Module and Application Description

PROCONTROL P
Communication

Coupling Module for External Systems

87TP01 – E/R1210

Application

Module 87TP01–E/R1210 is used for connecting external systems to the PROCONTROL system. In combination with module 87TS01–E/R2510 (Figure 1), it is intended to control the data exchange between the PROCONTROL station bus and the interface of an external system.

![Diagram](image)

Figure 1: 87TP01 module combined with an 87TS01 module

Features

Module 87TP01 controls and monitors the protocol to the external system and performs the required data conversions.

It is mounted on a 24 V station–bus backrack. Voltage supply is provided double via US (24 V) of the station–bus backplane. If module 87TP01 is used in conjunction with an 87TS01/R2510 (5 V module), the 87TS01 needs to be mounted on a station–bus backrack with a 5 V supply using an 89NG03 (including a central clock pulse). For new cabinets with 24 V supplies, 87TS01/R1510 modules are available.

Both modules, 87TS01 and 87TP01, are to be installed in the same cabinet belonging to the same station.

The connection to the 87TS01 module is established via an RS232 interface. Data exchange with the 87TS01 takes place using the PROCONTROL standard protocol.

The interface for the external system is available on the process connector.

On the module, 3 potential–isolated interfaces are provided.

The RS232 interface is used as a point–to–point connection.

Analog and binary signals are exchanged between the PROCONTROL system and the external system. Format and assignments of these signals depend on the protocol used.

The module uses a service interface according to RS232 for

– Structuring the signal connections between PROCONTROL and external system,
– Diagnostic purposes.

The service computer is a common PC type 386 or higher, using a DOS operating system, standard software and a special user software for the 87TP01 module.

ABB
Data exchange between PROCONTROL and an external system

Data formats

For each 87TS01 module, a maximum of 1024 signals can be transferred according to the following allocations in both directions:

1 up to 15 single binary signals without time stamp using 1 telegram
1 up to 32 single binary signals with time stamp using 9 telegrams
1 analog value using 1 telegram
1 counter reading of 16 bits using 1 telegram
1 counter reading of 32 bits using 4 telegrams

The data formats depend on the protocol used.

According to the allocations defined above, each 87TS01 coupling module can be used to maximally transmit the following telegrams:

Data telegrams from PROCONTROL to an external system

222 send—location telegrams without time stamp (reception via address list) *

* In the case of the 87TS01—E/R2510 or /R1510, registers 223 through 230 (8 telegrams) are reserved for receiving the system time.

Data telegrams from an external system to PROCONTROL

200 send—location telegrams
No time—stamping of the external—system signals on module 87TS01 or 87TP01.

For increasing the number of data telegrams from and to the station bus, several 87TS01 modules can be connected to the 87TP01 (Figure 2). A maximum of 5 modules can be cascaded. Additionally, grouping and allocating to two RS232 interfaces is possible in order to be able to separate the send and receive functions (sending and receiving are possible over one and the same interface, however, not at the same time. Interruptions during transmission of one block are not possible).

![Diagram](image_url)

Figure 2: The 87TP01 combined with several 87TS01 modules

*) In case other interface standards are used, the appropriate interface converters need to be applied.
Design of the module

The hardware architecture of the module (cf. ‘Function diagram’) mainly consists of the following parts:
- Microprocessor with memory (RAM, EPROM, EEPROM/flash EPROM),
- Interfaces for the 87TS01, the external system and the service computer,
- Power supply section providing the internal module voltages and the supply of the interface elements for the external system from the 24 V (US) voltage.

Function

After loading the data from the service computer, the module automatically generates the address lists needed for the 87TS01 modules and the lists and data which are necessary for handling the protocol with the external system. The address lists needed are loaded onto the 87TS01 modules. To be able to distinguish the different lists, different addresses have to be set on the 87TS01 modules. After this, the 87TS01 modules are ready for operation.

