VE.Direct Protocol

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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: http://www.victronenergy.com/support-and-downloads/whitepapers.

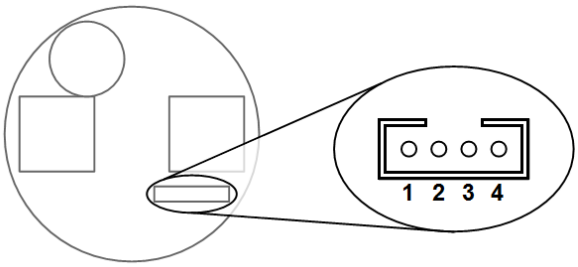
The VE.Direct interface includes two modes: Text-mode and the HEX-mode. The purpose of the Text-mode is to make retrieving information extremely simple. The product will periodically transmit all run-time fields. The HEX-mode allows not only to read data but also write data, for example, change settings.

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.

This document currently describes only the Text-mode. It will be expanded to include the HEX-mode information.

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	Function
1	GND
2	VE.Direct-TX
3	VE.Direct-RX
4	Power +

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.

Serial port configuration

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

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Message format

The device transmits blocks of data in 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.

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

The units used by the serial interface are as follows:

Label	Units	Description	BMV600	BMV700	MPPT*
V	mV	Main (battery) voltage	•	•	•
VS	mV	Auxiliary (starter) voltage	•	•	
VM	mV	Mid-point voltage of the battery bank		•	
DM	‰	Mid-point deviation of the battery bank		•	
VPV	mV	Panel voltage			•
PPV	W	Panel power			•
I	mA	Current	•	•	•
T	°C†	Battery temperature		•	
P	W	Instantaneous power		•	
CE	mAh‡	Consumed Amp Hours	•	•	
SOC	‰‡	State-of-charge	•	•	
TTG	Minutes‡§	Time-to-go	•	•	

* The VE.Direct protocol is available in the MPPT 70/15 from firmware version v1.09 and up, and only in newer type MPPT 70/15's. Note that the chargers with product id 0x300 will not support the full protocol (only PID, SER and FW).

† When no temperature sensor is connected, "---" will be sent instead of a value.

‡ When the BMV is not synchronised, these statistics have no meaning, so "---" will be sent instead of a value.

§ When the battery is not discharging the time- to-go is infinite. This is represented as -1.

Label	Units	Description	BMV600	BMV700	MPPT*
Alarm		Alarm condition active	•	•	
Relay		Relay state	•	•	
AR		Alarm reason	•	•	
LOAD		Load output state			•
H1	mAh	Depth of the deepest discharge	•	•	
H2	mAh	Depth of the last discharge	•	•	
H3	mAh	Depth of the average discharge	•	•	
H4		Number of charge cycles	•	•	
H5		Number of full discharges	•	•	
H6	mAh	Cumulative Amp Hours drawn	•	•	
H7	mV	Minimum main (battery) voltage	•	•	
H8	mV	Maximum main (battery) voltage	•	•	
H9	Seconds	Number of seconds since last full charge	•	•	
H10		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	Minimum auxiliary (battery) voltage	•	•	
H16	mV	Maximum auxiliary (battery) voltage	•	•	
H17	0.01 kWh	Amount of discharged energy		•	
H18	0.01 kWh	Amount of charged energy		•	
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		Converter state			•
BMV		Model description	•	•	
FW		Firmware version	•	•	•
PID		Product ID		•	•
SER#		Serial number			•
HSEi		Last error (i=0..3)			•
HSYU	0.01 kWh	Yield total (user resettable counter)			•
HSYS	0.01 kWh	Yield total (non resettable counter)			•
HSVPV	mV	Maximum panel voltage			•
HSV	mV	Maximum battery voltage			•
HSDS		Day sequence number (0..364)			•
HDnY	0.01 kWh	Yield (n=day)			•
HDnC	0.01 kWh	Consumed (n=day)			•
HDnV	mV	Maximum battery voltage (n=day)			•
HDnVL	mV	Minimum battery voltage (n=day)			•
HDnEi		Last error (i=0..3, n=day)			•
HDnTB	Minutes	Time in Bulk (n=day)			•
HDnTA	Minutes	Time in Absorption (n=day)			•
HDnTF	Minutes	Time in Float (n=day)			•
HDnPPV	W	Maximum power (n=day)			•

** Deprecated since version 1.15, use the HSYU, HD0Y, HD0PPV, HD1Y, HD1PPV equivalents instead.

Label	Units	Description	BMV600	BMV700	MPPT*
HDnI	mA	Maximum battery current (n=day)			•
HDnVPV	mV	Maximum panel voltage (n=day)			•

Table I Supported Text-mode fields

Detailed field description

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 of the BMV. During normal operation, this will be "OFF". When a relay alarm occurs the value will change to "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

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.

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

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

LOAD

This shows the load output state of the MPPT charger. When the load output is active it will show "ON", when the load is switched off (e.g. short circuit or battery voltage too low) it will show "OFF". Note that the LOAD item is only available on charger models that have a load output.
Note: This field is available in the MPPT charger since version 1.12

PID

The product id:

BMV-700	0x203
BMV-702	0x204
BMV-700H	0x205
MPPT 70/15	0x300

MPPT 75/15 (*)	0xA042
MPPT 100/15	0xA043
MPPT 100/30	0xA044
MPPT 150/35	0xA041
MPPT 75/50	0xA040
MPPT 100/50	0xA045

(*)The difference between 0x300 and 0xA042 is the memory size of the microcontroller. The 0xA042 has more memory.

CS

The converter state of the charger. See the table below for the possible values.

Off	0
Fault	2
Bulk	3
Absorption	4
Float	5

ERR / HSEi / HDnEi

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

No error	0
Battery temperature too high	1
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
Input voltage too high (solar panel)	33
Input current too high (solar panel)	34
Factory calibration data lost	116
Invalid/incompatible firmware	117
User settings invalid	119

Note for HS* and HDn* fields: The n index in the HDn fields is used to indicate the day, where 0=today, 1=yesterday up to 30 days ago. The i index in the HSEi and HDnEi is used to indicate the error event history, where 0=the most recent error up to 3 errors ago.

SER#

The serial number of the charger. The notation is LLYYMMSSSSS, where LL=location code, YYWW=production datestamp (year, week) and SSSSS=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.
Note: This field is available in the BMV since version 2.08. It is also deprecated, refer to the field PID instead.

Document history

Version	Date	Changes
1	24 April 2008	Document created.
1.1	05 May 2008	Added historical information for the starter battery. 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 Added detailed field description paragraph 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

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