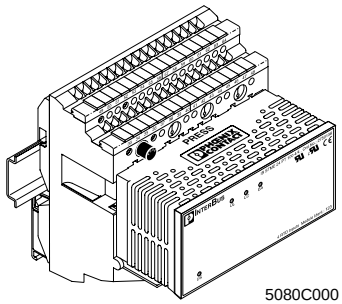
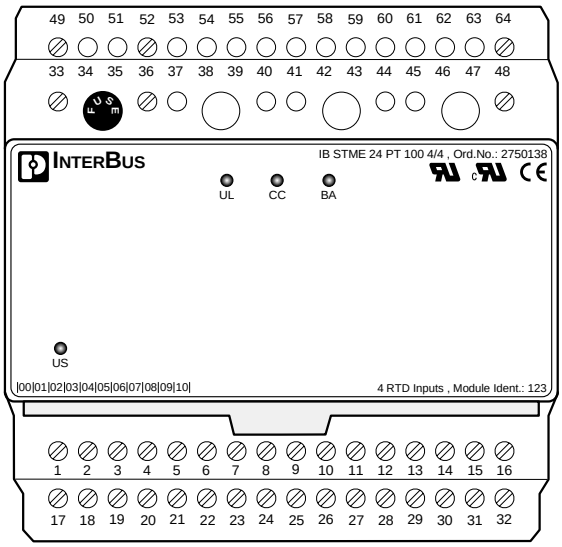
IB ST (ZF) 24 PT 100 4/4

Analog Input Module with 4 Channels for the Connection of Resistance Temperature Detectors (RTDs)



5080C000

Data Sheet 5080C 01/2000



5080C001

Figure 1 IB ST 24 PT 100 4/4 module

This data sheet is intended to be used in conjunction with the IBS SYS PRO UM E User Manual.

Ground the mounting rail. The module is grounded by installing it on the mounting rail.

Terminal Assignment

Signal	Terminal			
+24 V supply	33 and 36			
Ground of the supply (⊥)	49 and 52			
Functional earth ground (FE)	48 and 64			
Channel	**1**	**2**	**3**	**4**
Sensor power	2 and 3	6 and 7	10 and 11	14 and 15
Sensor current	1 and 4	5 and 8	9 and 12	13 and 16
Shield	20	24	28	32
Not used; do not wire!	17 to 19, 21 to 23, 25 to 27, and 29 to 31			

Local Diagnostic and Status Indicators

Des.	Color	Meaning
UL	Green	Supply voltage for the electronics module
CC	Green	Cable check
BA	Green	Bus active
US	Green	24 V I/O supply voltage

