# Module and Application Description

# PROCONTROL P

Input/Output,
Signal Conditioning

## Universal Input for Binary and Analog

1KGF 100 822, Edition 06/05

# 81EU01-E/R1210

## Application

The universal input module connects the following transmitters:

**Binary Transmitters**

- Single and changeover contacts with or without line monitor
- Inductive initiators acc. to NAMUR DIN 19234
- Electronic transmitters

**Analog transmitters for current signals**

- Twin-wire transducers 4 ... 20 mA supplied from the input module
- 4-wire transducers 0 ... 20 mA, 4 ... 20 mA and 0 ... 5 mA with external power source

**Temperature transducers**

Thermocouples with transducers for current signals of 4 ... 20 mA and cold junctions inside the transducer. Linearization is on the input module.

- Resistance thermometers with transducers for current signals of 4 ... 20 mA

The module consists of 16 function units. Each function unit may be used for any type of input mode. Any combination is possible. Parameter allocation and setting is programmed easily via the configuration list. The programmed values are stored in an EEPROM to ensure that they are not lost in the event of power failure. They can be changed any time.

Up to four limit values can be allocated to each analog signal.

Up to four independent correction and filter calculations can be performed independently on each input module. Programming is done by function block structuring. Observe the boundary conditions for this application

## Features

The module can be plugged into any station of the PROCONTROL bus system. It incorporates a standard interface for the PROCONTROL station bus.

The module transmits the input signals and/or converted input signals in telegrams via the station bus to the PROCONTROL bus system. Before transmission the telegrams are checked and provided with parity bits. This ensures that the receiving module can check for fault-free transmission.

The module checks the telegrams received over the station bus, e.g. those intended for corrective calculations, by their parity bits for fault-free transmission.

Provision is made to eliminate interference among the function units of the module and the station bus.

A short-circuit-proof and monitored transmitter power source is available for each function unit, suitable for the various applications.

In case the internal monitoring circuits or the input signal monitor respond, disturbance annunciation ST (general disturbance) will be indicated on the front panel of the module.

Response of the internal monitoring circuits is indicated as disturbance annunciation SG (module disturbance) on the front panel of the module.

## Application of binary transmitters

### Types of transmitters

The function units of the module can be used for

- single/changeover contacts with 48 V supply from the module, incl. monitoring
- single/changeover contacts with 48 V supply from the module, without monitoring
- single/changeover contacts with 24 V supply from the module, without monitoring
- contacts or electronic transmitters with external power supply of up to 60 V, without monitoring
- inductive initiators acc. to NAMUR (DIN 19234), with supply from the module, incl. monitoring.

For the applicable type of connection refer to the connection diagrams

For programming of the application-specific settings refer to the configuration list.

### Transmitter power supply from the module

The transmitter power supply for the different binary mode applications is available for each function unit at the appropriate output Sn.

The transmitter power supply is short-circuit-proof and monitored on the module.

The applications of “single/changeover contacts with 48 V supply from the module with or without monitoring” allow parallel supply of max. 4 contacts with a common root from one Sn supply output.

The application of “single/changeover contacts with 24 V supply from the module, without monitoring” allows parallel supply of max. 16 contacts with a common root from one Sn supply output.

Those inputs grouped together to be supplied from one common source are susceptible to mutual interference.

In the case of common supply, those Sn supply outputs which are not required shall not be used.

If the transmitters are supplied from an external power source, the respective Sn supply output on the module shall not be used.

It is not permissible to connect several Sn supply outputs in parallel.

The maximum permissible static potential difference between the reference potentials shall not be exceeded when an external power source is used.

### Binary signal input circuit and monitoring

Signal input for binary transmitters is through inputs En.

Each input uses a bounce suppression time which results from a number n of processing cycles. The module detects the first signal change as an effective signal if the presence of the signal exceeds the bounce suppression time.

- Up to and including version P0010 or P1010, the number of processing cycles n = 3.
- From version P0011 or P1011 on upwards, the number of processing cycles n can be user-configured.

In the applications of “single/changeover contacts with 48 V supply from the module with or without monitoring”, a current of about 5 mA will flow through the closed contact.

In the applications of “single/changeover contacts with 48 V supply from the module with monitoring”, a resistor of 47 kOhm +/- 2 % shall be connected in parallel with the contact. This allows to monitor the following faults:

- Wire break and short-circuit to earth in the transmitter line
- Wire break and short-circuit to earth in the transmitter supply line
- Interruption in suppression resistor when the contact is open
- Breaking of changeover contact.

When the inductive initiator acc. to NAMUR (DIN 19234) is used, the signals of a function unit are evaluated as follows:

- Up to and including version P0006
  active area free En = ”1” signal
  active area covered En = ”0” signal.
- Version P0007 or P1007 or higher
  active area free En = ”0” signal
  active area covered En = ”1” signal.

Monitoring with this application:

- Wire break and short-circuit to earth in the transmitter line
- Wire break and short-circuit earth to in the transmitter supply line
- Interruption in the transmitter.
- Overloading of an input, from version P0011 or P1011 on upwards:

  If an input is overloaded due to faulty circuitry for instance, the function unit concerned is switched off immediately. The message ”Process channel fault” in the diagnosis register and the disturbance bit set in the data telegram indicate that a fault has occurred at the function unit concerned. Every 30 sec there will be a new attempt to reactivate the disconnected function unit.

### Reaction to the response of a monitoring function

As soon as a monitoring function responds, the relevant transmitter signals are set to zero in the telegram, the single disturbance bit and the general disturbance bit are set to 1.

## Use of analog transmitters

### Types of transmitters

The function units of the module can be used for

- 2-wire transducers, 4 ... 20 mA, supplied from the input module
- 4-wire transducers, 0 ... 20 mA, 4 ... 20 mA and 0 ... 5 mA with external power supply of the transducer
- and the following thermocouples with transducers for 4 ... 20 mA and a cold junction before or inside the transducer. Linearization is in the input module.
  - Thermocouples type S (PtRh-Pt) acc. to DIN IEC 584
  - Thermocouples type K (NiCr-Ni) acc. to DIN IEC 584
  - Thermocouples type J (Fe-CuNi) acc. to DIN IEC 584
  - Thermocouples type L (Fe-CuNi) acc. to DIN 43710
  - Thermocouples type N (NiCrSil-NiSil)
- resistance thermometers Pt 100 acc. to DIN IEC 751 with transducer for 4 ... 20 mA

For type of connection refer to the connection diagrams.

For programming of the application-specific settings refer to the configuration list.

### Transducer supply

The transducer supply from the input module is short–circuitproof, is available at the respective supply output Sn and is monitored on the input module.

In the case of external supply of the transducer, the supply contact of the respective function unit is not used.

The maximum potential difference among the reference potentials shall not be exceeded in case of external power supply.

Several Sn supply outputs shall not be connected in parallel.

### Analog signal input circuit and monitoring

The current input signal is converted into a measuring voltage by a high-precision measuring resistor, transmitted to the input measuring amplifier via a multiplexer and finally converted into a 12-bit analog signal by an analog-to-digital converter.

The input measuring amplifier and the analog-to-digital converter are monitored by means of reference voltages.

The analog signals are monitored for plausibility on the module. The monitor responds as soon as the upper limit (OG) or the lower limit (UG) is violated.

These limits can be readjusted via the configuration list. The upper limit is preset to 118.75 % and the lower limit to -6.25 %.

The plausibility check can be suppressed for each function unit separately. This requires the entry of the OG and UG maximum values into the configuration list.

The input module transmits the digital 12-bit signal, complemented by a prefix sign, as telegram to the station bus.

When the analog signal monitor has responded, the analog value telegram is transmitted with the disturbance bit set.

- Overloading of an input, from version P0011 or P1011 on upwards:

  If an input is overloaded due to faulty circuitry for instance, the function unit concerned is switched off immediately. The message ”Process channel fault” in the diagnosis register and the disturbance bit set in the data telegram indicate that a fault has occurred at the function unit concerned. Every 30 sec there will be a new attempt to reactivate the disconnected function unit.

