Module and Application Description

PROCONTROL | P
Input, Output, Signal Conditioning

Input Module for Binary Signals

81EU01-E/R3010

Application

The input module is used as a substitute for the following input modules with transmitters:
81EB01-E/R1010
- 6 changeover contacts with non-equivalence monitor
- 6 changeover contacts with non-equivalence and line monitor
- 12 single contacts
- 12 single contacts with line monitor

The module incorporates a total of 12 function units. Each function unit may be used for any type of input mode.
Combining changeover contacts with non-equivalence monitoring (operating mode 1) and single contacts (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 monitors is admissible.
Parameter allocation and parameter setting can be 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 a power failure. They can be changed any time.

Features

The module can be plugged into any PROCONTROL station with external power supply. It is equipped with a standard interface for the PROCONTROL station bus.
The module transmits the input signals and/or converted input signals in the form of telegrams, over the station bus, to the PROCONTROL bus system. Before transmission, the telegrams are checked and marked with test flags. This ensures that the receiving module can check for error-free transmission.

The individual function units of the module are non-interfering, mutually as well as towards the station bus.
A short-circuit-proof and monitored transmitter power supply is available for each function unit, suitable for the various applications.
As soon as the internal monitoring circuits, the non-equivalence monitor or the input signal monitoring function respond, disturbance annunciation ST (general disturbance) on the front panel of the module is illuminated.

Application with binary transmitters

Types of transmitters

The function units of the module can be used for:
- Changeover contacts with 48 V supply from the module, with non-equivalence monitor, without line monitor
- Changeover contacts with 48 V supply from the module, with non-equivalence monitor and line monitor
- Single contacts with 48 V supply from the module, without monitoring
- Single contacts with 48 V supply from the module, with monitoring

For the applicable type of connection please refer to the connection diagrams.
For programming 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 monitored on the module.
The application "Single contacts with 48 V supply from the module, without monitoring" allows parallel supply of a maximum of 2 contacts with a common root from one Sn supply output.
Inputs grouped together for joint power supply are susceptible to mutual interference. It is not permissible to connect several Sn supply outputs in parallel.

**Binary signal input circuit and monitoring**

Signal input for binary transmitters takes place via inputs Rn1 and Rn2. Inputs Gn1 and Gn2 have no function, on the module, they are connected to Rn1 and Rn2.

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 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.

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

A 'Process channel fault' message in the diagnosis register and the disturbance bit set in the data telegram indicate that a fault has occurred in the function unit concerned. Every 30 seconds, there will be a new attempt to reactivate the disconnected function unit.

**Line monitoring**

If a resistor is mounted in parallel with the single or changeover contact (see Connection diagrams), it is possible to monitor the lines and the transmitters.

This allows monitoring for 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 the suppression resistor when the contact is open
- Breaking of the changeover contact
- Input overloading

**Non-equivalence monitor**

Changeover contacts are generally monitored for non-equivalence. For this purpose, the signals of the two evaluation circuits of a function unit are compared with each other inside the processing section. If they are not found to be non-equivalent, a disturbance message is issued.

When the changeover contact is switched over, the non-equivalence monitor responds. In the evaluation circuit, however, the disturbance message is delayed by 0.5 seconds so that switching procedures within this time do not trigger a disturbance message.

**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, and the single disturbance bit and the general disturbance bit are set to 1.

**Event generation**

The input module transmits its data 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 immediately receives permission to transmit.

When being used for binary transmitters, the module interprets the following occurrences as events:
- Switching of a connected contact
- Response of a monitor

**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. It is possible to simulate all the send registers.

**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 carry 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 disturbance LED goes off.

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

Settings are possible 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>
<tbody>
<tr>
<td>Type of transmitter, measuring range</td>
<td>Changeover contact without monitor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Changeover contact with monitor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact, 48 V without monitor</td>
<td></td>
</tr>
<tr>
<td>Bounce suppression (processing cycles)</td>
<td>Contact, 48 V with monitor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1 ... 10</td>
<td>Changeover contact without monitor</td>
</tr>
</tbody>
</table>

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:
- 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 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 annuciations 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) receive the disturbance messages from the input module via the bus.

Diagnosis

In the processing section of the module, the received telegrams, the formation of the telegrams to be sent and 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 at the same time.

Upon request, the module sends a telegram with 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 voltages disturbed
- Hardware defect on the module
Changeover 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>
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</thead>
<tbody>
<tr>
<td></td>
<td>System</td>
<td>Station</td>
<td>Module</td>
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<tr>
<td>Changeover contacts</td>
<td>a a a 0</td>
<td>R31 R32 M3 R21 R22 M2</td>
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<tr>
<td>FE1 – FE3</td>
<td></td>
<td>FE5/6</td>
<td></td>
</tr>
<tr>
<td>Changeover contacts</td>
<td>a a a 1</td>
<td>R61 R62 M6 R51 R52 M5</td>
<td></td>
</tr>
<tr>
<td>FE4 – FE6</td>
<td></td>
<td>FE11/12</td>
<td></td>
</tr>
<tr>
<td>Module cycle time</td>
<td>a a a 205</td>
<td>Time value 100 msec</td>
<td></td>
</tr>
<tr>
<td>Diagnosis register</td>
<td>a a a 246</td>
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Single contacts (operating mode 2)