Internal Circuit Diagram

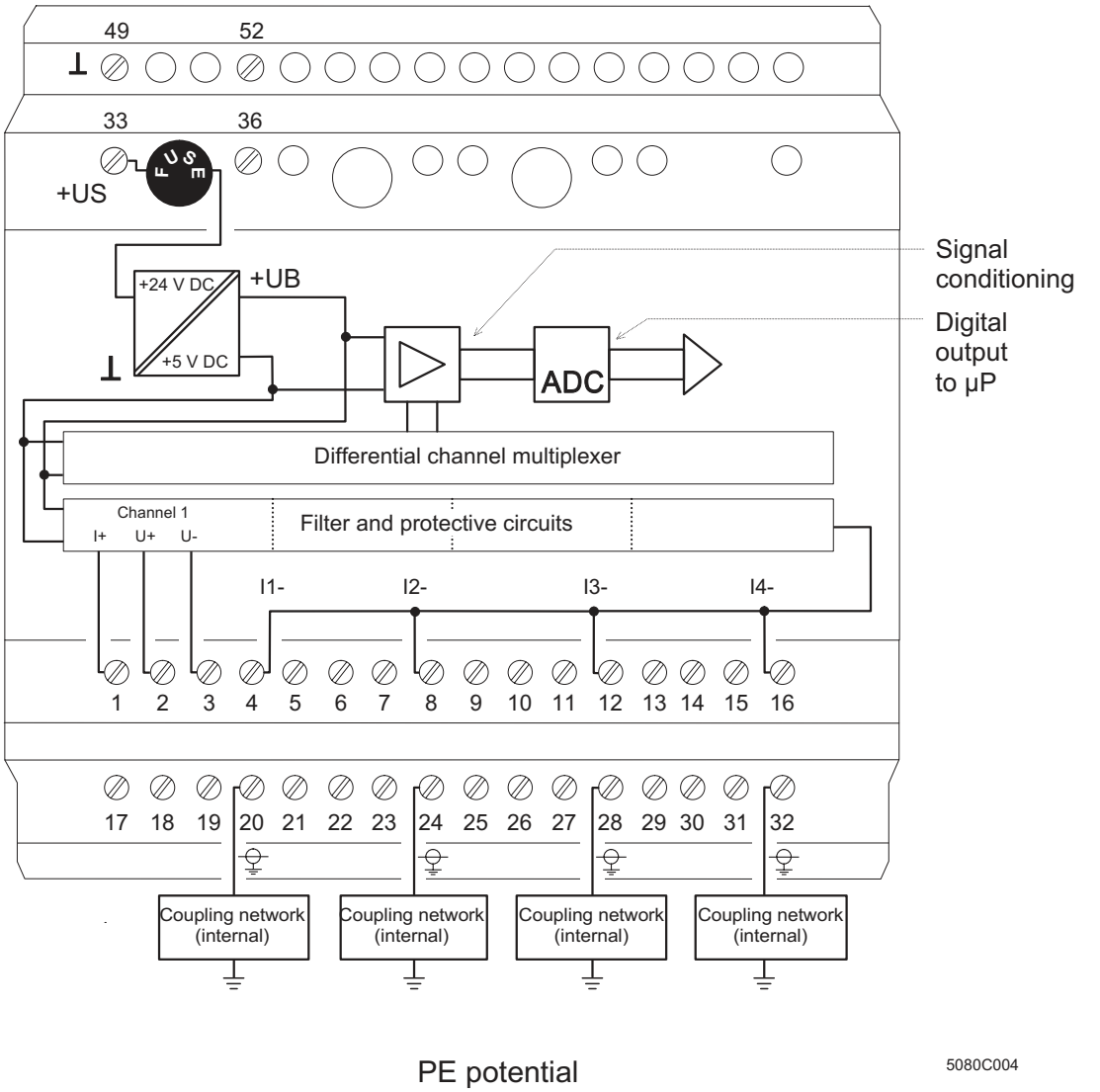


Figure 2 Internal wiring of the module terminals

Electrical Isolation of the Function Areas

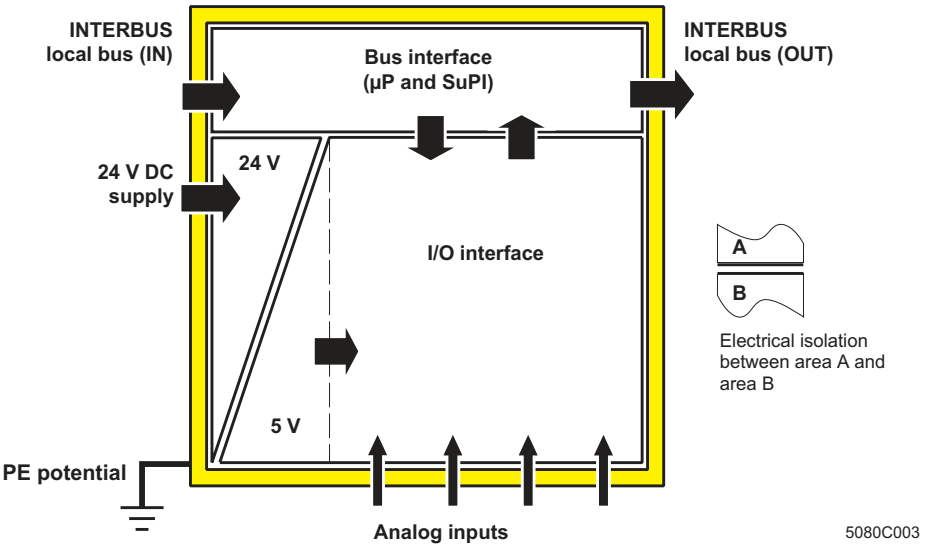


Figure 3 Electrical isolation of the function areas

Connection Examples

Connection of the Supply Voltage and Potential Jumpering

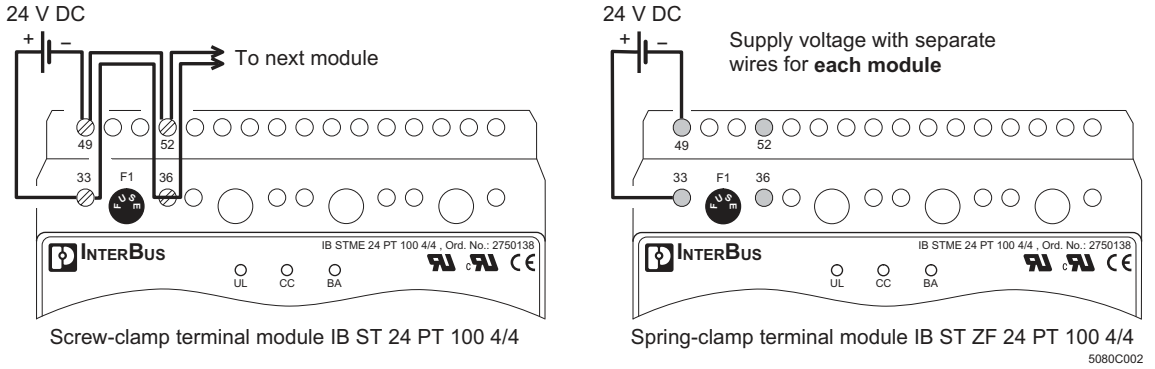


Figure 4 Connection of the supply voltage

Potential jumpering in the screw-clamp module:
