Module description

PROCONTROL P
Communication

Coupling Module
Serial Interface on the Station Bus

87TS01 – E/R22../R23../R25..

Publication No.
D KWL 6309 90 E, Edition 10/92
Replacing D KWL 6309 90 E, Edition 09/90

Application

Module 87TS01 is a coupling module used for connecting computers or external systems to the PROCONTROL system.

For this purpose, the module is equipped with a serial interface type RS 232c or RS 422 through which a POS process operator station, a PDDS programming, diagnosis and display system, a CDS control diagnosis system, or another type of computer can communicate with the PROCONTROL system.

The module’s scope of action extends over the entire PROCONTROL system.

The application of the various module versions is described in the relevant application descriptions.

Features

The module can be plugged into any multi-purpose processing station belonging to the PROCONTROL bus system, and is equipped with a standard interface for the PROCONTROL station bus.

This module requires 2 divisions for mounting space. It can be plugged into subrack slots with address wiring 1 through 58 for the station bus.

The module uses a standard interface for participating in data communication within the PROCONTROL system.

The telegrams received from the station bus are checked for error-free transmission.

Using a serial RS 232c interface, the module is capable of receiving instructions and data coming from a computer in accordance with a defined protocol, as well as transferring instructions and data to a computer.

Module design

The module essentially consists in:

– Station–bus interface
– Processing section
– Serial interface in accordance with RS 232c or RS 422

Station bus interface

The station bus interface is responsible for conditioning the telegrams to be received and transmitted through the station bus interface.

The module uses two shared memories:

One shared reception memory for the telegrams to be received and one shared transmission memory for the telegrams to be transmitted.

The use of a standard station–bus interface limits the number of sink telegrams which can be received at the same time to a maximum of 230, using addresses 0...229 of the shared reception memory.

The number of source telegrams is limited to a maximum of 200 at addresses 0...199 of the shared transmission memory.

The exact number of sink and source telegrams is given in the application descriptions for the individual software versions.

The entire data exchange taking place between station–bus interface and processing section is handled by the shared memories.

Processing section

Technical features are described in the relevant application description of the individual software versions.
Serial interface

Two 25–pole connectors X1 and X2, both wired in parallel, are located on the module front.

They both contain one RS 232c interface and one RS 422 interface. However, only one type of interface may be active per connector.

Each one of these two interfaces contains two channels: channel 1 and channel 2.

The RS 232c interface is used to connect a computer to the module. This is done through channel 1 of the RS 232c interface. Either one of the two connectors, X1 or X2, can be used for this purpose.

Channel 2 of interface type RS 232c cannot be used for interfacing a computer.

The RS 422 interface serves the purpose of parallel—connecting up to five 87TS01 modules and connecting them jointly to the computer using an RS 232c interface.

For this purpose, the modules are given a certain module address specifically for the computer, a so-called coupling module number.

This coupling—module number helps the computer to distinguish the modules jointly connected.

Connection of a computer or parallel connection of several 87TS01 modules requires the use of tailored standard cable sets.

Among other things, these cables contain circuitry for automatic switchover from the RS 422 to the RS 232c interface.

In the absence of specific circuitry, interface type RS 422 will be active in both connectors, X1 and X2.

Changeover from interface type RS 422 to interface type RS 232c takes place via the ENABLE line which, in both connectors, is linked to contact 13.

As soon as the BUSEN signal from the ENABLE line is applied to GND, a switchover to the RS 232c interface will take place in the connector concerned.
The following figures show the contact assignments of connectors X1 and X2 wired in parallel.

