

Profibus – Interface for Thermo-6 / Thermo-5 (Protocol Profibus-DP)**Contents**

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1 General

This protocol is supported with Thermo-6/Gate-6 and Thermo-5 units.

2 Settings on the temperature control unit

2.1 Thermo-6 / Gate-6

The following settings must be made on the temperature control unit Thermo-6 or interface server Gate-6.

Parameter	Profile	Menu level	Value	Remarks
Protocol	Standard	Gate \ Protocol converter	15	Profibus-DP
Profibus-DP address	Extended	Gate \ Protocol converter	-	
Remote control address	Standard	Setting \ Remote control	-	Set parameters for the individual units according to the addresses programmed in the Profibus environment.

Table 1: Settings on Thermo-6 / Gate-6

2.2 Thermo-5

The following settings must be made on the temperature control unit Thermo-5.

Parameter	Profile	Menu level	Value	Remarks
Protocol	Standard	Setting \ Remote	15	Profibus-DP
Compatibility Profibus to S4	Standard	Setting \ Remote	no	
Profibus node 1..4	Standard	Setting \ Remote	-	Set parameters according to the node address used
Address	Standard	Setting \ Remote	-	Set parameters for the individual units according to the addresses programmed in the Profibus environment.

Table 2: Settings on Thermo-5

3 Interface concept

The control system of the production machine communicates with the connected temperature control units via the Profibus interface. Values are transmitted from the machine to the units and vice versa. The machine assumes the master function, the temperature control unit reacts as a slave.

4 Description of hardware

It is connected externally by a 9-pin Sub-D plug connection.

4.1 Thermo-6 / Gate-6

For the Thermo-6 unit, the Gate-6 interface server is equipped with an additional ZP board, which allows communication via Profibus.



Fig. 1: Profibus-DP (ZP) connection Gate-6

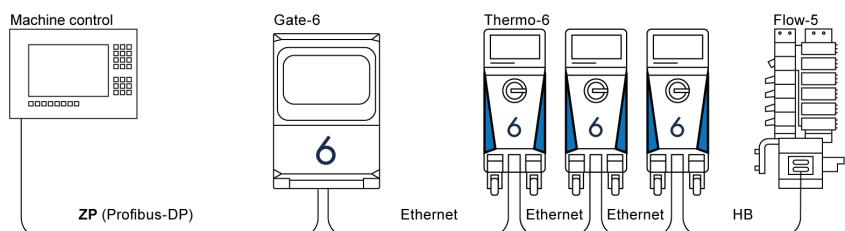


Fig. 2: Communication Gate-6 and Thermo-6 with any interface

4.2 Thermo-5

In the Thermo-5 unit, the basic control unit is fitted with an additional ZP circuit board.



Fig. 3: Profibus-DP (ZP) connection Thermo-5

5 Safety concept

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

6 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.

Table 3: ProfibusDP – Interface parameters

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".

7 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 <https://knowledge.hb-therm.eu>.

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.

8 GSD-file

The GSD file is available for download at <https://knowledge.hb-therm.eu> 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

To inquire about the availability of a customized GSD file, please contact the HB-Therm national representative (www.hb-therm.com).

9 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

9.1 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 temperature 1	1	0,1 °C	0–4000 (e.g. 1325 = 132,5 °C)	
	Nominal value temperature 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	1	-	-	

Module	Description	Word	Unit	Range	Note
	Bit 8: Alarm reset (for acknowledging P-/M-alarms) Bit 9–14: Reserve Bit 15: Watchdog				
Istwert Externfuehler 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 temperature 1	1	0,1 °C	0–4000	
	Nominal value temperature 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)

Module	Description	Word	Unit	Range	Note
	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 Bit 15: Watchdog	8	-	-	
	Actual value external sensor	9	0,1 °C	0–4000	

Table 4: 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-6/Thermo-5, with connected external flow meter Flow-5.
- 4) Thermo-6: Set the parameter [Source external sensor](#) under [Setting/External sensor](#) to "OpcUa".
 Thermo-5: Set the parameter [Sensor type external sensor](#) under [Setting/Miscellaneous](#) 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.

9.2 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 temperature 1	1	0,1 °C	0–4000 (e.g. 1325 = 132,5 °C)	
	Nominal value temperature 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)	1	-	-	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				
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)

Module	Description	Word	Unit	Range	Note
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)
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 Flow Max 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 Flow Max 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 Temp Ext 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 Temp Ext 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 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	16			

Table 5: 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-6/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.