Commissioning the Modbus communication bus

Heat pumps Qi, T^2 and Gemini

Heat production:

The heat pump equipment can be connected to the automation system with Modbus. The heat pump controller supports two different Modbus modes:

- Controller network: exchange of process data with a controller from another manufacturer
- BACS/device: exchange of process data, parameters and operating information

When the heat pump system installation has progressed to the state where all sensor connections and wireless connections are connected, the Modbus connection can be commissioned.

Selecting the commissioning mode

Modbus cards are to be connected to the controllers when the device is powered off.

1. Start the equipment. Wait until the operating panel is in the basic state.
2. Go to *Service/Settings* by turning the knob of the terminal (cogwheel icon ⚙)
3. Select *Expert* by turning the knob → press the knob (to execute selection)
4. Choose *Expert* as user level → press the knob
5. Accept the selection by pressing the knob
6. Move to *Settings/maintenance* on the vertical menu (wrench icon 🔧)
7. Choose *Parameter list* by pressing the knob → the controller will update the terminal, duration appr. 2 min.
8. Choose *Time and date* active (the background of the text turns dark)
9. Turn the knob to *Modbus*
10. Define Modbus settings

   Page 1
   6651: Slave address → 1…247
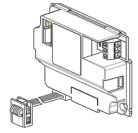   6652: Baud rate → 1 200…11 5200
   6653: Parity → Even / Odd / None

   Page 2
   6654: Stop bit

Modbus testing
- The parameters and display values between Modbus and automation can be seen on Source / Consumer menu

Recommended settings

- The bit rate is 19 200 (with cable length < 500m)
- Parity: even
- Stop bits: 1

All Modbus network devices must have the same bit rate, parity and stop bits.

The master device in the heat pump system and the other devices are connected to each other with Modbus expansion modules. The terminators of the Modbus add-on modules are to be set to the ON position in the first and last devices.

Terminator with DIP switches
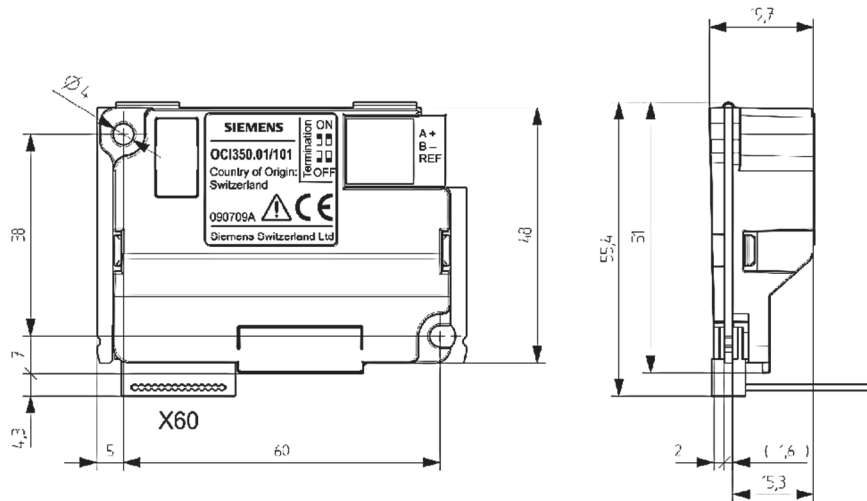
Position "on"

Position "off"

LED = operation mode

Connection:

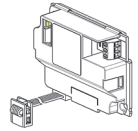| X60	Connection cable to RVS controller	Straight LP connector
A+	TxD+/RxD+	Connection Modbus: 3-pin screw-coupling
B-	TxD-/RxD-	
REF	Ground	

Modbus description:

Modbus General Description	(Default value bold)
Connector	3-pole Screw terminal (A+, B-, REF)
Interface type	RS485
Termination	termination resistor selectable with DIP Switch
Modbus Version (modbus.org)	Modbus Application Protocol Specification V1.1b
	Modbus over Serial Line V1.02
Modbus Mode	RTU
Modbus Role	Slave
Slave Address	1...247 ("---" = master)
Baud rate	Configurable
	1'200, 2'400, 4'800, 9'600, **19'200**, 38'400, 57'600, 76'800, 115'200
Start bit	1
Data bit	8
Stop bit	**1**/2
Parity	**Even**/Odd/None
Modbus function codes	0x03 Read Holdingregisters
	0x06 Write Single Register (not for structured data types)
	0x10 Write multiple Register
Broadcast	not supported
Data type	Always 2 Byte per Register
	Signed /Unsigned 16bit & 32bit (32 bit in 2 Registers)
	Structured Data
Coding	Most significant first
Telegramm Length	max 44 Data byte
Response Timeout	300 ms
Parameter ACS7xx	[6651] Slave address
	[6652] Baud rate
	[6653] Parity
	[6654] Stop bit
Read/Write acces by registers	**only bold register can be read/written.**
	Non bold Register must be read/written at same time with the previous (bold) register

