Application

The input module for binary signals is used to connect sensors to NAMUR (acc. to DIN 19 234).

The module incorporates 16 function units with line monitoring and requires 8 successive addresses on the 10-bus.

The sensors are connected on a 2-wire basis and are fed from the module.

The module is available in the following version:

- 81 EN10-E/R0100 Sensors to NAMUR (DIN 19234) with monitoring for wire break and short circuit

Features

The module can be plugged into every multi-purpose processing station of the PROCONTROL bus system. It has a slot requirement of one division.

It incorporates a standard interface SEA to the 10-bus.

The module receives the binary signals from touchless processing NAMUR-sensors installed in the process and transfers them in the form of telegrams to the PROCONTROL bus system via the 10-bus.
Description

Basically, the module consists of three functional blocks:

- Acquisition, conditioning and monitoring of the binary input signals from the process.

- Parallel/serial conversion of the conditioned binary signals.

- Bus adaption with output of the binary values in the form of telegrams to the IO-bus.

There is no interaction between the bus side and the process. No potential isolation is provided.

SIGNAL INPUT FROM THE PROCESS

The module is designed to scan up to 16 NAMUR-sensors which are installed in the process and supplied by the module.

It is possible to use inductive and capacitive sensors.

The sensors are supplied from the module in such a way that interactions are excluded.

When an effective medium or material comes within the active range, an inductive sensor is blocked while a capacitive sensor becomes conducting.

When an inductive sensor responds and becomes blocked, the associated bit RXX in the data telegram is set to logic "1".

When a capacitive sensor responds and becomes conducting, the associated bit RXX in the data telegram is set to logic "0".

The binary signals are acquired by the input circuit in parallel form with a time delay of typically 4 ... 14 ms (filter time constant).

Each of the received binary signals is monitored for disturbances in the peripherals. The following disturbances are detected:

- Wire break in the sensor supply line (SXX)
- Wire break in the sensor line (RXX)
- Fault to earth in the sensor line (RXX)
- Short circuit in the sensor supply line (SXX) with US
- Short circuit in the sensor line (RXX) with US
- Interruption in the sensor
- Short circuit in the sensor

Response of the peripherals monitor causes:

- the individual disturbance annunciation MXX in the data telegram to respond,

- the associated general disturbance annunciation SMX in the data telegram to respond,

- the associated data of the corresponding function unit to be set to logic "0",

- the light-emitting diode for disturbance annunciation ST on the module front to be set.

The NAMUR-sensors are connected via process connector X2I in 2-wire arrangement, the NAMUR-sensors being supplied by the module via contacts SXX.

WIRING OF UNUSED FUNCTION UNITS

If unused function units of the module are not provided with a resistor of 1 kOhm, individual disturbance annunciation MXX and general disturbance annunciation SMX are set in the data telegram of these function units.

Therefore, transmitter simulation modules 81 E501/R0400 are connected to the unused function units.

The transmitter simulation modules are plugged onto the appropriate contacts of the process connector, instead of being wired to the sensor.
DATA OUTPUT TO THE IO-BUS

Whenever the module is called by its starting address, it transfers the data and specification telegrams of its function units during the following transfer cycles to the IO-bus.

The standard interface to the IO-bus is provided by bus connector X11.

Bus connector X11 also incorporates the feed-in for supply voltage US and reference potential Z.

Data communication with the module

The module is provided on its front with 3 hex. code switches which serve to set the module starting address.

When the module is called by its starting address as defined by the hex. code switches, it transfers its data and specification telegrams to the IO-bus during the following transfer cycles.

As soon as the module is called by an address telegram with its starting address, it transfers the data telegram of its first 4 function units during the next transfer cycle.

The subsequent addresses of the remaining function units are recognized within the module and transferred to the IO-bus during the transfer cycles which follow.

FORMATION OF ADDRESS

The bus control module transfers address telegrams of 16 bit length to call the individual modules connected to the IO-bus.

Each incoming address is compared by the module with its own module address.

This comparison takes place in parallel mode.

