Module Description

Application

The 87TS50 module is a coupling module that is used to connect the PROCONTROL station bus with the Advant Fieldbus 100.

The module links the Advant Power system with the PROCONTROL system, for instance for an Advant Power turbine control application that is controlled from a PROCONTROL process operator station.

The 87TS50 is equipped with two RS485 interfaces for connecting the Advant Fieldbus 100.

The scope of action of one module extends over the entire Advant Power/PROCONTROL system. The required parameters, addresses, etc. are loaded onto the module in the form of a configuration list.

The module can operate in redundant stations.

Features

The module can be installed on any station of the PROCONTROL bus system. It is equipped with a standard interface for the PROCONTROL station bus and an interface for the Advant Fieldbus 100. The module uses four module addresses on the PROCONTROL station bus and one station address on the Advant Fieldbus 100.

The following data transfer can take place on the module:

- Conversion of up to 6000 listen-in telegrams and up to 256 destination telegrams of the PROCONTROL system into 400 data elements for the Advant Power system.
- Conversion of up to 6000 data elements of the Advant Power system into 800 send-location telegrams of the PROCONTROL system.

All listened-in telegrams and data elements (DATs) are subjected to receive monitoring. The quantity of messages sent to the PROCONTROL bus can be adapted by setting thresholds.

When the module is used in redundant stations, the following applies:

When used in the passive redundancy, sending of send-location telegrams to the PROCONTROL station bus as well as to the Advant Fieldbus 100 is suppressed.

The module requires redundant +24 V operating voltages, USA and USB.

The operating voltages refer to reference conductor Z.

On the module front, indicators signal the following conditions:

- FAULT Advant Power Interface fault
- RUN, on the left Advant Power Interface active
- ST Disturbance
- SG Module disturbance
- HLT Processor halt
- RUN, on the right Active
- MODE Operating mode

For commissioning and service purposes, the module is equipped with an interface (user monitor) that can be used for loading the configuration list and for calling up all important information regarding telegram data, data elements and module-specific configurations. The ambient temperature of the module can be read from register 202.

Marginal application conditions

The module uses 3 slots on the PROCONTROL subrack. Two slots (module addresses) on the right, next to the module, are to be kept unused. If two 87TS50 modules (R5010 only) are mounted next to each other, only one slot needs to be kept free, since the left division of the module does not occupy a module address; cf. Section 'Processing (data conversion from Advant Power to PROCONTROL)'. In the case of redundant applications, no other input, output, binary and analog control or coupling modules (except for the 87TS50-E/R5010) may be used in the same station as this type of module.
The 87TS50 module is intended to be used in station-bus cabinets 89MS01/R0200 or 89MS02/R0100. In case the module is to be used in PROCONTROL station-bus cabinets type ZS1, special adjustments need to be made.

- The SRA line (contact d18) must be connected to a ZD contact (contacts b2, b14, d26), per wire-wrap, in that subrack where the module is installed.
- In the ZS1 cabinet, the module only uses the USA supply. Redundant supply as in the case of 89MS01/02 cabinets is not possible.
- The -24 volt supply (contact z32) must not be connected in the same subrack where the module is installed. Therefore, the module has only one contact for reference point ZD.

Please note:

- Stations in which the 87TS50 is being used, are privileged stations with a maximum of 2048 response telegrams handled in cyclic mode. For this purpose, the following settings need to be programmed on the communication controller (88VA01/VA02):
  - 2048 telegrams
  - Privileged station
- The 87TS50 module stores information in its RAM. In order to make sure that this RAM is deleted completely, the module should not be plugged in again before a waiting period of approx. 10 sec has expired.

Design of the module

The module essentially consists of:

- Station-bus interface
- Advant Fieldbus 100 interface
- Processing section
- Service and commissioning interface

Station-bus interface

The station-bus interface adapts the module signals to the PROCONTROL bus. It listens in on the receive and destination telegrams and transfers the send-location telegrams to the PROCONTROL bus.

The listen-in address list is transferred to the station-bus interface from the processing section. The station-bus interface partly performs the processing of the receive telegrams (change recognition and receive monitoring).

