RESOL VBus Protocol Specification

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1. VBus protocol

The VBus protocol is used by our solar controllers like EL1, MIDI Pro and DeltaSol Pro for communication purposes. This document specifies the general structure and some device-specific extensions to this protocol.

1.1. Physical layer

The data are received using the asynchronous serial (COM) port of a PC. The serial port parameters are: 9600 baud, 1 start, 8 data and 1 stop bit, no parity and no handshake. Our bus is a single-master system because we have no possibility to recognise and/or repair collisions if two modules send at the same time. The solar controller is always the master, that means that not more than one regulator can be connected to one VBus. Optionally connected modules are only allowed to send if this is requested by the master.

1.2. Common structure

The most important point of the V-Bus protocol is the special meaning of every byte's MSB (most significant bit). This bit must always be reset with only one exception: a special synchronisation byte used to initiate a new communication, which has the value 0xAA. If a byte with set MSB is received during the communication cycle, the ongoing reception is canceled and all received data is discarded.
The most important aspect of the VBus protocol is the spezial meaning of the MSBs (Most Significant Bits) of each byte that is to be transmitted. With only exception all bytes must have the MSB cleared. The exception mentioned is the synchronization byte which initiated the communication cycle. The synchronization byte has the value of 0xAA. If a byte with MSB set is received during normal communication and it is no synchronization byte the communication cycle is canceled and the received data is discarded. The general structure is as follows:

synchronization byte
header
frame 1
frame 2
...

Table 1: Common Structure

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1.2.1. Header

The header contains all necessary information about source, destination and length of the following message.

destination address (low byte)
destination address (high byte)
source address (low byte)
source address (high byte)
protocol version
command (low byte)
command (high byte)
frame count
header CRC

Tabelle 2: Structure of VBus header

destination address (low- and highbyte): address of the module which should receive the message
source address (low- and highbyte): address of the module which sent the message
protocol version: version of the VBus protocol (0x10 for version 1.0 at the moment)
command (kow- and highbyte): device-dependent command
frames count: number of frames attached to this header
header CRC: checksum for integrity verification; is computed by binary inverting the sum of all header bytes, beginning with the destination address (the MSB is cleared)

1.2.2. Frames

The frames allow the transmission of extra data after the header. They contain device-specific information which are described below.
To work around the restriction that all MSB must be cleared these bits are stored in a separate byte. The general structure is illustrated in the following table:

frame byte 1
frame byte 2
frame byte 3
frame byte 4
septett
frame CRC

Table 3: Structure of VBus frame

frame byte 1: contains the first data byte; the MSB is stored in bit 0 of the septett byte
frame byte 2 contains the second data byte; the MSB is stored in bit 1 of the septett byte
frame byte 3 contains the third data byte; the MSB is stored in bit 2 of the septett byte
frame byte 4 contains the fourth data byte; the MSB is stored in bit 3 of the septett byte
septett: storage for data byte MSBs
frame CRC: checksum for integrity verification; is computed by inverting the sum of all frame bytes (MSB is cleared)

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1.2.3. Sample communication

This sample communication demonstrates the usage of the protocol. It shows a request of the Midi Pro to an MSR-44 module and the response. This sample illustrates the structure of the messages and not their content which is described later on.

Header	0xAA	sync byte
	0x11	destination address (low byte)
	0x44	destination address (high byte)
	0x10	source address (low byte)
	0x66	source address (high byte)
	0x10	protocol version
	0x00	command (low byte)
	0x02	command (high byte)
	0x01	frames count
	0x21	header CRC
1. data frame	0x07	frame byte 1
	0x04	frame byte 2
	0x0F	frame byte 3
	0x00	frame byte 4
	0x00	septet byte
	0x65	frame CRC

Table 4: communication MIDI Pro → MSR-44

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	0xAA	sync byte
Header	0x10	destination address (low byte)
	0x66	destination address (high byte)
	0x11	source address (low byte)
	0x44	source address (high byte)
	0x10	protocol version
	0x00	command (low byte)
	0x01	command (high byte)
	0x04	frames count
		header CRC
1. data frame	0x0F	frame byte 1
	0x0F	frame byte 2
	0x00	frame byte 3
	0x00	frame byte 4
	0x00	septet byte
	0x61	frame CRC
2. data frame	0x38	frame byte 1
	0x22	frame byte 2
	0x38	frame byte 3
	0x22	frame byte 4
	0x05	septet byte
	0x46	frame CRC
3. dataframe	0x38	frame byte 1
	0x22	frame byte 2
	0x38	frame byte 3
	0x22	frame byte 4
	0x05	septet byte
	0x46	frame CRC
4. data frame	0x00	frame byte 1
	0x00	frame byte 2
	0x00	frame byte 3
	0x00	frame byte 4
	0x00	septet byte
	0x7F	frame CRC

