Description
Data transmission:

Profinet

Single Basic Controller - Touch
SBC-T Typ: R8500…

Inhaltsverzeichnis

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Preface

This description was prepared with the greatest possible care.
However, the information contained herein does not constitute a guarantee of product properties.
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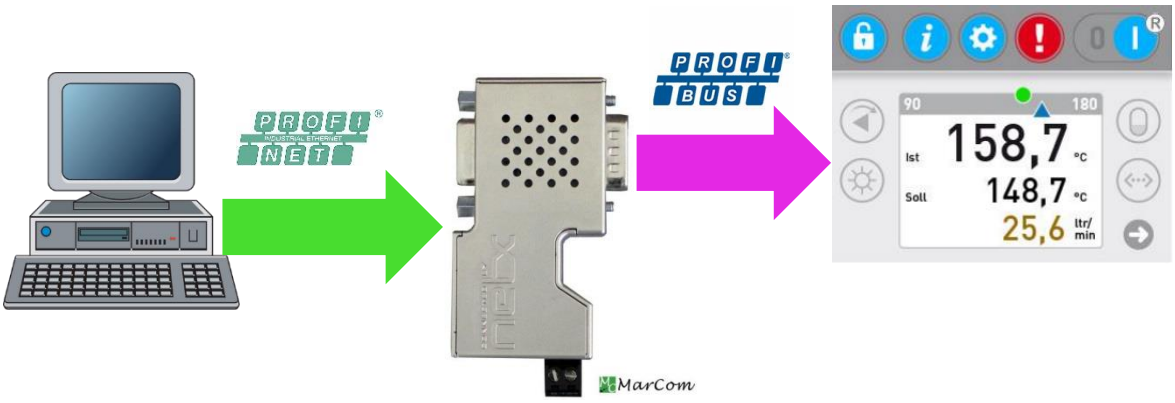
SINGLE Temperiertechnik GmbH reserves the right to make changes in the interest of technical progress at any time.

1 Interface, general description

The "Basic Controller-Touch" SBC-T (also called controller) is suitable for connection to the Profibus-DP bus system.
A gateway connector is used for connection to a Profinet network.



This makes it possible to have the controller monitored and controlled via Profinet by a master (e.g. an industrial or personal computer or SPS).

In the following you will find the description of the Profibus interface.
The description of the gateway can be found in appendix 1 & 2

The process of a communication is always controlled by the master.
The downstream control device works as a "slave".
Each control device has its own device address.

If the control device detects transmission errors or plausibility errors (e.g. exceeding of range limits), it will not accept these data.
The previously existing, valid data will remain unchanged.

Control device settings:

Device address:	The controller address 1...125 is set on the controller. See parameter: "Adr“
Baudrate:	93,75 kBaud ... 12 MBaud (with automatic recognition)

It is essential to observe the operating instructions belonging to the control device.

GSD – file:
Please cover over: Single Temperiertechnik GmbH, Hochdorf.
Internet: www.single-temp.de

1.1 Commissioning

Note
Commissioning of the control unit with Profibus-DP connection may only be carried out by trained personnel in compliance with the safety regulations.
It is essential that you have sound experience in working with Profibus-DP.
Please also refer to our FAQ list.

For Commissioning you need the following components:

- Connector plug for the PROFIBUS connection to the control device
- PROFIBUS-cable (This cable is usually already installed on site!)
- Diskette with GSD-file
- Project planning tool for the PROFIBUS-DP

In order to ensure that the control device works properly, the following steps must be carried out during commissioning:

PROFIBUS- Anschluss: Connect the control device with the PROFIBUS-cable.

Set the following parameters on the control device:

Parameter „Protocol“	to„Profibus DP“
Parameter „Address“	to the required Profibus address. (Default address is 2)
Parameter „Baudrate“	No setting possible. The required baud rate is automatically detected and is displayed. Display "ndt" = no baud rate detected.

diagnostic display:
The following diagnostic displays are shown in the "Status" parameter:

Data Exchange:	The device is located in data- exchange-modus. The communication is O.K. The data exchange with the master takes place.

Wait Param.:
The bus connection is recognized. The control device is waiting for the Parameterization by the master. This is done automatically.

no connection:	The control device is not properly connected to the bus	
	z.B.:	-There may be a wiring error -The Master is not active -The protocol is not set correctly

DP Hardware-Error: Error in the Profibus hardware of the control device.
Send the device in for inspection. However, the normal regular operation of the device is still possible. For further information see alarm list.