Contact assignments of connectors X1 and X2:

Active contact assignments for interface type RS 232c:
Active contact assignments for interface type RS 422:

- CD - 1 CARRIER DETECT CHANNEL 1 acc. to RS422 (+)
- CD - 1 CARRIER DETECT CHANNEL 1 acc. to RS422 (-)
- CTS - 1 CLEAR TO SEND CHANNEL 1 acc. to RS422 (+)
- CTS - 1 CLEAR TO SEND CHANNEL 1 acc. to RS422 (-)
- DTR - 1 DATA TERMINAL READY CHANNEL 1 acc. to RS422 (+)
- DTR - 1 DATA TERMINAL READY CHANNEL 1 acc. to RS422 (-)
- GND 0V
- GND 0V
- RTS - 1 REQUEST TO SEND CHANNEL 1 acc. to RS422 (+)
- RTS - 1 REQUEST TO SEND CHANNEL 1 acc. to RS422 (-)
- TxD - 1 TRANSMIT DATA CHANNEL 1 acc. to RS422 (+)
- TxD - 1 TRANSMIT DATA CHANNEL 1 acc. to RS422 (-)
- RxD - 1 RECEIVE DATA CHANNEL 1 acc. to RS422 (+)
- RxD - 1 RECEIVE DATA CHANNEL 1 acc. to RS422 (-)
- TxD - 2 TRANSMIT DATA CHANNEL 2 acc. to RS422 (+)
- TxD - 2 TRANSMIT DATA CHANNEL 2 acc. to RS422 (-)
- RxD - 2 RECEIVE DATA CHANNEL 2 acc. to RS422 (+)
- RxD - 2 RECEIVE DATA CHANNEL 2 acc. to RS422 (-)
/BUSEN ENABLE RS422 → RS232C. RS232C → RS422
Annunciation functions

Faults within the module or communication errors are detected by the module and are signalled appropriately.

For this purpose, the unit can use two ways of fault annunciation:

- Visible fault annunciation on the module by means of light-emitting diodes on the module front panel.

- Fault message transferred over the station–bus line for "SST – general station disturbance”.

Annunciations on the module

Two red and two green light-emitting diodes are located on the module front panel:

- Light-emitting diode ST
  Red light-emitting diode ST will emit a steady light whenever a disturbance has been detected in the area of the station–bus interface.

- Light-emitting diode STV
  Red light-emitting diode STV will emit a steady light whenever a disturbance has been detected on the processing section of the module.

Light-emitting diodes are operated by the station–bus interface.

ST or STV are indicated to the station bus in the form of a "general disturbance” signal transmitted over the SST bus line.

Green light-emitting diodes M1 and M2 indicate operating statuses of the processing section and are operated by the processing section.

M1 indicates that serial output is activated. M2 indicates that job processing is activated.

For disturbance signalling on the station bus, the "general disturbance” signal is issued on the station bus using the SST bus line.

Diagnosis

Throughout the entire PROCONTROL system, it is possible to diagnose and indicate the status of any module within this system from a control system operator station.

Module settings

All module–specific and application–specific settings are implemented on the module either by using dual in–line switches or jumpers, i.e. either plug-in type jumpers or wire–wrap connections are used.

Setting the coupling–module numbers

Up to five 87TS01 modules may be connected in parallel to the serial interface.

The coupling–module numbers are used by the computer to identify the individual modules. This number may be assigned only once per computer.

The numbers are set at switch S1 using contacts 1 through 4.

<table>
<thead>
<tr>
<th>Coupling-module No.</th>
<th>Switch settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S1: ON: 1:2:3:4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S1: ON: 1:2:3:4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S1: ON: 1:2:3:4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S1: ON: 1:2:3:4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>S1: ON: 1:2:3:4</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Setting the baud rate**

The serial interfaces are capable of operating at different baud rates.

The basic factory setting for both channels is 9600 baud.

Both channels of the serial interface can be set separately, the respective setting then also being effective for the appropriate channel of the RS 422 interface.

Jumpers X7 (wire-wrap connection) and X16 (plug-in jumper) apply to channel 1.