### Connection of thermocouples and resistance thermometers

The connection of thermocouples and resistance thermometers requires a transducer to be connected in the incoming circuit. It is required that the cold junction for thermocouples is located before or inside the transducer.

The thermocouples and the associated transducer are linear with respect to the thermal e.m.f. Therefore, the current signals within 4 ... 20 mA from the temperature transducers for thermocouples are linearized in the input module. For this purpose, the characteristics of the permissible thermocouples are stored on the EPROM of the input module.

The resistance thermometer and the associated transducer are linear with respect to temperature. Linearization on the input module is not required.

Within the plausibility limits, the measured value transmitted to the station bus is always identical with the measured temperature.

The temperature transmitters and the associated transducers shall be selected according to the required measuring range.

When earthed thermocouples are used, isolated transducers are required.

Measuring ranges:

The transmitters have the following ranges.

| Thermocouple | Range of linearity | 100 % value |
|---|---|---|
| Type S | 0 ... 1200 °C | 1000 °C |
| Type K | 0 ... 600 °C | 600 °C |
| | 0 ... 1000 °C | 1000 °C |
| Type L | 0 ... 200 °C | 150 °C |
| | 0 ... 400 °C | 300 °C |
| Type N | 0 ... 600 °C | 600 °C |
| Type J | 0 ... 300 °C | 300 °C |
| | 0 ... 600 °C | 600 °C |

| Resistance thermometer | Range of linearity | 100 % value |
|---|---|---|
| Pt 100 | 0 ... 150 °C | 150 °C |
| | 0 ... 300 °C | 300 °C |
| | 0 ... 600 °C | 600 °C |

If the measuring range limits are violated, a disturbance bit will be added to the temperature values.

The measuring range of the module which can be represented is -200 % ...+199.9 %. The minimum and maximum values which are actually transmitted depend on the type of transducer selected.

## Use for correction and filter calculations

When used for analog signal input, the following function blocks are available on the module for correcting flow rate and level measurements and filtering measured values:

- Correcting function for flow rates of water/steam KOR1
- Correcting function for flow rates of gases with variable reference pressure KOR3
- Correcting function for levels NIV
- Non-linear filter FIL

One function block can be used per function unit with the maximum limited to 4 per module.

Function blocks KOR1, KOR3 and NIV include the FIL function.

The function blocks have inputs for specifying the correcting quantity and basic calculation values and outputs for putting out the corrected value and internal status messages. The function block outputs of corrected values are allocated to the analog value telegrams of the associated function unit.

Module inputs, signals from the station bus and fixed values must be allocated to the function block inputs to perform the corrections. These data are specified by the user.

This procedure is referred to as structuring. The sum of these data makes up the structure list. This list is stored on the EEPROM of the module.

For details on structuring the function blocks refer to the function block descriptions.

The following limit values of the module shall be observed for structuring:

- max. number of function blocks 4
- max. number of signals from the bus 20
- max. number of function blocks per function unit 1

The use of function blocks increases the cycle time of the module by the calculation time specified for each function block.

The module automatically determines the required cycle time which is stored in module register 205. The cycle time can be read from this register using the PDDS.

The corrected analog values are output to the PROCONTROL bus system in the form of telegrams.

Moreover, the uncorrected raw values can be output in a telegram.

Telegrams arriving over this bus for the function blocks may be faulty and therefore contain a disturbance bit. The module uses this value in its arithmetic operations and transmits the calculated value in a telegram with the disturbance bit set.

The module incorporates a monitoring feature which checks the telegrams to be received by the bus for cyclic updating. When a signal has not been updated for a particular time (since the send module failed for instance), the receive time monitoring will respond. This monitoring function sets the disturbance bit in the receive register allocated to this telegram. The module then uses the last value transmitted in this telegram and forwards the calculated value with the disturbance bit set.

## Limit signals

When the module is used for analog signal input, max. 4 limit values can be programmed for each function unit. One out of four hysteresis values can be selected for each limit value.

Programming is by means of the PDDS on the basis of the limit value list. The limit value list is stored on the module in an EEPROM.

The limit value list can be stored in a RAM if changes shall be made. But these data will be lost in case of voltage failure. In that case, the module changes over to the list in the EEPROM immediately. If the limit value list is loaded both into EEPROM and RAM, the list processing will be performed in the mode defined by the PDDS, i.e. EEPROM/RAM.

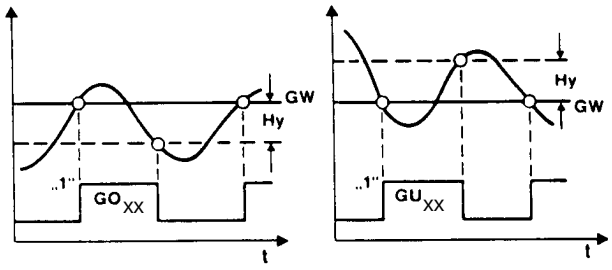
In the event mode, any violation of a limit value is immediately signalled to the station bus in the form of a limit signal telegram. The same happens when the input signal monitoring feature responds, but in this case together with the associated analog value telegram. Then the disturbance bits of the analog value and limit signals telegrams will be set. All limit values allocated to the analog value are set to “0”.

The limit value range is -150 % ... +150 % of the selected signal range.

The following hysteresis values can be set for each limit value individually:

- HY1 = 0.39 %
- HY2 = 1.56 % (standard setting)
- HY3 = 3.12 %
- HY4 = 6.25 %

The hysteresis can be above or below the limit value depending on whether violation of the minimum or maximum value has been selected (see Fig. 1).




Upper limit value Lower limit value

Fig. 1: Option for limit value setting

When function blocks are used, the limit values are always derived from the corrected analog values.

## Event generation

The input module transmits the data in telegrams to the station bus either cyclically or in the event mode.

In the event mode, data are transmitted whenever binary or analog values have changed in the module. In this case, the cyclic mode is interrupted and the module is immediately granted the permission to transmit.

When binary transmitters are connected, the module interprets the following occurrences as events:

- Switching of a connected contact, response of a NAMUR transmitter, change in a connected electronic signal.
- Response of a monitor

When analog transmitters are connected, the module interprets the following occurrences as events:

- Response of a limit signal
- Response of a monitor
- Change of an analog value by an adjustable threshold value within an adjustable time span since the last transmission to the station bus.

  As soon as the module detects the change of an analog value by more than the specified value, the module initiates an event transfer if the set time value has been exceeded since the last transfer, too.

| | |
|---|---|
| Adjustable<br>analog value change: | 0.2 % ... 6.8 %<br>standard setting: 1.56 % |
| Adjustable time value<br>for current signals | 40 ms, 200 ms<br>standard setting: 200 ms |
| for temperature signals | 200 ms, 1000 ms, 2000 ms<br>standard setting: 1000 ms |

The values on the configuration list are set by means of the PDDS

## Simulation

A maximum of 32 signals can be simulated.

**Simulation of send registers**

Send register simulation is possible for both binary and analog transmitters by means of PDDS. All 16 send register can be simulated.

**Simulation of receive registers**

Receive register simulation is possible with function blocks for correction and filter calculations. Simulation is performed by means of the PDDS. All 20 bus signals can be simulated.

## Setting the operating modes

The type of application and the setting values are required to be loaded in the form of a configuration list before the module can take up operation. Before that, all process inputs of the module have a high-resistance bias and the module transmits no data telegrams on the bus. The fault lamps ST and SG signal the presence of disturbances. Nevertheless, the module can receive data via the bus. The module is waiting for the configuration list to be transmitted by the PDDS.

After transmission of the configuration list, the module takes an active part in bus communication. The disturbance LEDs are deenergized.

The configuration list contains all the settings required by the module, listed acc. to function units (table 1).

Settings can be performed within the defined range of values.

The column for standard setting contains the default value which is entered if no other value is set.

