Module and Application Description

PROCONTROL P
Input, Output, Signal Conditioning

Input Module for Binary Signals
16-fold
81EU01-E/R3110

1KGF 100 437, Edition 08/04

Application

The input module is used as a substitute for the following input modules with transmitters:

81EB02-E/R1020
- 16 changeover contacts or single contacts with line monitor

81EB02-E/R1122
- 16 single contacts without monitor
- 16 binary outputs of electronic devices (electronic signals)

The module incorporates a total of 16 function units. Every function unit may be used for any type of input mode.

The module can be used for two types of application (operating mode 1 and 2). The operating modes differ in their register allocation (cf. Table 2). The operating mode is set indirectly by specifying the type of transmitter.

Combining contacts with a 48 V supply, with or without line monitor (operating mode 1), with contacts with 24 V supply or electronic signals (operating mode 2) is not possible.

Line monitoring is possible only if a resistor has been mounted in parallel with the contact (cf. Connection diagrams).

Combining contacts with and without line monitor is admissible.

The allocation as well as the settings of all the parameters can be programmed easily with the help of the configuration list. The programmed values are stored in an EEPROM to ensure that they are not lost in the event of a power failure. They can be changed any time.

Features

The module can be plugged into any PROCONTROL station with an external power supply unit. It is equipped with a standard interface for the PROCONTROL station bus.

The module transmits the input signals or converted input signals in the form of telegrams to the PROCONTROL bus system over the station bus. Before transmission, the telegrams are checked and marked with test flags. This ensures that the receiving module can check for error-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 supply is available for each function unit and is suitable for the various applications.

 As soon as the internal monitoring circuits respond or the input signal monitoring function is indicated by disturbance annunciation ST (general disturbance) on the front panel of the module.

Application with binary transmitters

Binary transmitters

The function units of the module can be used for
- Single or changeover contacts
  with 48 V supply from the module, with monitoring
- Single or changeover contacts
  with 24 V supply from the module, without monitoring
- Single or changeover contacts
  with 48 V supply from the module, without monitoring
- Contacts or electronic signals
  with external power supply up to 60 V, without monitoring

For the applicable type of connection please refer to the connection diagrams.

For the programming of the application-specific settings please 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 Sn output.
The transmitter power supply is short-circuit-proof and is monitored on the module.

The applications for "Single or changeover contacts with 48 V supply from the module, with monitoring" allows parallel supply of max. 4 contacts with a common root from one Sn supply output.

The application for "Single or changeover contacts with 24 V supply from the module, without monitoring" allow parallel supply of max. 16 contacts with a common root from one Sn supply output.

Inputs grouped together for joint power supply are susceptible to mutual interference.

In case a common power supply is used, those Sn supply outputs which are not needed must not be used.

If the transmitters are supplied from an external power source, the associated Sn supply output on the module must 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 takes place via inputs En.

Each input uses a bounce-suppression time which is based on a number n of processing cycles. The module detects the first signal change as an effective signal if the duration of the signal exceeds the bounce-suppression time.

The number of processing cycles n is user-definable.

In the applications for "Single or changeover contacts with 48 V supply from the module, with monitoring", a current of about 5mA will flow through the closed contact.

In the applications for "Single or changeover contacts with 48 V supply from the module, with monitoring", a 47-Kohm resistor (± 2 %) has to be connected in parallel with the contact. This allows monitoring of 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 of suppression resistor when contact is open
- Breaking of the changeover contact
- Input overloading

If an input is overloaded due to faulty circuitry, for instance, the function unit concerned is switched off immediately.

The 'Process channel fault' message 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 seconds, 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 in the telegram are set to 0, the associated single disturbance bit and the general disturbance bit are set to 1.

**Event generation**

The input module transmits its information in the form of telegrams to the station bus, either cyclically or in the event mode.

In the event mode, data are transmitted whenever binary 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 being used for binary transmitters, the module interprets the following occurrences as events:

- Switching of a connected contact
- Change of a connected electronic signal
- Response of a monitoring function

**Simulation**

A maximum of 32 signals can be simulated.