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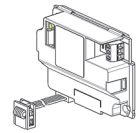
System addresses:

|	ID	Read/ Write	Register address	Unit	Resolution (divider of the value read)	Lower limit °C	Upper limit °C	Device 1	Devices 2, 3 etc.
Operating temperatures:									
Temperature of the domestic hot water storage tank	B3	R	11264	°C	1/64	0	140	x	
Domestic hot water consumption	B38	R	12302	°C	1/64	-28	350	x	
Common flow temp	B10	R	18436	°C	1/64	0	140	x	
Heating accumulator tank temperature (Exhaust Air Heat Recovery)	B4	R	17410	°C	1/64	0	140	x	
Outside temp	B9	R	35851	°C	1/64	-50	50	x	
LC 1, flow temp	B1	R	1046	°C	1/64	0	140	x	x
LC2, flow temp	B12	R	4118	°C	1/64	0	140	x	x
Temperatures: Heat pump (-s)									
Flow temp HP	B21	R	20484	°C	1/64	0	140	x	x
Heat pump return water	B71	R	20480	°C	1/64	0	140	x	x
Liquid circuit in	B91	R	20871	°C	1/64	-28	350	x	x
Liquid circuit out	B92	R	20877	°C	1/64	-28	350	x	x
Hot gas	B81	R	20856	°C	1/64	-28	350	x	x
Condenser temperature difference		R	20867	°C	1/64	-50	140	x	x
Temp diff evaporator		R	20869	°C	1/64	-50	140	x	x
Readable setpoints:									
Common flow temp setpoint	B10	R	18432	°C	1/64	0	140	x	
Heating accumulator tank temperature (Exhaust Air Heat Recovery)	B4	R	17408	°C	1/64	0	140	x	
Additional heat source setpoint		R	30724	°C	1/64	0	140	x	
LC1, flow temp setpoint	B1	R	1048	°C	1/64	0	140	x	x
LC2, flow temp setpoint	B12	R	4120	°C	1/64	0	140	x	x
Readable set point values: Heat pump (-s)									
Heat pump return water	B71	R	20482	°C	1/64	0	140	x	x
Status data:									
Heat pump status		R	20556	see status data		0	1000	x	x
Compressor status info	K1	R	20834	0=off/1=on		0	1	x	x
Domestic hot water resistor status	K6	R	11371	0=off/1=on		0	1	x	
* Electric heater 1 status	K25	R	20838	0=off/1=on		0	1	x	x
* Electric heater 2 status	K26	R	20840	0=off/1=on		0	1	x	x
Additional heat source status	K27	R							
Change-over valve status	Q3	R	38420	0=heating/1=DHW		0	1	x	
Liquid pump speed	Q8	R	20844	% (V)	1/100	0	100 (10)	x	x
Liquid pump status	Q8	R	20842	0=off/1=on		0	1	x	x
Charging pump speed	Q9	R	20848	% (V)	1/100	0	100 (10)	x	x
Charging pump status	Q9	R	20846	0=off/1=on		0	1	x	x
DHW charging pump speed	Q34	R	37906	% (reverse)	1/100	0	100	x	
Energy monitoring:									
Cumulative heat production		R	29696	kWh (32Bit data)	1	0	999999	x	x
Cumulative energy consumption		R	29699	kWh (32Bit data)	1	0	350000	x	x
Cumulative coefficient of efficiency		R	29702		1/100	0	10	x	x
Momentary heat production		R	20823	kWh (32Bit data)	1/100	0	999999	x	x
Momentary energy consumption		R	20826	kWh (32Bit data)		0	999999	x	x
Momentary coefficient of efficiency		R	20832			0	20	x	x
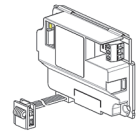
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	ID	Read/Write	Register address	Unit	Resolution (divider of the value read)	Lower limit °C	Upper limit °C	Device 1	Devices 2, 3 etc.
Run monitoring:									
Compressor running time	K1	R	20505	h	1/3600	0	199999	x	x
Compressor start-up counter	K1	R	20507	pcs	1	0	199999	x	x
Running time of electric heater for domestic hot water	K6	R	11272	h	1/3600	0	199999	x	
Start-up counter for the electric domestic hot water heater	K6	R	11274	pcs	1	0	199999	x	
Electric immersion heater 1 running time	K25	R	20517	h	1/3600	0	199999	x	x
Electric heater 1 start-up counter	K25	R	20519	pcs	1	0	199999	x	x
Electric immersion heater 2 running time	K26	R	20521	h	1/3600	0	199999	x	x
Electric heater 2 start-up counter	K26	R	20523	pcs	1	0	199999	x	x
Alert:									
Alert	K10	R	35887	0=off/1=on		0	1	x	x
Alert message		R	39040	see alarm codes		0	65535	x	x
Heat pump reset		R/W	20547	0=no/1=yes		0	1	x	x
Writable se points:									
DHW temp setpoint	B3	R/W	10241	°C	1/64	8	80	x	
Domestic hot water on/off		R/W	10240	0=OFF/1=ON		0	1	x	
Setpoint HP	B10 / B4	R/W	14337	°C	1/64	8	120	x	
Writable setpoints: Heat pump (-s)									
** Heat pump step control ON-OFF	H1	R/W	36896	0 = RELEASED 1 = PREVENTED		0	1	x	x
HP operation prevention	EX3	R/W	36914	0 = PREVENTED 1 = RELEASED		0	1	x	x
*** Switching differential HP	B71	R/W	20569	°C	1/64	1	20	x	
**** Source pump start-up (free cooling, for one pump)		R/W	45077	0 = FREE COOLING 1 = NORMAL		0	1	x	
***** Writable set point values: Heating circuits									
Heating circuit 1									
Set point value		R/W	1025		1/64	4	35	x	
Reduced setpoint		R/W	1026		1/64	4	35	x	
Protection setpoint		R/W	1026		1/64	4	35	x	
Heating curve slope		R/W	1028			0,1	4,0	x	
Supply water min. value		R/W	1034	°C	1/64	8	95	x	
Supply water max. value		R/W	1035	°C	1/64	8	95	x	
Directional transfer		R/W	1029		1/64	-4,5	4,5	x	
Heating circuit 2									
Set point value		R/W	4097		1/64	4	35	x	
Reduced setpoint		R/W	4098		1/64	4	35	x	
Protection setpoint		R/W	4099		1/64	4	35	x	
Heating curve slope		R/W	4100			0,1	4,0	x	
Supply water min. value		R/W	4106	°C	1/64	8	95	x	
Supply water max. value		R/W	4107	°C	1/64	8	95	x	
Directional transfer		R/W	4101		1/64	-4,5	4,5	x	