Special setting for function unit 1:

Two plug-in jumpers X100 and X101 are provided on the module for connecting four-wire transducers.
For standard applications, these jumpers are plugged into positions 1/2 and 4/5.
In the positions 2/3 and 5/6, lines E01 (z02) and S01 (z04) are permanently connected to Z.
In this case, function unit 1 is no longer available.

| | Range of values | PDDS presetting |
|---|---|---|
| Type of transmitter, measuring range | 0 ... 20 mA<br>4 ... 20 mA<br>0 ... 5 mA<br>TE type S, 0 ... 1200 °C<br>TE type K, 0 ... 600 °C<br>TE type K, 0 ... 1000 °C<br>TE type L, 0 ... 200 °C<br>TE type L, 0 ... 400 °C<br>TE type N, 0 ... 600 °C<br>TE type J, 0 ... 300 °C<br>TE type J, 0 ... 600 °C<br>Pt 100, 0 ... 150 °C<br>Pt 100, 0 ... 300 °C<br>Pt 100, 0 ... 600 °C<br>Contact, 48 V with monitor<br>Contact, 48 V without monitor<br>Contact, 24 V without monitor<br>Contact/electronic signal, up to 60 V<br>Inductive initiator acc. to NAMUR (DIN 19234) | 4 ... 20 mA |
| Plausibility limit, lower end | -200 ... 0 % | -6.25 % |
| Plausibility limit, upper end | 0 ... 199.9 % | 118.75 % |
| Threshold value | 0.2 ... 6.8 % (step approx. 0.2 %) | 1.56 % |
| Time-out<br>(time-out not possible with binary signals) | 40, 200, 1000 , 2000 msec | 200 msec |
| Transfer raw value | Yes, No | No |
| No. of function block | (1 ... 4), KOR1, KOR3, NIV, FIL | - |
| Bounce suppression (processing cycles) **) | 1 ... 10 | 3 |
| Filter function *) | 16 2/3, 50, 60 Hz | 50 Hz |
| Linearization<br>(relevant only for thermocouples) | Yes, No | No |

Table 1: Configuration list

*) Setting valid for all function units with analog transmitters.

**) Setting possible from version P0011 or P1011 on upwards.

## Signal output to the PROCONTROL bus

The module transfers the data telegrams through a standard interface to the station bus. Data transfer is serial.

Identification of signals

The conditioned and digitalized input signals and the limit signals formed in the module are written into special registers. The processing section writes the following data into the address part of the data telegram:

| | | | |
|---|---|---|---|
| System address | (possible | 0 ... 3) | |
| Station address | (possible | 1 ...249) | |
| Module address | (possible | 0 ... 58) | |
| Register address | (possible 0 ... 31 | | for analog values and limit signals |
| | 32 ... | 35 | for binary values |
| | 36 ... | 99 | vacant |
| | 101 ... | 104 | for raw values |
| | 205 | | for module cycle |
| | 246 | | for diagnosis data) |

## Data communication with the module

**Address formation**

The system and station addresses are identical for all modules of a PROCONTROL station. They are set automatically by the station bus control module.

The module address is set automatically when the module is plugged into the slot reserved in the PROCONTROL station.

The data words of the input signals and the diagnosis results are written into special registers of the shared memory. The register number is the register address. A register is permanently assigned to each data word. Assignment is automatic when a process signal is connected to the process connector of the module.

No telegrams are transferred for function units which are not used.

If none of the four possible limit signals of an existing input signal is programmed, the associated limit signal telegram will not be transferred.

If not all limit values of an input signal are programmed, those bits in the limit signal telegram which belong to the non-programmed limit values are always set to “0”.

**Reading the data**

Address-related information is needed to read the contents of a register. Table 2 shows this information and the contents of the respective register.

| 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 FE1 | 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 | *2 |
| | | | | | | MW1 | | | | | | | | | | | | | | | |
| Limit signals FE1 | a | a | a | 1 | 0 | 0 | 0 | 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 FE16 | a | a | a | 30 | VZ | MW16 | | | | | | | | | | | | MB *1 | | SM | *2 |
| Limit signals FE16 | a | a | a | 31 | 0 | 0 | 0 | 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 |
| Binary values FE1 - FE4 | a | a | a | 32 | 0 | 0 | 0 | E 4 | NE 4 | M 4 | E 3 | NE 3 | M 3 | E 2 | NE 2 | M 2 | E 1 | NE 1 | M 1 | SM | 3 |
| Binary values FE5 - FE8 | a | a | a | 33 | 0 | 0 | 0 | E 8 | NE 8 | M 8 | E 7 | NE 7 | M 7 | E 6 | NE 6 | M 6 | E 5 | NE 5 | M 5 | SM | 3 |
| Binary values FE9 - FE12 | a | a | a | 34 | 0 | 0 | 0 | E 12 | NE 12 | M 12 | E 11 | NE 11 | M 11 | E 10 | NE 10 | M 10 | E 9 | NE 9 | M 9 | SM | 3 |
| Binary values FE13 - FE16 | a | a | a | 35 | 0 | 0 | 0 | E 16 | NE 16 | M 16 | E 15 | NE 15 | M 15 | E 14 | NE 14 | M 14 | E 13 | NE 13 | M 13 | 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 | Allocation see Fig. 2 | | | | | | | | | | | | | | | | 0 |

Table 2: Register allocation and bit significance in the telegrams (applies to all analog value telegrams)

Explanation

| | | |
|---|---|---|
| FE | = | function unit |
| SM | = | general disturbance signal, telegram |
| VZ | = | sign |
| MWn | = | digital measured value |
| En | = | binary signal input |
| NEn | = | negated value of En |
| Mn | = | individual disturbance signal |
| GOn | = | max. limit value n violated |
| GUn | = | min. limit value n violated |
| DA | = | data type |
| a | = | address depending on place of installation |

Note:

In the limit signals (if not disturbed), bits GU and GO are always antivalent.

*1 Measuring range, depending on type of transmitter, for

- temperature sensors
  - 00 measuring range 0 ... 150 °C
  - 01 measuring range 0 ... 300 °C
  - 10 measuring range 0 ... 600 °C
  - 11 measuring range 0 ... 1000 °C
- current sensors: 00 fixed

*2 Data type, depending on type of transmitter, for

- current sensors: 5
- temperature sensors: 6

| 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 | |
| Status message, function block | a | a | a | 100 | 0 | 0 | 0 | MF 3 | MF 2 | MF 1 | MF 3 | MF 2 | MF 1 | MF 3 | MF 2 | MF 1 | MF 3 | MF2 | MF1 | SM | 1 |
| | | | | | | | | Function block 4 | | | Function block 3 | | | Function block 2 | | | Function block 1 | | | | |
| Raw value 1 | a | a | a | 101 | VZ | 100 % | 50 % | 25 % | 12.5 % | 6.25 % | 3.125 % | 1.56 % | 0.78 % | 0.39 % | 0.195 % | 0.097 % | 0.048 % | 0 | 0 | SM | 5 |
| | | | | | | Raw value for function block 1 | | | | | | | | | | | | | | | |
| Raw value 2 | a | a | a | 102 | VZ | Raw value for function block 2 | | | | | | | | | | | | 0 | 0 | SM | 5 |
| Raw value 3 | a | a | a | 103 | VZ | Raw value for function block 3 | | | | | | | | | | | | 0 | 0 | SM | 5 |
| Raw value 4 | a | a | a | 104 | VZ | Raw value for function block 4 | | | | | | | | | | | | 0 | 0 | SM | 5 |

Table 3: Register allocation and bit significance of the additional telegrams for structuring

Explanation:

DA =data type
SM = general disturbance signal, telegram
VZ = sign
MFn = status message n
(signal outputs of the function blocks)
a = address depending on the place of installation

Note:

The telegrams of the registers 101 to 104 will be transmitted only if the raw values are output too, and the associated correction function is structured.

## Diagnosis and annunciation functions

**Disturbance annunciations on the module**

The following annunciations are signalled on the front panel of the module:

| | Designation of LED |
|---|---|
| - Disturbance | ST |
| - Disturbance Module | SG |

The LED ST signals all disturbances of the module and disturbances in the data communication with the module.

The LED SG signals module disturbances only.