Table 5: communication MSR-44 → MIDI Pro

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1.2.4. Used Addresses

The fields of destination and source address of the messages's header contains information about sender and recipient. The combination of the addresses and the command specify the content of the attached frames.
The structure of the addresses is as follows:

4	0	1	5
sensor count	relay count	number to distinguish module with same sensor and relay count	sub address of module if more than one can be on the bus

Table 6: Structure of address

The module in the example above has 4 sensors, no relay and the sub address 5. Addresses beginning with 401 belong to the WMZ-M1 module. A complete list can be found below:

Address (high byte)	Address (low byte)	Module
00	1X	DFA
00	2X	Computer
32	1X	EL1
32	2X	DELTASol Pro
40	1X	WMZ-M1
44	1X	MSR-44
52	1X	DELTASol Plus
55	1X	EL2/3
66	1X	MIDI Pro
73	1X	DELTASOL M
74	1X	DELTASOL ES

Table 7: Used Addresses

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1.2.5. Command

There are three basic commands used:

Command (high byte)	Command (low byte)	Description
01	00	message contains data
02	00	message contains data, waiting for response
03	00	requesting response

Table 8: Commands

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1.3. Device-specific information

This chapter decribes the device-specific information that is stored in the message's frames.

1.3.1. DELTASol Pro / DeltaSol BS3 Version VBus

1.3.1.1. DELTASol Pro→DFA (Command 0x0100)

1. Frame	temperature sensor 1 (low byte)
	temperature sensor 1 (high byte)
	temperature sensor 2 (low byte)
	temperature sensor 2 (high byte)
2. Frame	temperature sensor 3 (low byte)
	temperature sensor 3 (high byte)
	speed relay 1
	speed relay 2
3.Frame	R-Flags 1
	R-Flags 2
	error
	[frei]
4. Frame	runtime relay 1 (low byte)
	runtime relay 1 (high byte)
	runtime relay 2 (low byte)
	runtime relay 2 (high byte)

Table 9: DELTASol Pro→DFA

temperature sensors 1 to 3: measured values from sensors 1 to 3 in 0,1°C
speed relay 1 and 2: speed+ in %
R-Flags 1 and 2: program internal flags
Error: program internal flag
runtime relay 1 and 2: runtime of both pumps in hours

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1.3.2. WMZ-M1 / WMZ

1.3.2.1. Regulator→WMZ-M1 / WMZ (Command 0x0300)

No frames are sent.

1.3.2.2. WMZ-M1 /WMZ →Regulator (Command 0x0100)

1. Frame	heat kWh (low byte)
	heat kWh (high byte)
	heat Wh (low byte)
	heat Wh (high byte)
2. Frame	volume (low byte)
	volume (high byte)
	power (low byte)
	status byte
3. Frame	temperature T_{flow} (low byte)
	temperature T_{flow} (high byte)
	temperature T_{return} (low byte)
	temperature T_{return} (high byte)
4. Frame	heat MWh (low byte)
	heat MWh (high byte)
	power (high byte)
	glycol

Table 10: WMZ-M1/ WMZ →Regulator (Command 0x0100)

Heat MWh, kWh, Wh: (ranging 0-999)
volume: in 0,01 m³/h
power: in 0,01 kW
status byte: bit 0: WMZ bit (a new kWh was accumulated)
bit 1: error sensor 1
bit 2: error sensor 2
bit 3: error EEPROM
bit 4: impuls of volume sensor
Tflow, Treturn: measured values on sensors 1 and 2 in 0,1°C
Glycol: type of freeze protection liquid

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1.3.3. DeltaSol BS Plus

1.3.3.1. DeltaSol BS Plus => DFA (0x4221 => 0x0010, Befehl 0x0100)

1. Frame	S1 (Lowbyte)
	S1 (Highbyte)
	S2 (Lowbyte)
	S2 (Highbyte)
2. Frame	S3 (Lowbyte)
	S3 (Highbyte)
	S4 (Lowbyte)
	S4 (Highbyte)
3. Frame	Speed Relay 1
	Speed Relay 2
	Relaymask
	Errormask
4. Frame	System time (Lowbyte)
	System time (Highbyte)
	Scheme
	Options mask
5. Frame	Runtime relay 1 (Lowbyte)
	Runtime relay 1 (Highbyte)
	Runtime relay 2(Lowbyte)
	Runtime relay 2 (Highbyte)
6. Frame	Heat quantity in Wh (Lowbyte)
	Heat quantity in Wh (Highbyte)
	Heat quantity in kWh (Lowbyte)
	Heat quantity in kWh (Highbyte)
7. Frame	Heat quantity in MWh (Lowbyte)
	Heat quantity in MWh (Highbyte)
	Version (Lowbyte)
	Version (Highbyte)