The address transferred by the bus control module has the following structure:

```
 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
```

- **Module address**: Always 000
- **Register address**: Specification (0 or 1)
- **Parity bit**: Always 000

The address transferred by the bus control module is compared with the address set on the module.

The address required by the module for comparison has the following structure:

```
 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
```

- **Register address**: Specification
- **Address switch S3**: Address switch S2
- **Parity bit**: Always 000

If bits 3 to 11 of the address telegrams are the same, the module responds and transfers the data telegram of its first register address to the IO-bus during the next clock cycle.

The binary value registers are directly addressed by bits 1 and 2.

The 0 address bit is the so-called specification bit. Depending on the state of the specification bit, either a specification telegram or a data telegram is transferred.

- 0 = data telegram
- 1 = specification telegram
Formation of telegrams

Altogether, eight telegrams are formed by the module. Whenever the module is addressed by the bus control module, a telegram is sent to the I0-bus.

DATA TELEGRAM

The 16 binary signals are transferred under the even-numbered addresses. Each data telegram has a length of 16 bits with the following contents:

| Reg.No. | 15 | 14 | 13 | 12 | 11 | 10 | 9  | 8  | 7  | 6  | 5  | 4  | 3  | 2  | 1  | 0     |
|---------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|
| 0       | 0  | 0  | 0  | R4 | NR4| M4 | R3 | NR3| M3 | R2 | NR2| M2 | R1 | NR1| M1 | SM1  |
| 1       | 1  | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    |
| 2       | 0  | 0  | 0  | R8 | NR8| M8 | R7 | NR7| M7 | R6 | NR6| M6 | R5 | NR5| M5 | SM2  |
| 3       | 1  | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    |
| 4       | 0  | 0  | 0  | R12| NR12| M12| R11| NR11| M11| R10| NR10| M10| R9 | NR9| M9 | SM3  |
| 5       | 1  | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    |
| 6       | 0  | 0  | 0  | R16| NR16| M16| R15| NR15| M15| R14| NR14| M14| R13| NR13| M13| SM4  |
| 7       | 1  | 0  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    |

Legend:
Reg.Nr. = Register number
R(XX) = Binary input signal XX
NR(XX) = Binary input signal XX inverted
SM(XX) = General disturbance bit telegram

Note: NRXX is the negated value of RXX which is formed internal to the module. When the sensor monitor responds, the following applies:
MXX = "1"; SMX = "1"; RXX = NRXX = "0"
Annunciation functions

Disturbances in the module, in the process peripherals and in the communication with the IO-bus are detected and signalled by the module.

The disturbances can be signalled by the module in the following three ways:

- Visual disturbance annunciation on the module by the light-emitting diode ST visible on the module front which emits a steady red light in the event of a disturbance
- Annunciation via bus line SME of the IO-bus
- Annunciation by setting general disturbance bit SM in the data telegram.

ANNUNCICATION ON THE MODULE

The red light-emitting diode ST is connected with bus line SME. It emits a steady light when a disturbance annunciation is transferred via bus line SME, and/or when a general disturbance bit SM is set in the data telegram.

ANNUNCIATIONS TO THE IO-BUS

A disturbance annunciation is output in the following cases:

- If the module is not addressed by a valid address telegram within 7 seconds.

Disturbance annunciation signal SME and light-emitting diode ST are set. When the module is called again by the bus control module, SME and ST are reset after 200 ms.

- If one or more of the bus connecting lines are disturbed.

Disturbance annunciation signal SME and light-emitting diode ST are set as long as the disturbance is present. After the disturbance has been removed, SME and ST are reset after 200 ms.

- When the module has detected a disturbance in the peripherals (see "Signal input from the process").

Individual disturbance bit MX and general disturbance bit SMX as well as light-emitting diode ST are set as long as the disturbance is present. After the disturbance has been removed, MX and SMX are reset immediately while ST is reset after 200 ms.

Setting of the module

SETTING OF ADDRESS

The module starting address is to be set by means of address switches S1, S2 and S3. The module starting address is the address of the first 4 function units.

In addition to this address, the module occupies the next following 7 IO-bus addresses.

The address is set with the module withdrawn, and can be read on the front panel.

S1 is the most significant address switch, and S3 the least significant address switch.

