VALLOX DIGIT bus protocol

Translated April 11 2021 from the Finish document written by Vallox/Petteri Kähärä
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Also valid for Helios KWL, with additional comments in Annex B

1 Common

DIGIT's communication between the modules is based on a bus implemented with a secure twisted pair, where the communication takes place as RS 485 serial communication. The RS 485 design allows a maximum of 32 modules, each containing both a transmitter and a receiver.

2. Data transmission

DIGIT communication is based on two-way RS 485 serial communication.

9600 bps, no parity (N), 8 data bits, 1 STOP bit.

3. Protocol

3.1 Request / response service principle

The structure of the request / response principle is shown in Figure 1. The module requesting information (requester) determines from which module the information is desired by setting the content of the RECEIVER variable to the module address of the destination. The requester sets the contents of the REQUEST variable to 0 for the information request. What information the requester wants is indicated by setting the content of the VARIABLE variable to the address of the register from which the information is requested.

All modules (except the requester) listen on the bus and the module whose module address corresponds to the contents of the RECEIVER variable forms a response packet in which the DATA variable contains the response to the sent request. This response packet is sent back to the requester.

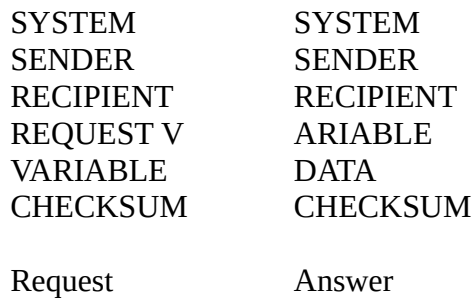

Figure 1. Updating a network variable on a request / response basis

The requester waits for a response for a maximum of 10 ms. If the answer is no. time come, send the requester the request packet again and wait again for the max. 10 ms. If 10 responses are not received during the request / wait period, the requesting module enters fault mode.

The request / response principle is used when transferring information from the recipient to the requester, for example when the remote control requests one of the setpoints from the host motherboard.

The request / reply principle is used when transferring information from the recipient to the requester, for example, when the remote control asks the host motherboard for one of the setpoints.

3.2 End-to-end acknowledged service

The structure of the send / acknowledge principle is shown in Figure 2. The module sending the information determines to which module the information is to be sent by setting the content of the RECEIVER variable to the module address of the destination. What information the sender sends is indicated by setting the contents of the VARIABLE variable to the address of the register whose information is sent. The actual information is set in the DATA variable.

All modules (except the sender) listen to the bus and the module whose module address corresponds to the contents of the RECEIVER variable acknowledges the checksum of the received packet.

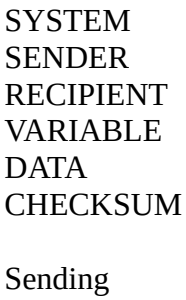

Figure 2. Updating the network variable with the send / acknowledge principle

The sender waits for an acknowledgment for a maximum of 10 ms. If the acknowledgment does not time to come, resend the packet and wait again for max. 10 ms. If 10 acknowledgments are not received during the transmission / wait period, the sending module enters fault mode.

The send / acknowledge principle is used when transferring information from the sender to the receiver, for example when the remote control sends a new setpoint to the master-motherboard.

3.3 Unacknowledged service principle

The structure of the unacknowledged transmission principle is shown in Figure 3. The module sending the information determines to which module group the information is to be sent by setting

The content of the RECIPIENT variable is the address of the target group. What information the sender sends is indicated by setting the contents of the VARIABLE variable to the address of the register whose information is sent. The actual information is set in the DATA variable.

All modules (except the sender) listen to the bus and those modules whose group address matches the content of the RECEIVER variable receive the packet without acknowledging it in any way.

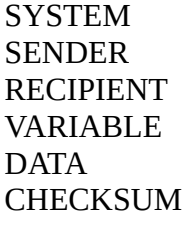

Figure 3. Updating the network variable with the unacknowledged transmission principle

The problem with the unacknowledged transmission principle is that the sender does not know if the information went to all the modules for which the information was intended. The

unacknowledged transmission principle is used when transmitting information from a sender to multiple recipients, for example, when a remote control sends a new setpoint to other remote controls and a slave motherboard.