**Possible settings for channel 1:**

<table>
<thead>
<tr>
<th>Baud rate [baud]</th>
<th>Jumper X16/1 – X16/2</th>
<th>Wire-wrap connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>open</td>
<td>X7/9 – X7/6</td>
</tr>
<tr>
<td>600</td>
<td>open</td>
<td>X7/9 – X7/5</td>
</tr>
<tr>
<td>1200*</td>
<td>open</td>
<td>X7/9 – X7/4</td>
</tr>
<tr>
<td>1200</td>
<td>closed</td>
<td>X7/9 – X7/6</td>
</tr>
<tr>
<td>2400*</td>
<td>open</td>
<td>X7/9 – X7/3</td>
</tr>
<tr>
<td>2400</td>
<td>closed</td>
<td>X7/9 – X7/5</td>
</tr>
<tr>
<td>4800*</td>
<td>open</td>
<td>X7/9 – X7/2</td>
</tr>
<tr>
<td>4800</td>
<td>closed</td>
<td>X7/9 – X7/4</td>
</tr>
<tr>
<td>9600</td>
<td>closed</td>
<td>X7/9 – X7/3</td>
</tr>
<tr>
<td>19200</td>
<td>closed</td>
<td>X7/9 – X7/2</td>
</tr>
</tbody>
</table>

Jumpers X7 (wire-wrap connection) and X15 (plug-in jumpers) apply to channel 2.

**Possible settings for channel 2:**

<table>
<thead>
<tr>
<th>Baud rate [baud]</th>
<th>Jumper X15/1 – X15/2</th>
<th>Wire-wrap connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>open</td>
<td>X7/11 – X7/6</td>
</tr>
<tr>
<td>600</td>
<td>open</td>
<td>X7/11 – X7/5</td>
</tr>
<tr>
<td>1200*</td>
<td>open</td>
<td>X7/11 – X7/4</td>
</tr>
<tr>
<td>1200</td>
<td>closed</td>
<td>X7/11 – X7/6</td>
</tr>
<tr>
<td>2400*</td>
<td>open</td>
<td>X7/11 – X7/3</td>
</tr>
<tr>
<td>2400</td>
<td>closed</td>
<td>X7/11 – X7/5</td>
</tr>
<tr>
<td>4800*</td>
<td>open</td>
<td>X7/11 – X7/2</td>
</tr>
<tr>
<td>4800</td>
<td>closed</td>
<td>X7/11 – X7/4</td>
</tr>
<tr>
<td>9600</td>
<td>closed</td>
<td>X7/11 – X7/3</td>
</tr>
<tr>
<td>19200</td>
<td>closed</td>
<td>X7/11 – X7/2</td>
</tr>
</tbody>
</table>

* Both settings possible.

Plug-in jumper X11 refers to the transmission rate and must always be plugged in.

**Memories and jumpers for memory interfacing**

Diverse types of memories may be used on memory positions A104 through A109 and on position A401.

For the various memory types, the appropriate jumpers are provided on the module for interfacing these memories.

For each position, the memory–specific jumper assignments are given below.

**Position A401:**

This position houses the memory for the bus program of the station–bus interface. There are no jumpers assigned to it.

<table>
<thead>
<tr>
<th>Module type:</th>
<th>Jumper:</th>
</tr>
</thead>
<tbody>
<tr>
<td>27256/27C256</td>
<td>EPROM 32 K x 8 bit</td>
</tr>
</tbody>
</table>

**Special settings**

The two plug-in jumpers X4 are located on the module (see also “Mechanical design”).

They have no application–related purpose, and are used for factory–testing of the station–bus interface only.

**Attention:** During normal module operation, these two jumpers must always be plugged in.

**Positions A107, A109:**

These two positions are used for the variables memory (A107 low–byte and A109 high–byte) of the processing section. The assigned jumper is jumper X6.

<table>
<thead>
<tr>
<th>Memory type:</th>
<th>Jumper:</th>
</tr>
</thead>
<tbody>
<tr>
<td>62256</td>
<td>RAM 32 K x 8 bit</td>
</tr>
</tbody>
</table>

Both positions need to be equipped with the same type of memory.

**Positions A106, A108:**

These positions are intended for the program memory (A106 low–byte and A108 high–byte) of the processing section. The assigned jumpers are jumpers X8 and X9.

<table>
<thead>
<tr>
<th>Memory type:</th>
<th>Jumper:</th>
</tr>
</thead>
<tbody>
<tr>
<td>27256/27C256</td>
<td>EPROM 32 K x 8 bit</td>
</tr>
<tr>
<td>27C512</td>
<td>EPROM 64 K x 8 bit</td>
</tr>
</tbody>
</table>
Position A105:

This position is intended for the shared memory. There are no jumpers assigned to it.