Table 11: DeltaSol BS Plus => DFA (command 0x0100)

temperature sensors 1 to 4: measured values from sensors 1 to 4 in 0,1°C
speed relay 1 and 2: speed+ in %
runtime relay 1 and 2: runtime of relays in hours

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1.3.4. DeltaSol M

1.3.3.1. Regulator (Address 0x7311) o DFA (Command 0x0100)

1. Frame	S1 (Lowbyte)
	S1 (Highbyte)
	S2 (Lowbyte)
	S2 (Highbyte)
2. Frame	S3 (Lowbyte)
	S3 (Highbyte)
	S4 (Lowbyte)
	S4 (Highbyte)
3. Frame	S5 (Lowbyte)
	S5 (Highbyte)
	S6 (Lowbyte)
	S6 (Highbyte)
4. Frame	S7 (Lowbyte)
	S7 (Highbyte)
	S8 (Lowbyte)
	S8 (Highbyte)
5. Frame	S9 (Lowbyte)
	S9 (Highbyte)
	S10 (Lowbyte)
	S10 (Highbyte)
6. Frame	S11 (Lowbyte)
	S11 (Highbyte)
	S12 (Lowbyte)
	S12 (Highbyte)
7. Frame	Irradiation in W/m² (Lowbyte)
	Irradiation in W/m² (Highbyte)
	[not used]
	[not used]
8. Frame	Pulse counter 1 (Bit 2_0 - 2_7)
	Pulse counter 1 (Bit 2_8 - 2_{15})
	Pulse counter 1 (Bit 2_{16} - 2_{23})
	Pulse counter 1 (Bit 2_{24} - 2_{31})
9. Frame	Pulse counter 2 (Bit 2_0 - 2_7)
	Pulse counter 2 (Bit 2_8 - 2_{15})
	Pulse counter 2 (Bit 2_{16} - 2_{23})
	Pulse counter 2 (Bit 2_{24} - 2_{31})

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10. Frame	Errormask sensor open (Lowbyte)
	Errormask sensor open (Highbyte)
	Errormask sensor short circuit (Lowbyte)
	Errormask sensor short circuit (Highbyte)
11. Frame	Sensormask (Lowbyte)
	Sensormask (Highbyte)
	[not used]
	[not used]
12. Frame	Speed Relais 1
	Speed Relais 2
	Speed Relais 3
	Speed Relais 4
13. Frame	Speed Relais 5
	Speed Relais 6
	Speed Relais 7
	Speed Relais 8
14. Frame	Speed Relais 9
	Speed Relais 10
	Speed Relais 11
	Speed Relais 12
15. Frame	[not used]
	[not used]
	Relaymask (Lowbyte)
	Relaymask (Highbyte)
16. Frame	Errormask (Lowbyte)
	Errormask (Highbyte)
	Warningmask (Lowbyte)
	Warningmask (Highbyte)
17. Frame	Version
	Revision
	System time (Lowbyte)
	System time (Highbyte)

Table 12: DELTASol M • DFA (Command 0x0100)

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1.3.3.2. Heat circuit module 1 (Adress 0x7312) o DFA (Command 0x0100)

(When option Heat circuit module 1 is active)

1. Frame	Flow temperature (Lowbyte)
	Flow temperature (Highbyte)
	Remote control (Lowbyte)
	Remote control (Highbyte)
2. Frame	Outside temperature (Lowbyte)
	Outside temperature (Highbyte)
	Storage tank temperature (Lowbyte)
	Storage tank temperature (Highbyte)
3. Frame	Target flow temperature (Lowbyte)
	Target flow temperature (Highbyte)
	Relaymask
	[not used]

Table 13: HC-Module 1 o Regulator (Command 0x0100)

1.3.3.3. HC-Module 2 (Command 0x7313) o DFA (Command 0x0100)

(When option Heat circuit module 2 is active)

1. Frame	Flow temperature (Lowbyte)
	Flow temperature (Highbyte)
	Remote control (Lowbyte)
	Remote control (Highbyte)
2. Frame	Outside temperature (Lowbyte)
	Outside temperature (Highbyte)
	Storage tank temperature (Lowbyte)
	Storage tank temperature (Highbyte)
3. Frame	Target flow temperature (Lowbyte)
	Target flow temperature (Highbyte)
	Relaymask
	[not used]

Table 14: HC-Module 2 o Regulator (Command 0x0100)

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1.3.3.4. Heat quantity measurement 1 (Address 0x7316) o DFA (Command 0x0100)

(When option Heat quantity measurement 1 is active)

1. Frame	Flow temperature (Lowbyte)
	Flow temperature (Highbyte)
	Return temperature (Lowbyte)
	Return temperature (Highbyte)
2. Frame	Flow rate (Lowbyte)
	Flow rate (Highbyte)
	Heat quantity Wh (Lowbyte)
	Heat quantity Wh (Highbyte)
3. Frame	Heat quantity kWh (Lowbyte)
	Heat quantity kWh (Highbyte)
	Heat quantity MWh (Lowbyte)
	Heat quantity MWh (Highbyte)