If you want to connect more module , an external jumper is required between the terminals 33 and 36 (Us), 49 and 52 (⊥).

Typical Sensor Connections

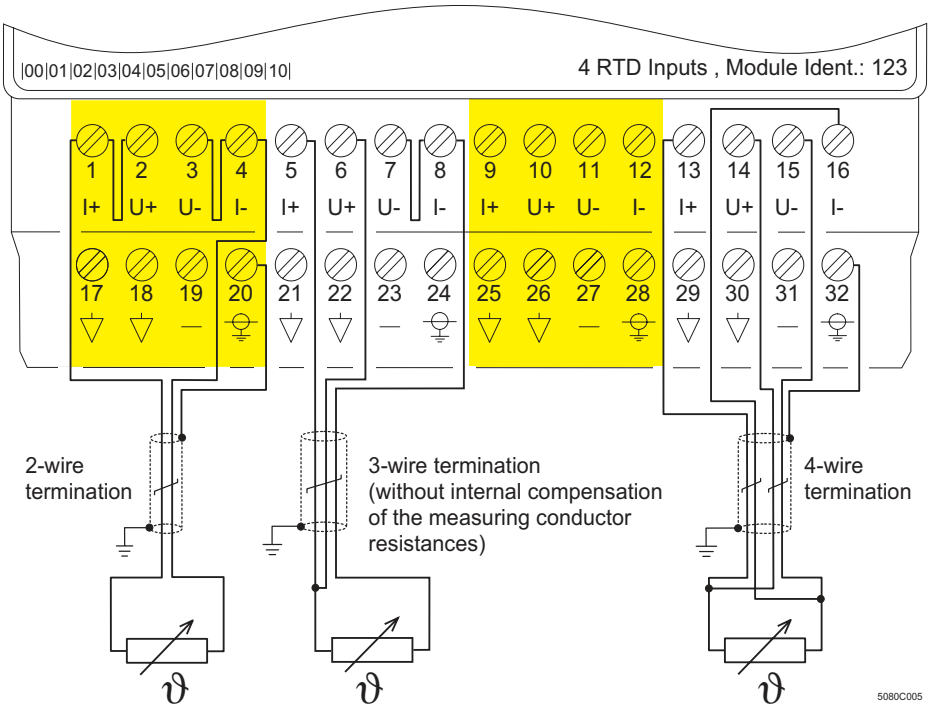


Figure 5 Sensor connection in 2-, 3-, and 4-wire termination

Always connect sensors using shielded, twisted-pair cables. Connect the shield directly to the terminals 20, 24, 28, or 32. Additional wiring is not necessary. Connect the shield of the sensor with PE potential.

