

Profibus – Interface for Thermo-5 (Protocol Profibus-DP)

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1 General

This enhanced protocol is only supported with HB-Therm Thermo-5 units. Following settings are necessary:

Menu **Setting \ Remote**

- Set parameter **Protocol** to "15".
- Set parameter **Compatibility Profibus to S4** to "no".
- The parameters **Profibus node 1** to **Profibus node 4** has to be configured to the correct hardware address of node address in the Profibus environment.
- Set parameter **Address** to the corresponding value (this address has also be configured on the Profibus master)

2 Interface concept

The control system of the production machine communicates via the standardized Profibus – interface with the temperature control units connected to it. Values are transmitted from the machine to the units and vice versa. The machine assumes the master function, the temperature control units are the slaves.

3 Description of hardware

The basic control system of the device is equipped with an additional board ZP, allowing communication via the Profibus. It is connected externally by a 9-pole Sub-D plug.

4 Safety concept

Transmission is ensured by the basic procedure of the Profibus. No additional protection is provided.

5 Communication protocol

Bus system:	Profibus DP
Interface:	RS-485
Transmission rate:	max. 12 MBit/s
Sequence of operation:	normales DP-Polling of all slaves
Format:	user data consists of 2-byte words. All values are coded into 16-bit binary values.
Address setting:	adjustable on unit (1–125)
Physical units :	the Celsius scale is used for temperature units, flow rate is recorded in L/min.

There is a master message and a slave message. The message structure is basically identical for both directions. Normally data processing in the control system of the temperature control unit takes longer than the polling cycle (interrogation cycle) via the Profibus. The slave response therefore includes a counter variable which is incremented each time the data is reprocessed. This allows the master to check whether the data have already been "collected".

6 Example of use

As a help, an example to connect HB-Therm Temperature Control Units to a Siemens S7 environment is available and can be downloaded under www.hb-therm.ch.

Note:

The test program was initially checked on the following Siemens S7 hardware versions:

- CPU 315-2 DP 6ES7 315-2AH14-0AB0

There is no guarantee for proper function of the test program in case of other Siemens S7 hardware versions. If there are problems by using hardware versions not listed above, please contact the Siemens Support Office directly.

7 GSD-file

The GSD file is available for download at www.hb-therm.ch or is included in the application examples.

Note:

Problems with the GSD-file may occur with a few Profibus Masters of the SPS Mitsubishi due to optional application commands. In this case the problem can be solved by making following changes in the GSD-file (e.g. by using a text editor):

- Freeze_Mode_supp= 0
- Sync_Mode_supp = 0

For the availability of an already adapted GSD file, contact the HB-Therm representative (www.hb-therm.ch).

8 Modules

There are different modules on the GSD-File for transmission of nominal and actual values available which can be implemented in any order in the Profibus environment. The number of bytes transferred over a Profibus-Node is limited

8.1 Master transmission (machine – temperature control unit)

The following modules are available with write access (Wr).

Module	Description	Word	Unit	Range	Note
Sollwerte Wr	Nominal value 1	1	0,1 °C	0–4000	
	Nominal value 2	2	0,1 °C	0–4000	
Ueberwachung Temp Wr	Valid upper deviation nominal / actual value	1	0,1 K	0–4000	¹⁾
	Valid lower deviation nominal / actual value	2	0,1 K	0–4000	¹⁾
	Valid temperature difference main / return line	3	0,1 K	0–4000	¹⁾
Ueberwachung Flow Wr	Valid minimum flow rate	1	0,1 L/min	0–4000	¹⁾
	Valid maximum flow rate	2	0,1 L/min	0–4000	¹⁾
Betriebsart Wr	Operating mode Bit 0: Unit ON/OFF ²⁾ Bit 1: Cooling ON/OFF Bit 2: Mould evacuation ON/OFF Bit 3: Leak stopper ON/OFF Bit 4: External sensor ON/OFF Bit 5: 2nd nominal value ON/OFF Bit 6,7: Reserve Bit 8: Alarm reset (for acknowledging P-/M-alarms) Bit 9–14: Reserve	1	-	-	