The station-bus interface uses four module addresses within a PROCONTROL station and is able to transmit up to 800 send-location telegrams.

For decoupling the processing section from the station-bus interface of the 87TS50, telegram image memories and a FIFO memory are used.

Advant Fieldbus 100 interface

The Advant Fieldbus 100 interface performs the adaptation to the Advant Fieldbus 100. It listens in on the receive data elements and transfers the send data elements to the Advant Fieldbus 100.

The interface is based on the CI520 module and two external modems TC625 which are connected to connectors X3 and X4 via the TK515 cable.

The listen-in and send-location address list is transferred from the processing section to the Advant Fieldbus 100 interface. The Advant Fieldbus 100 interface handles some of the processing of the receive data elements (receive monitoring).

The Advant Fieldbus 100 interface uses a station address on the Advant Fieldbus 100 and is able to transfer up to 400 send data elements.

Processing section

This part of the 87TS50 module is responsible for:

- Initializing the module
- Configuring the module
- Data conversion from PROCONTROL to Advant Power
- Data conversion from Advant Power to PROCONTROL
- Clock synchronizing for the Advant Power system
- Monitoring the module functions

Initializing the module

The module is initialized in two phases. Both phases are run through automatically.

Initialization of the module for the bus systems is initiated as soon as the module is connected to voltage, i.e. when it is plugged into the module slot. During this initialization phase all of the red LEDs of the module are ON at first. After approx. 5 sec, the individual segments of the operating-status display are activated one after the other. During this time, the user may interrupt the procedure from the user monitor of the module for configuring the Ethernet interface.

After the operating-status display has reached value '1', the initialization phase of the processing section begins. The operating-status display now counts from 1 to 6. If the module stays in state 6, no configuration list will be loaded. The two disturbance lamps ST and SG still emit a steady light, the FAULT lamp is OFF.

- After the configuration list has successfully been loaded and activated, the operating-status display enters state '9'. The two disturbance lamps ST and SG go off, and the RUN lamp on the left is illuminated.
- The RUN LED on the right indicates that the processing section is active.
Configuring the module

The module is configured via its interface (user monitor) by loading a configuration list into the RAM. For this purpose, the module is connected to a PC and is loaded using the APBRIDGE configuration program. After that, the list can be saved in the FLASH PROM of the module (which effects a restart and automatic activation of the list).

The module can either be started with a list available in the RAM or in the FLASH PROM. Loading a list into the RAM is possible in the 'Waiting for configuration list' state only.

The list is safeguarded by a checksum.

The basic structure of a configuration list and an explanation of the parameters and data of the list are given in the 'Application Description'.

Data conversion from PROCONTROL to Advant Power

The 87TS50 receives every telegram that is transferred over the PROCONTROL bus. Based on the listen-in address list, the telegrams that are to be monitored are selected. The data telegrams are transferred to the Advant Fieldbus 100 interface if they have changed as compared to their previous state.

Counter data and binary data are transferred to the Advant Power system without any restrictions. In the case of analog data, the accuracy of the measuring ranges selected for the real-value data elements and the resulting resolution of the single-precision floating-point arithmetic are determined.

All of the listened-in telegrams are subjected to receive monitoring. In the case of analog or counter values, response of the receive monitoring function causes a mark to be set in a data element (Advant Power-specific error value ‘NAN’ for real values, ‘ERROR’ for integer and long integer values). Binary data are set to zero.

The disturbance bits of analog and counter telegrams can (optionally) be configured on one of the bits of a Boolean data element. A disturbance bit set in a telegram causes the error value ‘NAN’ to be allocated in the real-value data element, and ‘ERROR’ in the integer and the long integer data element.

The module can listen in on telegrams using data types 0-25, 27, 28 and 29 (time telegrams of system clock only).

Valid ranges for PROCONTROL addresses and data types in listen-in telegrams:

- Station address: 1-249
- Module address: 0-59
- Register address: 0-199
- Data types: 0-25, 27, 28

Furthermore, 256 destination telegrams can be received by the 87TS50 (e.g. for operation via a PROCONTROL process operator station).