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<th>Type of information</th>
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<td>System</td>
<td>Station</td>
<td>Module</td>
</tr>
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<td>Single contacts</td>
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<td>R31 M31 R32 M32 R21 M21</td>
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<tr>
<td>FE1 – FE3</td>
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<td>FE5 FE6 FE3 FE4 FE1 FE2</td>
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<tr>
<td>Single contacts</td>
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<td>R61 M61 R62 M62 R51 M51</td>
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<td>FE4 – FE6</td>
<td></td>
<td>FE11 FE12 FE9 FE10 FE7 FE8</td>
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<tr>
<td>Module cycle time</td>
<td>a a a 205</td>
<td>Time value 100 msec</td>
<td></td>
</tr>
<tr>
<td>Diagnosis register</td>
<td>a a a 246</td>
<td></td>
<td></td>
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Table 2: Register allocation and bit significance of the telegrams

Explanation:
- FE = Function unit
- Rn1 = Binary signal input, evaluation circuit 1
- Rn2 = Binary signal input, evaluation circuit 2
- Mn = Single disturbance signal
- SM = General disturbance signal, telegram
- DA = Data type
- a = Address according to location

Note: If a transmitter is disturbed, the following signals are set:
- In changeover contact mode:
  - The single disturbance signal Mn = 1 and the associated input signals Rn1 and Rn2 = 0
- In single contact mode
  - In the case of a disturbance which does not affect the joint transmitter power supply: the single disturbance signal Mn1 or Mn2 = 1 and the associated input signal Rn1 or Rn2 = 0
  - In the event of a disturbance of the joint transmitter power supply: both single disturbance signals Mn1 and Mn2 = 1 and both input signals Rn1 and Rn2 = 0.

The distinction between operating modes and the resulting assignments of the data words in the telegrams is made by indicating ‘changeover contact’ or ‘48 V contact’ in the configuration list.

The two types of transmitters cannot be combined.
Module operating

Diagnosis register 246

<table>
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<tr>
<th>Bit</th>
<th>Type</th>
<th>Parameter fault</th>
<th>Process channel fault</th>
<th>Processing fault</th>
<th>Checksum error</th>
<th>Timer defective</th>
<th>Module restart executed</th>
<th>Bus deactivation defective</th>
<th>Event mode fault</th>
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</table>

CDS messages *)

6615 6600 6601 6602 6604 6605 6606 6612

Module not operating

Wrong firmware PROM
Hardware defect of processing section
EEPROM not valid
Processing initialization active

Module not accessible from bus
Module transmitter switched off by bus control module
Module address not within 0 - 58
Hardware defect of bus interface

\( \geq 1 \)

ST

SST

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

Figure 2: 81EU01/R3010 diagnosis 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.
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 the process inputs. Connector X11 contains the standard station bus interface and the operating voltages for the module.
Connection diagrams

**Changeover contacts (operating mode 1)**

*With non-equivalence monitor*

Note
The wiring corresponds to the one used for the 81EB01/R1010. When the substitute module is used, the wiring needs not be changed.
Line monitoring is not possible.

*With line monitor and non-equivalence monitor*

For line monitoring, a 47-Kohm resistor is needed, connected in parallel with the changeover contact (NO contact and NC contact).
In the case of unused function units, a resistor and a jumper must be used, or the monitoring function has to be deactivated for this function unit via the PDDS.
Changeover contacts with and without line monitors may be combined.
Lines which are not needed (represented by a broken line in the connection diagram) may be omitted.
Single contacts (operating mode 2)
For each function unit, one or two single contacts may be connected to R11 or G11 and/or R12 or G12.

Without line monitor

Circuitry of unused function units

Note
The wiring corresponds to the one for the 81EB01/R1010. When the substitute module is used, changes need not be made. Line monitoring is not possible.

With line monitor

Circuitry of unused function units

For line monitoring, a 47-Kohm resistor is needed, connected in parallel with the single contact. For unused function units, a jumper has to be used, or the monitoring has to be deactivated for this function unit via the PDDS. Combining single contacts with and without line monitor is admissible. Lines which are not needed (represented by a broken line in the connection diagram) may be omitted.
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

View of connector side:

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>R42</td>
<td>R12</td>
</tr>
<tr>
<td>04</td>
<td>R41</td>
<td>R11</td>
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<tr>
<td>06</td>
<td>G42</td>
<td>G12</td>
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<td>08</td>
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<td>G31</td>
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<td>32</td>
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</tbody>
</table>
Side view and view of the module front

[Diagram of the module front with labels X11, X21, ST Disturbance, and other annotations]

1 EPROM programmed, order number: GJR2403641Pxxx
   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, typ. 24 V
- Power consumption at US = 24 V (depending on the configuration):
  - Changeover contact: 140 mA 15 mA
  - Single contact: 140 mA 15 mA
- Power dissipation: 4.0 ... 10.0 W depending on operating voltage and configuration
  Approximation formula: 4.0 W + 24 V • (∑ current per FU with active transmitter)

**Binary transmitter**

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

**Output values**
- Output voltage: 48 V ±5 %
- Output current: ≤ 32 mA
- Response time of the monitor: ≤ 0.5 sec

**Times**

**Processing time**
- For complete module:
  - Binary transmitters: 5 msec
  - Bounce suppression time (adjustable 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/R3010 Order number: GJR2403600R3010

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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