H1 interface developers manual

Firmware version 17.01

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Overview of solution

The H1 interface bridges the often complex communication methods with a heat pump controllers and provides access through a simple standard interface over RS-232.
The interfacing on the computer side is the same even if connected to different heat pump models.
For example, reading the radiator return temperature or setting the room temp will use the same method on IVT, NIBE, Thermia heat pumps and their different models.

The interface has hardware and software support for different connectivity with heat pumps. When interfaces are manufactured, the interfacing circuit for the relevant heat pump is implemented and the specific firmware is loaded into the controller.

Features summary

- Available in two versions. The standard using the H1-protocol or the optional using the Modbus protocol. The H1-protocol is easier to use and provides more functionality but the Modbus protocol is compatible with PLC:s and commercial equipment.
- Available with USB (standard) or RS-232 interface.
- Available in Standard cable connected model, or Raspberry PI PCB formats to fit directly on GPIO connector.
- Interface provides a generic platform to communicate with different heat pumps using the same standard protocol and parameters.
- Provides a secure and convenient way to read and write information to and from heat pump controllers.
- Interface is provided in different hardware configuration, supporting the majority of all popular heat pump models.
- Features galvanic insulation (RS-232 version), electrically separating the heat pump from the connected equipment.
- Firmware upgradable via the serial interface and Windows based upgrade program.
- A LED indicator shows status and enables for troubleshooting.
- Has support for Dallas 1-wire sensors. Up to 16 can be connected. (not supported)
- Has support for Electrical meter S0 or Led-eye connection. Up to 2 electrical meters can be connected.
- Easy clear text based protocol in clear text manageable directly from serial terminal

H1-Protocol interface type (standard)

Serial interface specifications

Interface: RS-232 or USB(serial), Modbus with RS-232 or RS-485
Baud rate: 19200
Bits: 8
Stop bits: 1
Flow control none
Protocol: H1-Proprietary as described in this manual.

Communication structure

All communication is made in plain text and all numbers are in hexadecimal format. Tests of communications can be managed from standard terminal software, such as Putty.

Data received from the interface has a two letter command structure + data and always end with chr 13 + chr 10 (Carriage Return + New Line, \r\n).
The command sent to the interface is always two capital letters followed by optional data and an ending (cr).

When powering up the interface (getting power from the heat pump) it first displays copyright information like below, followed by version information. This information is also shown at reset. You can manually reset the interface by sending the letter "!".

```
(C)2013-2017 Arandis AB, Pitea Sweden.
http://www.husdata.se
XV401028
```

The version information start with XV followed by three hexadecimal bytes.
1. Firmware/Interface variant for different heat pump types.
   Rego600, Rego400, Rego80, Rego1000, NIBE EB100, NIBE Styr2002, Thermia Diplomat, Thermia Villa.
2. Version
3. Revision

After this message is displayed, the communication with the heat pump will initialize. It can take up to 30 seconds depending on heat pump model.
The registers on the heat pump is then automatically acquired by the interface and will be output continuously via the serial interface. After all registers are read once, the interface will only output data if something changes. For example if a temperature is changed on a sensor, it will output the new value.
If all values need to be refreshed the Re-sync command can be called by the command XR.

Registers

The interface firmware has a common set of pre-programmed heat pump registers to be read and written to. These registers are listed at the end of this document.

The register data format is a 2 byte number, ex 0101. The leftmost number (4 bits) representing the data type and the rest is the actual index number. For example on 0001, the left 0 indicating that this is a temperature. 001 indicating the Radiator return sensor index number. And likewise 1A01, 1 is indicating that this is a bool on/off device. and A01 indicating index for the Compressor.

No	Unit / Data type	Additional info
0	Degrees	Divide by 10
1	On/off bool	0 or 1
2	Number	Divide by 10
3	Percent	Divide by 10
4	Ampere	Divide by 10
5	kWh	Divide by 10
6	Hours	As is
7	Minutes	As is
8	Degree minutes	As is
9	kw	As is
A	Pulses	As is (For S0 El-meter pulse counter)

There are two types of registers. The "Common" and the "HP-Specfic" registers.

