Module and Application Description

PROCONTROL P

Input, Output,
Signal Conditioning

Input Module for Temperature Sensors

16–fold

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Application

This input module is used for connecting the following sensors:

Sensors used for absolute temperatures

– Thermocouples, PtRh–Pt	acc. to DIN IEC 584
– Thermocouples, NiCr–Ni	acc. to DIN IEC 584
– Thermocouples, Fe–CuNi (Type L)	acc. to DIN 43710
– From version P0002 on upwards Thermocouples, NiCr–CuNi	acc. to DIN IEC 584
– From version P0003 on upwards Thermocouples, Fe–CuNi (Type J)	acc. to DIN IEC 584
– Thermocouples, TXK	
– Thermocouples, NiCrSil–NiSil	acc. to DIN IEC 584
– Resistance thermometers, Pt 100	acc. to DIN IEC 751
– Resistance thermometers, Ni 100	acc. to DIN 43760
– Resistance thermometers, Pt 100x	
– Resistance thermometers, Pt 50	
– Resistance thermometers, Cu 100	
– Resistance thermometers, Cu 50	
– Resistance thermometers, GR21	
– Resistance thermometers, GR23	

Sensors used for differential temperatures

– Thermocouples NiCr–Ni
– Thermocouples Fe–CuNi

Special sensors

– Potentiometric sensors

The module contains 16 function units which may optionally be used for measuring circuits including thermocouples and/or resistance thermometers designed for 2 or 4–wire connection.

Each measuring circuit uses:

– 1 or 2 function units for thermocouples (depending on the type of compensation)
– 1 function unit for resistance thermometers connected by a 2–wire connection
– 2 function units for resistance thermometers connected by a 4–wire connection.

Each measuring circuit is monitored separately. Up to four limit signals can be generated for each measured value.

Features

The module can be plugged into any PROCONTROL station with redundant 24 V supply and is equipped with a standard interface to the PROCONTROL station bus.

The module sends the converted input signals, in the form of telegrams, to the PROCONTROL bus system via the station bus. The telegrams are checked before they are sent, and are marked with test flags. This way, checking for fault–free transmission to the receiving module is ensured.

The individual measuring circuits are activated via a relay multiplexer and are therefore individually potential–free. The input signals are transmitted to the processing section as potential–isolated signals. Thus, non–interaction between process and bus is ensured.

Adaptation to the temperature sensor used, the measuring range and (for thermocouples) the type of compensation is made separately for each measuring circuit via the programming, diagnosis and display system (PDDS). This setting does not require any subsequent recalibration.

A response of internal monitoring circuits or of the input signal monitoring function is indicated as disturbance annunciation ST (general disturbance) on the module front.

A response of internal monitoring circuits is indicated as an SG disturbance (module disturbance) on the module front.

Signal conditioning and monitoring

The following sections describe the first measuring circuit; the description applies analogously to the other circuits.

SIGNAL INPUT FOR THERMOCOUPLES

Depending on the type of compensation a thermocouple measuring circuit uses 1 or 2 function units.

The thermocouple is connected to inputs E11(+) and E12(−) of a function unit. Its voltage is fed into a differential amplifier.

The output signal of the differential amplifier is routed, after voltage/frequency conversion, to a 16−bit counter, which adds up the incoming pulses over a period of 40 ms. In the processing section the 16−bit binary value is converted to a 13−bit data word (12 bits + sign), taking into account the set measuring range and the type of thermocouple (linearization) as well as the cold junction temperature. The data word is then written into the shared memory and is later, on request, sent to the PROCONTROL bus system.

To ensure correct interpretation of the measured value, the processing section is informed, in coded form, of the set measuring range and the type of connected thermocouple. These data are listed in the configuration list in the EEPROM.

Cold junction temperature

The cold junction temperature (end of compensation line), which is needed by the processing functions for compensation purposes, may be measured in various ways (cf. ”Connection diagrams”).

Measurement using a compensation resistor

The temperature is measured by means of a compensation resistor used as a resistance thermometer. The resistor is connected at inputs En1(+) and En2(−) of a function unit and supplied with a constant current coming from a constant current source inside the input module. Its voltage is fed into a differential amplifier.

If the compensation line is routed to inputs E11 and E12 of the input module connector, the XP 8669 compensation resistor is plugged into inputs En1 and En2 of the function unit to be compensated. If the compensation line is connected to a subdistributor strip outside the PROCONTROL station, the XP 8670 resistor may be plugged in there. The strip is then connected to module inputs En1 and En2.

Each thermocouple can be compensated individually using a separate compensation resistor; or several thermocouples can be connected in groups using joint compensation resistors.

A corresponding entry in the configuration list is made through the programming, diagnosis and display system (PDDS).

If the temperature is determined in the subdistributor, the resistance of the compensation lines corrupts the measured values according to the following relation:

$$TF = -R_{line}/6.82 \text{ Ohm/K } ^{*)}$$

This error can be eliminated by specifying the line resistance. The corresponding entry is made from the PDDS.

*) The formula refers to the indicated compensation resistor XP 8669 or XP 8670.

Fixed temperature

If the temperature at the end of the compensation line is constant and known, this temperature will be entered for compensation. The corresponding entry in the configuration list is made from the PDDS.

SIGNAL INPUT FOR RESISTANCE THERMOMETERS

Depending on the type of compensation used (2 or 4−wire connection), a resistance thermometer measuring circuit uses 1 or 2 function units.

The resistance thermometer is connected to inputs E11(+) and E12(−) of a function unit.

In the case of a 2−wire connection the resistance thermometer is supplied with a constant current from within the function unit; in the case of a 4−wire connection the current is supplied automatically through the following function unit (cf. ”Connection diagrams”).

The voltage at the resistance thermometer is fed into a differential amplifier.