INTERBUS IN Process Data Word

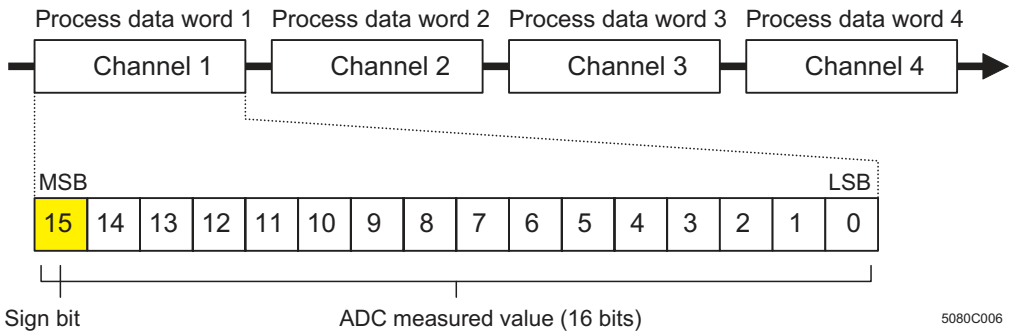


Figure 6 Sequence of the four INTERBUS IN process data words in the INTERBUS ring and representation of the bits of a process data word

Bit Assignment of the INTERBUS IN Process Data Word

The 16 bits of the calculated measured value (16-bit ADC resolution) are used according to the following table. Bit 15 is the sign bit (SB).

Celsius Scale (Table on page 6)

The permissible temperature ranges for the characteristic curves are marked in the table on page 6 in the first three columns. The temperatures range from -200°C to +850°C for Pt 100 sensors and Pt 1000 sensors.
The sensor characteristic curves for Ni 100 and Ni 1000 sensors range from -60°C to +250°C (DIN characteristic) and from -60°C to +200°C (SAMA characteristic).
Temperature values outside the permissible range cause the error code $E004_{hex}$ of the corresponding channel to be indicated.

Fahrenheit Scale (Table on page 7)

The permissible temperature ranges for the characteristic curves are marked in the table on page 7 in the first three columns. The temperatures range from -328°F to +1562°F for Pt 100 sensors and Pt 1000 sensors.
The sensor characteristic curves for Ni 100 and Ni 1000 sensors range from -76°F to +482°F (DIN characteristic) and from -76°F to +342°F (SAMA characteristic).
Temperature values outside the permissible range cause the error code $E004_{hex}$ of the corresponding channel to be indicated.

Celsius Scale

Sensor			Temperature	Process Data Word		
				Decimal	Hexadecimal	Binary
			+3276.7°C	+32767	7FFF	0111 1111 1111 1111
			...	...	...	...
			+1000.0°C	+10000	2710	0010 0111 0001 0000
			...	...	...	...
Pt 100/Pt 1000			+850.0°C	+8500	2134	0010 0001 0011 0100
			...	...	...	...
	Ni100/Ni 1000 **DIN** characteristic		+250.0°C	+2500	09C4	0000 1001 1100 0100
			...	...	...	...
		Ni 100/Ni 1000 **SAMA** characteristic	+200.0°C	+2000	07D0	0000 0111 1101 0000
			...	...	...	...
			+100.0°C	+1000	03E8	0000 0011 1110 1000
			...	...	...	...
			+10.0°C	+100	0064	0000 0000 0110 0100
			...	...	...	...
			+1.0°C	10	000A	0000 0000 0000 1010
			...	...	...	...
			+0.1°C	1	0001	0000 0000 0000 0001
			...	...	...	...
			0.0°C	0	0000	0000 0000 0000 0000
			...	...	...	...
			-0.1°C	-1	FFFF	1111 1111 1111 1111
			...	...	...	...
			-1.0°C	-10	FFF6	1111 1111 1111 0110
			...	...	...	...
			-10.0°C	-100	FF9C	1111 1111 1001 1100
			...	...	...	...
			-60.0°C	-600	FDA8	1111 1101 1010 1000
			...	...	...	...
			-100.0°C	-1000	FC18	1111 1100 0001 1000
			...	...	...	...
			-200.0°C	-2000	F830	1111 1000 0011 0000
			-273.1°C	-2731	F555	1111 0101 0101 0101