**Disturbance messages to the annunciation system**

The annunciation system and the CDS control diagnosis system receive the disturbance messages from the input module via the bus.

**Diagnosis**

In the processing section of the module the received telegrams, the generation of the telegrams to be transmitted and the internal signal processing are monitored for errors (self-diagnosis).

If a disturbance occurs, the type of the disturbance is stored in the diagnosis register and a disturbance signal is transmitted to the PROCONTROL system at the same time.

When requested, the module transmits a telegram which contains the data stored in the diagnosis register (register 246) (see Fig. 2).

The contents of the diagnosis register, the signals on the general disturbance lines, the messages on the CDS, and lamps ST and SG are shown in Fig. 2.

If message ”Process channel fault” is indicated in the diagnosis register, this may be due to one of the following reasons:

- Analog signal not plausible; values are above or below the plausibility limits specified.
- Internal reference values of analog inputs disturbed.
- Transmitter monitoring responded.
- Correcting function disturbed.

If message ”Processing fault” is indicated in the diagnosis register, this may be due to one of the following reasons:

- No valid configuration list.
- Internal module voltages disturbed.
- Hardware fault on the module.

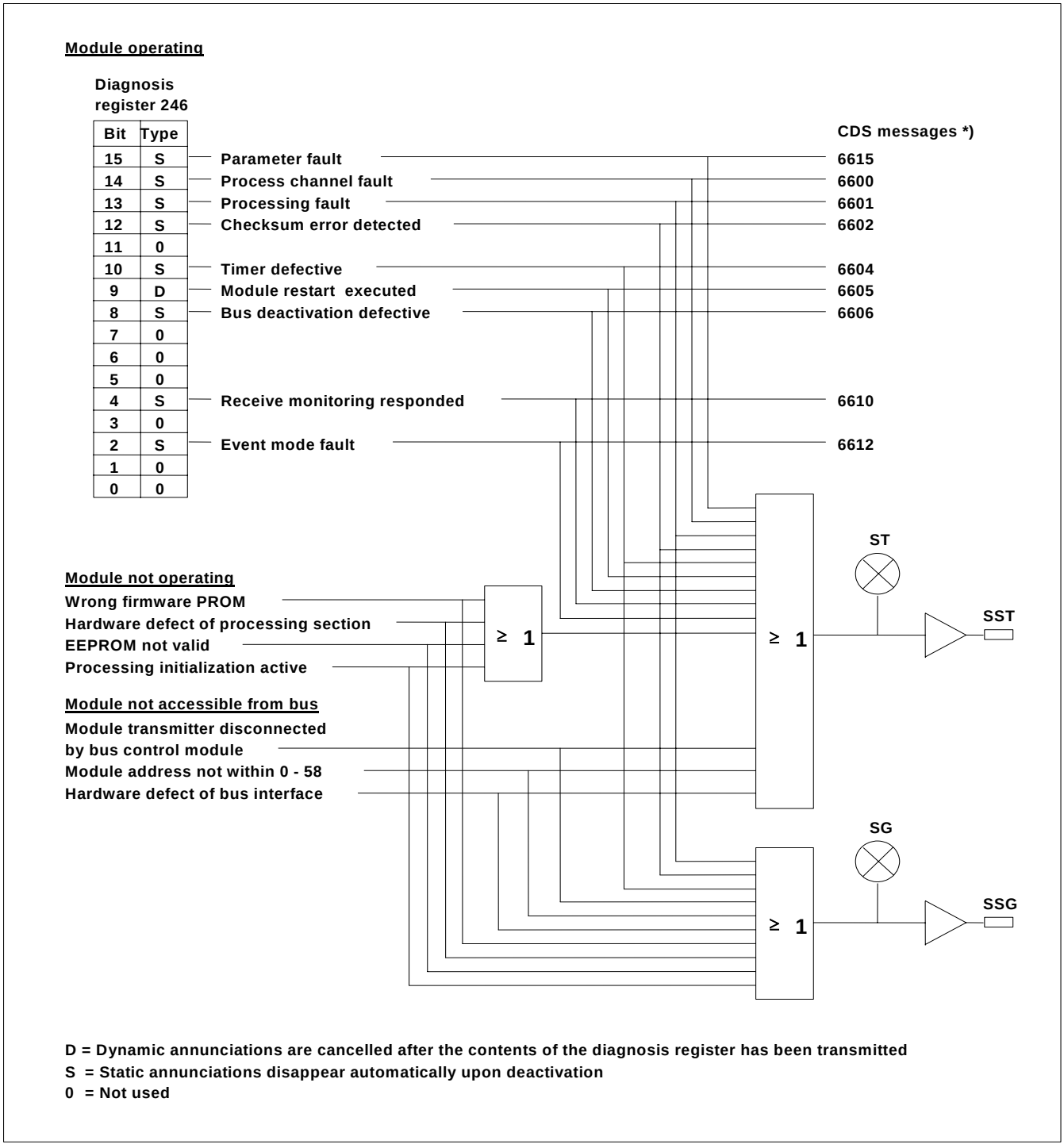



Fig. 2: Diagnosis messages of 81EU01

*) The control diagnosis system (CDS) provides a description for every message number. This description comprises:

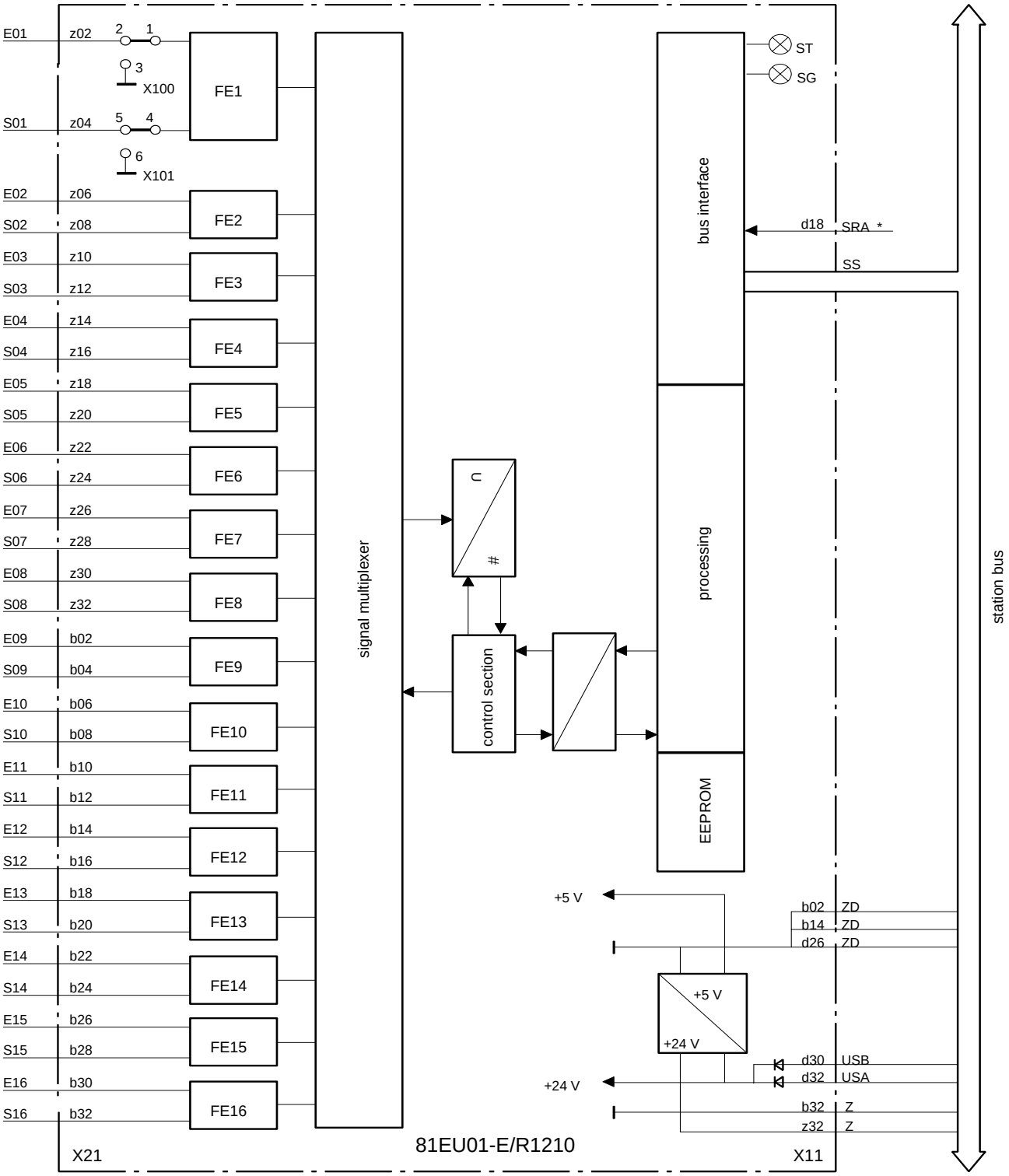
- Information about cause and effect of the disturbance
- Recommendations for elimination.