The output signal of the differential amplifier is routed, after voltage/frequency conversion, to a 16−bit counter which adds up the incoming pulses over a period of 40 ms. In the processing section the 16−bit binary value is converted to a 13−bit data word (12 bits + sign), taking into account the set measuring range and the type of resistance thermometer (linearization). The data word is then written to the shared memory and is later, on request, sent to the PROCONTROL bus system.

In 2−wire connections the line resistance will corrupt measured values according to the following formula:

$$R_{total} = R_{xx} + 2\,L / (Kappa \cdot A)$$

where:
- L = wire length (single)
- Kappa = line conductivity
- A = cross section in mm^2
- xx = resistance thermometer

This error can be eliminated by specifying the line resistance; the corresponding entry in the configuration list is made from the PDDS.

Automatic calibration

For resistance thermometer input, the module is provided with an automatic calibration function by which the current source is consecutively connected to a high–accuracy resistor of 100 Ohm and 330 Ohm. The two measured values serve as reference values for error correction. This procedure is used to compensate drift and ageing of the constant–current source.

The offset and amplification errors resulting from the resistor tolerances in the various measuring ranges are determined in the as–delivered condition and are written into a table in the EEPROM as correcting values; these values are then used to correct the measured values.

Input signal monitoring

The digitized input signal is monitored for plausibility against adjustable limit values. The monitoring function responds as soon as the input signal exceeds the upper limit value of the selected measuring range or falls below the lower limit value .

The limits can be set in the limit value list.
Default values for these limits are 150 % and –18.75 %.

When the monitoring system responds, the red disturbance lamp ST on the front panel of the module emits a steady light, and the "process channel fault" bit in the diagnosis register is set. The disturbed measured value is transmitted with the fault flag set.

Input signal monitoring can be disabled for individual measuring circuits by entering (through the PDDS) the relevant maximum limits (–200 %, +199.9 %) into the configuration list.

The plausibility limits of the cold junction temperature are –23 °C and +72 °C. If these values are exceeded or not reached, the associated measured values are compensated by a value corresponding to the cold junction temperature of +25 °C, and are transmitted with the fault flag set.

In the temperature range of –23 °C to 0 °C the associated measured values are compensated by a value corresponding to the cold junction temperature of 0 °C and transmitted with the fault flag set.

Input En1 of each function unit is given a high–resistance bias inside the module, providing for the detection of wire breaks in sensors or wire breaks/short circuits in the connected resistance thermometers.

In the case of an error an analog value of –199.9 % is transmitted with the fault flag set.

Event generation

During normal operation the input module is prompted cyclically by the PROCONTROL bus system to transmit its measured values. If values change within the cycle time, the system generates an "event".

As soon as an event occurs, the new values are given priority for transmission to the PROCONTROL bus system.

Event triggering for limit signals

When upper or lower limits are violated, a change of limit signals trips an event message.

An event message will also be generated when an input signal monitoring response is detected.

Event triggering for analog signals

The processing section monitors the measured value; if between transmissions to the station bus that value changes by more than an user–set threshold value, an event message is generated, provided a set time ("time–out") – which can be fixed at 200, 1000 or 2000 ms (default) – has passed since the latest transmission to the station bus.

The threshold value is adjustable from 0.2 % ... 6.8 % (default=1.56 %) in increments of approximately 0.2 %.

The corresponding entry in the configuration list is made from the PDDS.

Limit signal generation

Four independent limit signals can be programmed for each function unit. For each individual limit value any one of the following four hysteresis values may be selected:

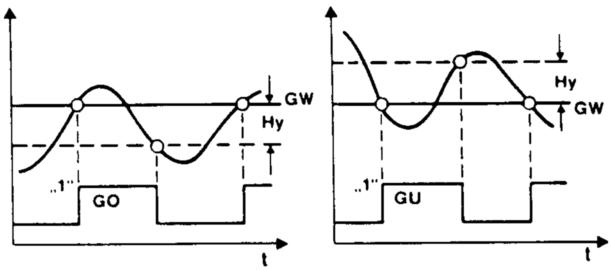
HY1 = 0.39 %

HY2 = 1.56 % (default)

HY3 = 3.12 %

HY4 = 6.25 %

The hysteresis may be located above or below the limit value, depending on whether a minimum value or maximum value violation has been selected (cf. Fig. 1).



Upper limit value | Lower limit value

GO: Violation of upper limit | GU: Violation of lower limit

Fig. 1: Options for limit value settings

Limit signals are generated by the processing section. Limit values and their associated hysteresis values are written into EEPROM.

A second limit value list can be kept in RAM memory; depending on the operating mode set by the PDDS either one of these lists can be used (EEPROM <–> RAM switch–over).

In the event of a power failure the RAM list will be lost; i.e. after power is restored, the EEPROM list will be used.

A changed limit signal will be reported to the station bus as an "event".

When an input signal monitoring response is detected, all limit signals assigned to the measured value are set to "0", and all associated disturbance signals to "1".

The range for limit values is 0 %...150 % of the set measuring range.

Linearization

The digitized input signal is linearized by the microprocessor in the processing section. For this purpose the EPROM firmware contains all characteristics of the permissible thermocouples and resistance thermometers. Within the linearity range of the selected sensor (cf. Table 2) the measured value transmitted to the station bus always corresponds to the measured temperature.

Measurement of temperature differentials

In the module configuration list the option "Measurement of temperature differentials" can be selected; for this option the following data apply:

– Thermocouple:	NiCr–Ni			
– Max. absolute temperature:	400	...	600	°C
– Max. temperature differential:	–100	...	+350	K
– Measuring range:	0	...	200	°C
– Thermocouple:	Fe–CuNi			
– Max. absolute temperature:	400	...	600	°C
– Max. temperature difference:	–75	...	+262.5	K
– Measuring range:	0	...	150	°C

The two thermocouples are connected to inputs En1 and En2 of a function unit (cf. "Connection diagrams").