Depending on the protocol used at the external—system interface, the module starts transmitting the data or waits for the appropriate protocol calls from the external system. In accordance with the default PROCONTROL standard protocol, data are transferred between the 87TS01 and the 87TP01 module only in case any changes have taken place.

According to the external—system protocols used, the program performs the required format conversions and marshalling operations on the 87TP01.

The following converting operations are possible:
- Single—bit marshalling from any bit position in the PROCONTROL telegram to any position in the external—system data format and vice versa.
- Format—conversions for analog values and counter readings.
- Formation of standard telegrams.

Addressing

The 87TP01 module does not require a module address from the station bus. The module address for the telegrams (send—location) to the station bus are defined by the slot for the 87TS01 modules.

Programming

All data required for data transmission, mainly address and marshalling information as well as parameters for the interface (e.g. type and baud rates) are transferred from the service computer to the module in specified lists using the required format.

Module settings

Contacts X4, X5, X101, X102, X103, X104, X105, X106, X107, X108, X109, X110, X111 are used for internal module signals. They must not be changed or connected otherwise (cf. ‘Side view’).

Protocols

The following protocols are implemented:
- MODBUS
- 3964R (Siemens)
- ANSI X3.28
- TELEPERM ME

For further details, please, refer to the following descriptions:

MODBUS Publication No. D KWL 6335 94 E
3964R (Siemens) Publication No. D KWL 6336 94 E
Interfaces

Interface for the external system

The signals for the 3 possible interfaces according to RS232, RS422 and RS485 are all connected to connector X21 at the same time. However, only one type of interface with the external system can be used at a time.

INTERFACE ACCORDING TO RS232 (STANDARD)

<table>
<thead>
<tr>
<th>Signal</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCD</td>
<td>Data carrier detect</td>
</tr>
<tr>
<td>RXD</td>
<td>Receive data</td>
</tr>
<tr>
<td>TXD</td>
<td>Transmit data</td>
</tr>
<tr>
<td>DTR</td>
<td>Data terminal ready</td>
</tr>
<tr>
<td>SGND</td>
<td>Signal ground</td>
</tr>
<tr>
<td>DSR</td>
<td>Data set ready</td>
</tr>
<tr>
<td>RTS</td>
<td>Request to send</td>
</tr>
<tr>
<td>TS</td>
<td>Clear to send</td>
</tr>
<tr>
<td>RI</td>
<td>Ring indicator</td>
</tr>
<tr>
<td>Screen</td>
<td>Connection for cable screen</td>
</tr>
</tbody>
</table>

For applications implemented at the time, signals RXD, TXD, and SGND are used.

Interface for the 87TS01

On connector X3, two interfaces according to RS232 are available. The following signals are connected:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>TXD1</td>
<td>Transmit data</td>
</tr>
<tr>
<td>RXD1</td>
<td>Receive data</td>
</tr>
<tr>
<td>SGND1</td>
<td>Signal ground</td>
</tr>
<tr>
<td>TXD2</td>
<td>Transmit data</td>
</tr>
<tr>
<td>RXD2</td>
<td>Receive data</td>
</tr>
<tr>
<td>SGND2</td>
<td>Signal ground</td>
</tr>
</tbody>
</table>

for interface 1

for interface 2

Interface for the service computer

The interface according to RS232 on connector X2 includes the following signals:

<table>
<thead>
<tr>
<th>Signal</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCD *)</td>
<td>Data carrier detect</td>
</tr>
<tr>
<td>RXD</td>
<td>Receive data</td>
</tr>
<tr>
<td>TXD</td>
<td>Transmit data</td>
</tr>
<tr>
<td>DTR *)</td>
<td>Data terminal ready</td>
</tr>
<tr>
<td>SGND</td>
<td>Signal ground</td>
</tr>
<tr>
<td>DSR *)</td>
<td>Data set ready</td>
</tr>
<tr>
<td>RTS *)</td>
<td>Request to send</td>
</tr>
<tr>
<td>TS *)</td>
<td>Clear to send</td>
</tr>
<tr>
<td>RI *)</td>
<td>Ring indicator</td>
</tr>
</tbody>
</table>

Signals RXD, TXD, SGND are used.