2 Transfer of the parameters

The communication

The Master sends data to the control device
In the opposite direction, the controller sends a response to the Profibus master.
This process takes place cyclically and is controlled by the master.

The control device is configured using the GSD file.

The following modules are available for the control device SBC-T

1. Process image:	Modul:	„Single process data“
2. Configuration channel:	Modul:	„Parameter Channel“
3. Processimage and configuration channel:	Modul:	„Single process data+parameter“

2.1 Processimage (process reflection)

In the process image, certain parameters are transferred according to a fixed scheme.

2.1.1

2.1.2 from Master to control device: Transmission of setpoint 1 and control word

Byte 1	Byte 2	Byte 3
setpoint High Byte	setpoint Low Byte	Control word

Setpoint: The parameter consists of two data bytes:

Example:		Dez.	Hex.	High-Byte	Low-Byte
Setpoint:	230	00E6	00	E6	

Corresponds e.g. to 230°C or 230°F or 23.0°C depending on parameter "CF
(see parameter list of the control device).

The numerical value is handled as shown in the display.

150	➡	15,0	with comma
150	➡	150	without comma

Control word:

Bit 0:	device „on“ / „off“	1 = on
Bit 1:	Device "cool down" and "off“	1 = on
Bit 2:	Sensor intern/extern	1 = extern
Bit 3:	leak stop function	1 = on
Bit 4*:	mould evacuation	1 = on
Bit 5:	lowering setpoint (2nd setpoint)	1 = on
Bit 6*:	optimization	1 = on
Bit 7:	---	---

*Regarding Bit 4 „mould evacuation“:
Changing from "0" to "1" causes a one-time mould evacuation.
To trigger a new emptying, the bit must be set to "0" once in the meantime.
The current device status can be read in the status of the process data. After the mould evacuation is finished, the status "Device off and mould evacuation off" is reported.

*Regarding Bit 6 „optimization“:
Changing from "0" to "1" causes a single optimization.
To trigger an optimization again, the bit must be set to "0" once in the meantime.
If bit 6 is set to "0", any optimization that may be running is aborted.
The current optimization status can be read from the status of the process data.

2.1.1 from control device to master: transferring the process data

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Status specification	act value, act. control sensor High Byte	act value , act. control Low Byte	act value , return / external High Byte	act value , return / external Low Byte

Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
Flow rate High Byte	Flow rate Low Byte	pressure High Byte	pressure Low Byte	0x00	0x00

Byte 12	Byte 13	Byte 14	Byte 15	Byte 16	Byte 17
Film-temperature High Byte	Film-temperature Low Byte	Output level 0x9C….0x64	Alarm 1	Alarm 2	Status

Definition "Status specification":
indicates whether a range error occurred when writing the setpoint.

0 =	Setpoint O:K:
1 =	Setpoint-specification incorrect

Definition „Alarm 1“:

Bit 0 =	Collective alarm (marked with * alarms do not go into the collective alarm)
Bit 1 =	Alarm 1 *
Bit 2 =	---
Bit 3 =	Alarm pump (motor protection switch has responded)
Bit 4 =	Alarm filling level, level
Bit 5 =	Flow alarm (option) / flow monitor
Bit 6 =	System error
Bit 7 =	optimization error *

Definition „Alarm 2“:

Bit 0 =	---
Bit 1 =	---
Bit 2 =	Alarm Film temperature
Bit 3 =	Sensor break alarm (current control sensor)
Bit 4 =	Alarm Druck zu hoch (Option)
Bit 5 =	---
Bit 6 =	nearly empty*
Bit 7 =	---

Definition „Status“:

Bit 0 =	device on / off	1 = on
Bit 1 =	device cool down and off	1 = on
Bit 2 =	sensor intern/external	1 = external
Bit 3 =	leak stop function	1 = on
Bit 4 =	mould evacuation	1 = on
Bit 5 =	lowering setpoint (2nd setpoint) 1 = on	
Bit 6 =	Optimization	1 = on
Bit 7 =	Manual / remote operation	1 = Manual

2.1.2 from master to control device:

Transmission example for transmitting setpoint 1 and control word

Condition: Parameter "Unit" = °C and not °F or 0.1°C

Byte 1 + 2: A setpoint of 50°C should be transmitted to the controller.
Sollwert: 50 decimal = 0x0032 hexadecimal als 16 Bit Integer-value

Byte 3: The control system should be switched on (Bit 0 = 1).