In this case no compensation is necessary.

The other module functions (input signal monitoring, limit signal generation, event generation) apply to this operating mode, too; they relate to the differential temperature signal generated by the thermocouple.

In the processing section an absolute temperature of 500 °C is assumed for one of the two thermocouples.

In the event of deviations from the absolute temperature of 500 °C a measuring error is registered which corresponds to the linearity deviation of the thermocouple at this temperature.

Maximum linearity error in the range of 400 to 600 °C:

– Fe–CuNi +/– 0.5 °C

– NiCr–Ni +/– 0.2 °C

Signal output

The module transmits data to the station bus via the standard interface. Data are transferred serially.

Signal designation

The conditioned and digitized input signals and the limit signals generated in the module are written into specific registers (cf. ”Data communication”). The following data are written into the address portion of the data telegram:

– System address (possible values: 0 ... 3)
– Station address (possible values: 1 ... 249)
– Module address (possible values: 0 ... 58)
– Register address (possible values: 0 ... 31 for signals
246 for diagnosis data)

These data provide for a unique identification of all signals.

Operating modes

On delivery the module does not contain a configuration list in its EEPROM; such a list must be created individually via the PDDS. The module only knows its system, station and module address and expects the PDDS to deliver a valid configuration list to that address. Meanwhile, all inputs are given a high–resistance bias, and the module, while addressable via the bus, does not participate in any bus communication.

During this period the disturbance annunciation lamps, ST and SG, are on; the corresponding signal lines are activated.

Configuration list

The configuration list contains all module–relevant data, grouped according to the measuring circuits.

	Value range	PDDS default
Sensor type, measuring range, type of measurement	See Table 2	Fe–CuNi, 0 ... 600 ˚C, absolute
Function unit for compensation, type	None Fixed FE 1 ... FE 16	–
Fixed value compensation	0 ... 70 ˚C 0 ... 50 Ohm	–
Lower plausibility limit	– 200 ... 0 %	– 18.75 %
Upper plausibility limit	0 ... 199.9 %	150 %
Threshold value	0.2 ... 6.8 % (in increments of approx. 0.2 %)	1.56 %
Time–out	200, 1000, 2000 ms	2000 ms
Filter function	50 Hz, 60 Hz	50 Hz

Table 1: Configuration list

Measuring range

The module analog inputs and the characteristics registered in the sensor program store are designed for:

– Thermocouples with input voltages of –10 mV ... +60 mV
– Resistance thermometers of 0...360 Ohm

The module can indicate a measuring range of –200 % ... +199.9 %. The actual minimum or maximum values transmitted depend on the selected measuring range and sensor type as shown in Table 2.

Type	Sensor		Measuring range	Type of measurement	Linearity range	Code in data telegram	Accuracy present on delivery
S	Thermocouples	PtRh–Pt	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C 0 ... 1000 °C	absolute	–45 °C ... +260 °C –40 °C ... +535 °C –45 °C ... +1060 °C 0 °C ... +1740 °C	00 01 10 11	<0.15 K <0.3 K <0.6 K <1 K
K	Thermocouples	NiCr–Ni	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C 0 ... 1000 °C	absolute	–190 °C ... +290 °C –170 °C ... +580 °C –140 °C ... +1180 °C –160 °C ... +1270 °C	00 01 10 11	<0.15 K <0.3 K <0.6 K <1 K
L	Thermocouples	Fe–CuNi	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C	absolute	–200 °C ... +290 °C –170 °C ... +590 °C –140 °C ... +890 °C	00 01 10	<0.15 K <0.3 K <0.6 K
	Thermocouples	TXK	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C	absolute	–190 °C ... +270 °C –170 °C ... +560 °C –190 °C ... +775 °C	00 01 10	<0.15 K <0.3 K <0.6 K
N	Thermocouples	NiCrSil–NiSil	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C 0 ... 1000 °C	absolute	–260 °C ... +300 °C –210 °C ... +540 °C –190 °C ... +1100 °C –90 °C ... +1240 °C	00 01 10 11	<0.15 K <0.3 K <0.6 K <1 K
E	Thermocouples	NiCr–CuNi	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C 0 ... 1000 °C	absolute	–75 °C ... +225 °C –150 °C ... +450 °C –273 °C ... +900 °C –273 °C ... +1000 °C	00 01 10 11	<0.15 K <0.3 K <0.6 K <1 K
J	Thermocouples	Fe–CuNi	0 ... 600 °C	absolute	–210 °C ... +900 °C	10	<0.6 K
	Resistance thermometers	Pt 100	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C	absolute	–75 °C ... +225 °C –150 °C ... +450 °C –273 °C ... +900 °C	00 01 10	<0.15 K <0.3 K <0.6 K
	Resistance thermometers	Ni 100	0 ... 150 °C	absolute	–45 °C ... +170 °C	00	<0.15 K
	Resistance thermometers	Pt 100x	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C	absolute	–75 °C ... +225 °C –150 °C ... +450 °C –273 °C ... +900 °C	00 01 10	<0.15 K <0.3 K <0.6 K
	Resistance thermometers	Pt 50	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C	absolute	–75 °C ... +225 °C –150 °C ... +450 °C –273 °C ... +900 °C	00 01 10	<0.15 K <0.3 K <0.6 K
	Resistance thermometers	Cu 100	0 ... 150 °C	absolute	–75 °C ... +225 °C	00	<0.15 K
	Resistance thermometers	Cu 50	0 ... 150 °C	absolute	–75 °C ... +225 °C	00	<0.15 K
	Resistance thermometers	GR21	0 ... 150 °C 0 ... 300 °C 0 ... 600 °C	absolute	–75 °C ... +225 °C –150 °C ... +450 °C –273 °C ... +900 °C	00 01 10	<0.15 K <0.3 K <0.6 K
	Resistance thermometers	GR23	0 ... 150 °C	absolute	–75 °C ... +225 °C	00	<0.15 K
K	Thermocouples	NiCr–Ni	0 ... 200 K	differential	+400 °C ... +600 °C	00	<0.35 K
L	Thermocouples	Fe–CuNi	0 ... 150 K	differential	+400 °C ... +600 °C	01	<0.15 K
	Potentiometric sensors		0 ... 150 Ω	–	0 Ω ... 150 Ω	00	<0.15 Ω
	Compensation resistor		–	absolute	0 °C ... +72 °C	00	<0.07 K

