven high to power the isolated side of the interface. How to program the DTR and RTS differs between used operating systems and hardware.

For more details see:

[https://www.victronenergy.com/live/vedirect\\_protocol:faq#q2when\\_using\\_the\\_vedirect\\_to\\_rs232\\_interface\\_what\\_pins\\_do\\_i\\_need](https://www.victronenergy.com/live/vedirect_protocol:faq#q2when_using_the_vedirect_to_rs232_interface_what_pins_do_i_need)

## Message format

The device transmits blocks of data at 1 second intervals. Each field is sent using the following format:

<Newline><Field-Label><Tab><Field-Value>

The identifiers are defined as follows:

| Identifier    | Meaning  |
|---------------|--|
| <Newline>     | A carriage return followed by a line feed (0x0D, 0x0A).  |
| <Field-Label> | An arbitrary length label that identifies the field. Where applicable, this will be the same as the label that is used on the LCD. |
| <Tab>         | A horizontal tab (0x09).   |
| <Field-Value> | The ASCII formatted value of this field. The number of characters transmitted depends on the magnitude and sign of the value.      |

## Data integrity

The statistics are grouped in blocks with a checksum appended. The last field in a block will always be "Checksum". The value is a single byte, and will not necessarily be a printable ASCII character. The modulo 256 sum of all bytes in a block will equal 0 if there were no transmission errors. Multiple blocks are sent containing different fields.

For more details see:

[https://www.victronenergy.com/live/vedirect\\_protocol:faq#q8how\\_do\\_i\\_calculate\\_the\\_text\\_checksum](https://www.victronenergy.com/live/vedirect_protocol:faq#q8how_do_i_calculate_the_text_checksum)

## Fields

The values sent over the serial communications interface do not necessarily use the same units as the values on the LCD.

**Note:** The BMV-60xS does not have a full VE.Direct interface. There is only limited support for the Text-mode, see Table I. More details can be found in the document *BMV-60xS Text Protocol*.

[http://www.victronenergy.com/upload/documents/BMV-60xS\\_Text\\_Protocol.pdf](http://www.victronenergy.com/upload/documents/BMV-60xS_Text_Protocol.pdf)

The units used by the serial interface are as follows:

| Label | Units                | Description                             | BMV 60x        | BMV 70x        | BMV71x SmartShunt | MPPT <sup>1</sup> | Phoenix Inverter | Phoenix Charger | Smart BuckBoost |
|-------|----------------------|---|----------------|----------------|-------------------|-------------------|------------------|-----------------|-----------------|
| V     | mV                   | Main or channel 1 (battery) voltage     | •              | •              | •                 | •                 | •                | •               | •               |
| V2    | mV                   | Channel 2 (battery) voltage             |                |                |                   |                   |                  | • <sup>2</sup>  |                 |
| V3    | mV                   | Channel 3 (battery) voltage             |                |                |                   |                   |                  | • <sup>2</sup>  |                 |
| VS    | mV                   | Auxiliary (starter) voltage             | • <sup>3</sup> | • <sup>3</sup> | • <sup>3</sup>    |                   |                  |                 |                 |
| VM    | mV                   | Mid-point voltage of the battery bank   |                | • <sup>4</sup> | • <sup>4</sup>    |                   |                  |                 |                 |
| DM    | ‰                    | Mid-point deviation of the battery bank |                | • <sup>4</sup> | • <sup>4</sup>    |                   |                  |                 |                 |
| VPV   | mV                   | Panel voltage                           |                |                |                   | •                 |                  |                 |                 |
| PPV   | W                    | Panel power                             |                |                |                   | •                 |                  |                 |                 |
| I     | mA                   | Main or channel 1 battery current       | •              | •              | •                 | • <sup>5</sup>    |                  | •               | •               |
| I2    | mA                   | Channel 2 battery current               |                |                |                   |                   |                  | • <sup>2</sup>  |                 |
| I3    | mA                   | Channel 3 battery current               |                |                |                   |                   |                  | • <sup>2</sup>  |                 |
| IL    | mA                   | Load current                            |                |                |                   | • <sup>6</sup>    |                  |                 |                 |
| LOAD  |                      | Load output state (ON/OFF)              |                |                |                   | • <sup>7</sup>    |                  |                 |                 |
| T     | °C <sup>8</sup>      | Battery temperature                     |                | • <sup>9</sup> | • <sup>9</sup>    |                   |                  |                 |                 |
| P     | W                    | Instantaneous power                     |                | •              | •                 |                   |                  |                 | •               |
| CE    | mAh <sup>10,11</sup> | Consumed Amp Hours                      | •              | •              | •                 |                   |                  |                 |                 |

<sup>1</sup> The VE.Direct protocol is available in the MPPT 70/15 since firmware version v1.09 and up, and only in newer type MPPT 70/15s: the ones with a product id other than 0x300. The first batches, with PID 0x300, only support fields PID, SER and FW.

<sup>2</sup> Available on Phoenix Smart Chargers with triple outputs only

<sup>3</sup> Available when the AUX input is configured as Starter Battery

<sup>4</sup> Available when the AUX input is configured as Mid Point

<sup>5</sup> MPPT 75/15 and 100/15: Since firmware version v1.15 onwards, the current reported under “I” is the battery current. Firmware version v1.14 and before report the current measured at the output of the converter, without detailing if this current was going to the battery or the loads.

<sup>6</sup> Available since version v1.15, and only for models with a load output.

<sup>7</sup> Available since version v1.12, and only for models with a load output.

<sup>8</sup> When no temperature sensor is connected, “---” will be sent instead of a value.