Thus, fast disturbance elimination is ensured

## Function diagram

Terminal designations: The module consists of a printed circuit board (see “Mechanical design”). The printed circuit board is equipped with connectors X21 and X11. Connector X21 contains all process inputs

Connector X11 incorporates the standard interface with the station bus and the operating voltages of the module.

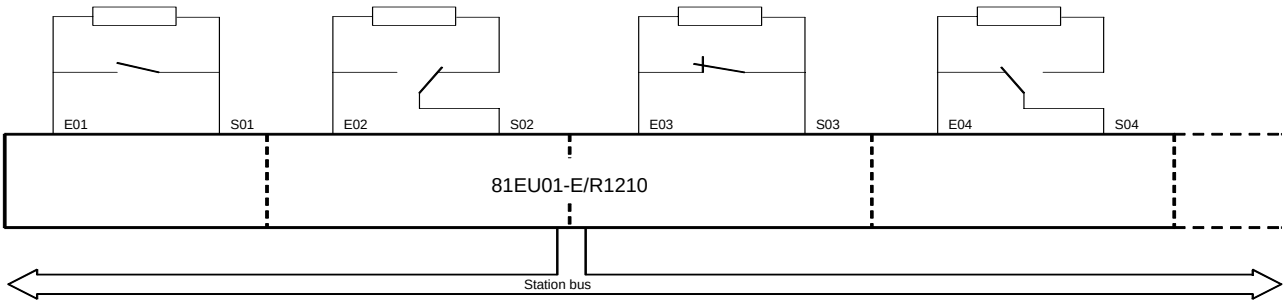



* For proper functioning of the module, connector X11/d18 has to be connected to ZD (once per subrack).

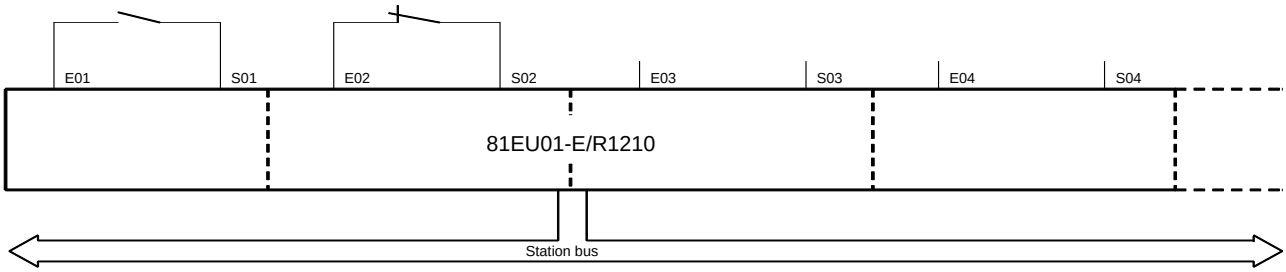
# Connection diagrams (each connection diagram can be used for each function unit.)

**Standard application**

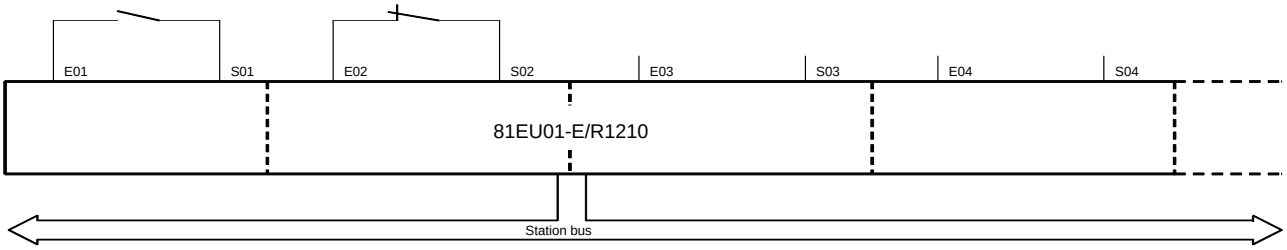
Single/changeover contacts with 48 V supply from the module
**with** monitoring



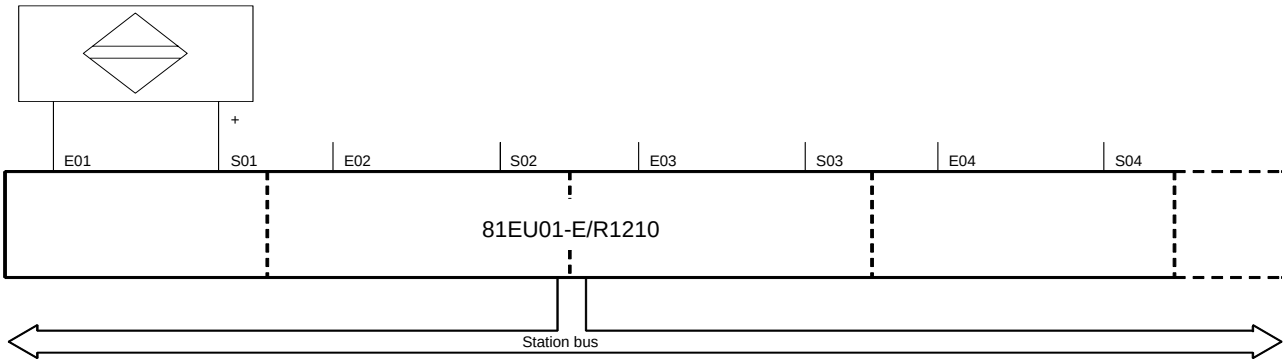

Single/changeover contacts with 48 V supply from the module
**without** monitoring



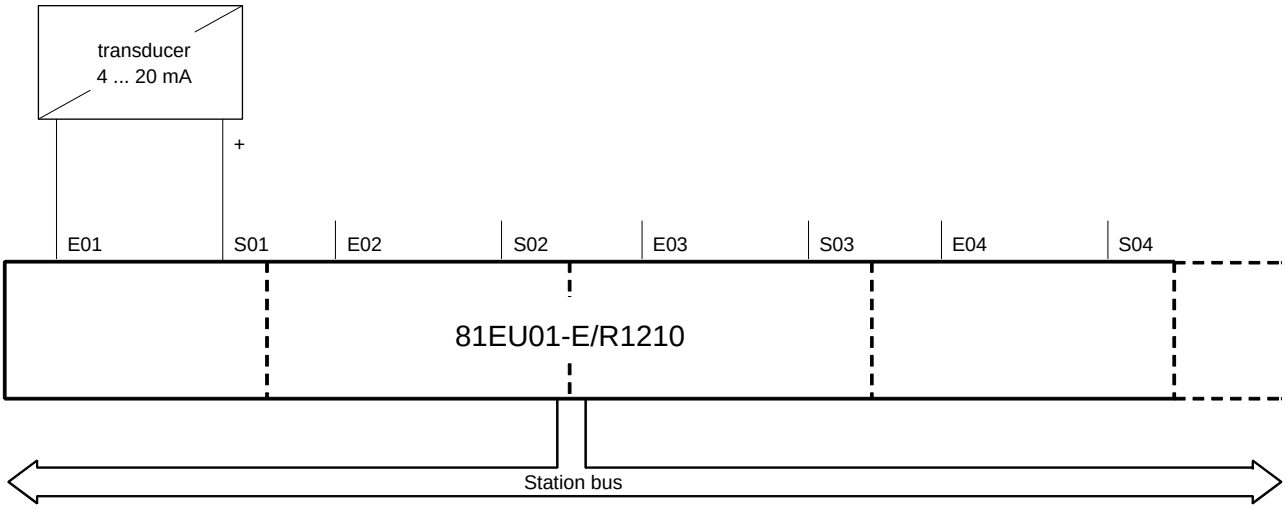
Single/changeover contacts with 24 V supply from the module
**without** monitoring