The interface is continuously syncing with the Common registers and will output any change. A Common register consists of sensor information, status of devices (compressor, pumps, valves), a few standard settings and a some other controller parameter such as Degree minutes. The Common registers has a common structure and id's for all heat pump models.

With the "XL" command will get a list of all available registers for to connected heatpump and with the "XP" command you have the option to turn on clear text register names and values shown in decimal. This feature is convenient for test and debug.

The HP-Specific registers will only be read and output if the "XS" command is sent. These registers are unique for every heat pump model. You can set/write to some of the HP-Specific registers using the "XW" command. Please see tables in the end of this document for details.

Example of register data output from the interface

```
XR00010106(cr)          0x0001=reg Radiator return of temp type (0)
                        0x0106=data (0x01*256)+0x06 = 262 = 26.2 deg C

XR00030198(cr)          0x0003=reg Heat carrier return of temp type (0)
                        0x0198=data (0x01*256)+0x98 = 408 = 40.8 deg C

XR0006FFE6(cr)          0x0001=reg Cold carrier out of temp type (0)
                        0xFFE6 and 0x8000 = true (left most bit set=negative)
                        0xFFE6=data ((0xFF*256)+0xE9)-65536 = -2.3 deg C

XR1A040001(cr)          0x1A04=reg Radiator return of on/off type (1)
                        0x0001=data ON
```

Example of data output from the interface with clear text output turned on (XP)

```
XR000200ED   002 Radiator Forward (23.7c)
XR0003018A   003 Heat carrier Return (39.4c)
XR000400E9   004 Heat carrier Forwrd (23.3c)
XR00050075   005 Brine in/Evaporator (11.7c)
XR00060057   006 Brine out/Condenser (8.7c)
XR0007FF6A   007 Outdoor (-15.0c)
XR0008DEAD   008 Indoor (-853.1c)
XR000901D3   009 Hot water 1 / Top (46.7c)
XR000B024A   00B Hot gas / Compr. (58.6c)
XR000E0000   00E Air intake (0.0c)
XR002000D9   020 Radiator Forward 2 (21.7c)
XR00210000   021 Indoor 2 (0.0c)
XR1A010001   A01 Compressor (1.0 )
XR1A040001   A04 Pump Cold circuit (1.0 )
XR1A050001   A05 Pump Heat circuit (1.0 )
XR1A060001   A06 Pump Radiator (1.0 )
XR1A070000   A07 Switch valve 1 (0.0 )
XR1A090000   A09 Fan (0.0 )
XR1A0A0001   A0A High Pressostat (1.0 )
XR1A0B0001   A0B Low Pressostat (1.0 )
XR1A0C0000   A0C Heating cable (0.0 )
XR1A0D0000   A0D Crank case heater (0.0 )
XR1A200000   A20 Alarm (0.0 )
```

Commands for the H1 Interface.

Data to interface

Command	Function	Example / Returns
XV	Request version number	XV010304(cr)
XR	Request read and dump of Real-time registers	XR(cr)
XS	Request read and dump of heat pump specific registers	XS(cr)
XWrrrrdddd	Set a register value on HP. rrrr=register, dddd=data.	XW010600AA(cr) XW01(ok)
XL	Request list of register names	XL(cr)
XP	Toggle clear text register names print out	XP(cr) Warmwater (35.2c)
XM	Enable auto refresh of all registers every second minute. default=off	
XA	Disable auto read registers and output change.	
XO	Enable auto read registers and output on change. default = on	
XU	Enable simulator mode. Will output random data every second.	Only available on rego600 firmware.
RP1, RP0	Enable/disable Can bus activity printout	Only rego800/1000
SA	Toggle OFF/ON to printout collected pulses every 10 sec. Default=on	
SP	Print out collected pulses and reset counter.	
SS	Set S0 port 1 to Input port instead to detect an on/off state.	
WE	Scan for 1-wire temp sensors and return all ID's	
WR	Read all 1-wire temp sensors and dump result.	
XBxx	Read alarm logs XB=Last log, XB05 = 5 last logs, etc. Max 20. Support only for Rego 600 and Rego2000.	XB010E0B1B0D3130 Or XB1540 (R2000) See below for desc.