Table 2: Types of sensors and measuring ranges

Data communication with the module

Address formation

All modules of a particular PROCONTROL station have the same system and station addresses.

The addresses are set automatically by the station bus control module as soon as the module is plugged into the associated slot of the PROCONTROL station.

The data words of the analog input signals and the results of the diagnosis are written into specific registers of the shared memory. The register number also serves as the register address. Each data word has a register permanently assigned to it. The assignment takes place automatically by connecting a process signal to the module process connector.

For unused measuring circuits no telegrams are sent .

If none of the 4 possible limit values of an existing measuring circuit are programmed, the associated limit value telegram will not be transmitted.

If limit values of a measuring circuit are left unprogrammed, the corresponding bits in the limit value telegram are set to ”0”.

Data readout

To read out the contents of a register, the register address must be known. Table 3 shows address entries together with the contents of the associated registers. Addresses marked ”a” vary with the module location.

Type of information	Address word				Data word (bit address)																DA
	System	Station	Module	Register	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Analog value MK1	a	a	a	0	VZ	100 %	50 %	25 %	12.5 %	6.25 %	3.125 %	1.56 %	0.78 %	0.39 %	0.195 %	0.097 %	0.048 %	MB 1 *)		SM 1	*)
						MW1															
Limit signals MK1	a	a	a	1				GO 4	GU 4	M 4	GO 3	GU 3	M 3	GO 2	GU 2	M 2	GO 1	GU 1	M 1	SM	3
⋮	⋮	⋮	⋮	⋮	⋮															⋮	⋮
Analog value MK16	a	a	a	30	VZ	MW16												MB 16 *)		SM 16	*)
Limit signals MK16	a	a	a	31				GO 4	GU 4	M 4	GO 3	GU 3	M 3	GO 2	GU 2	M 2	GO 1	GU 1	M 1	SM	3
Module cycle time	a	a	a	205	Time value 100 ms				Time value 10 ms				Time value 1 ms				Time value 0.1 ms				0
Diagnosis register	a	a	a	246	For register allocation see Fig. 2																0

Table 3: Register allocation and bit significance of telegrams

Legend:

MKn = Measuring circuit n
DA = Data type
SMn = General disturbance annunciation, telegram
VZ = Sign
MBn = Code in data telegram
MWn = Digital measured value
Mn = Single disturbance annunciation
GOn = Max. limit value n overflow
GUn = Min. limit value n underflow
a = Address location – dependent

Note:

In limit signals (non – disturbed) the two bits GU and GO are always non – equivalent.

*) Code in data telegram and data type:

	Code in data telegram	Measuring range
Data type 6	00	0 ... 150 °C
	01	0 ... 300 °C
	10	0 ... 600 °C
	11	0 ... 1000 °C
Data type 7	00	0 ... 200 K
	01	0 ... 150 K

In the case of differential measurements with NiCr – Ni or Fe – CuNi, the data type of the analog value telegrams is different from the other operating modes DA = 7.

Diagnosis and annunciation functions

Disturbance annunciations on the module

Disturbances are indicated by two LEDs on the module front:

	LED designation
– Disturbance	ST
– Module disturbance	SG

The ST LED reports module disturbances and data communication disturbances involving the module.

The SG LED reports module disturbances only.

Disturbance signals to the alarm annunciation system

Disturbance signals issued by the input module are transmitted to the alarm annunciation system or the diagnosis system of the control system (CDS) via the bus.