Possible setting of the hex. code address switches:

<table>
<thead>
<tr>
<th>Address switch</th>
<th>Address switch</th>
<th>Address switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>S2</td>
<td>S3</td>
</tr>
<tr>
<td>adjustable</td>
<td>adjustable</td>
<td>adjustable</td>
</tr>
<tr>
<td>0 - F</td>
<td>0 - F</td>
<td>0 or 8 permitted</td>
</tr>
</tbody>
</table>

Only bit 3 of the address word is set with the 3rd address switch. Therefore, only address 0 or 8 can be set.

When the module is used in connection with a bus coupling module 88 QT02, value 1 must be set on address switch S1.

By setting the 1st address switch to position "1", bus coupling module 88 QT02 is notified that specification telegrams are transferred by the module.
Functional diagram

The module consists of a printed circuit board (see "Mechanical design") which is equipped with two connectors X11 and X21 as well as three address switches S1, S2 and S3.

TERMINAL DESIGNATIONS

Connector X11 incorporates the standard interface to the IO-bus SEA and the operating supply voltage.

Connector X21 incorporates the process connections.
Connection diagram

The module has 16 binary signal inputs with power supply for connection of the NAMUR-sensors.
Mechanical design

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

Connector:
- to DIN 41 612
  - 1 x for 10-bus connection, 48-pole, edge connector type F (connector X11)
  - 1 x for process connection, 32-pole, edge connector type F (connector X21)

Weight: approx. 0.42 kg

The exact contact allocation of the individual connectors can be seen from Operating principles description "Connectors for 10-bus Modules" GKWE705321 or from the functional diagram of the module.
POSITIONS OF THE ADJUSTABLE COMPONENTS AND VISUAL DISPLAYS ON THE FRONT

Light-emitting diode for disturbance annunciation ST

ID-BUS address

<table>
<thead>
<tr>
<th>Signif.</th>
<th>Hex.</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>100</td>
<td>236</td>
</tr>
<tr>
<td>S2</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>S3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

81 EN10-E
POSITIONS OF THE ADJUSTABLE COMPONENTS ON THE PRINTED CIRCUIT BOARD

The printed circuit board contains the three address switches S1, S2 and S3 for setting the module starting address.

In addition, this printed circuit board is fitted with connectors X11 and X21.

Connector X11 provides the standard interface SEA for I/O-bus connection, while connector X21 exclusively serves for process connection.
Technical data

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

POWER SUPPLY

Rated voltage: 16.8 V ... 33 V
Operating voltage US: 24 V
Current consumption $I_{typ}$: 100 mA
Power dissipation $P_{typ}$: 2.4 W

The values specified for $I_{typ}$ and $P_{typ}$ apply for unloaded inputs. To obtain an exact value, the input loads must be added.

Reference potential IO-bus Z: 0 V

INPUTS

Number of NAMUR-sensors to be connected: 16
Input designations: R1, S1 ... R16, S16

The binary inputs are protected for a max. voltage of 1.5 kV acc. to GKWEB00036.

INPUT VALUES

No-load voltage at SXX $U_L$: 7.7 V ... 9 V
Input resistance at RXR $R_E$: 1kOhm +/- 10 %
Switching point $I_S$: 1.2 ... 2.1 mA
Switching point Rated value $I_{S,\text{rated}}$: 1.65 mA
Line resistance $R_L$: $\leq$ 50 Ohm

Monitoring for interruption $I_S$: $\leq$ 0.11 mA
Monitoring for short circuit $R_L$: $\leq$ 220 Ohm

Filter time constant type: 4 ... 14 ms

OUTPUTS

Output designation: IO-bus standard interface SEA
PERMISSIBLE TEMPERATURE RANGES

Operating temperature: 0 °C ... 70 °C
Storage temperature: -40 °C ... 85 °C

ORDERING DATA

1. Complete module:
Type designation: 81 EN10-E/R0100
Order number: BKWE855500R0100

2. Transmitter simulation module
for unused function units
Type designation: 81 ESO1/R0400
Order number: 6JR2355800R0400

Technical data are subject to change without notice.

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