Data from interface

Input	Description	Usage Example
XRrrrrdddd(cr)	Receive new data from a register. rrrr= Reg ID, dddd=data.	
XV040304	Interface version	
WRxxxxxxxxpptt(cr)	Return DS temp: x=8 bytes DS-ID, pp=00=+ FF=-	
XE002	Info. Rego1000 interface was moved to other Rego version, re-synchronizing.	
XE005	Can bus communication error, Check cables (Rego 800/1000 only)	
XE006	Fatal error identifying Rego1000 version. Contact Husdata.se	

XE007	Unsupported Rego800 version detected, switching to compatibility mode.	
XI024	NIBE EB100 detected comm alarm, will be reset in 10 minutes	
XI025	NIBE EB100 alarm has been reset	
XB010E0B1B0D3130	XB 01 0E0B1B 0D3130 01 = Alarm Code Next part is date YYMMDD Last part is Time HHMMSS Rego 600 only	For Rego 600 Only
XB1540 XB1541 XB1542	XB 1540 1540 = alarmcode 1540h= 5440 HP Alarm Command XB always answers with 3 rows of alarmcodes. 0000= no alarm.	For Rego 2000 Only

Modbus protocol interface type (optional)

Serial interface specification (Modbus)
Interface: RS-232 or RS-485
Baud rate: 19200 but can special ordered for other baudrate
ID: 8 but can be special ordered for other ID:s
Protocol: Modbus

Modbus command implementation

- COIL_STATUS, Read one or many. First register: 1, 0x0001
  Used for compressor, pumps, valves, etc.
- INPUT_REGISTERS, read one or many. First register: 30001, 0x7501
  Used for temp sensors
- HOLDING_REGISTERS, read one or many. First register: 40001, 0x9C01
  Read settings like heat curve or temp set.
- SET_REGISTERS,   Set heat curve or indoor temp. First register: 40001, 0x9C01

General information

Supported heat pump models

Type	SW	HW	Heat pump models	Technical
A	00	R	IVT Greenline / Optima 900	Rego 600 Serial
B	05	I	IVT 490	Rego 400 Serial
C	35	C	IVT Premiumline X, Optima/290-AW	Rego 800, Can bus
D	30	C	IVT Greenline HE/HC/HA+Prem HQ/EQ	Rego 1000, Can bus
E	40	N	NIBE xx45	EB100, RS-485
F	50	N	NIBE Fighter series	Styr 2002, RS-485
G	60	D	Thermia Diplomat series	901510, i2c
H	70	D	Thermia Villa series *	901353, i2c
I	10	E	IVT AirX, Geo312, Vent202	Rego 2000