Byte 1	Byte 2	Byte 3
setpoint High Byte 0x00	setpoint Low-Byte 0x32	Control word 0x01

Response from the control device to the master: Transfer of the process image

The control device shows the following parameter values (parameter unit = °C):

Byte 1: status specification: The last specification was okay.
Byte 2 + 3: act. value: 55 (decimal) = 0x0037 (hexadecimal as 16 Bit Integer-value)
Byte 4 + 5: act. value return or external: 50 (dec.) = 0x0032(hex.)
Byte 6 + 7: act. value flow rate: (only if available) 0 (dec.) = 0x0000 (hex.)
Byte 8 + 9: act. value pressure: (only if available) 0 (dec.) = 0x0000 (hex.)
Byte 10 +11: 0x00
Byte 12 + 13: act. value film temperature: 100 (dec.) = 0x0064 (hex.)
Byte 14: output value: 33 (dec.) = 0xDF (hex. as 8 Bit Integer-value)
Byte 15: Alarm 1 The common alarm has responded.
Byte 16: Alarm 2 The film temperature alarm has been activated.
Byte 17: Status The control device is switched on.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Status specification 0x00	act value, act. control sensor High Byte 0x00	act value, act. control sensor Low Byte 0x37	act value, return / external High Byte 0x00	act value, return / external Low Byte 0x32

Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
Flow rate High Byte 0x00	Flow rate Low Byte 0x00	pressure High Byte 0x00	pressure Low Byte 0x00	performance 0x00	performance 0x00

Byte 12	Byte 13	Byte 14	Byte 15	Byte 16	Byte 17
film temperature High Byte 0x00	film-temperature Low Byte 0x64	Output level -100…+100 0xDF	Alarm 1 0x01	Alarm 2 0x04	Status (read) 0x01

2.2 Configuration channel

Each parameter can be addressed individually via the configuration channel.
The master in the Profibus- DP has the possibility to read out all available data of the control devices and, if allowed, to change them.

The command or parameter transfer takes place in both directions via defined data blocks.

Terms:

command code	[**BC**]:	"tells" the device what it has to "do"	(1 byte)
Parameter code	[**PC**]:	designates each individual parameter that can be called up in the controller	(1 byte)
Parameter value	[**PW**]:	indicates the value of a parameter	(3 bytes)

number ranges

command codes	[**BC**]	0x10, 0x20, 0x21
Parameter code	[**PC**]:	0x00...0xFF
Parameter value	[**PW**]:	the parameter value (16-bit integer) is composed of the pure numerical value PWH and PWL and the decimal place PWK

Parameter value High-Byte	[**PWH**]
Parameter value Low- Byte	[**PWL**]
decimal point	[**PWK**]

Configuration of the parameters via the configuration channel.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Consecutive number 0x00 ... 0xFF	always: 0x01	Command code BC 0x10, 0x20 or. 0x21	always: 0x00	Parameter code PC 0x00 ... 0xFF	Parameter value PWH High-Byte	Parameter value PWL Low-Byte	Decimal point PWK 0x00 ... 0xFF

Byte 1
consecutive number:
The master should prefix each new request with a new sequence number. This is repeated by the control device in the response. So, it is possible to assign request and answer to each other.

Byte 2: always 0x01

Byte 3
Command code, BC:
0x10: read parameters
0x20: write parameters
0x21: Write parameters and store them in a power-failure-proof memory

The power failure-proof semiconductor memory (EAROM, EEPROM)
allows max. 1.000.000 writing cycles.

Byte 4: always 0x00

Byte 5
Parameter code, PC: request:
Addresses the parameter to be configured (see table).

Response:
If the reading process from the control unit was error-free, byte 5 in the response from the control unit contains the parameter code PC. If the write operation to the controller was error-free, byte 5 contains the value 00H (acknowledge).