SYSTEM: This variable can be used to isolate separate systems connected to the same bus. Available in 1H-FFH (255 pcs.). Currently implemented only 1, so forced to always set to 1.

SENDER: the variable indicates from which module the information in question comes.
11H-1FH = motherboard 1-15.
21H-2FH = remote control 1-15.
31H-FFH = reserved.

RECIPIENT: the variable indicates to which module this information comes.
10H = all motherboards.
11H-1FH = motherboard 1-15.
20H = all remote controls.
21H-2FH = remote control 1-15.
30H-FFH = reserved.

REQUEST: This variable allows the sender to request the recipient to respond to the request. must always be set to 0.

VARIABLES: The variable indicates what information is being processed.

DATA: The value of the VARIABLES variable. Possible values are described above in connection with the corresponding variable.

CHECKSUM: The sum of the previous bytes in 8-bit. The recipient of the packet himself adds the bytes before the checksum and compares it with the contents of the CHECKSUM variable. If the results do not match, the recipient rejects the received packet.

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-06H I / O port r read only

Read only! WRONG! converting more than one bit to one burns the transformer!
Speed is safely defined in variable 29H.

Fan speed relays:

bit 0 = speed 1	0 = off	1 = on	read only
bit 1 = speed 2	0 = off	1 = on	read only
bit 2 = speed 3	0 = off	1 = on	read only
bit 3 = speed 4	0 = off	1 = on	read only
bit 4 = speed 5	0 = off	1 = on	read only
bit 5 = speed 6	0 = off	1 = on	read only
bit 6 = speed 7	0 = off	1 = on	read only
bit 7 = speed 8	0 = off	1 = on	read only

- 07H I / O port

bit 5 = reheating	0 = off	1 = on	read only

- 08H I / O port

bit 1 = damper motor position	0 = winter	1 = summer	read only
bit 2 = fault information relay	0 = open	1 = closed	read only
bit 3 = input fan	0 = on	1 = off	
bit 4 = preheating	0 = off	1 = on	read only
bit 5 = exhaust fan	0 = on	1 = off	
bit 6 = fireplace / boost switch	0 = open	1 = closed	read only

- 29H CURRENT FAN SPEED

Allowed values:
01H = speed 1
03H = speed 2
07H = speed 3
0FH = speed 4
1FH = speed 5
3FH = speed 6
7FH = speed
FFH = speed 8

- 2AH MAXIMUM CURRENT MEASURED MOISTURE CONTENT read only
33H = 0% RH FFH = 100% RH calculation formula: (x-51) / 2.04

- 2BH CURRENT CURRENT MEASURED CO2 CONCENTRATION upper byte read only
The CO2 concentration in 16-bit upper byte directly indicates the concentration in PPM

- 2CH MAXIMUM CURRENT MEASURED CO2 CONCENTRATION lower only read only
The CO2 concentration in 16-bit subbyte directly indicates the concentration in PPM

- 2DH CO2 SENSORS INSTALLED ON THE MACHINE read only

bit 1 = sensor 1	0 = not installed	1 = installed
bit 2 = sensor 2	0 = not installed	1 = installed
bit 3 = sensor 3	0 = not installed	1 = installed
bit 4 = sensor 4	0 = not installed	1 = installed
bit 5 = sensor 5	0 = not installed	1 = installed

- 2EH MILLAMPER / VOLTAGE MESSAGE read only
Current mA / voltage message to the machine on a scale of 00H to FFH

- 2FH MEASURED% RH CONCENTRATION FROM SENSOR 1 read only
33H = 0% RH FFH = 100% RH calculation formula: (x-51) / 2.04

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- 30H MEASURED% RH CONCENTRATION FROM SENSOR 2 read only
  33H = 0% RH FFH = 100% RH calculation formula: (x-51) / 2.04

- 32H OUTDOOR TEMPERATURE read only
  Outdoor temperature on the NTC sensor scale.

- 33H EXHAUST TEMPERATURE read only
  Exhaust air temperature on the NTC sensor scale.