**Simulation of send registers**

Send registers of binary transmitters can be simulated by means of the PDDS. All of the send registers can be simulated.

**Setting the operating modes**

The type of application and the setting values need 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 are given a high-resistance bias and the module transmits no data telegrams on the bus. The ST lamp indicates the presence of a disturbance. Nevertheless, the module can receive information over the bus. The module waits for the configuration list to be transmitted by the PDDS.

After transmission of the configuration list, the module fully participates in bus communication. The lamp goes off.

The configuration list contains all the settings required by the module, listed according to function units (Table 1). Settings can be made within the defined range of values. The column for the PDDS default setting contains the default value which is entered if no other value is set.

<table>
<thead>
<tr>
<th></th>
<th>Value range</th>
<th>PDDS default setting</th>
</tr>
</thead>
</table>
| Transmitter type, measuring range | 48 V contact with monitoring  
48 V contact without monitoring  
24 V contact without monitoring  
Contact / electronic signal up to 60 V  
1...10 | 48 V contact with monitoring |
| Bounce suppression (processing cycles) |                                                                  | 3                         |

Table 1: Configuration list
Signal output to the PROCONTROL bus

The module sends the data telegrams over its standard station bus interface. The data are transferred serially.

Signal identification

The conditioned and digitized input signals as well as the status and diagnosis data formed in the module are written into special registers. The processing section writes the following data into the address part of the data telegram:

**48 V contacts (operating mode 1)**
- System address (within 0 .. 3)
- Station address (within 1 .. 249)
- Module address (within 0 .. 58)
- Register address (within 0 .. 3 for binary values, 205 for module cycle time, 246 for diagnostic data)

**24 V contacts (operating mode 2)**
- System address (within 0 .. 3)
- Station address (within 1 .. 249)
- Module address (within 0 .. 58)
- Register address (within 0 .. 1 for binary values, 205 for module cycle time, 246 for diagnostic data)

Data communication with the module

Address formation

The system and station addresses are identical for all the modules of one and the same 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 results of the diagnosis are written into special registers of the shared memory. The register number also serves as the register address. Each data word is assigned a permanent register. This assignment is done automatically when a process signal is connected to the process connector of the module.

Always all the telegrams are being sent.

Reading the data

Address data are needed for reading the contents of a register. Table 2 shows the address data and the contents of the associated registers.

Diagnosis and annunciation functions

Disturbance annunciations on the module

Disturbances are indicated by an LED on the module front:

- Disturbance ST

Light-emitting diode ST indicates all module disturbances and data communication disturbances involving the module.

Disturbance signals to the annunciation system

The annunciation system or the control diagnosis system (CDS) receives the disturbance messages from the input module via the bus.

Diagnosis

In the processing section of the module, the telegrams received and the formation of the telegrams to be sent, as well as the internal signal processing are monitored for fault-free condition (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.

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

The contents of the diagnosis register, the message on the general disturbance line, the messages on the CDS, and the ST lamp are shown in Figure 2.

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

- Transmitter monitoring responded
- Input monitoring responded

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

- Invalid configuration list
- Internal module voltage disturbed
- Hardware defect on the module
**48 V contacts (operating mode 1)**

<table>
<thead>
<tr>
<th>Type of information</th>
<th>Address word</th>
<th>Data word (bit address)</th>
<th>DA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sys-</td>
<td>Stat-</td>
<td>Mod-</td>
</tr>
<tr>
<td>Binary values</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>FE1 – FE4</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>FE5 – FE8</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>FE9 – FE12</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Module cycle time</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Diagnosis register</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>

**24 V contacts or electronic signals (operating mode 2)**

<table>
<thead>
<tr>
<th>Type of information</th>
<th>Address word</th>
<th>Data word (bit address)</th>
<th>DA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sys-</td>
<td>Stat-</td>
<td>Mod-</td>
</tr>
<tr>
<td>Binary values</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>FE1 – FE8</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>FE9 – FE16</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
<tr>
<td>Module cycle time</td>
<td>a</td>
<td>a</td>
<td>a</td>
</tr>
</tbody>
</table>