<sup>9</sup> Available when the AUX input is configured as Temperature

<sup>10</sup> When the BMV is not synchronised, these statistics have no meaning, so “---” will be sent instead of a value.

<sup>11</sup> When configured as DC monitor, “---” will be sent instead of a value.

| Label | Units                         | Description   | BMV 60x | BMV 70x | BMV71x SmartShunt | MPPT <sup>1</sup> | Phoenix Inverter | Phoenix Charger | Smart BuckBoost |
|-------|-------------------------------|---|---------|---------|-------------------|-------------------|------------------|-----------------|-----------------|
| SOC   | % <sup>10,11</sup>            | State-of-charge   | •       | •       | •                 |                   |                  |                 |                 |
| TTG   | Minutes <sup>10, 11, 12</sup> | Time-to-go  | •       | •       | •                 |                   |                  |                 |                 |
| Alarm |                               | Alarm condition active  | •       | •       | •                 |                   |                  |                 |                 |
| Relay |                               | Relay state   | •       | •       | •                 | • <sup>13</sup>   | • <sup>14</sup>  | •               |                 |
| AR    |                               | Alarm reason  | •       | •       | •                 |                   | •                |                 |                 |
| OR    |                               | Off reason  |         |         |                   | • <sup>15</sup>   | • <sup>16</sup>  |                 | •               |
| H1    | mAh <sup>11</sup>             | Depth of the deepest discharge  | •       | •       | •                 |                   |                  |                 |                 |
| H2    | mAh <sup>11</sup>             | Depth of the last discharge   | •       | •       | •                 |                   |                  |                 |                 |
| H3    | mAh <sup>11</sup>             | Depth of the average discharge  | •       | •       | •                 |                   |                  |                 |                 |
| H4    | <sup>11</sup>                 | Number of charge cycles   | •       | •       | •                 |                   |                  |                 |                 |
| H5    | <sup>11</sup>                 | Number of full discharges   | •       | •       | •                 |                   |                  |                 |                 |
| H6    | mAh <sup>11</sup>             | Cumulative Amp Hours drawn  | •       | •       | •                 |                   |                  |                 |                 |
| H7    | mV                            | Minimum main (battery) voltage  | •       | •       | •                 |                   |                  |                 |                 |
| H8    | mV                            | Maximum main (battery) voltage  | •       | •       | •                 |                   |                  |                 |                 |
| H9    | Seconds <sup>11</sup>         | Number of seconds since last full charge                                      | •       | •       | •                 |                   |                  |                 |                 |
| H10   | <sup>11</sup>                 | Number of automatic synchronizations  | •       | •       | •                 |                   |                  |                 |                 |
| H11   |                               | Number of low main voltage alarms   | •       | •       | •                 |                   |                  |                 |                 |
| H12   |                               | Number of high main voltage alarms  | •       | •       | •                 |                   |                  |                 |                 |
| H13   |                               | Number of low auxiliary voltage alarms  | •       |         |                   |                   |                  |                 |                 |
| H14   |                               | Number of high auxiliary voltage alarms                                       | •       |         |                   |                   |                  |                 |                 |
| H15   | mV <sup>3</sup>               | Minimum auxiliary (battery) voltage   | •       | •       | •                 |                   |                  |                 |                 |
| H16   | mV <sup>3</sup>               | Maximum auxiliary (battery) voltage   | •       | •       | •                 |                   |                  |                 |                 |
| H17   | 0.01 kWh                      | Amount of discharged energy (BMV) /<br>Amount of produced energy (DC monitor) |         | •       | •                 |                   |                  |                 |                 |

<sup>12</sup> When the battery is not discharging the time- to-go is infinite. This is represented as -1.

<sup>13</sup> Available on SmartSolar mppt chargers since firmware version v1.17

<sup>14</sup> Available on Smart Phoenix Inverter

<sup>15</sup> Available on SmartSolar mppt chargers since firmware version v1.44 (VE.Direct models) and v1.03 (SmartSolar VE.Can models)

<sup>16</sup> Available on Phoenix Inverter v1.16

| Label    | Units    | Description  | BMV<br>60x | BMV<br>70x | BMV71x<br>SmartShunt | MPPT <sup>1</sup> | Phoenix<br>Inverter | Phoenix<br>Charger | Smart<br>BuckBoost |
|----------|----------|--|------------|------------|----------------------|-------------------|---------------------|--------------------|--------------------|
| H18      | 0.01 kWh | Amount of charged energy (BMV) /<br>Amount of consumed energy (DC monitor) |            | •          | •                    |                   |                     |                    |                    |
| H19      | 0.01 kWh | Yield total (user resettable counter)                                      |            |            |                      | •                 |                     |                    |                    |
| H20      | 0.01 kWh | Yield today  |            |            |                      | •                 |                     |                    |                    |
| H21      | W        | Maximum power today  |            |            |                      | •                 |                     |                    |                    |
| H22      | 0.01 kWh | Yield yesterday  |            |            |                      | •                 |                     |                    |                    |
| H23      | W        | Maximum power yesterday  |            |            |                      | •                 |                     |                    |                    |
| ERR      |          | Error code   |            |            |                      | •                 |                     | •                  | •                  |
| CS       |          | State of operation   |            |            |                      | •                 | •                   | •                  | •                  |
| BMV      |          | Model description (deprecated)   | •          | •          | •                    |                   |                     |                    |                    |
| FW       |          | Firmware version (16 bit)  | •          | •          | •                    | •                 | •                   |                    |                    |
| FWE      |          | Firmware version (24 bit)  |            |            |                      |                   |                     | •                  | •                  |
| PID      |          | Product ID   |            | •          | •                    | •                 | •                   | •                  | •                  |
| SER#     |          | Serial number  |            |            |                      | •                 | •                   | •                  | •                  |
| HSDS     |          | Day sequence number (0..364)   |            |            |                      | • <sup>17</sup>   |                     |                    |                    |
| MODE     |          | Device mode  |            |            |                      |                   | •                   | •                  | •                  |
| AC_OUT_V | 0.01 V   | AC output voltage  |            |            |                      |                   | •                   |                    |                    |
| AC_OUT_I | 0.1 A    | AC output current  |            |            |                      |                   | •                   |                    |                    |
| AC_OUT_S | VA       | AC output apparent power   |            |            |                      |                   | • <sup>18</sup>     |                    |                    |
| WARN     |          | Warning reason   |            |            |                      |                   | •                   |                    |                    |
| MPPT     |          | Tracker operation mode   |            |            |                      | • <sup>19</sup>   |                     |                    |                    |
| MON      |          | DC monitor mode  |            |            | • <sup>20</sup>      |                   |                     |                    |                    |
| DC_IN_V  | 0.01 V   | DC input voltage   |            |            |                      |                   |                     |                    | •                  |
| DC_IN_I  | 0.1 A    | DC input current   |            |            |                      |                   |                     |                    | •                  |
| DC_IN_P  | 1 W      | DC input power   |            |            |                      |                   |                     |                    | •                  |