Fahrenheit Scale

Sensor			Temperature	Process Data Word		
				Decimal	Hexadecimal	Binary
			+3276.7°F	+32767	$7FFF_{hex}$	$0111\ 1111\ 1111\ 1111_{bin}$
			...	...	...	...
Pt 100/Pt 1000			+1562.0°F	+15620	$3D04_{hex}$	$0011\ 1101\ 0000\ 0100_{bin}$
			...	...	...	...
			+1000.0°F	+10000	2710_{hex}	$0010\ 0111\ 0001\ 0000_{bin}$
			...	...	...	...
	Ni100/Ni 1000 **DIN** characteristic		+482.0°F	+4820	$12D4_{hex}$	$0001\ 0010\ 1101\ 0100_{bin}$
			...	...	...	...
		Ni 100/Ni 1000 **SAMA** characteristic	+392.0°F	+3920	$0F50_{hex}$	$0000\ 1111\ 0101\ 0000_{bin}$
			...	...	...	...
			+100.0°F	+1000	$03E8_{hex}$	$0000\ 0011\ 1110\ 1000_{bin}$
			...	...	...	...
			+10.0°F	+100	0064_{hex}	$0000\ 0000\ 0110\ 0100_{bin}$
			...	...	...	...
			+1.0°F	10	$000A_{hex}$	$0000\ 0000\ 0000\ 1010_{bin}$
			...	...	...	...
			+0.1°F	1	0001_{hex}	$0000\ 0000\ 0000\ 0001_{bin}$
			...	...	...	...
			0.0°F	0	0000_{hex}	$0000\ 0000\ 0000\ 0000_{bin}$
			...	...	...	...
			-0.1°F	-1	$FFFF_{hex}$	$1111\ 1111\ 1111\ 1111_{bin}$
			...	...	...	...
			-1.0°F	-10	$FFF6_{hex}$	$1111\ 1111\ 1111\ 0110_{bin}$
			...	...	...	...
			-10.0°F	-100	$FF9C_{hex}$	$1111\ 1111\ 1001\ 1100_{bin}$
			...	...	...	...
			-76.0°F	-760	$FD08_{hex}$	$1111\ 1101\ 0000\ 1000_{bin}$
			-100.0°F	-1000	$FC18_{hex}$	$1111\ 1100\ 0001\ 1000_{bin}$
			...	...	...	...
			-328.0°F	-3280	$F330_{hex}$	$1111\ 0011\ 0011\ 0000_{bin}$
			...	...	...	...
			-459.6°F	-4596	$EE0C_{hex}$	$1110\ 1110\ 0000\ 1100_{bin}$
			+3276.7°F	+32767	$7FFF_{hex}$	$0111\ 1111\ 1111\ 1111_{bin}$

Error Messages

In normal mode, every process data input word contains the temperature value of the corresponding channel. When an error occurs on a channel or module, a code is written to the corresponding input word that indicates the error cause.

If the value E0xxh occurs in the process data this is not a measured value but an error message.