* Not released yet

Common registers

H1-ID (hex)	Modbus (hex)	Temperatures	Unit	System availability
0001	7531	Radiator Return	Degrees	ABCDEFG I
0002	7532	Radiator Forward	Degrees	B G I
0003	7533	Heat carrier Return	Degrees	ABCDE
0004	7534	Heat carrier Forward	Degrees	ABCDEF I
0005	7535	Brine In / Evaporator	Degrees	A CDEFG I
0006	7536	Brine Out / Condenser	Degrees	A CDEFG I
0007	7537	Outdoor	Degrees	ABCDEFG I
0008	7538	Indoor	Degrees	ABCDEFG I
0009	7539	Hot water 1 / Top	Degrees	ABCDEFG I
000A	753A	Hot water 2 / Mid	Degrees	ABCDEF I GT3x on A
000B	753B	Hot gas / Compressor	Degrees	ABCDEF I
000C	753C	Suction gas	Degrees	EF I
000D	753D	Liquid flow	Degrees	EF
000E	753E	Air intake	Degrees	A CD I
000F	753F	Exhaust air	Degrees	A C EF
0010	7540	Air outlet	Degrees	A EF
0011	7541	Pool	Degrees	C EF
0012		Pressure tube	Degrees	G
0020		HC2: Radiator Forward	Degrees	D
0021		HC2: Indoor	Degrees	
ID		**Other registers**	**Unit**	**System availability**
4101		Load L1	Ampere	EF
4102		Load L2	Ampere	EF
4103		Load L3	Ampere	EF
x104		Add heat status	kW or %	A CD-%, E-kW
2105		Degree minutes/integral	Number	EFG
0107	7542	Heating Setpoint	Degrees	ABCDEFG
3108		Compressor speed	%	CD
3109		Circ. pump speed	%	G I
3110		Brine pump speed	%	G

ID			Unit	
0111		Hot water Setpoint	Degrees	B D G
0208		Hot water Stoptemp	Degrees	FG
0120		HC2: Heating Setpoint	Degrees	D
AFF1		Collected Pulses meter 1	Pulses	<all>
AFF2		Collected Pulses meter 2	Pulses	<all>
ID		**Settings**	**Unit**	
2201		Operating mode 1	Number	E
2202		Operating mode 2	Number	
0203	9C41	Room temp target	Degrees	A CDEF
2204	9C42	Room sensor influence	Number	A CDEF
x205	9C43	Heat set 1, Curve Left	Num/Degr	A CDEF
x206	9C44	Heat set 2, Curve Right	Num/Degr	CD
x207		Heat set 3, Curve Parallel	Num/Degr	A EF
X208		Hot Water Stop temp		
0220		HC2: Room temp target	Degrees	
0222		HC2: Curve Left	Num/Degr	D F
0223		HC2: Curve Right	Num/Degr	D
0224		HC2: Curve Parallel	Num/Degr	F
ID		**Status**	**Unit**	**System availability**
1A01	0001	Compressor	On/Off	ABCDEFG I
1A02	0002	Add heat step 1	On/Off	AB FG I
1A03	0003	Add heat step 2	On/Off	AB FG I
1A04	0004	Pump Cold circuit	On/Off	A CDEFG
1A05	0005	Pump Heat circuit	On/Off	A CDEF I
1A06	0006	Pump Radiator	On/Off	AB G
1A07	0007	Switch valve 1	On/Off	A CDEFG I
1A08	0008	Switch valve 2	On/Off	
1A09	0009	Fan	On/Off	BCD I
1A0A	000A	High Pressostat	On/Off	BCD
1A0B	000B	Low Pressostat	On/Off	BCD
1A0C	000C	Heating cable	On/Off	CD I
1A0D	000D	Crank shaft heater	On/Off	CD
1A0E		Shunt open	On/Off	B
1A0F		Shunt close	On/Off	B
1A19		Add Heat step 3	On/Off	F I
2A20	000E	Alarm	Number	ABCDEF I

IVT Rego 1000 specific registers

ID(hex)	Settings writable	Unit	Min/Max
2F00	Program Generation	Number	
2F01	Program Version	Number	
2F02	Program Revision	Number	

Rego 800 specific registers

ID(hex)	Read only registers	Unit	Min/Max Comment
0F50	Adj. curve at 20° out	Degrees	Only Optima
0F51	Adj. curve at 15° out	Degrees	Only Optima
0F52	Adj. curve at 10° out	Degrees	Only Optima
0F53	Adj. curve at 5° out	Degrees	Only Optima