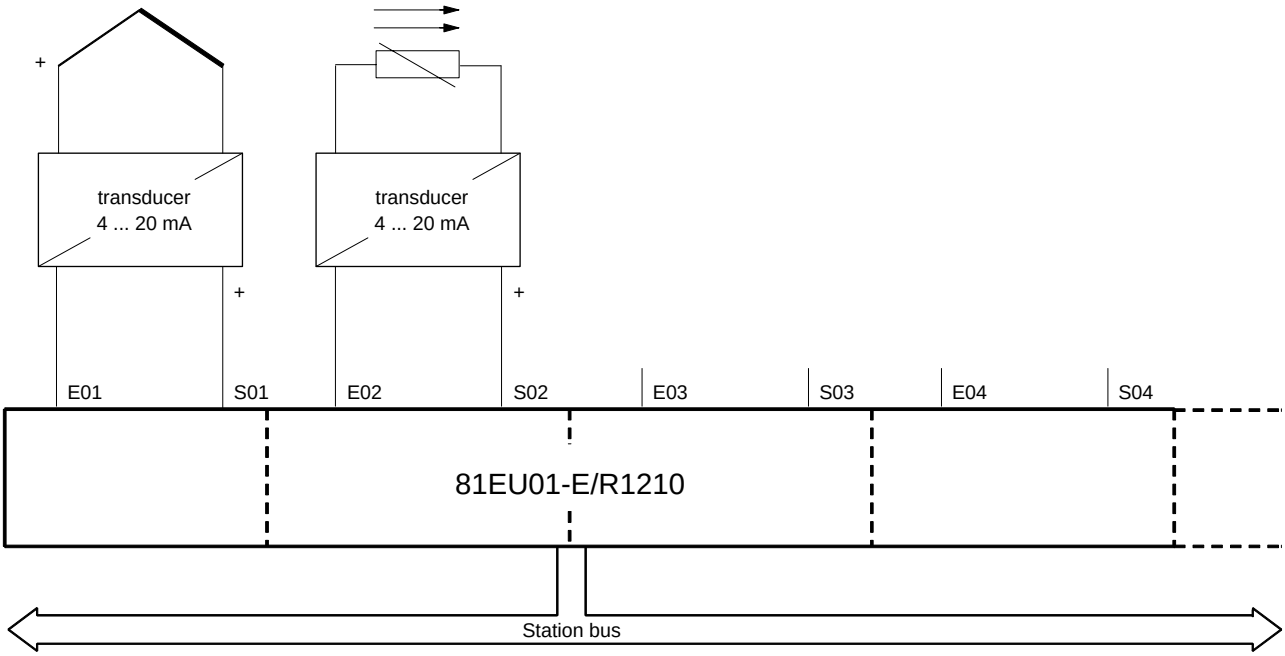

Inductive initiator acc. to NAMUR (DIN 19234)



2-wire transducer, 4 ... 20 mA supplied from the module

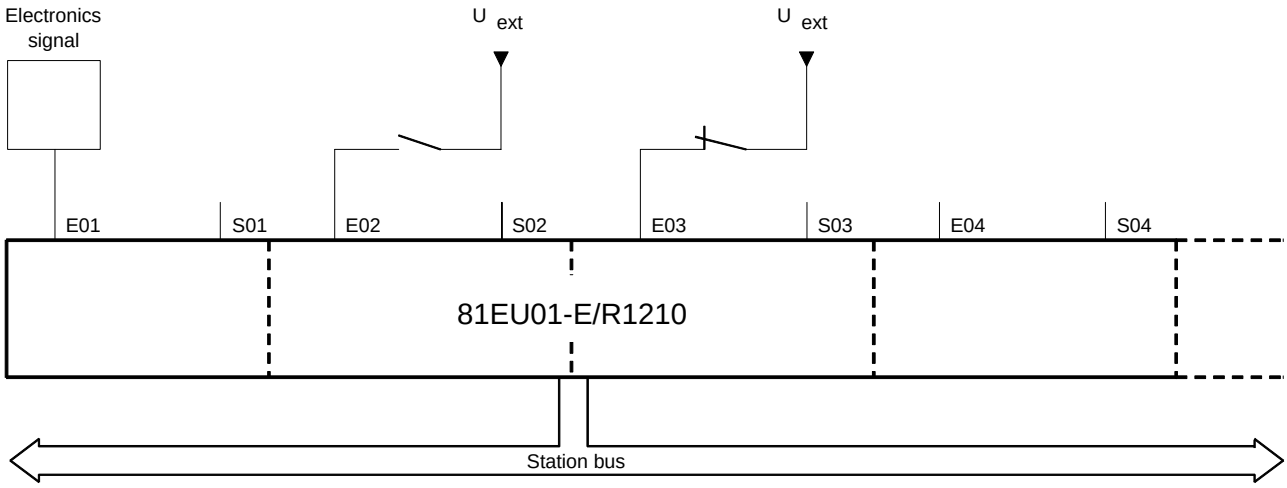



Temperature transducer



**Special application**

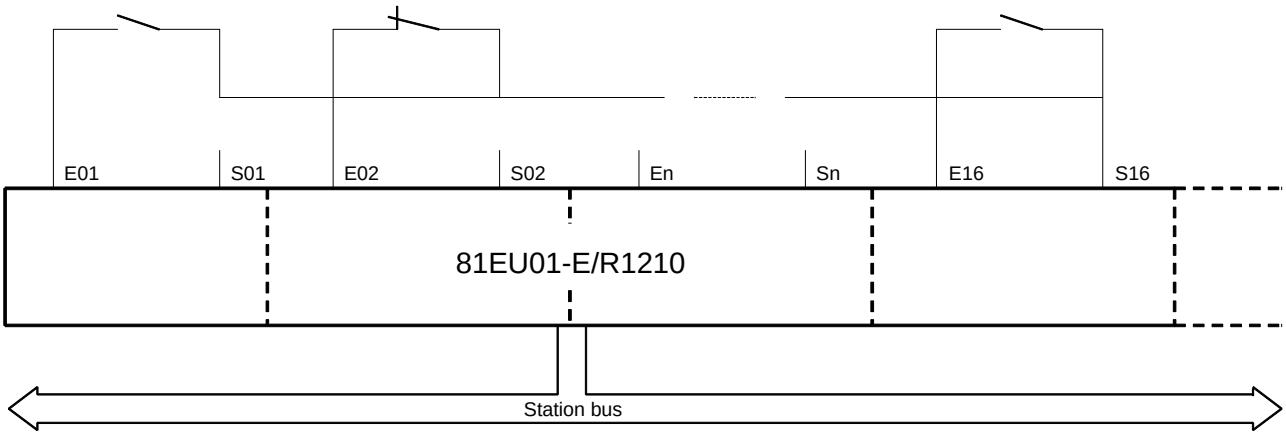
Contacts or electronic transmitters with external power supply
**without** monitoring




Caution:
Max. static potential difference between the reference potentials permissible < 0.5 V