The connections needed for signals DCD — DSR and RTS — CTS are provided by jumpers on the W159 connecting cable.

*) Handshake signals are not used with the protocols implemented.

For contact assignments of the individual connectors, please, refer to 'Mechanical design'.

Diagnosis and annunciation functions

On the module front, several LEDs are located for indicating disturbances and operating states.

Disturbance annunciations (red)

<table>
<thead>
<tr>
<th>ST</th>
<th>General disturbance annunciation, activated in case of any disturbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG</td>
<td>Module disturbance, activated in case of internal module disturbances</td>
</tr>
<tr>
<td>SK1</td>
<td>Disturbance of communication 1, activated in case of disturbances of the interfaces with the 87TS01</td>
</tr>
<tr>
<td>SK2</td>
<td>Disturbance of communication 2, activated in case of disturbances of the interface with the external system</td>
</tr>
</tbody>
</table>

Status annunciations (green)

<table>
<thead>
<tr>
<th>RUN</th>
<th>Running signal, activated when the processor is operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>DK5</td>
<td>Data communication with service computer, activated when data transfer takes place on the interface with the service computer</td>
</tr>
<tr>
<td>DK1</td>
<td>Data communication 1, activated when data transfer takes place on the interfaces with the 87TS01</td>
</tr>
<tr>
<td>DK2</td>
<td>Data communication 2, activated when data transfer takes place on the interface with the external system</td>
</tr>
</tbody>
</table>
Function diagram

Terminal designations

The printed-circuit board includes connectors X11 and X21, and X2 and X3 on the front panel. Connector X21 contains all external-system inputs and outputs. Connector X11 contains operating voltages USA and USB, reference points Z and ZD, and signal SRA. Connectors X2 and X3 contain the interface signals for the service computer and the 87TS01.

* Handshake signals of the interfaces are not used with the protocols implemented.
** Not available.
*** For proper module function, connector X11/d18 has to be connected to ZD (once per subrack).
Connection diagrams

Connection in the case of one 87TS01

Connection in the case of several 87TS01 modules linked to one RS232 interface

Connection in the case of grouped 87TS01 modules linked to two RS232 interfaces

* For connecting the external system, a W160 cable with a 25-pole HDP20 male connector can be used.

* If the external system uses another type of connector, the cable needs to be adapted accordingly.
Mechanical design

Board size: 6 units, 1 division, 160 mm deep
Connector: to DIN 41 612
1 x for station–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. 0.38 kg

View of connector side:

Contact assignments of process connector X11

View of contact side:

<table>
<thead>
<tr>
<th></th>
<th>d</th>
<th>b</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>–</td>
<td>ZD</td>
<td>–</td>
</tr>
<tr>
<td>04</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>06</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>08</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>10</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>12</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>14</td>
<td>–</td>
<td>ZD</td>
<td>–</td>
</tr>
<tr>
<td>16</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>18</td>
<td>SRA</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>20</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>22</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>24</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>26</td>
<td>ZD</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>28</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>30</td>
<td>USB</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>32</td>
<td>USA</td>
<td>Z</td>
<td>Z</td>
</tr>
</tbody>
</table>

Contact assignments of process connector X21

View of contact side:

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>02</td>
<td>DCD ①*</td>
<td>Screen</td>
</tr>
<tr>
<td>04</td>
<td>RXD ①</td>
<td>–</td>
</tr>
<tr>
<td>06</td>
<td>TXD ①</td>
<td>RXD/TXD–A ③</td>
</tr>
<tr>
<td>08</td>
<td>DTR ①*</td>
<td>–</td>
</tr>
<tr>
<td>10</td>
<td>SGND ①</td>
<td>DGND ①</td>
</tr>
<tr>
<td>12</td>
<td>DSR ①*</td>
<td>–</td>
</tr>
<tr>
<td>14</td>
<td>RTS ①*</td>
<td>–</td>
</tr>
<tr>
<td>16</td>
<td>CTS ①*</td>
<td>RXD/TXD–B ③</td>
</tr>
<tr>
<td>18</td>
<td>RI ①*</td>
<td>–</td>
</tr>
<tr>
<td>20</td>
<td>Screen</td>
<td>–</td>
</tr>
<tr>
<td>22</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>24</td>
<td>TXD+ ②</td>
<td>–</td>
</tr>
<tr>
<td>26</td>
<td>TXD– ②</td>
<td>–</td>
</tr>
<tr>
<td>28</td>
<td>GND ②</td>
<td>–</td>
</tr>
<tr>
<td>30</td>
<td>RXD+ ②</td>
<td>–</td>
</tr>
<tr>
<td>32</td>
<td>RXD– ②</td>
<td>–</td>
</tr>
</tbody>
</table>

① RS232, active
② RS422, not active
③ RS485, not active

* Not used

Contact assignments of connector X2

1  DCD *
2  RXD
3  TXD
4  DTR *
5  SGND
6  DSR *
7  RTS *
8  CTS *
9  RI *

* Not used

Contact assignments of connector X3

1  GND
2  TXD1
3  RXD1
4  SGND1
5  TXD2
6  RXD2
7  SGND2
8–15 Not used
View of module side and module front

EPROM programmed

1. Order number: GKWE857941Pxxxx
2. Order number: GKWE857942Pxxxx

xxxx = Position number indicating the applicable program version
Technical data

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

**Power supply**

Operating voltage USA/USB: 24 V  
Current consumption: approx. 200 mA  
Power dissipation: 5 W

**Interfaces**

*External system*

Type: RS232  
Baud rate: 300 ... 19200 baud  
Maximum distance: 15 m

Other types of electrical interfaces (e.g. CL 20) can be implemented using external interface converters.

**87TS01**

Type: RS232  
Baud rate: 9600 baud (optionally 19200 baud)  
Maximum distance: 1 m

*Service computer*

Type: RS232  
Baud rate: 9600 baud  
Maximum distance: 6 m

**Number of signals**

For each 87TS01: cf. section ‘Data exchange between PROCONTROL and an external system’

**Data throughput between an 87TP01 and an 87TS01**

(at 9600 baud)

*from the 87TP01 to the 87TS01*  
Max. 3 send jobs with a total of max. 100 telegrams, each 16 bits per second

*from the 87TS01 to the 87TP01*  
Max. 5 listen—in jobs with a total of max. 100 telegrams, each 16 bits per second

**Total data throughput in both directions**  
Max. 100 telegrams, 16 bits each, also in the case of cascaded 87TS01 modules

**Data throughput between an 87TP01 and an external system**

The transmission times between the 87TP01 and the external system depend on the signal quantities, the protocol and the response of the external system. Details are given in the application descriptions of the protocols concerned.

**Interference immunity**

ESD acc. to IEC 801/2 (front panel): 8 kV, severity 3 (air discharge)  
EMC acc. to IEC 801/4: 0.5 kV, severity 2  
Destruction acc. to IEC 810/5 (draft IEC TC 65 (sec) 137): 0.5 kV, severity 1
ORDERING DATA

Order no. for complete module:
Type designation 87TP01 – E/R1210
Order number  
GKWE857900R1210

Accessories:
Coupling module 87TS01 – E/R2510 or  
GJR2368900R2510
Coupling module 87TS01 – E/R1510  
GJR2368900R1510
W160 cable to the external system  
GKWE602579Rxxxx
W161 cable to one or several 87TS01  
GKWE602580Rxxxx
W158 cable to two or several separate 87TS01  
GKWE602577Rxxxx
W159 cable to the service PC  
GKWE602578Rxxxx
89IP03/R0040 cable from the 87TS01 to the 87TS01  
GJR2363100R0040

xxxx = length in cm

Technical data are subject to change without notice!