Module	Description	Word	Unit	Range	Note
	Bit 15: Watchdog				
Istwert Externfühler Wr	Actual value external sensor	1	0,1 °C	0–4000	4)
Ueberwachung Temp Ext 1–4 Wr	Valid temperature difference main / return line ext. 1	1	0,1 K	0–4000	1), 3)
	Valid temperature difference main / return line ext. 2	2	0,1 K	0–4000	1), 3)
	Valid temperature difference main / return line ext. 3	3	0,1 K	0–4000	1), 3)
	Valid temperature difference main / return line ext. 4	4	0,1 K	0–4000	1), 3)
Ueberwachung Temp Ext 5–8 Wr	Valid temperature difference main / return line ext. 5	1	0,1 K	0–4000	1), 3)
	Valid temperature difference main / return line ext. 6	2	0,1 K	0–4000	1), 3)
	Valid temperature difference main / return line ext. 7	3	0,1 K	0–4000	1), 3)
	Valid temperature difference main / return line ext. 8	4	0,1 K	0–4000	1), 3)
Ueberwachung Flow min Ext 1–4 Wr	Valid minimum flow rate ext. 1	1	0,1 L/min	0–4000	1), 3)
	Valid minimum flow rate ext. 2	2	0,1 L/min	0–4000	1), 3)
	Valid minimum flow rate ext. 3	3	0,1 L/min	0–4000	1), 3)
	Valid minimum flow rate ext. 4	4	0,1 L/min	0–4000	1), 3)
Ueberwachung Flow min Ext 5–8 Wr	Valid minimum flow rate ext. 5	1	0,1 L/min	0–4000	1), 3)
	Valid minimum flow rate ext. 6	2	0,1 L/min	0–4000	1), 3)
	Valid minimum flow rate ext. 7	3	0,1 L/min	0–4000	1), 3)
	Valid minimum flow rate ext. 8	4	0,1 L/min	0–4000	1), 3)
Ueberwachung Flow max Ext 1–4 Wr	Valid maximum flow rate ext. 1	1	0,1 L/min	0–4000	1), 3)
	Valid maximum flow rate ext. 2	2	0,1 L/min	0–4000	1), 3)
	Valid maximum flow rate ext. 3	3	0,1 L/min	0–4000	1), 3)
	Valid maximum flow rate ext. 4	4	0,1 L/min	0–4000	1), 3)
Ueberwachung Flow max Ext 5–8 Wr	Valid maximum flow rate ext. 5	1	0,1 L/min	0–4000	1), 3)
	Valid maximum flow rate ext. 6	2	0,1 L/min	0–4000	1), 3)
	Valid maximum flow rate ext. 7	3	0,1 L/min	0–4000	1), 3)
	Valid maximum flow rate ext. 8	4	0,1 L/min	0–4000	1), 3)
Series 5 Wr	Nominal value 1	1	0,1 °C	0–4000	
	Nominal value 2	2	0,1 °C	0–4000	
	Valid upper deviation nominal / actual value	3	0,1 K	0–4000	1)
	Valid lower deviation nominal / actual value	4	0,1 K	0–4000	1)
	Valid temperature difference main / return line	5	0,1 K	0–4000	1)
	Valid minimum flow rate	6	0,1 L/min	0–4000	1)
	Valid maximum flow rate	7	0,1 L/min	0–4000	1)
	Operating mode	8	-	-	
	Bit 0: Unit ON/OFF ²⁾				
	Bit 1: Cooling ON/OFF				
	Bit 2: Mould evacuation ON/OFF				

Module	Description	Word	Unit	Range	Note
	Bit 3: Leak stopper ON/OFF Bit 4: External sensor ON/OFF Bit 5: 2nd nominal value ON/OFF Bit 6,7: Reserve Bit 8: Alarm reset (for acknowledging P-/M-alarms) Bit 9–14: Reserve Bit 15: Watchdog				
	Actual value external sensor	9	0,1 °C	0–4000	

Table 1: Master transmission (machine – temperature control unit)

- 1) The value 0 means monitoring is switched off.
- 2) Must be set to 0 to shut down via Cooling and/or Mould evacuation.
- 3) only Thermo-5, with connected external flow meter Flow-5.
- 4) Set parameter [Sensor type external sensor](#) to "Profibus".