If communication is faulty, the following error messages may appear in Byte 5:

03 H	-Procedure error (invalid command code).
	-Device is not in remote mode.
04 H	-Range specification not met (value too large or too small)
05 H	-Byte 2 ≠ 0
06 H	-the addressed parameter is a "read only parameter
08 H	-Parameter code is invalid
09 H	-Command execution not possible
	(e.g. optimization cannot be triggered)
FEH	-Error while writing into the power failure protected memory
FFH	-general error

Byte 6, 7 and 8
Parameter value:
Bytes 6, 7 and 8 contain the parameter value PWH and PWL
and the decimal place PWK.
The parameter value consists of three data bytes:
2 data bytes (numerical value), 1 data byte (decimal place).

examples:	Dez.	Hex.	PWH	PWL	decimal place
act. value (°C or °F):	215	00D7	00	D7	00
setpoint (°C oder °F):	230	00E6	00	E6	00
output ratio, "cool" (%)	-16	FFF0	FF	F0	00
setpoint ramp (°C/min):	2,2	0016	00	16	01

The parameter value is calculated as follows:
Dec: 2.2 = 22 with one decimal place
Hex.: = 0016 (PWH PWL) = 01 (1 decimal point)

negative values:
Formation by the binary 2's complement.

2.2.1 Parameter codes (Table 1)

Parameter	Para- Code	Read Write	other
Cockpit			
1. setpoint	0x21	RW	
Expert			
Regulation	0x10	RO	
Film temperature	0x14	RO	
return/external	0x12	RO	
Current output level	0x60	RO	
Flow rate	0x15	RO	Option
Pressure	0x16	RO	Option
Device functions			
Alarm value	0x38	RW	
Leak stop function on/off	0xA7	RW	
Remote on/off	-		
Mould evacucuation active	-		
Pump overrun	0xD4	RW	Cool down before switch off
Pump control on/off	0xB3	RW	on=1, Ab SW-Version V48/18
Self-optimization	0x88	RW	
Basic settings			
language	0xD9	RW	
unit	0x1B	RW	
Keyboard lock	0x85	RW	
Lock code	-		
Factory access Single	-		
Pressure unit	0xE5	RW	Option
Flow rate unit	0xE6	RW	Option
Device parameters			
fill	0xD0	RW	
Direct cooling	0x94	RW	
Venting after switch-on	-		
Switch-off temperature	0x93	RW	
Changetime	0xA1	RW	
Changeover setpoint 1/2	0xD6	RW	Option
Aquatimer Start time	0xA9	RW	
Aquatimer	0xA0	RW	
Filling time control	0xB0	RW	
Restart lock	0x90	RW	Emergency-Off
Process data USB cycle	-		
External Sensor	0xD7	RW	Option on=1 off=0
Temperature parameter			

2. setpoint	0x22	RW	
Output limit heating	0x64	RW	
Output limit cooling	0x69	RW	
XP - heat	0x40	RW	
TV - heat	0x41	RW	
TN -heat	0x42	RW	
XP - cool	0x50	RW	
TV - cool	0x51	RW	
TN - cool	0x52	RW	
Switching hysteresis heating / cooling	0x46	RW	
Dead zone not heating	-		
Heating cycle time	0x43	RW	
Cooling cycle time	0x53	RW	
upper setpoint limit	0x2C	RW	
lower setpoint limit	0x2B	RW	
System Closed temperature	0xA2	RW	
Setpoint ramp rising	0x2F	RW	
Setpoint ramp falling	0x2E	RW	
Switching hysteresis Switching on cooling	0x5A	RW	Only at 2Pc cooling
Switching hysteresis Switching off cooling	0x59	RW	Only at 2Pc cooling
Offset internal temperature sensor	0xAB	RW	
Offset film temperature sensor	0xAF	RW	
Offset feedback or external sensor	0xAD	RW	
Analog values 4...20mA/0 ...10V	0x84	RW	
Temperature at 0V or 4mA	-		
Temperature at 10V or 20mA	-		
Flow rate Offset	0x8E		Option
Alarms			
configuration Alarm1	0x34	RW	
Film temperature limit	0x39	RW	
Alarm Flow	0x3B	RW	Option
Alarm Pressure too high	0x3E	RW	Option
communication			
Protocol	-		
Address	-		
Baudrate	-		Serial only
Data format	-		
Status	-		
Parameter			
Pump control			
Pump control selection	0xB1	RW	from SW version V48/18
Fixed actuating value	0xB2	RW	from SW-Version V48/18
Desired flow rate value	0xE7	RW	Option (from SW-Version V36/17)

deviation dT	0xB4	RW	from SW-Version V48/18
XP flow rate	0xB5	RW	from SW-Version V48/18
Tv flow rate	0xB6	RW	from SW-Version V48/18
Tn flow rate	0xB7	RW	from SW-Version V48/18