NOTE! The Gemini heat pump has two devices (controller 1 and controller 2). Modbus addresses are to be set controller-specifically.
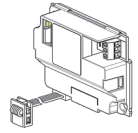
* On cascade systems electric heaters of heating (K25/K26) are to be connected and configured always on the first device NOT PRODUCING DOMESTIC HOT WATER. This has to be noted also when reading elecricm heater status information from the bus.

** The heat pump is slave to the upper-level automation. To enable the function, set from the control menu 5950 Input H1 function to Heat pump step 1 command ON. By changing the contact information, the heat pump recNoves permission to run, or a command to turn off. External sensors are not connected to the heat pump. Instead, upper-level automation does all of the external measurements. Using its internal automation, the heat pump ensures that source and charging pumps are running. Additionally, a controller monitors internal safety limits. External upper-level automation makes sure that compressors are toggled and control cascaded. When determining running times, the upper-level automation acknowledges the optimal compressor operation. Each controller recNoves individual commands when using step control. NOTE! Both compressors in the GEMINI are controlled using the STEP 1 ON command.

*** A system with a single heat pump the compressor will be started up on the basis of supply water switching differential setpoint. Setpoint is set computationally on the controller from the supply water setpoint. Switching differential defines the compressor operation cycle length and heating circuit temperature wobble. By increasing the setpoint the operation cycle will be extended and the circuit temperature wobble increases. Be decreasing the setpoint the cycile will be shortened and wobble decreased. In cascade systems the corresponding function is on start-up and shut-down of the first compressor stage. Other cascade stages start accrding to common supply water measurement B10.
Factory setting 6K.