Note:

If transmitted values or functions are not available, then the status bit "illegal value" and/or "illegal function" and the bit "common alarm operation" are set until the appropriate value is reset correctly. An alarm reset is not necessary. Compare the nominal values and actual values to determine which function is incorrect.

8.2 Slave transmission (temperature control unit - machine)

The following modules are available with read access (Rd).

Module	Description	Word	Unit	Range	Note
Zaehlervariable Rd	Counter variable poll	1	-	0–ffffH	5)
Sollwerte Rd	Nominal value 1	1	0,1 °C	0–4000	
	Nominal value 2	2	0,1 °C	0–4000	
Ueberwachung Temp Rd	Valid upper deviation nominal / actual value	1	0,1 K	0–4000	6)
	Valid lower deviation nominal / actual value	2	0,1 K	0–4000	6)
	Valid temperature difference main / return line	3	0,1 K	0–4000	6)
Ueberwachung Flow Rd	Valid minimum flow rate	1	0,1 L/min	0–4000	6)
	Valid maximum flow rate	2	0,1 L/min	0–4000	6)
Betriebsart Rd	Operating mode (set) Bit 0: Unit ON/OFF Bit 1: Cooling ON/OFF Bit 2: Mould evacuation ON/OFF Bit 3: Leak stopper ON/OFF Bit 4: External sensor ON/OFF Bit 5: 2nd nominal value ON/OFF Bit 6,7: Reserve Bit 8: Alarm reset (for acknowledging P-/M-alarms) Bit 9–14: Reserve Bit 15: Watchdog ⁹⁾	1	-	-	7)
Istwert Temp Rd	Actual temperature main line	1	0,1 °C	0–4000	
	Actual temperature return line	2	0,1 °C	0–4000	
	Actual temperature external sensor	3	0,1 °C	0–4000	
Istwert Stellgrad Rd	Actual regulation ratio	1	%	-100 to +100	
Istwert Durchfluss Rd	Actual flow rate	1	0,1 L/min	0–4000	

Module	Description	Word	Unit	Range	Note
Status Rd	Status operating mode Bit 0: Unit ON/OFF ^{8), 10)} Bit 1: Cooling ON/OFF ⁸⁾ Bit 2: Mould evacuation ON/OFF ⁸⁾ Bit 3: Leak stopper ON/OFF ⁸⁾ Bit 4: External sensor ON/OFF ⁸⁾ Bit 5: 2nd nominal value ON/OFF ⁸⁾ Bit 6: Remote control operation ON/OFF Bit 7: Reserve Bit 8: Common alarm Process (P) Bit 9: Common alarm Unit (M) Bit 10: Common alarm Operation (B) Bit 11–15: Reserve	1	-	-	
	Status alarms Bit 0: Upper deviation exceeded (P) Bit 1: Lower deviation exceeded (P) Bit 2: Temperature difference exceeded (P) Bit 3: Flow rate exceeded (P) Bit 4: Flow rate not reached (P) Bit 5: Process alarm: others (P) Bit 6: Reserve Bit 7: Malfunction level (M) ¹¹⁾ Bit 8: Malfunction over temperature (M) ¹¹⁾ Bit 9: Malfunction sensor break (M) ¹¹⁾ Bit 10: Malfunction mains (M) ¹¹⁾ Bit 11: Malfunction: others (M) ¹¹⁾ Bit 12: Reserve Bit 13: Illegal value (set or limit) (B) Bit 14: Illegal function (operating mode) (B) Bit 15: Reserve	2	-	-	
Ueberwachung Temp Ext 1-4 Rd	Valid temperature difference main / return line ext. 1	1	0,1 K	0–4000	6), 12)
	Valid temperature difference main / return line ext. 2	2	0,1 K	0–4000	6), 12)
	Valid temperature difference main / return line ext. 3	3	0,1 K	0–4000	6), 12)
	Valid temperature difference main / return line ext. 4	4	0,1 K	0–4000	6), 12)
Ueberwachung Temp Ext 5-8 Rd	Valid temperature difference main / return line ext. 5	1	0,1 K	0–4000	6), 12)
	Valid temperature difference main / return line ext. 6	2	0,1 K	0–4000	6), 12)
	Valid temperature difference main / return line ext. 7	3	0,1 K	0–4000	6), 12)
	Valid temperature difference main / return line ext. 8	4	0,1 K	0–4000	6), 12)