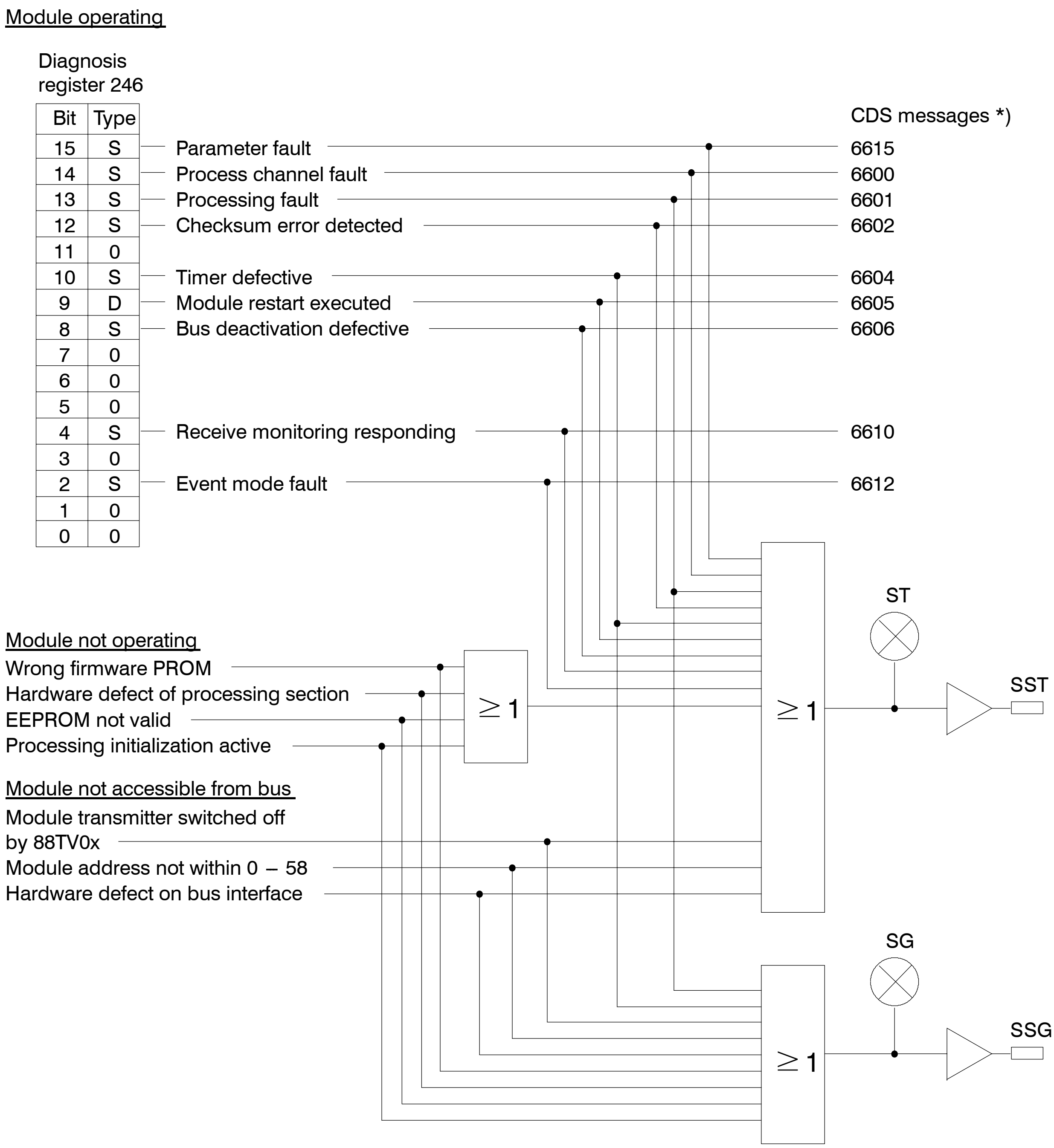
Diagnosis

The processing section checks incoming telegrams, the formation of telegrams to be sent and internal signal processing for faults (self–diagnosis).

In the event of a disturbance, the fault type is written into the diagnosis register, and a disturbance signal is sent to the PROCONTROL system.

On request, the module sends a telegram containing the data stored in the diagnosis register (register 246) (cf. Fig. 2).

Fig. 2 shows the diagnosis register contents, signals from the general disturbance line and the CDS, and the ST lamp.



D = Dynamic annunciations are cancelled after the contents of the diagnosis register has been transmitted
S = Static annunciations disappear automatically upon deactivation
0 = Not used

Fig. 2: 81ET03 diagnosis messages

*) The control diagnosis system (CDS) provides a description for every annunciation number. Among other data this description contains:

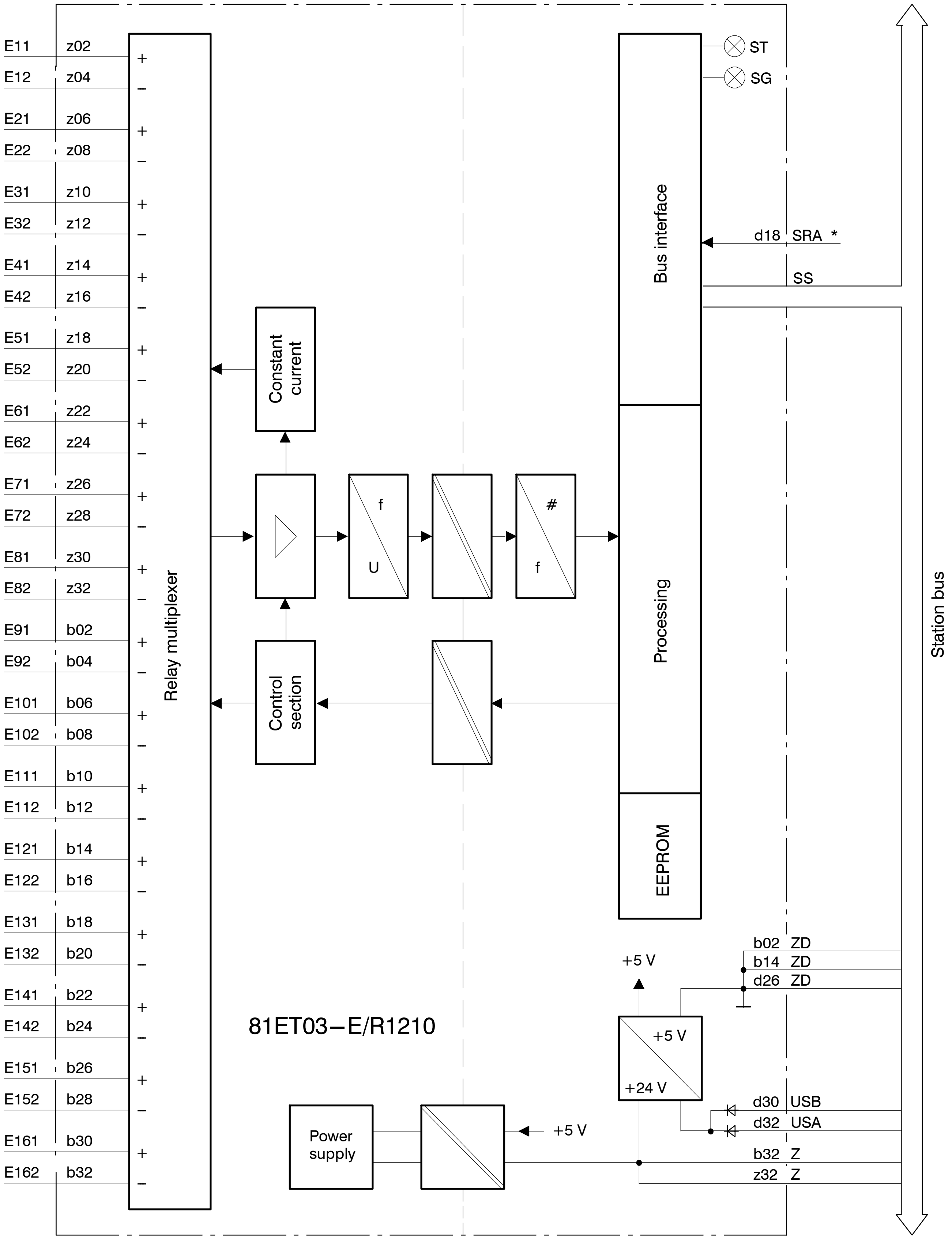
- Information on cause and effect of the disturbance
- Recommendations for its elimination.