<sup>17</sup> Available on BlueSolar mppt chargers since firmware version v1.16

<sup>18</sup> Available on Phoenix Inverter (some models) since firmware version v1.16

<sup>19</sup> Available on BlueSolar mppt chargers since firmware version v1.37

<sup>20</sup> Available since version v4.08



**Table I Supported Text-mode fields**

## Detailed field description

*I*

Both for MPPTs and BMVs: when  $> 0$ , the battery is being charged,  $< 0$  the battery is being discharged.

### **Alarm**

This shows the buzzer alarm state of the BMV. During normal operation, this will be "OFF". When a buzzer alarm occurs the value will change to "ON".

**Note:** This refers to the value of the alarm condition, and not the buzzer itself. This means that once a condition has occurred, the value will be "ON" until all alarm conditions have cleared; regardless of whether or not a button has been pressed to silence the buzzer.

### **Relay**

This shows the relay alarm state. The product specific descriptions show the factory default behaviour.

BMV: during normal operation the relay is "OFF", if a relay alarm occurs the value will change to "ON".

MPPT chargers: during normal operation the relay is "OFF", if there is a battery low voltage condition value will change to "ON".

Phoenix Smart Inverter: during normal operation (inverting) the relay is "ON".

Phoenix Smart Chargers: during normal operation (charging) the relay is "ON".

**Note for both Alarm and Relay:** BMV-600's with firmware v2.09 or lower used to send "On" and "Off" instead of "ON" and "OFF". It is therefore recommended to use a case-insensitive string comparison in your implementation, for example `stricmp()`.

### **FW**

The firmware version of the device. The version is reported as a whole number, e.g. 208 for firmware version 2.08. The value C208 means release candidate C for version 2.08.

**Note:** This field is available in the BMV since version 2.08

### **FWE**

The firmware version of the device. The version contains up to 6 digits, 0 padding on the left side is not mandatory. Examples: 0208FF or 208FF for firmware version 2.08 (last digit FF indicates an official release), 020801 for firmware version 2.08-beta-01.

### **AR**

Alarm reason; this field describes the cause of the alarm. Since multiple alarm conditions can be present at the same time the values of the separate alarm conditions are added. The value total is sent in decimal notation.

|                      |      | BMV | Inverter |
|----------------------|------|-----|----------|
| Low Voltage          | 1    | •   | •        |
| High Voltage         | 2    | •   | •        |
| Low SOC              | 4    | •   |          |
| Low Starter Voltage  | 8    | •   |          |
| High Starter Voltage | 16   | •   |          |
| Low Temperature      | 32   | •   | •        |
| High Temperature     | 64   | •   | •        |
| Mid Voltage          | 128  | •   |          |
| Overload             | 256  |     | •        |
| DC-ripple            | 512  |     | •        |
| Low V AC out         | 1024 |     | •        |
| High V AC out        | 2048 |     | •        |
| Short Circuit        | 4096 |     |          |
| BMS Lockout          | 8192 |     |          |

E.g. a value of 5 would indicate the presence of a low SOC alarm and a low Voltage.

**Note:** This field is available in the BMV since version 2.08

### **WARN**

Warning reason is implemented for inverters only. It provides the cause of a warning. The bit definition is the same as for AR. More warnings can be active at the same time. Warnings always represent the current status of the measured parameter (temperature/battery voltage in/VAC-out). This is different than for alarm reason AR. AR remembers the reason what caused the inverter to switch off (active protection) until it is switched on again.