- 34H EXHAUST TEMPERATURE read only
  Exhaust air temperature on the NTC sensor scale.

- 35H SUPPLY AIR TEMPERATURE read only
  Supply air temperature on the NTC sensor scale.

- 36H FAULT CONDITION ERROR NUMBER read only
  The number of the last fault
  05H = Supply air sensor fault
  06H = Carbon dioxide alarm
  07H = Outdoor sensor fault
  08H = Exhaust air sensor fault
  09H = Danger of the water coil freezing
  0AH = Exhaust air sensor fault

- 55H POST HEATING ON COUNTER
  Post-heating on time in seconds, counter.
  as a percentage: X / 2.5

- 56H POST HEATING OFF TIME
  Post-heating off-time in seconds, counter.
  as a percentage: X / 2.5

- 57H POST HEATING TARGET VALUE read only
  Target temperature of the air blown into the ventilation zone on the NTC sensor scale.

- 6DH FLAGS 2 flag variables r read only

bit 0 = CO2 higher speed request	0 = no others.	1 = speed. up
bit 1 = CO2 lower speed request	0 = no others.	1 = speed. down
bit 2 =% RH lower speed request	0 = no others.	1 = speed. down
bit 3 = switch lower speed request	0 = no others.	1 = speed. Down
bit 6 = CO2 alarm	0 = no others.	1 = CO2 alarm
bit 7 = cell freeze alarm	0 = no others.	1 = risk of freezing

- 6FH FLAGS 4 flag variables read only

bit 4 = risk of water coil freezing	0 = no others.	1 = risk of freezing
bit 7 = slave / master selection	0 = slave	1 = master

- 70H FLAGS 5 flag variables

bit 7 = preheating status flag	0 = on	1 = off

- 71H FLAGS 6 flag variable

bit 4 = remote control	0 = not working.	1 = function.	read only
bit 5 = activating the fireplace switch	read the variable and set this to one		
bit 6 = fireplace / boost function	0 = not working.	1 = function.	read only

- 79H FIREPLACE / POWER SWITCH COUNTER r read only
  Remaining time of the function in minutes, descending

- 8FH TRANSMISSION ALLOWED ONLY IN WRITING
  The modules are allowed to send data to the RS-485 bus. DATA = always 0.

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- 91H TRANSMISSION PROHIBITED write only
  Modules are prohibited from sending data to the RS-485 bus. DATA = always 0.

- A3H SELECT VARIABLES: INDICATOR LIGHTS

bit 0 = Power key	0 = off	1 = on	
bit 1 = CO2 key	0 = off	1 = on	
bit 2 =% RH key	0 = off	1 = on	
bit 3 = Post Heating key	0 = off	1 = on	
bit 4 = Filter guard LED	0 = 0ff	1 = on	read only
bit 5 = Post Heating LED	0 = off	1 = on	read only
bit 6 = fault LED	0 = off	1 = on	read only
bit 7 = service reminder	0 = off	1 = on	read only

- A4H POST HEATING SETPOINT
  Post-heating target value on the NTC sensor scale.

- A5H MAX FAN SPEED
  Maximum fan speed that can be set during adjustments.
  Allowed values:
  01H = speed 1
  03H = speed 2
  07H = speed 3
  0FH = speed 4
  1FH = speed 5
  3FH = speed 6
  7FH = speed
  FFH = speed 8

- A6H SERVICE REMINDER INTERVAL
  Service reminder interval in months.

- A7H PREHEATING SWITCHING TEMPERATURE
  Preheating switching temperature on the NTC sensor scale.

- A8H SUPPLY AIR FAN STOP TEMPERATURE
  Supply air fan stop temperature on the NTC sensor scale.

- A9H BASIC FAN SPEED
  Allowed values:
  01H = speed 1
  03H = speed 2
  07H = speed 3
  0FH = speed 4
  1FH = speed 5
  3FH = speed 6
  7FH = speed
  FFH = speed 8

- AAH PROGRAM VARIABLE
  bits 0-3 adjustment interval in 4-bit

bit 4 = automatic humidity level search	0 = off	1 = on
bit 5 = boost / fireplace switch status	0 = fireplace.	1 = boost switch
bit 6 = water / radiator model	0 = electricity	1 = water
bit 7 = cascade control	0 = off 1 = on	

- ABH SERVICE REMINDER MONTHLY COUNTER
  The monthly counter of the service reminder indicates the time remaining in months for the next service alarm. Downward.