Table 15 HQM-Module1oRegulator (Command 0x0100)

1.3.3.5. Heat quantity measurement 2 (Address 0x7317) o DFA (Command 0x0100)

(When option Heat quantity measurement 2 is active)

1. Frame	Flow temperature (Lowbyte)
	Flow temperature (Highbyte)
	Return temperature (Lowbyte)
	Return temperature (Highbyte)
2. Frame	Flow rate (Lowbyte)
	Flow rate (Highbyte)
	Heat quantity Wh (Lowbyte)
	Heat quantity Wh (Highbyte)
3. Frame	Heat quantity kWh (Lowbyte)
	Heat quantity kWh (Highbyte)
	Heat quantity MWh (Lowbyte)
	Heat quantity MWh (Highbyte)

Table 16 HQM-Module2oRegulator (Command 0x0100)

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1.3.5. DeltaSol ES

1.3.5.1. DeltaSol ES (0x7411) →DFA (command 0x0100)

1. Frame	Temperature Sensor 1 (Lowbyte)
	Temperature Sensor 1 (Highbyte)
	Temperature Sensor 2 (Lowbyte)
	Temperature Sensor 2 (Highbyte)
2. Frame	Temperature Sensor 3 (Lowbyte)
	Temperature Sensor 3 (Highbyte)
	Temperature Sensor 4 (Lowbyte)
	Temperature Sensor 4 (Highbyte)
3. Frame	Temperature Sensor 5 (Lowbyte)
	Temperature Sensor 5 (Highbyte)
	Temperature Sensor 6 (Lowbyte)
	Temperature Sensor 6 (Highbyte)
4. Frame	Temperature Sensor 7 (Lowbyte)
	Temperature Sensor 7 (Highbyte)
	Temperature Sensor 8 (Lowbyte)
	Temperature Sensor 8 (Highbyte)
5. Frame	Pulse counter (Lowbyte)
	Pulse counter (Highbyte)
	Irradiation (Lowbyte)
	Irradiation (Highbyte)
6. Frame	Relaybyte
	Speed Relais 1
	Speed Relais 2
	Speed Relais 3
7. Frame	System time (Lowbyte)
	System time (Highbyte)
	System scheme
	Options
8. Frame	Hours of operation Relais 1 (Lowbyte)
	Hours of operation Relais 1 (Highbyte)
	Hours of operation Relais 2 (Lowbyte)
	Hours of operation Relais 2 (Highbyte)
9. Frame	Hours of operation Relais 3 (Lowbyte)
	Hours of operation Relais 3 (Highbyte)
	Hours of operation Relais 4 (Lowbyte)
	Hours of operation Relais 4 (Highbyte)

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10. Frame	Hours of operation Relais 5 (Lowbyte)
	Hours of operation Relais 5 (Highbyte)
	Hours of operation Relais 6 (Lowbyte)
	Hours of operation Relais 6 (Highbyte)
11. Frame	Heat quantity Wh (Lowbyte)
	Heat quantity Wh (Highbyte)
	Heat quantity kWh (Lowbyte)
	Heat quantity kWh (Highbyte)
12. Frame	Heat quantity MWh (Lowbyte)
	Heat quantity MWh (Highbyte)

Table 17: DeltaSol ES (0x7411) →DFA (command 0x0100)

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1.3.6. FriWa

1.3.6.1. FriWa => DFA (0x7611 => 0x0010, command 0x0100)

1. Frame	S1 (Lowbyte)
	S1 (Highbyte)
	S2 (Lowbyte)
	S2 (Highbyte)
2. Frame	S3 (Lowbyte)
	S3 (Highbyte)
	S4 (Lowbyte)
	S4 (Highbyte)
3. Frame	S5 (Lowbyte)
	S5 (Highbyte)
	S6 (Lowbyte)
	S6 (Highbyte)
4. Frame	S7 (Lowbyte)
	S7 (Highbyte)
	S8 (Lowbyte)
	S8 (Highbyte)
5. Frame	S9 (Lowbyte)
	S9 (Highbyte)
	System time (Lowbyte)
	System time (Highbyte)
6. Frame	Speed Relais 1
	Speed Relais 2
	Relay status
	Sensor defects
7. Frame	Temperature hot water
	Options
	<internal>
	<internal>
8. Frame	Heat quantity Wh (Lowbyte)
	Heat quantity Wh (Highbyte)
	Heat quantity kWh (Lowbyte)
	Heat quantity kWh (Highbyte)
9. Frame	Heat quantity MWh (Lowbyte)
	Heat quantity MWh (Highbyte)
	Number of version
	Number of revision

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