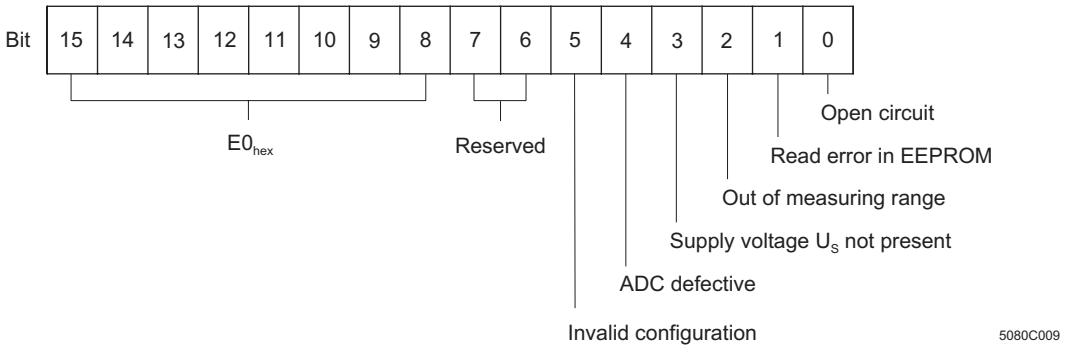


Figure 7 Bit assignment of the error code

Checking the Supply Voltage

The I/O supply voltage is permanently monitored. If the voltage value is outside the predefined range a module error message is released. The error code $E008_{hex}$ is entered into the process data input words instead of the temperature values.

Checking the Data in the Non-Volatile Memory

The configuration is not stored in the volatile memory of the EEPROM. If the configuration of the EEPROM is invalid, a module error message is released and the error code $E002_{hex}$ is written to all process data input words.

Monitoring Converter Activities

A timeout function checks the analog to digital converter (ADC). If the ADC fails, a module error message is released and the error code $E010_{hex}$ is entered in all process data input words.

INTERBUS OUT Process Data Word

HIGH and LOW Byte of the First Process Data Output Word

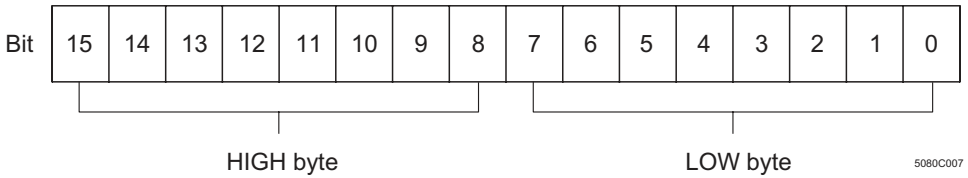


Figure 8 HIGH and LOW byte of the first process data output word

The module can be configured with the INTERBUS master. For this, only the LOW byte of the first process data output word is used. The configuration is valid for all four channels. The process data output words of channels 2, 3, and 4 are not evaluated. During configuration, the measured temperature values continue to be entered in the process data input words of channels 2, 3, and 4 (for channel 1 see note below). The format changes with every new configuration.

Possible Configurations in the LOW Byte

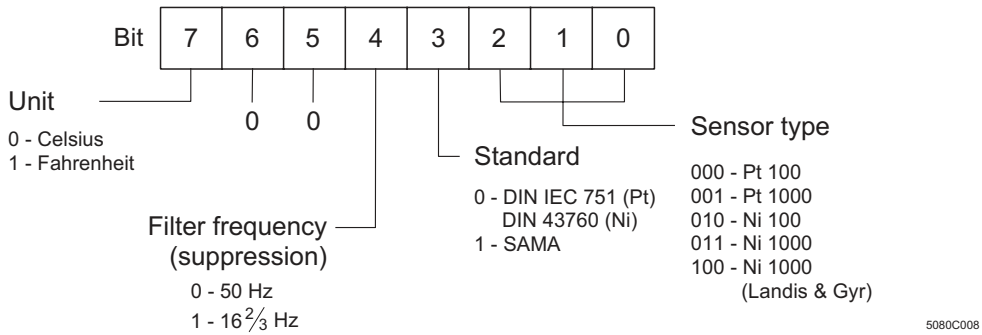


Figure 9 Possible configurations in the LOW byte

The configuration is stored in the non-volatile memory of the EEPROM and is saved when the supply voltage is disconnected. After the configuration is read/written, the 0000_{hex} value must be written to the first process data output word. This causes the first channel to be reset to measuring operation. In the first process data input word, the measured temperature value is transmitted. The default upon module delivery is that all bits of the configuration bytes are set to zero. This leads to the following configuration:
Process data format: °C, standard of the characteristic curve: DIN IEC 60751, sensor type: Pt 100, filter frequency: 50 Hz

Assignment of the HIGH and LOW Byte in the First Process Data Output Word

The control system transmits a request to the module to read or write the configuration through a corresponding process data output word.
The module confirms this process through a corresponding process data input word.