### **OR**

Off reason, this field described why a unit is switched off.

|                                     |            |
|-------------------------------------|------------|
| No input power                      | 0x00000001 |
| Switched off (power switch)         | 0x00000002 |
| Switched off (device mode register) | 0x00000004 |
| Remote input                        | 0x00000008 |
| Protection active                   | 0x00000010 |
| Paygo                               | 0x00000020 |
| BMS                                 | 0x00000040 |
| Engine shutdown detection           | 0x00000080 |
| Analysing input voltage             | 0x00000100 |

### **CAP\_BLE**

Off reason, this field described why a unit is switched off.

|                                |            |
|--------------------------------|------------|
| BLE supports switching off     | 0x00000001 |
| BLE switching off is permanent | 0x00000002 |

**PID**

The product id:

|                              |         |
|------------------------------|---------|
| BMV-700                      | 0x203   |
| BMV-702                      | 0x204   |
| BMV-700H                     | 0x205   |
| BlueSolar MPPT 70 15*        | 0x0300* |
| BlueSolar MPPT 75 50*        | 0xA040* |
| BlueSolar MPPT 150 35*       | 0xA041* |
| BlueSolar MPPT 75 15         | 0xA042  |
| BlueSolar MPPT 100 15        | 0xA043  |
| BlueSolar MPPT 100 30*       | 0xA044* |
| BlueSolar MPPT 100 50*       | 0xA045* |
| BlueSolar MPPT 150 70        | 0xA046  |
| BlueSolar MPPT 150 100       | 0xA047  |
| BlueSolar MPPT 100 50 rev2   | 0xA049  |
| BlueSolar MPPT 100 30 rev2   | 0xA04A  |
| BlueSolar MPPT 150 35 rev2   | 0xA04B  |
| BlueSolar MPPT 75 10         | 0xA04C  |
| BlueSolar MPPT 150 45        | 0xA04D  |
| BlueSolar MPPT 150 60        | 0xA04E  |
| BlueSolar MPPT 150 85        | 0xA04F  |
| SmartSolar MPPT 250 100      | 0xA050  |
| SmartSolar MPPT 150 100*     | 0xA051* |
| SmartSolar MPPT 150 85*      | 0xA052* |
| SmartSolar MPPT 75 15        | 0xA053  |
| SmartSolar MPPT 75 10        | 0xA054  |
| SmartSolar MPPT 100 15       | 0xA055  |
| SmartSolar MPPT 100 30       | 0xA056  |
| SmartSolar MPPT 100 50       | 0xA057  |
| SmartSolar MPPT 150 35       | 0xA058  |
| SmartSolar MPPT 150 100 rev2 | 0xA059  |
| SmartSolar MPPT 150 85 rev2  | 0xA05A  |
| SmartSolar MPPT 250 70       | 0xA05B  |
| SmartSolar MPPT 250 85       | 0xA05C  |
| SmartSolar MPPT 250 60       | 0xA05D  |
| SmartSolar MPPT 250 45       | 0xA05E  |
| SmartSolar MPPT 100 20       | 0xA05F  |
| SmartSolar MPPT 100 20 48V   | 0xA060  |
| SmartSolar MPPT 150 45       | 0xA061  |
| SmartSolar MPPT 150 60       | 0xA062  |
| SmartSolar MPPT 150 70       | 0xA063  |
| SmartSolar MPPT 250 85 rev2  | 0xA064  |
| SmartSolar MPPT 250 100 rev2 | 0xA065  |
| BlueSolar MPPT 100 20        | 0xA066  |
| BlueSolar MPPT 100 20 48V    | 0xA067  |
| SmartSolar MPPT 250 60 rev2  | 0xA068  |
| SmartSolar MPPT 250 70 rev2  | 0xA069  |
| SmartSolar MPPT 150 45 rev2  | 0xA06A  |
| SmartSolar MPPT 150 60 rev2  | 0xA06B  |
| SmartSolar MPPT 150 70 rev2  | 0xA06C  |
| SmartSolar MPPT 150 85 rev3  | 0xA06D  |
| SmartSolar MPPT 150 100 rev3 | 0xA06E  |
| BlueSolar MPPT 150 45 rev2   | 0xA06F  |
| BlueSolar MPPT 150 60 rev2   | 0xA070  |
| BlueSolar MPPT 150 70 rev2   | 0xA071  |