2.2.2 Parameter code (Table 2)

other Parameters			
Parameter	Para- Code	Read Write	Sonstiges
Actual temperature	0x10	RO	
act. Setpoint	0x20	RO	
Device on/off	0x8F	RW	
Device type	0x01	RO	
SW-Version	0x02	RO	

2.2.3 Transmission example for the configuration channel, command code 10 H

The control device should send the parameter (actual value, 10 H) to the master.
The actual value has the value of 225 degrees C. 225 (decimal) = 0xE1 (hex)

Master to control device:		Dec.	Hex
consecutive number:		1	0x01
always:		1	0x01
send Parameter:		16	0x10
always:		0	0x00
Parameter code (act value):		16	0x10
Parameter (High-Byte):		0	0x00
Parameter (Low -Byte):		0	0x00
decimal place:	0	0x00	

Transmission to control device: 0x01, 0x01 0x10, 0x00, 0x10, 0x00, 0x00, 0x00

control device to Master:	Dec.	Hex
consecutive number of the request:	1	0x01
always:	1	0x01
send Parameter:	16	0x10
always:	0	0x00
Parameter code (act. value):	16 *)	0x10
Parameter (High-Byte):	0	0x00
Parameter (Low -Byte):	225	0xE1
decimal playce:	0	0x00

Transmission to Master: 0x01, 0x01 0x10, 0x00, 0x10, 0x00, 0xE1, 0x00

*) Repeat PC = 16, because the read operation was error-free.

2.2.4 Transmission example for the configuration channel, command code 20 H

The control device receives the command :
"Transfer parameter XP heating (parameter code: 40H, parameter value: 5.0 %) to the data memory (RAM)".

Master to control device:		Dez.	Hex
consecutive number:		2	0x02
always:		1	0x01
command code:		32	0x20
always:		0	0x00
Parameter code (xp-heat)		64	0x40
Parameter (High-Byte):		0	0x00
Parameter (Low -Byte):		50	0x32
decimal place:	1	0x01	

Transmission to control device: 0x02, 0x01, 0x20, 0x00, 0x40, 0x00, 0x32, 0xFF

control device to Master:		Dec.	Hex
consecutive number of the request:		2	0x02
alyways:		1	0x01
command code:		32	0x20
always:		0	0x00
Parameter code:		0 *)	0x00
Parameter (High-Byte):		0	0x00
Parameter (Low -Byte):		0	0x00
decimal place:	0	0x00	

Transmission to Master: 0x02, 0x01, 0x20, 0x00, 0x00, 0x00, 0x00, 0x00

*) If the control device has "understood" the command of the master, it answers with the parameter code PC = 00, because the writing process was error-free.
In case of transmission or other (e.g. formal) errors, the controller responds at this point with corresponding error code.

2.2.5 Transmission example for the configuration channel, command code 21 H

The control device receives the command:
"Accept parameter SP1 = 200 °C (setpoint 1, parameter code: 0x21) and store power-failure-proof".

Master to control device:		Dec.	Hex
consecutive number:		3	0x03
always:		1	0x01
command code:		33	0x21
always:		0	0x00
Parameter code (SP1):		33	0x21
Parameter (High-Byte):		0	0x00
Parameter (Low -Byte):		200	0xC8
decimal place:	0	0x00	

Transmission to control device: 0x03, 0x01, 0x21, 0x00, 0x21, 0x00, 0xC8, 0x00

control device to Master:		Dec.	Hex
consecutive number of requests:		3	0x03
always:		1	0x01
command code:		33	0x21
always:		0	0x00
Parameter code:		0 *)	0x00
Parameter (High-Byte):		0	0x00
Parameter (Low -Byte):		0	0x00
decimal place:	0	0x00	

Transmission to Master: 0x03, 0x01, 0x21, 0x00, 0x00, 0x00, 0x00, 0x00

*) If the control device has "understood" the command of the master, it answers with the parameter code PC = 00, because the writing process was error-free.
In case of transmission or other (e.g. formal) errors, the controller responds at this point with corresponding error code.

2.3 Process image and configuration channel

Process image and configuration channel can also be transferred simultaneously.
For this purpose, the bytes of the configuration channel are added to those of the process image.