Read configuration

		HIGH Byte	LOW Byte
Output word		80_{hex}	00_{hex}
Input word	Result OK	80_{hex}	Previous configuration
	Result error	88_{hex}	Previous configuration

Write configuration

		HIGH Byte	LOW Byte
Output word		81_{hex}	New configuration
Input word	Result OK	81_{hex}	New configuration
	Result error	89_{hex}	Previous configuration

Adresses for Error Messages and Configuration

Status		Process Data Word	
	Decimal	Hexadecimal	Binary
Error messages	-7937	E0FF	1110 0000 1111 1111
	...	...	...
	-8192	E000	1110 0000 0000 0000
Reserved	...	...	...
Configuration	-32257	81FF	1000 0001 1111 1111
	...	...	...
	-32768	8000	1000 0000 0000 0000

Programming Data

ID code	$7B_{hex}$ (123_{dec})
Length code	4_{hex}
Input address area	8 bytes

Output address area	8 bytes
Parameter channel (PCP)	0 bytes
Register length	8 bytes

Assignment of the Module Terminals to the INTERBUS Reference

INTERBUS reference	Word	Word x															
	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Byte	Byte 0								Byte 1							
	Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Module terminals channel 1	Sensor current (+)	Sign bit	Terminal 1														
	Sensor power (+)		Terminal 2														
	Sensor power (-)		Terminal 3														
	Sensor current (-)		Terminal 4														
	Shield		Terminal 20														
Module terminals channel 2	Sensor current (+)	Sign bit	Terminal 5														
	Sensor power (+)		Terminal 6														
	Sensor power (-)		Terminal 7														
	Sensor current (-)		Terminal 8														
	Shield		Terminal 24														
Module terminals channel 3	Sensor current (+)	Sign bit	Terminal 9														
	Sensor power (+)		Terminal 10														
	Sensor power (-)		Terminal 11														
	Sensor current (-)		Terminal 12														
	Shield		Terminal 28														
Module terminals channel 4	Sensor current (+)	Sign bit	Terminal 13														
	Sensor power (+)		Terminal 14														
	Sensor power (-)		Terminal 15														
	Sensor current (-)		Terminal 16														
	Shield		Terminal 32														

Technical Data

General	
Housing dimensions (width x height x depth)	118 mm x 116 mm x 117 mm (4.646 in. x 4.567 in. x 4.606 in.)
Operating mode	Process data operation with 4 words
Connection type of the sensors	2-, 3-, or/and 4-wire technology
Total power consumption	2.4 W, typical
Permissible operating temperature	-25°C to 55°C (-13°F to +131°F)
Permissible storage temperature	-25°C to +75°C (-13°F to +167°F)
Degree of protection	IP 20, DIN 40050, IEC 60529
Class of protection	Class 3 VDE 0106, IEC 60536
Humidity	75% on average, 85% occasionally, no condensation
Air pressure (operation)	80 kPa to 106 kPa, 2000 m (6562 ft.) above sea level
Electrical isolation	Test voltage
Bus/inputs	500 V AC, 1 min., 50 Hz
Supply voltage/inputs	500 V AC, 1 min., 50 Hz
Supply voltage/protective conductor	500 V AC, 1 min., 50 Hz
I/O voltage/protective conductor	500 V AC, 1 min., 50 Hz
Emitted interference	EN 50081-2, Class A
Processor monitoring	Watchdog circuit
Preferred installation position	Panel mounting
Protective ground	Via DIN rail
Weight	540 g, typical

Interface	
INTERBUS ST interface	ST cable (supplied with the module)

Power Consumption	
Communications power	9 V
Current consumption from the local bus	85 mA, typical; 100 mA, maximum
Power consumption from the local bus	800 mW, typical
I/O supply voltage U_S	24 V DC
Current consumption of U_S	65 mA, typical; 85 mA, maximum
Power consumption from power pack and application side (24 V supply)	1.5 W, typical 2.0 W, maximum