|                                     |         |
|-------------------------------------|---------|
| BlueSolar MPPT 150/45 rev3          | 0xA072  |
| SmartSolar MPPT 150/45 rev3         | 0xA073  |
| SmartSolar MPPT 75/10 rev2          | 0xA074  |
| SmartSolar MPPT 75/15 rev2          | 0xA075  |
| BlueSolar MPPT 100/30 rev3          | 0xA076  |
| BlueSolar MPPT 100/50 rev3          | 0xA077  |
| BlueSolar MPPT 150/35 rev3          | 0xA078  |
| BlueSolar MPPT 75/10 rev2           | 0xA079  |
| BlueSolar MPPT 75/15 rev2           | 0xA07A  |
| BlueSolar MPPT 100/15 rev2          | 0xA07B  |
| BlueSolar MPPT 75/10 rev3           | 0xA07C  |
| BlueSolar MPPT 75/15 rev3           | 0xA07D  |
| SmartSolar MPPT 100/30 12V          | 0xA07E  |
| All-In-1 SmartSolar MPPT 75/15 12V  | 0xA07F  |
| SmartSolar MPPT VE.Can 150/70       | 0xA102  |
| SmartSolar MPPT VE.Can 150/45       | 0xA103  |
| SmartSolar MPPT VE.Can 150/60       | 0xA104  |
| SmartSolar MPPT VE.Can 150/85       | 0xA105  |
| SmartSolar MPPT VE.Can 150/100      | 0xA106  |
| SmartSolar MPPT VE.Can 250/45       | 0xA107  |
| SmartSolar MPPT VE.Can 250/60       | 0xA108  |
| SmartSolar MPPT VE.Can 250/70       | 0xA109  |
| SmartSolar MPPT VE.Can 250/85       | 0xA10A  |
| SmartSolar MPPT VE.Can 250/100      | 0xA10B  |
| SmartSolar MPPT VE.Can 150/70 rev2  | 0xA10C  |
| SmartSolar MPPT VE.Can 150/85 rev2  | 0xA10D  |
| SmartSolar MPPT VE.Can 150/100 rev2 | 0xA10E  |
| BlueSolar MPPT VE.Can 150/100       | 0xA10F  |
| BlueSolar MPPT VE.Can 250/70        | 0xA112  |
| BlueSolar MPPT VE.Can 250/100       | 0xA113  |
| SmartSolar MPPT VE.Can 250/70 rev2  | 0xA114  |
| SmartSolar MPPT VE.Can 250/100 rev2 | 0xA115  |
| SmartSolar MPPT VE.Can 250/85 rev2  | 0xA116  |
| BlueSolar MPPT VE.Can 150/100 rev2  | 0xA117  |
| Phoenix Inverter 12V 250VA 230V*    | 0xA201* |
| Phoenix Inverter 24V 250VA 230V*    | 0xA202* |
| Phoenix Inverter 48V 250VA 230V*    | 0xA204* |
| Phoenix Inverter 12V 375VA 230V*    | 0xA211* |
| Phoenix Inverter 24V 375VA 230V*    | 0xA212* |
| Phoenix Inverter 48V 375VA 230V*    | 0xA214* |
| Phoenix Inverter 12V 500VA 230V*    | 0xA221* |
| Phoenix Inverter 24V 500VA 230V*    | 0xA222* |
| Phoenix Inverter 48V 500VA 230V*    | 0xA224* |
| Phoenix Inverter 12V 250VA 230V     | 0xA231  |
| Phoenix Inverter 24V 250VA 230V     | 0xA232  |
| Phoenix Inverter 48V 250VA 230V     | 0xA234  |
| Phoenix Inverter 12V 250VA 120V     | 0xA239  |
| Phoenix Inverter 24V 250VA 120V     | 0xA23A  |
| Phoenix Inverter 48V 250VA 120V     | 0xA23C  |
| Phoenix Inverter 12V 375VA 230V     | 0xA241  |
| Phoenix Inverter 24V 375VA 230V     | 0xA242  |
| Phoenix Inverter 48V 375VA 230V     | 0xA244  |
| Phoenix Inverter 12V 375VA 120V     | 0xA249  |
| Phoenix Inverter 24V 375VA 120V     | 0xA24A  |
| Phoenix Inverter 48V 375VA 120V     | 0xA24C  |

|  |        |
|--|--------|
| Phoenix Inverter 12V 500VA 230V        | 0xA251 |
| Phoenix Inverter 24V 500VA 230V        | 0xA252 |
| Phoenix Inverter 48V 500VA 230V        | 0xA254 |
| Phoenix Inverter 12V 500VA 120V        | 0xA259 |
| Phoenix Inverter 24V 500VA 120V        | 0xA25A |
| Phoenix Inverter 48V 500VA 120V        | 0xA25C |
| Phoenix Inverter 12V 800VA 230V        | 0xA261 |
| Phoenix Inverter 24V 800VA 230V        | 0xA262 |
| Phoenix Inverter 48V 800VA 230V        | 0xA264 |
| Phoenix Inverter 12V 800VA 120V        | 0xA269 |
| Phoenix Inverter 24V 800VA 120V        | 0xA26A |
| Phoenix Inverter 48V 800VA 120V        | 0xA26C |
| Phoenix Inverter 12V 1200VA 230V       | 0xA271 |
| Phoenix Inverter 24V 1200VA 230V       | 0xA272 |
| Phoenix Inverter 48V 1200VA 230V       | 0xA274 |
| Phoenix Inverter 12V 1200VA 120V       | 0xA279 |
| Phoenix Inverter 24V 1200VA 120V       | 0xA27A |
| Phoenix Inverter 48V 1200VA 120V       | 0xA27C |
| Phoenix Inverter 12V 1600VA 230V       | 0xA281 |
| Phoenix Inverter 24V 1600VA 230V       | 0xA282 |
| Phoenix Inverter 48V 1600VA 230V       | 0xA284 |
| Phoenix Inverter 12V 2000VA 230V       | 0xA291 |
| Phoenix Inverter 24V 2000VA 230V       | 0xA292 |
| Phoenix Inverter 48V 2000VA 230V       | 0xA294 |
| Phoenix Inverter 12V 3000VA 230V       | 0xA2A1 |
| Phoenix Inverter 24V 3000VA 230V       | 0xA2A2 |
| Phoenix Inverter 48V 3000VA 230V       | 0xA2A4 |
| Phoenix Smart IP43 Charger 12 50 (1+1) | 0xA340 |
| Phoenix Smart IP43 Charger 12 50 (3)   | 0xA341 |
| Phoenix Smart IP43 Charger 24 25 (1+1) | 0xA342 |
| Phoenix Smart IP43 Charger 24 25 (3)   | 0xA343 |
| Phoenix Smart IP43 Charger 12 30 (1+1) | 0xA344 |
| Phoenix Smart IP43 Charger 12 30 (3)   | 0xA345 |
| Phoenix Smart IP43 Charger 24 16 (1+1) | 0xA346 |
| Phoenix Smart IP43 Charger 24 16 (3)   | 0xA347 |
| BMV-712 Smart                          | 0xA381 |
| BMV-710H Smart                         | 0xA382 |
| BMV-712 Smart Rev2                     | 0xA383 |
| SmartShunt 500A/50mV                   | 0xA389 |
| SmartShunt 1000A/50mV                  | 0xA38A |
| SmartShunt 2000A/50mV                  | 0xA38B |
| Smart BuckBoost 12V/12V-50A            | 0xA3F0 |

\* These models are phased out.