<table>
<thead>
<tr>
<th>Memory type:</th>
<th>Jumper:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6264</td>
<td>RAM 8 K x 8 bit</td>
</tr>
<tr>
<td>62256</td>
<td>RAM 32 K x 8 bit</td>
</tr>
</tbody>
</table>

Position A104:

This position is intended for the user memory. The assigned jumpers are jumpers X20 and X21.

<table>
<thead>
<tr>
<th>Memory type:</th>
<th>Jumper:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2764/27C64</td>
<td>EPROM 8 K x 8 bit</td>
</tr>
<tr>
<td>27128</td>
<td>EPROM 16 K x 8 bit</td>
</tr>
<tr>
<td>27256/27C256</td>
<td>EPROM 32 K x 8 bit</td>
</tr>
<tr>
<td>27C512</td>
<td>EPROM 64 K x 8 bit</td>
</tr>
</tbody>
</table>

For versions R23.. and R25.., this position remains unused.

Basic module settings and assignments of other jumpers and connectors

Connectors:

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>R22..</th>
<th>R23..</th>
<th>R25..</th>
</tr>
</thead>
</table>
| X1  | Connector, 25–pole  
Serial interface acc. to RS 232c or RS 422 |       |       |       |
| X2  | Connector, 25–pole  
Serial interface acc. to RS 232c or RS 422 |       |       |       |
| X3  | Connector, 48–pole  
Standard station–bus interface SS |       |       |       |
| X40 | Connector, 50–pole  
Testing of processing section and processor 80186 |       |       |       |
| 1–16*| Male testing connector, 16–pole  
Testing of station–bus interface |       |       |       |
| 40* | Male testing connector, 22–pole  
Testing of station–bus interface |       |       |       |
| 60* | Male testing connector, 20–pole  
Testing of station–bus interface |       |       |       |

Jumpers:

<table>
<thead>
<tr>
<th>No.</th>
<th>Meaning</th>
<th>R22..</th>
<th>R23..</th>
<th>R25..</th>
</tr>
</thead>
</table>
| X6  | Variables memory  
| X7  | Baud rate of channel 1 and channel 2, 9600 baud each  
(see baud rate settings) | X7/9 – X7/3  X7/11 – X7/3 | X7/9 – X7/3  X7/11 – X7/3 |
| X8  | Program memory  
(see memory interface) | X8/2 – X8/3 | X8/2 – X8/3 |
| X9  | Program memory  
(see memory interface) | X9/2 – X9/3 | X9/1 – X9/2 |
| X11 | Baud rate  
(always plugged in) | X11/1 – X11/2 | X11/1 – X11/2 |
| X15 | Baud rate of channel 2 (see baud rate settings) | X15/1 – X15/2 | X15/1 – X15/2 |
| X16 | Baud rate of channel 1 (see baud rate settings) | X16/1 – X16/2 | X16/1 – X16/2 |
| X20 | User memory  
(see memory interface) | X20/2 – X20/1 | X20/2 – X20/3 |
| X21 | User memory  
(see memory interface) | X21/2 – X21/4 | X21/2 – X21/4 |

* Interface between station bus and processing section.
Function diagram

The module consists of a printed-circuit board (see "Mechanical design").

Connection designations

For communication, the module is equipped with three connectors.

The two connectors X1 and X2 are located on the front panel. They contain the serial interface and are given the designations SS1 and SS2.

Connector X3 comprises the SS standard interface with the station bus as well as the voltage supply for the module.
Standard accessories

The standard cables and connectors listed below belong to the 87TS01 module.
Correct functioning of the possible module combinations is guaranteed only if the standard accessories are used.

89IP03 connecting cable
The 89IP03 connecting cable is used to connect two 87TS01 modules to the bus. The cable length is 40 mm.
The cable is plugged onto connector X1 or X2 on the module front panel.
The cable is provided with two 25-pole screw-on D-pin connectors.
RS 422 is the type of interface to be used in conjunction with the 89IP03 cable.