**** In case of a single common cascade source pump, free cooling switching on is to be written on the controller, from which the source pump is controlled. Common source pump control can be checked on the controller menu (configuration > 5803)
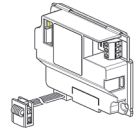
***** Writable setpoints for heating circuits are in use only if the heat pumps control heating shunt groups of the building.

Resolution:
The value read from the register must be divided by the number indicated by *resolution* so that the values will be displayed correctly in the monitoring system.

NOTE!
All analogue data are divisible by 1/64.

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Alarm codes:

Fault codes:	Alarm priority:*	Manually acknowledged	Sensor marking:	Fault:
0				No fault
10	6	No	B9	Outdoor sensor
26	6	No	B10	Total output flow sensor
30	6	No	B1	Output water sensor 1
31	6	No	B16	Cooling output water sensor
32	6	No	B12	Output water sensor 2
33	6	No	B21	Flow temp HP
35	9	No	B91	Source liquid input sensor
36	6	No	B81	Hot gas sensor
44	9	No	B71	Heat pump return sensor
45	6	No	B92	Source liquid output sensor
50	6	No	B3	Domestic hot water sensor
70	6	No	B4	Auxiliary accumulator sensor 1
71	6	No	B41	Auxiliary accumulator sensor 2
72	6	No	B42	Auxiliary accumulator sensor 3
73	6	No	B6	Solar collector sensor 1
74	6	No	B61	Solar collector sensor 2
81	6	No		LPB short circuit
82	3	No		LPB address conflict
83	8	No		BSB short circuit (internal bus)
98	8	No		Extra module 1
99	8	No		Extra module 2
100	3	No		2 time hosts
102	3	No		No backup clock running
105	5	No		Maintenance notification
106	6	Yes		The temperature in the source liquid is too low
107	9	Yes		Hot gas
117	6	No		Water pressure too high
118	6	No		Water pressure too low
121	3	No		Output flow temperature LP1
126	6	No		Domestic hot water charging temperature
127	6	No		Legionella prevention temperature
134	9	Yes		Heat pump connection fault
138	1	No		No heat pump control sensor
171**	6	No		Alarm contact 1 active
172**	6	No		Alarm contact 2 active (H2, H21, H22, H32)
173**	6	No		Alarm contact 3 active (EX)
174**	6	No		Alarm contact 4 active (H3)
201	9	Yes	B21	Frost alarm
222	9	Yes	E10	Heat pump pressure too high
223	9	Yes	E10	Overpressure in heating circuit start-up
224	9	Yes	E10	Overpressure in domestic hot water start-up
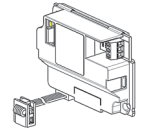
225	9	Yes	E9	Underpressure
226	9	Yes	E10	Compressor overload
229	9	Yes	E15	Collector circuit pressure switch
230	9	Yes	E14	Source pump overload
307	9	Yes		Emergency use
321	6	No	B38	Domestic hot water output sensor
353	3	No		Missing cascade sensor
355	9	Yes	E21,E22,E23	Asymmetric 3-phase current
358	6	Yes	E25	Soft starter
489	3	No		No cascade master
490	3	No		Cascade source missing
491	9	Yes		Maximum evaporation temperature
495	6	No		No Modbus communication connection

** Priority 5-9 alarms cause a continuous alarm from the controller (realay K10).

* *Alarm contact active 1-4 (171-174)* alarms are free alarm inputs programmed for Hx contacts. These can be programmed with overheating protection alarms for electrical resistors, alarm pressure gauges, as well as all alarms that come as top information.

Heat pump status:

Code #:	Status data
2	Error
10	Locked
17	Overrun active
25	Off
26	Emergency operation
27	Locked, externally
29	High heat pump pressure
30	Heat source flow switch
31	Heat source pressure switch
32	Hot gas limit
34	Maximum limit for switch-off temperature
35	Compressor minimum idle time is active
37	Active limit time
38	Compressor minimum run time active
44	Compressor and electric heater ON
46	Compressor ON
49	Flow active
50	Standby
51	No request
128	Passive cooling mode
139	Minimum limit for switch-off temperature
176	Locked, outside temperature limit
180	3-phase current asymmetric
181	Under pressure
183	Compressor overload
185	Liquid pump overload
189	Liquid temperature minimum limit (PILP)
190	Liquid temperature minimum limit (source)
191	Liquid temperature maximum limit