**Table 2: Register allocation and bit significance of the telegrams**

**Explanation:**
- FE = Function unit
- En = Binary signal input
- NEn = Negated value of En
- Mn = Single disturbance signal
- SM = General disturbance signal telegram
- DA = Data type
- a = Address according to location

**Please note:**
- In the case of undisturbed transmitters: Mn = 0 and NEn = negated value of En
- In the case of disturbed transmitters: Mn = 1 and NEn = En = 0
Figure 2: 81EU01/R3110 diagnostic messages

*) The control diagnosis system (CDS) provides a description for every message number. Among other data, this description contains:
- Information on cause and effect of the disturbance
- Recommendations for elimination of the fault.
This ensures quick elimination of a disturbance.

D = Dynamic annunciations are cancelled after the diagnosis register has been sent
S = Static annunciations disappear automatically upon deactivation
0 = Not used
Function diagram

Terminal designations: The module consists of a printed-circuit board (cf. "Mechanical design"). The printed-circuit board is equipped with connectors X21 and X11. Connector X21 contains all of the process inputs. Connector X11 contains the standard station bus interface and the operating voltages for the module.
Connection diagrams

48 V contacts with line monitor (operating mode 1)

<table>
<thead>
<tr>
<th>NO contact (1)</th>
<th>Changeover contact (1)</th>
<th>NC contact (1)</th>
<th>Changeover contact (1)</th>
<th>Circuitry of unused function units (2,3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E01 S01</td>
<td>E02 S02</td>
<td>E03 S03</td>
<td>E04 S04</td>
<td>Exx Sxx</td>
</tr>
</tbody>
</table>

(1) The resistor connected in parallel with the contacts (81ES05/R0100/R0200/R0300) is available in 3 versions (cf. Technical data).

(2) The resistors provided for unused function units are mounted on small, plug-type printed-circuit boards and need to be ordered separately (cf. Technical data).

(3) In addition to the application for unused function units, it is also possible to specify “48 V contact without monitoring” via the PDDS in order to prevent disturbance messages.

48 V contacts with and without line monitor (operating mode 1)

<table>
<thead>
<tr>
<th>With line monitor</th>
<th>With line monitoring</th>
<th>Without line monitoring (4)</th>
<th>Without line monitoring (4)</th>
<th>Circuitry of unused function units (2,3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E01 S01</td>
<td>E02 S02</td>
<td>E03 S03</td>
<td>E04 S04</td>
<td>Exx Sxx</td>
</tr>
</tbody>
</table>

(4) If the line monitor has been switched off via the PDDS, the resistor in parallel with the contact may be omitted.
Single 24 V contacts and/or electronic signals without line monitor (operating mode 2)

Electronic signal | NO contact | NC contact | NO contact | Circuitry of unused function units

E01 S01 E02 S02 E03 S03 E04 S04 Exx Sxx

Station bus
Mechanical design

Board size: 6 units, 1 division, 160 mm deep
Connector: to DIN 41 612
1 x for station bus connection, 48-pin edge-connector, type F (connector X11)
1 x for process connection, 32-pin edge-connector, type F (connector X21)

Weight: approx. 0.6 kg

Contact assignments of the X21 process connector

View of contact side:

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>E09</td>
<td>E01</td>
</tr>
<tr>
<td>04</td>
<td>S09</td>
<td>S01</td>
</tr>
<tr>
<td>06</td>
<td>E10</td>
<td>E02</td>
</tr>
<tr>
<td>08</td>
<td>S10</td>
<td>S02</td>
</tr>
<tr>
<td>10</td>
<td>E11</td>
<td>E03</td>
</tr>
<tr>
<td>12</td>
<td>S11</td>
<td>S03</td>
</tr>
<tr>
<td>14</td>
<td>E12</td>
<td>E04</td>
</tr>
<tr>
<td>16</td>
<td>S12</td>
<td>S04</td>
</tr>
<tr>
<td>18</td>
<td>E13</td>
<td>E05</td>
</tr>
<tr>
<td>20</td>
<td>S13</td>
<td>S05</td>
</tr>
<tr>
<td>22</td>
<td>E14</td>
<td>E06</td>
</tr>
<tr>
<td>24</td>
<td>S14</td>
<td>S06</td>
</tr>
<tr>
<td>26</td>
<td>E15</td>
<td>E07</td>
</tr>
<tr>
<td>28</td>
<td>S15</td>
<td>S07</td>
</tr>
<tr>
<td>30</td>
<td>E16</td>
<td>E08</td>
</tr>
<tr>
<td>32</td>
<td>S16</td>
<td>S08</td>
</tr>
</tbody>
</table>
Side view and view of the module front

EPROM programmed, order number: GJR2403642Pxxxx
xxxx = Position number according to the applicable program version.
Technical data

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

**Power supply**

Operating voltage UD 4.9 ... 5.1 V, typ. 5.0 V
Power consumption at UD = 5.0 V 220 mA
Operating voltage US 19.5 ... 30 V, typical 24 V
Power consumption at US = 24 V Configuration Basic current + per FU (transmitter active)
(depending on the type of configuration)
24 V contacts 100 mA 2 mA
48 V contacts 140 mA 15 mA
Power dissipation 4.0 ... 11 W
depending on operating voltage and configuration
Approximation formula:
4.0 W + 24 V • (∑ current per FU with active transmitter)

**Binary transmitter mode**

Single or changeover contacts with 48 V supply from the module, with/without line monitor

**Input values**

0 signal 6 ... 10.5 V
1 signal 14 ... 51 V
Response range of the monitoring function 0 ... 3 V
Input resistance 10 Kohms +11 %, -10 %
Destruction limit > 55 V
Line resistance (forward and return line) ≤ 100 ohms
Line length ≤ 1000 m

**Output values**

Output voltage 48 V ±5 %
Output current ≤ 32 mA
Response time of the monitoring function ≤ 0.5 sec

Contacts with 24 V supply from the module, without line monitor

**Input values**

0 signal 0 ... 3 V
1 signal 11.2 ... 30 V
Input resistance 15 Kohms +13 %, -10 %
Destruction limit > 65 V
Line resistance (forward and return line) ≤ 100 ohms
Line length ≤ 1000 m

**Output values**

Output voltage US – 5.5 V
Output current ≤ 50 mA
Contacts or electronic signals with external power supply, without line monitor

**Input values**

- 0 signal: 0 ... 3 V
- 1 signal: 11.2 ... 60 V
- Input resistance: 15 Kohms +13 %, -10 %
- Destruction limit: > 65 V
- Line resistance (forward and return line): ≤ 100 ohms
- Line length: ≤ 1000 m
- Stat. potential difference between the reference potentials of the external power supply: ≤ 0.5 V

**Times**

**Processing time**

- For complete module:
  - Binary transmitter: 5 msec
  - Bounce suppression time (adjustable within n = 1 ..10): n • 5 ms
  - Reaction time: n • 5 ms + 5 ms

**Initialization time**

- Upon power connection or when the module is plugged in: 1 ... 12 sec

**Contact resistance**

- Resistance value: 47 Kohms
- Power dissipation: ≥ 0.25 W
- Tolerance: ± 2 %

**Interference immunity (of the 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**

Order no. for complete module:

Type designation: 81EU01-E/R3110  
Order number: GJR2403600R3110

Suppression resistor for unused function units:

Type designation: 81ES01/R0200  
Order number: GJR2355800R0200

Suppression resistor for contact inputs:

Type designation: 81ES05/R0100 (with flat-pin plug)  
Order number: GKWE601766R0100
Type designation: 81ES05/R0200 (with wire end ferrules)  
Order number: GKWE601766R0200
Type designation: 81ES05/R0300 (with free wire ends)  
Order number: GKWE601766R0300

Technical data are subject to change without notice!
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