## CS

The state of operation. See the table below for the possible values.

|                             |     | MPPT | Inverter | Charger |
|-----------------------------|-----|------|----------|---------|
| Off                         | 0   | •    | •        | •       |
| Low power                   | 1   |      | • (1)    |         |
| Fault                       | 2   | •    | •        | •       |
| Bulk                        | 3   | •    |          | •       |
| Absorption                  | 4   | •    |          | •       |
| Float                       | 5   | •    |          | •       |
| Storage                     | 6   |      |          | •       |
| Equalize (manual)           | 7   | •    |          |         |
| Inverting                   | 9   |      | •        |         |
| Power supply                | 11  |      |          | •       |
| Starting-up                 | 245 | •    |          |         |
| Repeated absorption         | 246 |      |          | •       |
| Auto equalize / Recondition | 247 | •    |          | •       |
| BatterySafe                 | 248 |      |          | •       |
| External Control            | 252 | •    |          |         |

(1) Load search

## ERR

The error code of the device (relevant when the device is in the fault state). See the table below for the possible values.

|  |     |
|--|-----|
| No error   | 0   |
| Battery voltage too high                             | 2   |
| Charger temperature too high                         | 17  |
| Charger over current                                 | 18  |
| Charger current reversed                             | 19  |
| Bulk time limit exceeded                             | 20  |
| Current sensor issue (sensor bias/sensor broken)     | 21  |
| Terminals overheated                                 | 26  |
| Converter issue (dual converter models only)         | 28  |
| Input voltage too high (solar panel)                 | 33  |
| Input current too high (solar panel)                 | 34  |
| Input shutdown (due to excessive battery voltage)    | 38  |
| Input shutdown (due to current flow during off mode) | 39  |
| Lost communication with one of devices               | 65  |
| Synchronised charging device configuration issue     | 66  |
| BMS connection lost                                  | 67  |
| Network misconfigured                                | 68  |
| Factory calibration data lost                        | 116 |
| Invalid/incompatible firmware                        | 117 |
| User settings invalid                                | 119 |

**Note1:** Error 19 can be ignored, this condition regularly occurs during start-up or shutdown of the MPPT charger. Since version 1.15 this error will no longer be reported.

**Note2:** Error 21 can be ignored for 5 minutes, this condition regularly occurs during start-up or shutdown of the MPPT charger. Since version 1.16 this warning will no longer be reported when it is not persistent.

## HSDS

Historical data. The day sequence number, a change in this number indicates a new day. This implies that the historical data has changed. Range 0..364.

**Note:** The HSDS field is available in the MPPT charger since version v1.16.

**SER#**

The serial number of the device. The notation is LLYMMSSSSS, where LL=location code, YYWW=production date stamp (year, week) and SSSS=unique part of the serial number.  
Example: HQ1328Y6TF6

**BMV (deprecated)**

This field contains a textual description of the BMV model, for example 602S or 702. It is deprecated, refer to the field PID instead.

**MODE**

The possible values for the device mode are listed in this table.

|                       |     | Inverter | Charger |
|-----------------------|-----|----------|---------|
| VE_REG_MODE_CHARGER   | 1   |          | •       |
| VE_REG_MODE_INVERTER  | 2   | •        |         |
| VE_REG_MODE_OFF       | 4   | •        | •       |
| VE_REG_MODE_ECO       | 5   | •        |         |
| VE_REG_MODE_HIBERNATE | 253 | •(1)     |         |

(1) Smart only

**MPPT**

The possible values for the tracker operation are listed in this table.

|                            |   |
|----------------------------|---|
| Off                        | 0 |
| Voltage or current limited | 1 |
| MPP Tracker active         | 2 |

**MON**

The possible values for DC monitor mode are listed in this table.

|                       |    |
|-----------------------|----|
| Solar charger         | -9 |
| Wind turbine          | -8 |
| Shaft generator       | -7 |
| Alternator            | -6 |
| Fuel cell             | -5 |
| Water generator       | -4 |
| DC/DC charger         | -3 |
| AC charger            | -2 |
| Generic source        | -1 |
| Battery monitor (BMV) | 0  |
| Generic load          | 1  |
| Electric drive        | 2  |
| Fridge                | 3  |
| Water pump            | 4  |
| Bilge pump            | 5  |
| DC system             | 6  |
| Inverter              | 7  |
| Water heater          | 8  |

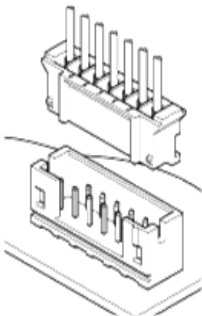






## Implementation guidelines

When implementing a VE.Text parser it is recommended to reserve two buffers. For the field label a buffer of 9 bytes is needed and for the field value a buffer length of 33 bytes is required. The value should be parsed as soon as a single field is received and should then be stored in a temporary record. The maximum number of fields in a block is 22; keep at least 22 temporary records. Once the complete block is validated by evaluating the checksum, the contents of the temporary records can be copied to its corresponding final records. If the checksum turned out to be invalid, the temporary records need to be cleared.