89IP04 resistor array
The 89IP04 resistor array is designed to ensure defined signal levels when several 87TS01 modules are connected in parallel.
The 89IP04 resistor array consists of 20 resistors which are mounted on a miniature printed-circuit board.
This miniature p.c.b. is accommodated in a 25-pole screw-on D-pin connector with protective cover. This pin connector is screwed onto the last free connector, X1 or X2, of the module configuration used.

89IP05 connecting cable
The 89IP05 connecting cable serves as the connection between a 87TS01 module and an RS 232c interface device.
The cable is linked to the module by means of a screw-on 25-pole D-pin connector.
Contact with the computer is established by means of a screw-on 25-pole D-socket connector.
The connecting cable is available in four lengths:

<table>
<thead>
<tr>
<th>Designation</th>
<th>Cable lengths</th>
</tr>
</thead>
<tbody>
<tr>
<td>89IP05/R0005</td>
<td>5 m</td>
</tr>
<tr>
<td>89IP05/R0010</td>
<td>10 m</td>
</tr>
<tr>
<td>89IP05/R0015</td>
<td>15 m</td>
</tr>
<tr>
<td>89IP05/R0020</td>
<td>20 m</td>
</tr>
</tbody>
</table>

Due to the special cable design, switchover to the RS 232c interface is made automatically.

Mechanical design

Board size: 6 units, 2 divisions, 160 mm deep
Connector: acc. to DIN 41 612
1 x for station-bus connection
48-pole, edge-connector, type F (connector X3)
2 x for serial interface
25-pole, edge-connector, type D (connectors X1 and X2)
Weight: approx. 0.55 kg

View of connector side:
Positioning of adjustable components and memory modules

For state and position of jumpers, refer to "Basic module settings".

Memory modules (for order numbers see "Application description")

1. Memory module A401 (EPROM)  Bus program, station—bus interface
2. Memory module A104 (EPROM)  User program
3. Memory module A105 (RAM)  Shared memory
4. Memory module A106 (EPROM)  Operating program of processing section, low byte
5. Memory module A107 (RAM)  Variables memory of processing section, low byte
6. Memory module A108 (EPROM)  Operating program of processing section, high byte
7. Memory module A109 (RAM)  Variables memory of processing section, high byte
Technical data

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

**Power supply**
- Operating voltage: \( UD^+ = +5 \text{ V} \)
- Current consumption, typical: \( ID_{typ} = 1.9 \text{ A} \)
- Power dissipation: \( P_{typ} = 9.5 \text{ W} \)
- Reference potential, station bus: \( ZD = 0 \text{ V} \)

**Module interfaces**
- SS – Standard interface, station bus, connector X3
- SS1 – Serial interface acc. to RS 232c or RS 422, connector X1
- SS2 – Serial interface acc. to RS 232c or RS 422, connector X2

**Serial interface acc. to RS 232c**
- Application: Computer connection
- Transmission: Serial transmission acc. to RS 232c
- Transmission rate: 300 – 19200 baud
- Transmission distance, max.: 20 m

**Input and output values of the serial interface acc. to RS 232c**
- Input voltage, max.: +/- 25 V
- Output voltage, max.: +/- 12 V
- Output current: 10 mA
- Short-circuit current, max.: 150 mA

**Permissible temperature ranges**
- Operating temperature: 0 °C...70 °C
- Storage temperature: −40 °C...85 °C

**ORDERING DATA for the 87TS01 module**
- Type designation: 87TS01-E/R22..
- Ordering number: GJR2368900R22..
- This module description also applies to module version GJR2360200R20..

**Note:**
These ordering data refer to the basic module firmware. Functional differences are described in the individual application descriptions.

**ORDERING DATA for standard accessories**

**89IP03 connecting cable**
- Type designation: 89IP03/R0040
- Ordering number: GJR2363100R0040

**89IP04 resistor array**
- Type designation: 89IP04/R0100
- Ordering number: GJR2363200R0100

**89IP05 connecting cable**
- Type designation: 89IP05/R0005...R0020
- Ordering number: GJR2363300R0005...R0020

Designation of version depending on cable length, see page 8.

Technical data are subject to change without notice!