0F54	Adj. curve at 0° out	Degrees	Only Optima
0F55	Adj. curve at -5° out	Degrees	Only Optima
0F56	Adj. curve at -10° out	Degrees	Only Optima
0F57	Adj. curve at -15° out	Degrees	Only Optima
0F58	Adj. curve at -20° out	Degrees	Only Optima
0F59	Adj. curve at -25° out	Degrees	Only Optima
0F5A	Adj. curve at -30° out	Degrees	Only Optima
0F5B	Adj. curve at -35° out	Degrees	Only Optima
0F60	Additional power	Degrees	
0F61	VV GT3 Start temp	Degrees	
0F62	VV GT9 Stopp temp	Degrees	
6F63	Runtime Comp rad	Hours	Only on some reg ver
6F64	Runtime Comp vv	Hours	Only on some reg ver
6F65	Runtime controller	Hours	Only on some reg ver
6F66	Runtime additional rad	Hours	Only on some reg ver
6F67	Runtime additional	Hours	Only on some reg ver

Rego 600 specific registers

ID(hex)	Settings writable	Unit	Min/Max
0F50	Adj. curve at 20° out	Degrees	
0F51	Adj. curve at 15° out	Degrees	
0F52	Adj. curve at 10° out	Degrees	
0F53	Adj. curve at 5° out	Degrees	
0F54	Adj. curve at 0° out	Degrees	
0F55	Adj. curve at -5° out	Degrees	
0F56	Adj. curve at -10° out	Degrees	
0F57	Adj. curve at -15° out	Degrees	
0F58	Adj. curve at -20° out	Degrees	
0F59	Adj. curve at -25° out	Degrees	
0F5a	Adj. curve at -30° out	Degrees	
0F5b	Adj. curve at -35° out	Degrees	
0F61	GT1 On value	Degrees	
0F62	GT1 On EL value	Degrees	
0F63	GT1 Off EL value	Degrees	
0F64	GT1 Off value	Degrees	
0F65	GT3 On value	Degrees	
0F66	GT3 Off value	Degrees	
0F67	GT4 Target value	Degrees	
0F68	Heat curve coupling	Degrees	

Rego600 Alarm codes

Alarm no	Description
0	No Alarm
1	Sensor radiator return (GT1)

2	Outdoor sensor (GT2)
1	Sensor hot water (GT3)
2	Mixing valve sensor (GT4)
5	Room sensor (GT5)
6	Sensor compressor (GT6)
7	Sensor heat tran fluid out (GT8)
8	Sensor heat tran fluid in (GT9)
9	Sensor cold tran fluid in (GT10)
10	Sensor cold tran fluid in (GT11)
11	Compresor circuit switch
12	Electrical cassette
13	HTF C=pump switch (MB2)
14	Low pressure switch (LP)
15	High pressure switch (HP)
16	High return HP (GT9)
17	HTF out max (GT8)
18	HTF in under limit (GT10)
19	HTF out under limit (GT11)
20	Compressor superhear (GT6)
21	3-phase incorrect order
22	Power failure

Thermia Alarm codes

Bit mask	Description
0	No Alarm
8	Warm water sensor failure
4	Return sensor failure
2	Forward sensor failure

Styr2002 NIBE 1245 specific registers (not verified, use at own risk)

ID(hex)	Settings writable	Unit	Min/Max
0F08	M1.6 : Stopp extra varmvatten		
0F09	M1.7 : Stopp kpr extra varmvatten		
0F0A	M1.8 : Intervall periodiskt XVV		
0F0B	M1.10 : Drifttid varmvatten (min)		
0F0C	M1.10 : Drifttid varmvatten (h)		
0F0D	M2.3 : Mintemp. framledning		
0F0E	M2.4 : Maxtemp. framledning		
0F0F	M2.5 : Kompensering yttre		
0F11	M2.7 : Max returtemperatur		
0F14	M3.0 : Beräknad framledningstemp 2		
0F17	M3.3 : Mintemp. framledning 2		
0F18	M3.4 : Maxtemp. framledning 2		
0F19	M3.5 : Kompensering yttre 2		
0F1A	M3.7 : Returledningstemperatur 2		

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