## Connector types

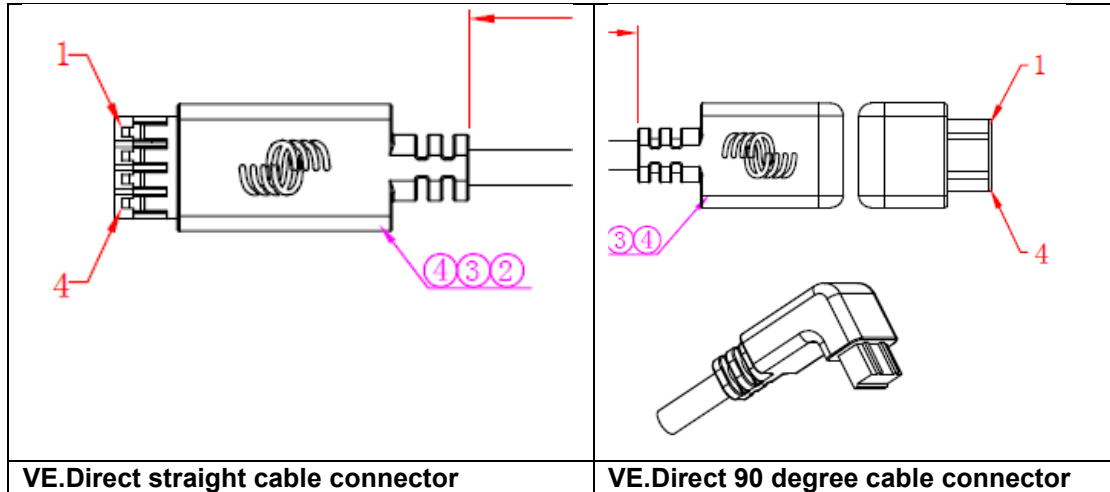
Below the information about the connector type used for VE.Direct. There are 3 through hole type connectors and 2 surface mount types available.

|   |   |                       |  |
|---|---|-----------------------|--|
| <b>Brand</b>  | JST   |                       |  |
| <b>Serie</b>  | PH connector, 4 pin types   |                       |  |
| <b>Description</b><br> | Pitch 2.0mm<br>Available in through hole and smt. Top and side entry models<br>Also a high version of the through hole top entry model is available<br>Most types are available from Farnell. |                       |  |
|   | Website information   |                       |  |
|   | <a href="http://www.jst-mfg.com/product/detail_e.php?series=199">http://www.jst-mfg.com/product/detail_e.php?series=199</a>   |                       |  |
|   | <a href="http://www.jst-mfg.com/product/pdf/eng/ePH.pdf">http://www.jst-mfg.com/product/pdf/eng/ePH.pdf</a>   |                       |  |
| <b>Through hole</b>   | <b>Farnell code</b>   | <b>JST code</b>       | <b>Link</b>  |
| <b>Pcb part straight</b>  | <a href="#">9492437</a>   | B4B-PH-K-S(LF)(SN)    | <a href="http://nl.farnell.com/jst-japan-solderless-terminals/b4b-ph-k-s-lf-sn/header-top-entry-4way-2mm/dp/9492437">http://nl.farnell.com/jst-japan-solderless-terminals/b4b-ph-k-s-lf-sn/header-top-entry-4way-2mm/dp/9492437</a>            |
| <b>Pcb part 90degree</b>  | <a href="#">9492488</a>   | S4B-PH-K-S(LF)(SN)    | <a href="http://nl.farnell.com/jst-japan-solderless-terminals/s4b-ph-k-s-lf-sn/header-side-entry-4way/dp/9492488">http://nl.farnell.com/jst-japan-solderless-terminals/s4b-ph-k-s-lf-sn/header-side-entry-4way/dp/9492488</a>                  |
| <b>Surface mount</b>  |   |                       |  |
| <b>Pcb part straight</b>  | <a href="#">9491929</a>   | B4B-PH-SM4-TB(LF)(SN) | <a href="http://nl.farnell.com/jst-japan-solderless-terminals/b4b-ph-sm4-tb-lf-sn/header-top-entry-smd-4way/dp/9491929">http://nl.farnell.com/jst-japan-solderless-terminals/b4b-ph-sm4-tb-lf-sn/header-top-entry-smd-4way/dp/9491929</a>      |
| <b>Pcb part 90 degree smd</b>   | <a href="#">9492631</a>   | S4B-PH-SM4-TB(LF)(SN) | <a href="http://nl.farnell.com/jst-japan-solderless-terminals/s4b-ph-sm4-tb-lf-sn/header-side-entry-smd-4way/dp/9492631">http://nl.farnell.com/jst-japan-solderless-terminals/s4b-ph-sm4-tb-lf-sn/header-side-entry-smd-4way/dp/9492631</a>    |
| <b>Pcb part straight high type</b>  | -   | BH4B-PH(LF)(SN)       | <a href="http://www.jst-mfg.com/product/detail_e.php?series=200">http://www.jst-mfg.com/product/detail_e.php?series=200</a><br><a href="http://www.jst-mfg.com/product/pdf/eng/ePH-H.pdf">http://www.jst-mfg.com/product/pdf/eng/ePH-H.pdf</a> |

|   |   |  |   |
|---|---|--|---|
|  |  |  |  |
| TH top entry  | TH side entry   | SMT top entry  | SMT side entry  |

## VE.Direct cable

For the VE.Direct cable a molded part was created to make it more durable. There is a straight and 90 degree angle model. See pictures below.