- AEH BASIC HUMIDITY LEVEL
  33H = 0% RH FFH = 100% RH calculation formula: (x-51) / 2.04

- AFH BYPASS OPERATING TEMPERATURE
  Bypass operating temperature on the NTC sensor scale.

- B0H DC SUPPLY AIR FAN CONTROL SETPOINT
  DC supply air fan control setpoint as a percentage.

- B1H DC EXHAUST FAN CONTROL SETPOINT
  DC exhaust fan control setpoint as a percentage.

- B2H CELL ANTI-FREEZE TEMPERATURE HYSTERESIS
  Hysteresis of cell antifreeze temperatures, 03H ≅ 1 ° C.

- B3H CARBON DIOXIDE CONTROL SETPOINT 16 BIT
  Carbon control control setpoint in 16-bit, the upper byte directly indicates the concentration PPM

- B4H CARBON DIOXIDE CONTROL SETPOINT 16 BIT
  Carbon control setpoint in 16-bit, lower byte directly indicates PPM concentration

- B5H VARIABLE PROGRAM2
  bit 0 = Maximum speed limit 0 = with adjustments 1 = always on

The use of variables other than those mentioned above is strictly prohibited!

ANNEX A CONVERSION TABLE: NTC SENSOR SCALE - ° C

HEX	DEC	°C	HEX	DEC	°C	HEX	DEC	°C	HEX	DEC	°C
00	0	-74	40	64	-12	80	128	9	C0	192	34
01	1	-70	41	65	-12	81	129	9	C1	193	34
02	2	-66	42	66	-12	82	130	9	C2	194	35
03	3	-62	43	67	-11	83	131	10	C3	195	35
04	4	-59	44	68	-11	84	132	10	C4	196	36
05	5	-56	45	69	-11	85	133	10	C5	197	36
06	6	-54	46	70	-10	86	134	11	C6	198	37
07	7	-52	47	71	-10	87	135	11	C7	199	37
08	8	-50	48	72	-9	88	136	11	C8	200	38
09	9	-48	49	73	-9	89	137	12	C9	201	38
0A	10	-47	4A	74	-9	8A	138	12	CA	202	39
0B	11	-46	4B	75	-8	8B	139	12	CB	203	40
0C	12	-44	4C	76	-8	8C	140	13	CC	204	40
0D	13	-43	4D	77	-8	8D	141	13	CD	205	41
0E	14	-42	4E	78	-7	8E	142	13	CE	206	41
0F	15	-41	4F	79	-7	8F	143	14	CF	207	42
10	16	-40	50	80	-7	90	144	14	D0	208	43
11	17	-39	51	81	-6	91	145	14	D1	209	43
12	18	-38	52	82	-6	92	146	15	D2	210	44
13	19	-37	53	83	-6	93	147	15	D3	211	45
14	20	-36	54	84	-5	94	148	15	D4	212	45
15	21	-35	55	85	-5	95	149	16	D5	213	46
16	22	-34	56	86	-5	96	150	16	D6	214	47
17	23	-33	57	87	-4	97	151	16	D7	215	48
18	24	-33	58	88	-4	98	152	17	D8	216	48
19	25	-32	59	89	-4	99	153	17	D9	217	49
1A	26	-31	5A	90	-3	9A	154	18	DA	218	50
1B	27	-30	5B	91	-3	9B	155	18	DB	219	51
1C	28	-30	5C	92	-3	9C	156	18	DC	220	52
1D	29	-29	5D	93	-2	9D	157	19	DD	221	53
1E	30	-28	5E	94	-2	9E	158	19	DE	222	53
1F	31	-28	5F	95	-2	9F	159	19	DF	223	54
20	32	-27	60	96	-1	A0	160	20	E0	224	55
21	33	-27	61	97	-1	A1	161	20	E1	225	56
22	34	-26	62	98	-1	A2	162	21	E2	226	57
23	35	-25	63	99	-1	A3	163	21	E3	227	59
24	36	-25	64	100	0	A4	164	21	E4	228	60
25	37	-24	65	101	0	A5	165	22	E5	229	61
26	38	-24	66	102	0	A6	166	22	E6	230	62
27	39	-23	67	103	1	A7	167	22	E7	231	63
28	40	-23	68	104	1	A8	168	23	E8	232	65
29	41	-22	69	105	1	A9	169	23	E9	233	66
2A	42	-22	6A	106	2	AA	170	24	EA	234	68
2B	43	-21	6B	107	2	AB	171	24	EB	235	69
2C	44	-21	6C	108	2	AC	172	24	EC	236	71
2D	45	-20	6D	109	3	AD	173	25	ED	237	73
2E	46	-20	6E	110	3	AE	174	25	EE	238	75
2F	47	-19	6F	111	3	AF	175	26	EF	239	77
30	48	-19	70	112	4	B0	176	26	F0	240	79
31	49	-19	71	113	4	B1	177	27	F1	241	81
32	50	-18	72	114	4	B2	178	27	F2	242	82
33	51	-18	73	115	5	B3	179	27	F3	243	86
34	52	-17	74	116	5	B4	180	28	F4	244	90
35	53	-17	75	117	5	B5	181	28	F5	245	93
36	54	-16	76	118	5	B6	182	29	F6	246	97
37	55	-16	77	119	6	B7	183	29	F7	247	100
38	56	-16	78	120	6	B8	184	30	F8	248	100
39	57	-15	79	121	6	B9	185	30	F9	249	100
3A	58	-15	7A	122	7	BA	186	31	FA	250	100
3B	59	-14	7B	123	7	BB	187	31	FB	251	100
3C	60	-14	7C	124	7	BC	188	32	FC	252	100
3D	61	-14	7D	125	8	BD	189	32	FD	253	100
3E	62	-13	7E	126	8	BE	190	33	FE	254	100
3F	63	-13	7F	127	8	BF	191	33	FF	255	100