This ensures quick elimination of disturbances.

Function diagram

Connection designations: The module consists of a printed circuit board (cf. ”Mechanical design”) with the connectors X21 and X11. Connector X21 contains all process inputs.

Connector X11 contains the standard station bus interface and the supply voltages for the module.

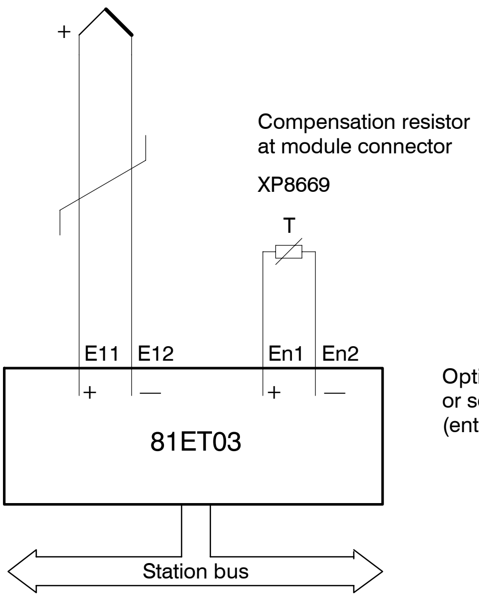


* For correct module operation connector terminal X11/d18 must be connected with ZD (once per subrack).

Connection diagrams

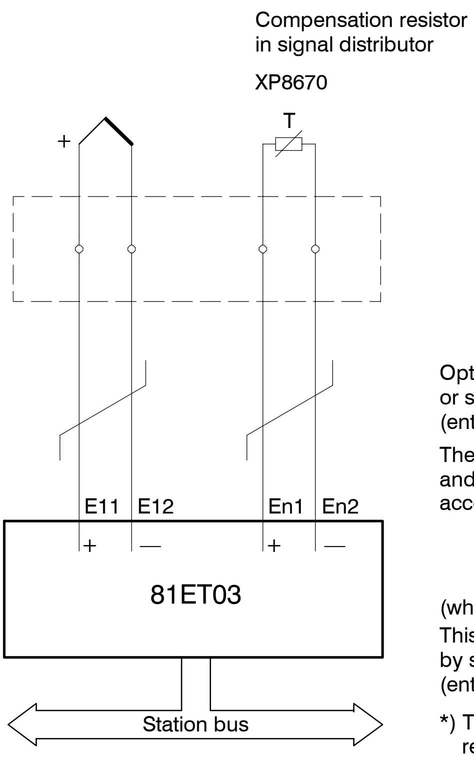
Sensor: Thermocouple

Compensation line up to module connector:



Optional compensation of individual sensors or sensor groups (entry from PDDS)

Compensation line up to signal distributor:



Optional compensation of individual sensors or sensor groups (entry from PDDS)

The compensation line resistance between the signal distributor and the module inputs corrupts the measurement results according to the following relation:

$$T_F = \frac{-R_{Line}}{6.82\ \mathrm{Ohm/K}} \quad ^{*)}$$

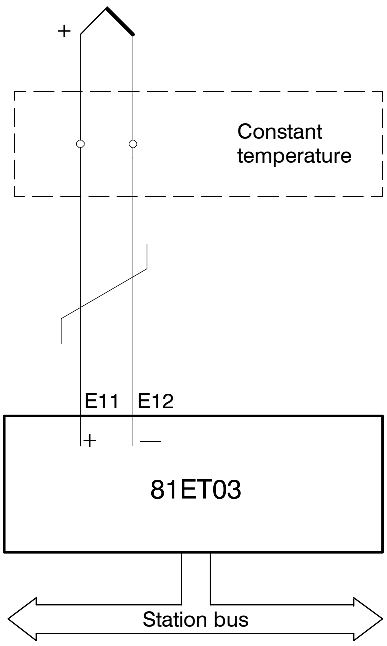
(where TF represents the measured value offset, expressed in Kelvin).

This measurement error can be compensated by specifying the line resistance (entry via PDDS).

*) The formula refers to the indicated compensation resistors XP 8669 and XP 8670.