## Document history

| Version | Date              | Changes  |
|---------|-------------------|--|
| 1       | 24 April 2008     | Document created.  |
| 1.1     | 05 May 2008       | Added historical information for the starter battery.<br>Added alarm and relay state information.  |
| 1.2     | 16 May 2008       | Added the part number for the serial to TTL cable.   |
| 2.0     | 16 June 2008      | Added a checksum field to the protocol, and removed the ETX framing character.   |
| 2.1     | 05 May 2009       | Added details on which RS232 connections must be implemented by the monitoring application.  |
| 2.2     | 24 June 2009      | Updated to reflect the change in product naming.   |
| 2.3     | 01 December 2009  | Added BMV-600S and field BMV, FW and AR  |
| 2.4     | 12 April 2011     | Renamed the protocol and document to BMV Text Protocol   |
| 2.5     | 16 October 2012   | Added details on On/Off vs ON/OFF for Relay and Alarm state  |
| 3.0     | 31 June 2013      | Document changed to be the VE.Direct specification document  |
| 3.1     | 16 August 2013    | Added BMV-70x alarms<br>Added detailed field description paragraph<br>Description of release candidates in FW field  |
| 3.2     | 7 February 2014   | Removed fields H13 and H14 from BMV-70x  |
| 3.3     | 24 March 2014     | Added history fields (HS* and HDn*) for the MPPT chargers.   |
| 3.4     | 22 May 2014       | Updated product id list (PID)  |
| 3.5     | 3 July 2014       | Added error 119 in the error code table (ERR)  |
| 3.6     | 30 July 2014      | Changed HDnYP> HdnY, HdnYC> HDnC, added HSdS   |
| 3.7     | 11 September 2014 | Text protocol I=Battery current, CS=Charger state.<br>Added remark HS*, HDn* are available since v1.15.<br>Added IL (load current)                                       |
| 3.8     | 24 September 2014 | Updated physical connection section<br>Removed HDn*, HS* sections, moved to HEX protocol<br>Updated HSdS description.  |
| 3.9     | 30 September 2014 | Reworded some sentences to make them more clear and changed footnote sign to numbers.<br><del>H19..H23 deprecated since v1.16</del> , HSdS will be available since v1.16 |
| 3.10    | 6 November 2014   | ERR section, added note 2 regarding error 21.  |
| 3.11    | 7 November 2014   | ERR section, updated note 2 regarding error 21.  |
| 3.12    | 9 December 2014   | H19..H23 will remain present   |
| 3.13    | 29 January 2015   | Added chapter 'Implementation guidelines'  |
| 3.14    | 25 March 2015     | Fields table: removed deprecated for fields H19..H23   |
| 3.15    | 1 May 2015        | Updated charger error code table (ERR)   |
| 3.16    | 9 July 2015       | Added information about connector types  |
| 3.17    | 20 July 2015      | Updated whitepaper url in the introduction section   |
| 3.18    | 20 August 2015    | Added links to open source page and vedirect faq   |
| 3.19    | 25 February 2016  | Updated PID section (MPPT models)<br>Relay field now also available in SmartSolar models   |
| 3.20    | 14 March 2016     | Updated with Phoenix Inverter textmode fields  |
| 3.21    | 1 April 2016      | Mention Asynchronous HEX-messages.<br>Added VE.Direct to RS232 interface cable.  |
| 3.22    | 28 September 2016 | Swapped RX & TX in the pinout  |
| 3.23    | 2 October 2017    | Added pin information for VE.Direct to RS232 interface   |
| 3.24    | 22 March 2018     | Added PIDs for 120V + 800VA + 1200VA inverters and new Smart Solar chargers  |
| 3.25    | 10 September 2018 | Added tracker information (MPPT)   |

| Version | Date              | Changes   |
|---------|-------------------|---|
| 3.26    | 27 November 2018  | <p>Added for Smart Phoenix Inverters:</p> <ul style="list-style-type: none"> <li>• PIDs for Smart Inverters 1600/2000VA - 230Vac</li> <li>• Support of hibernate mode</li> <li>• Relay description</li> <li>• Label AC_OUT_S</li> <li>• Label OR (off reason)</li> <li>• Label CAP_BLE</li> </ul> <p>Added Phoenix Smart Chargers:</p> <ul style="list-style-type: none"> <li>• Labels V2,V3,I2,I3 and FWE</li> <li>• Added FWE description</li> </ul> <p>Added SmartSolar MPPT VE.Can product ids.<br/>Update descriptions of CS, MODE and ERR fields.</p> |
| 3.27    | 11 September 2019 | <p>Update Supported Text-mode fields table:</p> <ul style="list-style-type: none"> <li>• OR filed was added to the SmartSolar since firmware version v1.44 (VE.Direct chargers) and v1.03 (SmartSolar MPPT VE.Can chargers)</li> </ul>  |
| 3.28    | 26 February 2020  | <p>Added new PIDs for SmartSolars and BlueSolars</p> <ul style="list-style-type: none"> <li>• From 0xA066 to 0xA071</li> <li>• From 0xA10B to 0xA116</li> </ul> <p>Changed maximum number of fields in a block, on the text protocol, from 18 to 22.</p>  |
| 3.29    | 20 July 2020      | Add FAQ URL to chapter "Data integrity"   |
| 3.30    | 01 February 2021  | Update introduction explaining new behaviour of Text-mode on newer implementations.   |
| 3.31    | 04 March 2021     | Update Physical interface description text.   |
| 3.32    | 30 June 2021      | <p>Added label MON</p> <p>Added new PIDs for BMV-71x and SmartShunt</p>   |
| 3.33    | 06 June 2023      | <p>Added new PIDs for MPPT chargers (from 0xA072 to 0xA07F and 0xA117)</p> <p>Added new text fields intended for any DC input information:</p> <ul style="list-style-type: none"> <li>• DC_IN_V</li> <li>• DC_IN_I</li> <li>• DC_IN_P</li> </ul> <p>Added new Smart BuckBoost:</p> <ul style="list-style-type: none"> <li>• Added to the PID list (0xA3F0)</li> <li>• Added to the Fields table</li> <li>• Fields used: PID, FEW, SER#, V, I, P, DC_IN_V, DC_IN_I, DC_IN_P, CS, OR, ERR.</li> </ul>   |