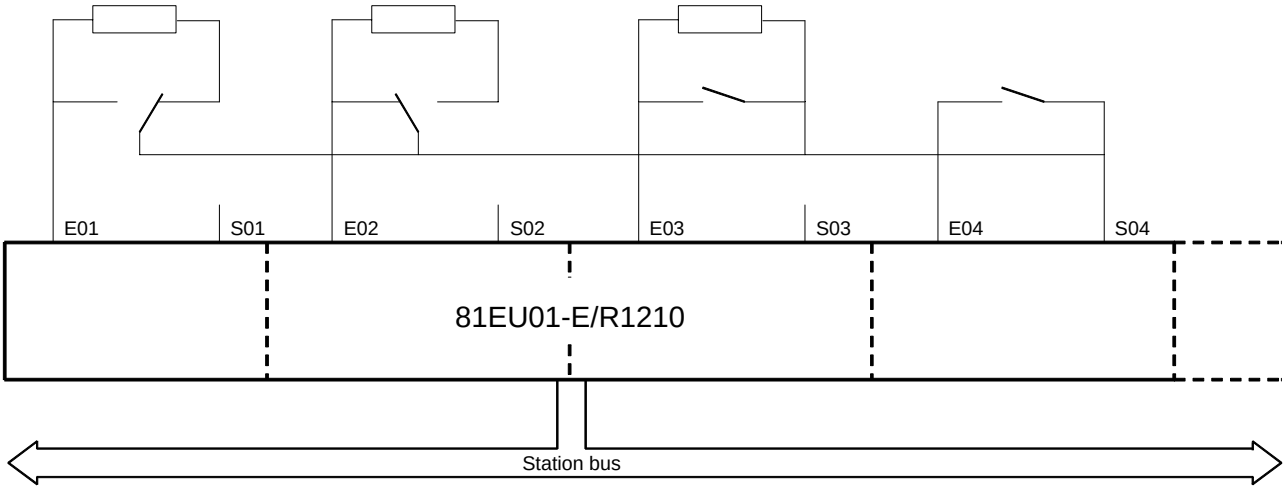
Parallel power supply:

Single/changeover contacts with 24 V supply from the module,
**without** monitoring, max. 16 contacts permissible

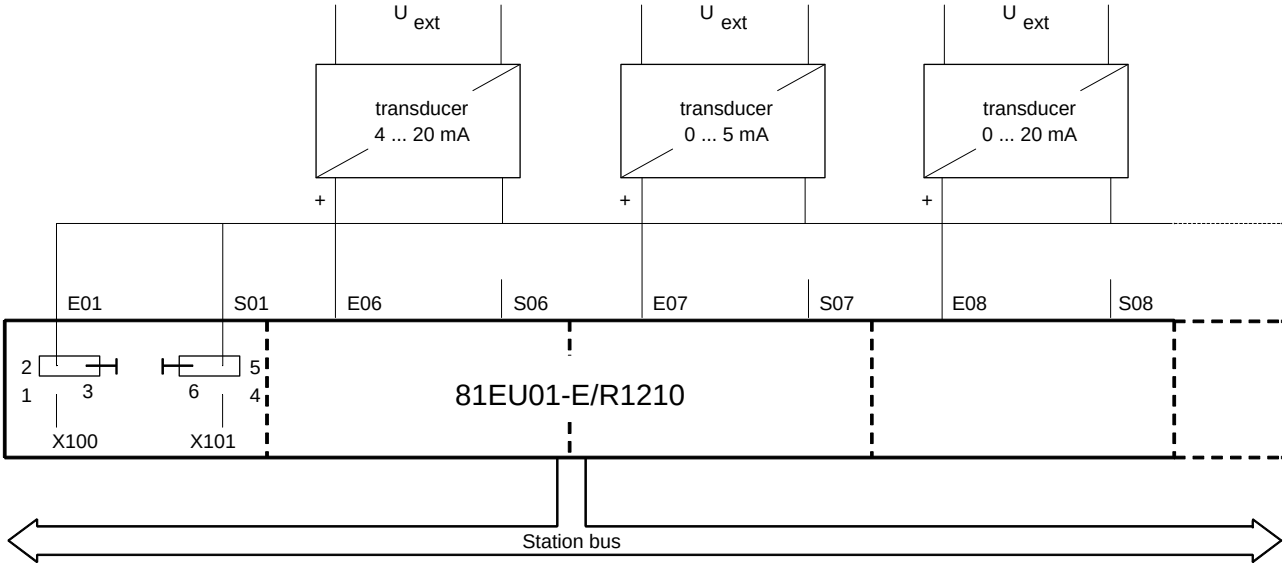


Parallel power supply:

Single/changeover contacts with 48 V supply from the module
with or without monitoring, max. 4 contacts permissible




4-wire transducer with external power supply




Caution:
The return lines of the externally supplied transducers are arranged in parallel and connected with the contacts E01 and S01.

This is permissible only for transducers connected to function units 2 to 16.

## Module design

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

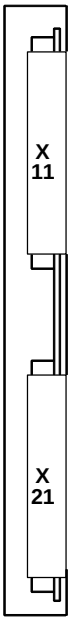
Connector: acc. to DIN 41612

1 x for station bus connection,
48-pole edge connector, type F
(connector X11)

1 x for process connection,
32-pole connector, type F
(connector X21)

Weight: approx. 0.5 kg

View of edge connector side::

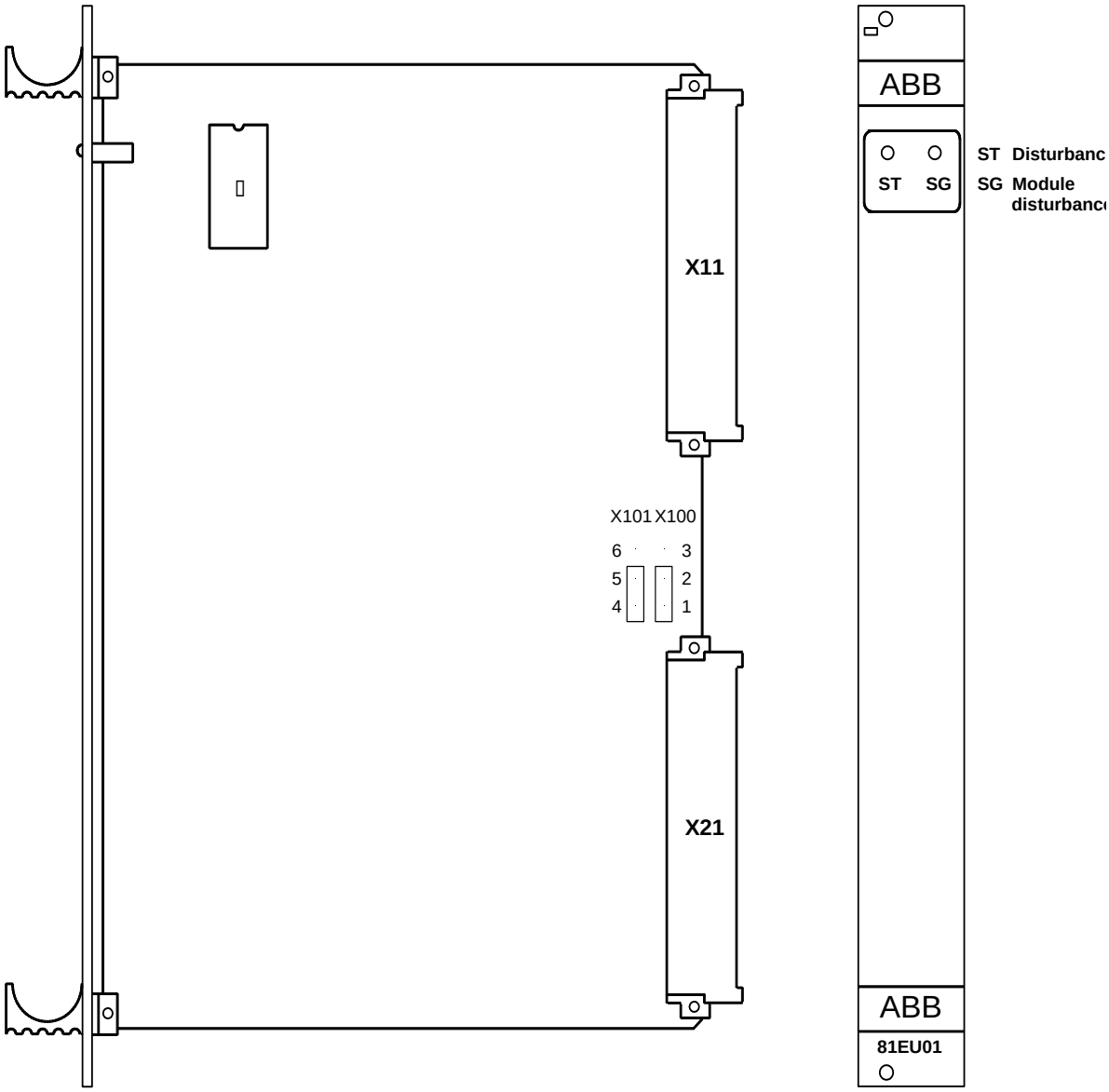



**Contact assignment of process connector X21**

View of contact side:

| | *b* | *z* |
|---|---|---|
| *02* | E09 | E01 |
| *04* | S09 | S01 |
| *06* | E10 | E02 |
| *08* | S10 | S02 |
| *10* | E11 | E03 |
| *12* | S11 | S03 |
| *14* | E12 | E04 |
| *16* | S12 | S04 |
| *18* | E13 | E05 |
| *20* | S13 | S05 |
| *22* | E14 | E06 |
| *24* | S14 | S06 |
| *26* | E15 | E07 |
| *28* | S15 | S07 |
| *30* | E16 | E08 |
| *32* | S16 | S08 |

Side view and view of module front




1 EPROM programmed, order number: GJR2391541Pxxxx
xxxx = position number indicating the applicable program version.

# Technical data

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

**Power supply**

| | | | |
|---|---|---|---|
| Operating voltage | +24 V | | |
| Current consumption (depending on configuration) | *Configuration* | *Basic requirem.* | *+ for each function unit when transmitter active* |
| | NAMUR | 140 mA | 9 mA |
| | contacts, 24 V | 140 mA | 2 mA |
| | contacts, 48 V | 140 mA | 17 mA |
| | 2–wire–transducer | 140 mA | 7 mA + meas. current |
| Reference potential | 0 V | | |
| Power dissipation | 3.4 ... 11 W<br>depending on the operating voltage and configuration<br>Approximation formula:<br>approx. 3.4 W + 24 V **.** (n **.** current per function unit when the transmitter is active).<br>n = number of function units configured | | |

**Binary transmitter mode**

*Single/changeover contacts with 48 V supply from the module, with/without monitoring*

Input values

| | |
|---|---|
| 0-signal without monitor | 0 ... 10.5 V |
| 0-signal with monitor | 6 ... 10.5 V |
| 1-signal | 14 ... 51 V |
| Response range of monitor | 0 ... 3 V |
| Input resistance | 10 kOhm + 11 %, - 10 % |
| Destruction limit | > 55 V |
| Resistance (forward and return lines) | ≤ 100 Ohm |

Output values

| | |
|---|---|
| Output voltage | 48 V +/- 5 % |
| Output current | max. 32 mA |
| Response time of monitoring function (for use with monitoring) | 0.5 sec |

*Contacts or electronic transmitters with 24 V supply from the module, without monitoring*

Input values

| | |
|---|---|
| 0-signal | 0 ... 3 V |
| 1-signal | 11.2 ... 30 V |
| Input resistance | 15 kOhm + 13 %, - 10 % |
| Destruction limit | > 65 V |
| Resistance (forward and return lines) | ≤ 100 Ohm |

Output values

| | |
|---|---|
| Output voltage | US - 5.5 V |
| Output current | max. 50 mA |

*Contacts or electronic transmitters with external power supply up to 60 V, without monitoring*

Input values

| | |
|---|---|
| 0-signal | 0 ... 3 V |
| 1-signal | 11.2 ... 60 V |
| Input resistance | 15 kOhm + 13 %, - 10 % |
| Stat. potential difference compared to reference potential of external power supply | < 0.5 V |
| Destruction limit | > 65 V |
| Resistance (forward and return lines) | ≤ 100 Ohm |

*Inductive initiators acc. to NAMUR (DIN 19234), supply from module, with monitor*

Input values

| | |
|---|---|
| Signal change at | 1.65 mA |
| Short-circuit alarm at | ≥ 6 mA |
| Open-circuit alarm at | ≤0.35 mA |
| Input resistance | 1 kOhm + 13 %, - 10 % |
| Destruction limit | > 12 V |
| Resistance (forward and return lines) | ≤ 50 Ohm |

Output values

| | |
|---|---|
| Output voltage | 8.2 ... 10 V |
| Output current | max. 10 mA |

**Analog transmitter mode**

Input values

| | |
|---|---|
| Input current, nominal signal range | 0 ... 20 mA |
| (corresponds to 0 ... 100 %) | 4 ... 20 mA |
| | 0 ... 5 mA |
| Maximum range | -1 ... 30 mA |
| Measuring resistor | 50 Ohm |
| Destruction limits | +/- 50 mA |
| Resistance (forward and return lines) | ≤ 100 Ohm |

Accuracy

All data referenced to 100 % of the upper limit of signal range (5 or 20 mA, unless otherwise specified)

| | |
|---|---|
| Accuracy | < 0.3 % |
| (over temperature range 0 to 70 °C, ageing, voltage range) | |
| Accuracy present on delivery (23 °C) | < 0.1 % |
| Quantization error | < 0.02 % |
| Linearity error | < 0.1 % |
| Response to temperature changes | < 50 ppm/K (typ. 30 ppm/K) |
| Errors by digital linearization | 1 LSB |
| Resolution, at 0 ... 20 mA | 12 bits |
| at 4 ... 20 mA | 12 bits |
| at 0 ... 5 mA | 10 bits |
| Common-mode rejection | 120 dB |
| Normal-mode rejection at 16 2/3, 50 and 60 Hz | 50 dB |

Transducer supply

| | |
|---|---|
| Output voltage (at I ≤ 25 mA) | US - 4.5 V |
| Output voltage (at I ≤ 50 mA) | US - 5.5 V |
| Output current | max. 50 mA |

Processing time

For complete module
**(no function blocks)**:

| | | |
|---|---|---|
| - Binary transmitters | | 5 msec |
| - Analog transmitters | | 80 msec |
| - Temperature measurements | | 320 msec |
| Additional time requirement if function blocks are used | | |
| (per function) | KOR1 | 105 msec |
| | KOR3 | 125 msec |
| | NIV | 105 msec |
| | FIL | 70 msec |

Bounce suppression time

| | |
|---|---|
| When binary transmitters are used | n . 5 msec |
| Set value n: | |
| up to version and including P0010 or P1010 | 3 |
| from version P0011 or P1011 on upwards | to be set within 1 ... 10 |

Reaction time

| | |
|---|---|
| When binary transmitters are used | n . 5 msec + 3 msec |

Initialization time

| | |
|---|---|
| When voltage is switched on or the module is plugged in | |
| Function blocks not used | 1 ... 12 sec |
| Function blocks used | 2 ... 22 sec |

Contact resistance

| | |
|---|---|
| Resistance value | 47 kOhm |
| Power dissipation | ≥ 0.25 W |
| Tolerance | +/- 2 % |

Interference immunity (of process inputs and outputs)

| | | |
|---|---|---|
| Electrostatic discharge immunity | DIN EN 61000-4-2 | 8 kV / 4 kV |
| Radiated, radio-frequency, electromagnetic field, immunity | DIN EN 61000-4-3 | 10V/m |
| Electrical fast transient/burst immunity | DIN EN 61000-4-4 | 2 kV |
| Surge Immunity | DIN EN 61000-4-5 | 2 kV / 1 kV |
| Conducted disturbances immunity | DIN EN 61000-4-6 | 10 V |

**ORDERING DATA**

Type designation: 81EU01-E/R1210 Order number: GJR2391500R1210

Technical data are subject to change without notice!

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