2.3.1 Master to control device

Byte 1	Byte 2	Byte 3
setpoint High Byte	setpoint Low Byte	Control word

Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
Consecutive number	always: 0x01	Command code BC	always: 0x00	Parameter code code PC	Parameter value PWH High Byte	Parameter value PWL Low Byte	Decimal place PWK

2.3.2 control device to Master:

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Status specification	Act. value, act. Control sensor High Byte	Act. value, act. Control sensor Low Byte	Act. value, return / External High Byte	Act. value, return / External Low Byte

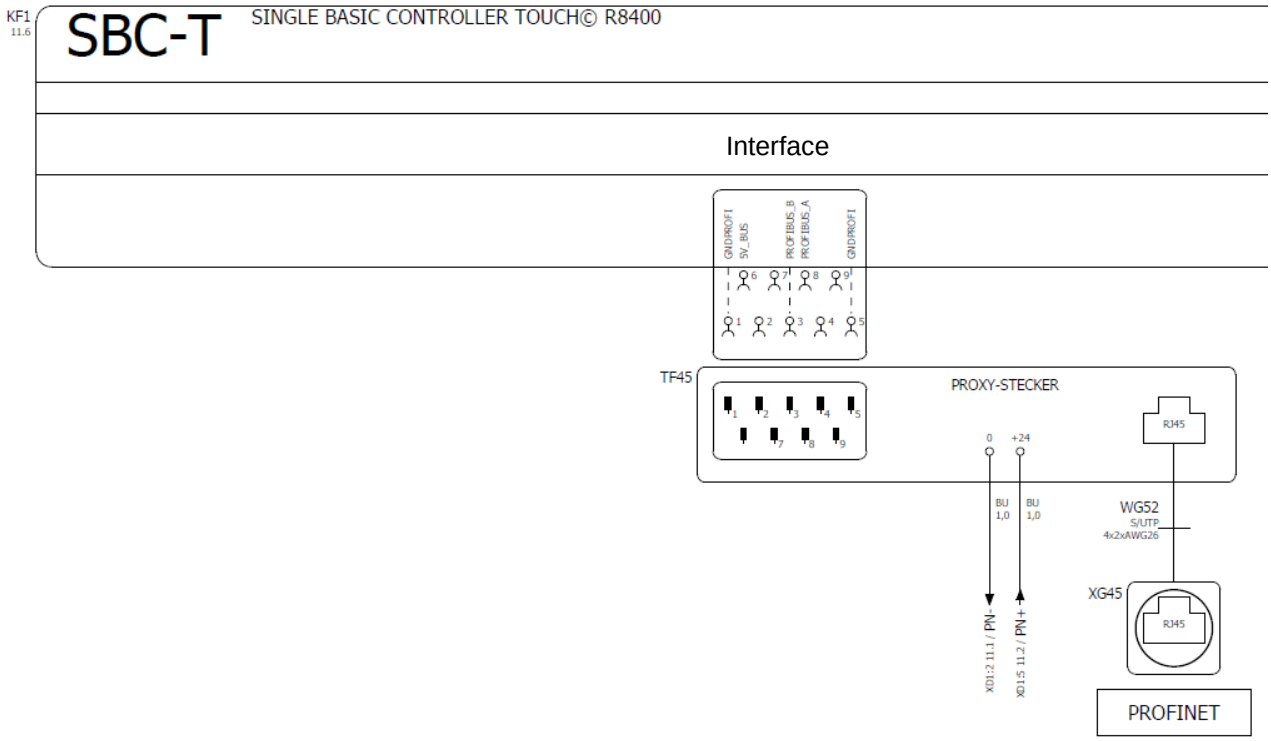
Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11
Flow rate High Byte	Flow rate Low Byte	pressure High Byte	pressure Low Byte	performance 0x00	performance 0x00

Byte 12	Byte 13	Byte 14	Byte 15	Byte 16	Byte 17
Film temperature High Byte	Film temperature Low Byte	output level	Alarm 1	Alarm 2	Read status

Byte 18	Byte 19	Byte 20	Byte 21	Byte 22	Byte 23	Byte 24	Byte 25
Consecutive number	always: 0x01	Command code BC	always: 0x00	Parameter code PC	Parameter value PWH High-Byte	Parameter value PWL Low-Byte	Decimal place PWK

3 Connection example

3.1 Connection Profinet



4 Attachements

4.1 Attachement 1 Instruction Profinet Gateway

4.2 Attachement 2 Commissioning with TIA Portal