Module	Description	Word	Unit	Range	Note
Ueberwachung Flow min Ext 1-4 Rd	Valid minimum flow rate ext. 1	1	0,1 L/min	0–4000	6), 12)
	Valid minimum flow rate ext. 2	2	0,1 L/min	0–4000	6), 12)
	Valid minimum flow rate ext. 3	3	0,1 L/min	0–4000	6), 12)
	Valid minimum flow rate ext. 4	4	0,1 L/min	0–4000	6), 12)
Ueberwachung Flow min Ext 5-8 Rd	Valid minimum flow rate ext. 5	1	0,1 L/min	0–4000	6), 12)
	Valid minimum flow rate ext. 6	2	0,1 L/min	0–4000	6), 12)
	Valid minimum flow rate ext. 7	3	0,1 L/min	0–4000	6), 12)
	Valid minimum flow rate ext. 8	4	0,1 L/min	0–4000	6), 12)
Ueberwachung FlowMax Ext 1-4 Rd	Valid maximum flow rate ext. 1	1	0,1 L/min	0–4000	6), 12)
	Valid maximum flow rate ext. 2	2	0,1 L/min	0–4000	6), 12)
	Valid maximum flow rate ext. 3	3	0,1 L/min	0–4000	6), 12)
	Valid maximum flow rate ext. 4	4	0,1 L/min	0–4000	6), 12)
Ueberwachung FlowMax Ext 5-8 Rd	Valid maximum flow rate ext. 5	1	0,1 L/min	0–4000	6), 12)
	Valid maximum flow rate ext. 6	2	0,1 L/min	0–4000	6), 12)
	Valid maximum flow rate ext. 7	3	0,1 L/min	0–4000	6), 12)
	Valid maximum flow rate ext. 8	4	0,1 L/min	0–4000	6), 12)
Istwert Ruecklauf TempExt 1-4 Rd	Actual temperature return line ext. 1	1	0,1 °C	0–4000	12)
	Actual temperature return line ext. 2	2	0,1 °C	0–4000	12)
	Actual temperature return line ext. 3	3	0,1 °C	0–4000	12)
	Actual temperature return line ext. 4	4	0,1 °C	0–4000	12)
Istwert Ruecklauf TempExt 5-8 Rd	Actual temperature return line ext. 5	1	0,1 °C	0–4000	12)
	Actual temperature return line ext. 6	2	0,1 °C	0–4000	12)
	Actual temperature return line ext. 7	3	0,1 °C	0–4000	12)
	Actual temperature return line ext. 8	4	0,1 °C	0–4000	12)
Istwert Flow Ext 1-4 Rd	Actual flow rate ext. 1	1	0,1 L/min	0–4000	12)
	Actual flow rate ext. 2	2	0,1 L/min	0–4000	12)
	Actual flow rate ext. 3	3	0,1 L/min	0–4000	12)
	Actual flow rate ext. 4	4	0,1 L/min	0–4000	12)
Istwert Flow Ext 5-8 Rd	Actual flow rate ext. 5	1	0,1 L/min	0–4000	12)
	Actual flow rate ext. 6	2	0,1 L/min	0–4000	12)
	Actual flow rate ext. 7	3	0,1 L/min	0–4000	12)
	Actual flow rate ext. 8	4	0,1 L/min	0–4000	12)