ANNEX B Comments from translator

READ Reading a Register

A device can request a register from the master by sending

VARIABLE = 00H
DATA = <register code>

Power Off

If the master device is switched off (by setting Bit 0 (Power key) in register A3H, the master will still respond to READ

Broadcasts

The Master device (if not switched off) every 12 seconds broadcasts the important registers: 2AH 2BH 2CH 32H 33H 34H 35H, eg.:

```
01 11 20 2b 00 5d
01 11 20 2c 00 5e
01 11 20 35 94 fb
01 11 20 34 9c 02
01 11 20 32 73 d7
01 11 20 33 7a df
01 11 20 2a 29 85
```

SETTING Writing into a Register

Experiences with Helios KWL show, that for setting a register, three recipents must be addressed in a sequence:

1. RECIPIENT 020H (broadcast)
2. RECIPENT 010H
3. RECPIENT 011H
   this last message MUST be followed by sending its CECKSUM twice!

```
01 21 20 a9 1f 0a           SET A9h to 1FH
01 21 10 a9 1f fa
01 21 11 a9 1f fb fb
```

Some registers will even be written with RECIPIENT 011H **twice**:

```
01 21 20 af a0 91           SET AFH to A0H
01 21 10 af a0 81
01 21 11 af a0 82
01 21 11 af a0 82 82
```

User Terminal

The user terminal can not be switched via setting Bit 0 (Power key) in register A3H

The user terminal (here ID=2EH) requests data for its display every 6 seconds approx, eg.:

```
01 2e 11 00 a3 e3           READ A3H
01 11 2e a3 09 ec
01 2e 11 00 29 69           READ 29H
01 11 2e 29 1f 88
01 2e 11 00 35 75           READ 35H
01 11 2e 35 94 09
```

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```
01 2e 11 00 a3 e3           READ A3H
01 11 2e a3 09 ec
01 2e 11 00 71 b1           READ 71H
01 11 2e 71 00 b1
```