I/O Supply Voltage (U_S)	
Nominal value	24 V DC
Permissible ripple	3.6 V_{pp} within the permissible voltage range
Permissible voltage range (including ripple)	18.5 V DC to 30.5 V DC
Current consumption of U_S	65 mA, typical
Electrical isolation	With DC/DC converter
Test voltage	500 V AC, 50 Hz, 1 min.
Protection against polarity reversal	Via diode connected in series
Surge voltage protection	Fuses in the terminal block base IBS TR5 0,4 AT
Transient protection	Yes
Failure detection	Yes
Power consumption from power supply unit and application side (24 V supply)	1.5 W, typical 2.0 W, maximum

Analog Inputs for Temperature Sensors (RTD)	
Number	4
Available sensor types	Pt 100, Pt 1000 Ni 100, Ni 1000
Standards for characteristic curves	DIN IEC 60751 (Pt 100, Pt 1000) DIN 43760 (Ni 100, Ni 1000) SAMA RC 21-4-1966 (Pt 100, Ni 100 corresponds to Type I) Landis & Gyr (Ni 1000)
Temperature measuring unit	Celsius or Fahrenheit scale
Temperature measuring range (value range)	-273,1°C to 3276.7°C on Celsius scale -459.6°F to 3276.7°F on Fahrenheit scale
Resolution of the measured values	0.1°C corresponds to 0.1 K on the Celsius scale 0.1°F corresponds to 0.056K on the Fahrenheit scale Temperature-proportional, linearized
Resolution of the ADC	16 bits
Measuring principle	Sigma-delta method
Representation of output value	16-bit two's complement
Sensor current	0.2 mA
Basic error limit	±0.003% of the value range (±0.1°C)
Temperature drift	±0.009% of the value range (±0.3°C)
Typical duration of a measuring cycle depending on the number of channels connected with 50 Hz suppression	1 channel: 258 ms 2 channels: 444 ms 3 channels: 630 ms 4 channels: 816 ms
Typical duration of a measuring cycle depending on the number of channels connected with 16.67 Hz suppression	1 channel: 618 ms 2 channels: 1164 ms 3 channels: 1710 ms 4 channels: 2256 ms

Module Error Messages	
Failure of the internal I/O supply voltage (+5 V DC)	Yes
Breakdown of fuse F1 for the I/O supply voltage	Yes
Breakdown of the external I/O supply voltage U_S of 24 V DC	Yes
Analog/digital converter defective	Yes
Content of the EEPROM invalid	Yes
Configuration invalid	Yes
Open circuit detection	No (error message in the process data input word)

Tolerances Influenced by Electromagnetic Fields		
Type of electromagnetic interference	Deviation of the measured temperature value	
	Relative	Absolute
Radiated-noise immunity according to IEC 60801-3: 1984 (field strength 10 V/m)	< ±0.3%	< ±10.0°C
Radiated-noise immunity according to IEC 60801-3: 1984 (field strength 3 V/m)	< ±0.005%	< ±0.2°C
Conducted high-frequency interference (0.15 MHz to 80 MHz) according to IEC 60801-6, Class 3 (ENV 50141: 1993)	< ±0.015%	< ±0.5°C
Transient interferences (burst) according to IEC 60801-4 Class 4 **up to 1000 V**	No deviation	No deviation
Transient interferences (burst) according to IEC 60801-4 Class 4 from **1000 V to 2000 V**	< ±0.5%	< ±18.0°C

All percentage data refers to the entire value range of the module ranging from -273.1°C to +3276.7°C.

Ordering Data

Description	Order Designation	Order No.
Analog input module (screw-clamp terminals)	IB ST 24 PT 100 4/4	27 52 76 7
Analog input module (spring-clamp terminals)	IB ST ZF 24 PT 100 4/4	27 50 95 0
Electronics module	IB STME 24 PT 100 4/4	27 50 13 8
Replacement terminal block (screw-clamp terminals)	IB STTB 24 PT 100 4/4	27 51 78 4
Replacement terminal block (spring-clamp terminals)	IB STTB ZF 24 PT 100 4/4	27 19 15 3
Fuses (0.4 AT)	IBS TR5 0,4 AT	27 53 47 8