Module	Description	Word	Unit	Range	Note
Series 5 Rd	Counter variable poll	1	-	0–ffffH	5)
	Nominal value 1	2	0,1 °C	0–4000	
	Nominal value 2	3	0,1 °C	0–4000	
	Valid upper deviation nominal / actual value	4	0,1 K	0–4000	6)
	Valid lower deviation nominal / actual value	5	0,1 K	0–4000	6)
	Valid temperature difference main / return line	6	0,1 K	0–4000	6)
	Valid minimum flow rate	7	0,1 L/min	0–4000	6)
	Valid maximum flow rate	8	0,1 L/min	0–4000	6)
	Operating mode (set)	9			7)
	Bit 0: Unit ON/OFF				
	Bit 1: Cooling ON/OFF				
	Bit 2: Mould evacuation ON/OFF				
	Bit 3: Leak stopper ON/OFF				
	Bit 4: External sensor ON/OFF				
	Bit 5: 2nd nominal value ON/OFF				
	Bit 6, 7: Reserve				
	Bit 8 Alarm reset (for acknowledging P-/M-alarms)				
	Bit 9–14 Reserve				
	Bit 15 Watchdog ⁹⁾				
	Actual temperature main line	10	0,1 °C	0–4000	
	Actual temperature return line	11	0,1 °C	0–4000	
	Actual temperature external sensor	12	0,1 °C	0–4000	
	Actual regulation ratio	13	%	-100 to +100	
	Actual flow rate	14	0,1 L/min	0–4000	
	Status operating mode	15			
	Bit 0: Unit ON/OFF ^{8), 10)}				
	Bit 1: Cooling ON/OFF ⁸⁾				
	Bit 2: Mould evacuation ON/OFF ⁸⁾				
	Bit 3: Leak stopper ON/OFF ⁸⁾				
	Bit 4: External sensor ON/OFF ⁸⁾				
	Bit 5: 2nd nominal value ON/OFF ⁸⁾				
	Bit 6: Remote control operation ON/OFF				
	Bit 7: Reserve				
	Bit 8: Common alarm Process (P)				
	Bit 9: Common alarm Unit (M)				
	Bit 10: Common alarm Operation (B)				
	Bit 11–15: Reserve				

Module	Description	Word	Unit	Range	Note
	Status alarms	16			
	Bit 0: Upper deviation exceeded (P)				
	Bit 1: Lower deviation exceeded (P)				
	Bit 2: Temperature difference exceeded (P)				
	Bit 3: Flow rate exceeded (P)				
	Bit 4: Flow rate not reached (P)				
	Bit 5: Process alarm: others (P)				
	Bit 6: Reserve				
	Bit 7: Malfunction level (M) ¹¹⁾				
	Bit 8: Malfunction overtemperature (M) ¹¹⁾				
	Bit 9: Malfunction sensor break (M) ¹¹⁾				
	Bit 10: Malfunction mains (M) ¹¹⁾				
	Bit 11: Malfunction: others (M) ¹¹⁾				
	Bit 12: Reserve				
	Bit 13: Illegal value (set or limit) (B)				
	Bit 14: Illegal function (operating mode) (B)				
	Bit 15: Reserve				

Table 2: Slave transmission (temperature control unit - machine)

- 5) Counter variable poll is incremented at each poll within the control system.
- 6) The value 0 means that monitoring is switched off.
- 7) "Operation mode (set)" normally mirrors the master message (echo). If a function is not available in the unit, the message OFF (0) is transmitted and the bit "common alarm operation" is set.
- 8) "Status operating mode" reports the actual states. However, a time-lag can be applied to these if a function cannot be activated immediately due to temperature-related or time-related factors (e.g. mould evacuation after cooling).
- 9) The watchdog written by the master will be returned as it was sent by the master.
- 10) During the functions Cooling and Mould evacuation, bit 0 (unit ON/OFF) is not reset until the unit cuts out entirely after completing this sequence of operations.
- 11) As a rule, acknowledgement is required.
- 12) only Thermo-5, with connected external flow meter Flow-5.

Note:

If transmitted values or functions are not available the status bit "illegal value" and/or "illegal function" and the bit "common alarm operation" will be set until the appropriate value has been reset correctly. An alarm reset is not necessary. You can determine which value and/or function is wrong by comparing the set and actual data.