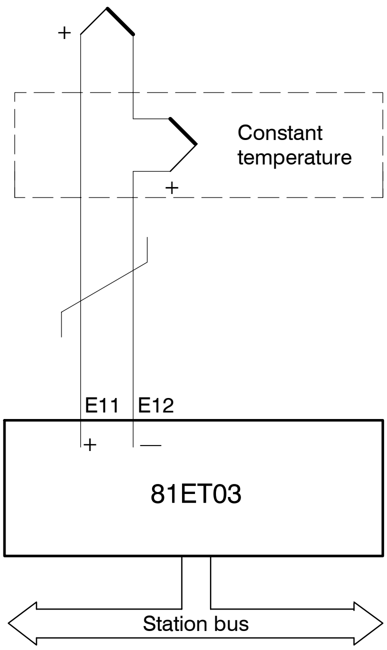
Sensor: Thermocouple

Constant temperature:



Internal compensation internally by entering the constant temperature (entry via PDDS)

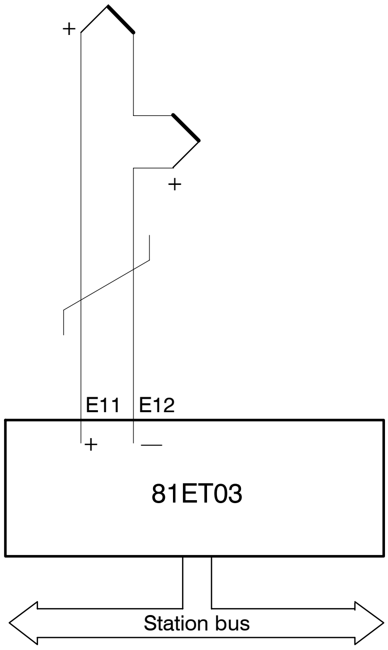
Local cold junction temperature compensation:



No compensation necessary (entry via PDDS)

Sensor: Thermocouple

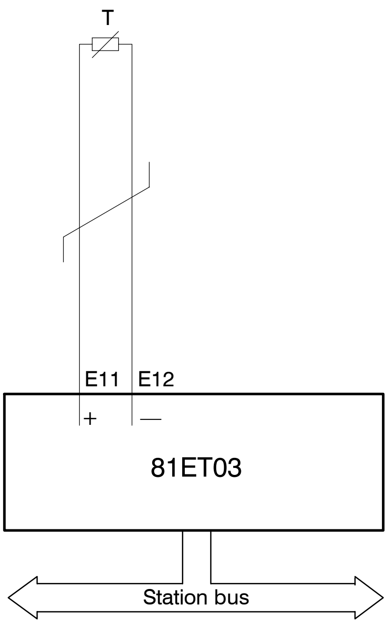
Differential temperature:



No compensation necessary
(entry via PDDS)

Sensor: Resistance thermometers

2 – wire connection:

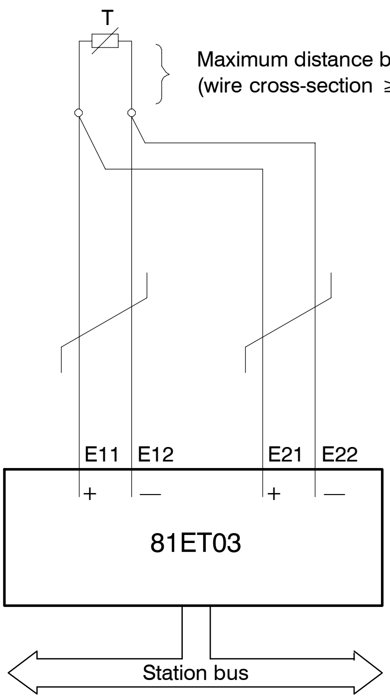


The measuring line resistance between the sensor and the module inputs corrupts the measured value. according to the formula:

$$R_{total} = R_{sensor} + R_L$$

This error can be eliminated by specifying the line resistance.
(entry via PDDS)

4 – wire connection:



Maximum distance between terminal point and measuring resistor: 2 m
(wire cross-section $\geq$ 0.5 mm^2, wire resistance $\leq$ 36 Ω/km)

The sensor always receives its supply power from the closest module terminals following the measuring circuit

Mechanical design

Board size: 6 units, 1 division, 160 mm deep

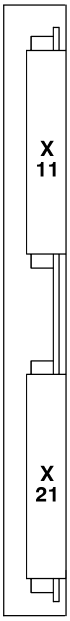
Connector: acc. to DIN 41 612

1 x for connection to station bus, 48 – pin edge – connector, type F (connector X11)

1 x for connection to process, 32 – pin edge connector, type F (connector X21)

Weight: approx. 0.6 kg

View of connector side:

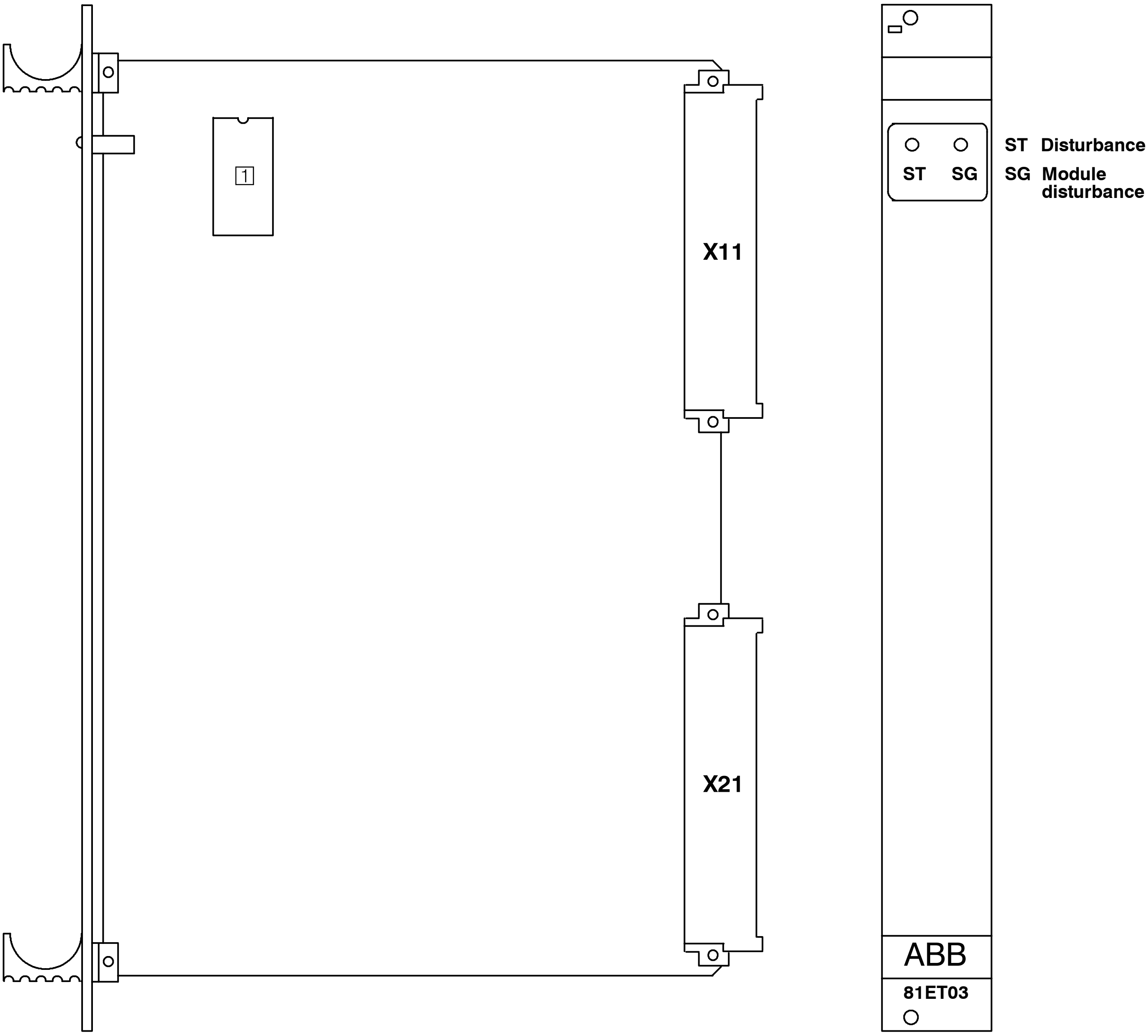


Contact assignments of process connector X21

View of contact side:

	b	*z*
02	E91	E11
04	E92	E12
06	E101	E21
08	E102	E22
10	E111	E31
12	E112	E32
14	E121	E41
16	E122	E42
18	E131	E51
20	E132	E52
22	E141	E61
24	E142	E62
26	E151	E71
28	E152	E72
30	E161	E81
32	E162	E82

Side view and module front view



1 EPROM, programmed, order number: GJR2389842Pxxxx

xxxx = Position number according to applicable program version.

Technical data

In addition to the system data, the following values apply:

Power supply

Operating voltage USA/USB		19.5 ... 30 V, typ. 24 V
Power consumption at	USA/USB = 19.5 V	200 mA
	USA/USB = 24 V	180 mA
	USA/USB = 30 V	140 mA
Power dissipation		3.9 ... 4.2 W, depending on operating voltage

Input values for thermocouples

Sensor voltage for thermocouples	− 10 ... +60 mV
Response voltage for wire break	< −15 mV or > +90 mV
Input resistance	> 1 Mohm
Sensor voltage for compensation resistors	< 1.5 V
Measuring current	< 1 mA
Common−mode rejection	> 120 dB
Normal−mode rejection at 50 Hz	> 60 dB
Normal−mode rejection at 60 Hz	> 60 dB

Input values for resistance thermometers

Sensor resistance	0 ... 360 Ohm
Pickup resistance for wire break and short−circuits	< 20 Ohm or > 470 Ohm
Input resistance	> 10 Mohm
Sensor voltage	0 ... 750 mV
Measuring current	< 2.1 mA
Common−mode rejection	> 120 dB
Normal−mode rejection at 50 Hz	> 60 dB
Normal−mode rejection at 60 Hz	> 60 dB

Output values

SS − Standard interface to station bus

Accuracy

All data referenced to 100 % of the measuring range (see table 2)	
Accuracy (over a temperature range of 0 to 70 °C, ageing, voltage range)	< 0.5 %
Accuracy present on delivery (23 °C)	< 0.1 % (see table 2)
Quantization error	< 0.05 %
Linearity error	< 0.2 %
Temperature sensitivity	< 250 ppm/K (typ. 70 ppm/K)
Cold junction effect in a temperature range (0 ... 70 °C, all other errors not included)	< 0.3 % (< 0.2 K)
Effect of supply voltage variation (4.75 ... 5.25 V)	none
Error due to digital linearization	< 0.05 %

Times

Processing time

1 ... 13 measuring circuits	typ. 630 ms, max. 640 ms
14 measuring circuits	typ. 650 ms, max. 680 ms
15 measuring circuits	typ. 690 ms, max. 730 ms
16 measuring circuits	typ. 730 ms, max. 770 ms

Initialization time

On power connection or when the module is plugged in	1 ... 12 s

Noise immunity (of process inputs and outputs)

ESD acc. to IEC 801/2	8 kV against front panel
EMC acc. to IEC 801/4	1 kV burst
Destruction acc. to (IEC 801/5), Draft: IEC TC 65 (Sec) 137	1 kV against reference potential

ORDERING DATA

Order no. for complete module:

Type designation:	81ET03–E/R1210	Order number.:	GJR2389800R1210

Order no. for compensation resistor:

Type designation:	XP 8669 a	Order number:	HEIE420692R1
	XP 8670 a		HEIE420696R1

Technical data are subject to change without notice!

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