Processing of the destination telegrams is done in the same way as in the case of the listen-in telegrams, however, with a higher priority.

Valid ranges for PROCONTROL addresses and data types in destination telegrams:

- Station address: 1-249
- Module address: 0-56 (slot address)
- Register address: 0-255
- Data types: 0-25, 27, 28

Data elements are output to the Advant Fieldbus 100 in the form of data-record elements (DSPs) at the cycle time that is specified for each individual DSP. A DSP can include up to eight data elements. In case telegram data change faster than the cycle time set for a particular data element, only the currently valid telegram value will be transmitted to the Advant Fieldbus 100.

Binary data:

For binary data, arbitrary bit marshalling between telegram bit positions 0 ... 15 and data element bit positions 0 ... 31 can be configured.

Analog data:

An analog value in the real-value data element is determined by the telegram value and the status of the disturbance bit. Additionally, the disturbance bit can be configured on an arbitrary bit position (0 ... 31) of a Boolean data element.
Counter data:

A counter value in an integer value data element (or a long integer data element) is determined by the telegram value and the status of the disturbance bit. Additionally, the disturbance bit can be configured on any bit position (0 ... 31) of a Boolean data element.

**Data conversion from Advant Power to PROCONTROL**

Data elements are received by the Advant Fieldbus 100 interface via data-record elements at their specific cycle time. They are cyclically scanned by the processing section (basic scan cycle) and are made available based on a value change (analog data) or a time interval (analog data, counter data) for outputting the send-location telegrams either by event-oriented or cyclic transmission.

Binary data are transmitted to the PROCONTROL system without any restrictions. Counter data can be converted only to a limited extent (value range: -16384 ... 16383). In the case of analog data, the accuracy is determined by the measuring range of the analog telegram and the resulting resolution of the lowest-order bit (0.049 %).

All of the listened-in data elements are subjected to receive monitoring. Response of the receive monitoring function stops the sending of the allocated analog or counter telegrams, and the relevant bit in the binary telegram is set to zero.

In the case of a violation of the value conversion range, the disturbance bit is set in the analog and counter telegrams. The same is true if the Advant Power-specific error values 'NAN', 'NAN under' (range underflow) and 'NAN over' (range overflow) are received.

Valid ranges for Advant Fieldbus 100 addresses, data types and cycle times in data elements:

- **Station address:** 1-80
- **DSP number:** 1-50
- **DSP cycle time:** 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096 milliseconds
- **Data types:** Boolean value, integer value, long integer value, real value

For the output of send-location telegrams to the PROCONTROL bus, 4 consecutive module slot addresses are used. The slot address of the module is determined by its center division; cf. Section 'Mechanical design'. The first transmittal or any following value changes in the telegrams are transferred over the PROCONTROL bus per event. After that, transmission will be cyclic.

The PROCONTROL address for outputting send-location telegrams is generated from:

- **System address:** is the system address of the bus system.
- **Station address:** is the address of that station where the 87TS50 is plugged in.
- **Module address:** is the slot address of the module (slot address +1 ... 3 can also be used for outputting send-location telegrams within the range of 200-800; these addresses must not be used by adjacent modules).
- **Register address:** 0 ... 199; is defined by CPS.
- **Data types:** 0 ... 25, 27, 28

Binary data:

For binary data, arbitrary bit marshalling between data-element bit positions 0 ... 31 and telegram bit positions 0 ... 15 can be configured.

![Diagram of binary data marshalling](image-url)
Analog data:

The analog telegram is determined by the status of the real-value data element and the status of the (optional) disturbance bits in the Boolean data element. If the measuring range is violated (overflow/underflow) by a converted value, the largest/smallest telegram value possible is sent.

Counter data:

A counter telegram is determined by the status of the integer data element (or long-integer data element) and the status of the (optional) disturbance bit in the Boolean data element. If the range has been violated (overflow/underflow) by a converted value, the largest/smallest telegram value possible is sent.
Clock synchronizing for the Advant Power system

If the time master function has been activated (cf. 'Configuring the module'), a cyclic time synchronizing signal is sent cyclically to the Advant Power system. If several 87TS50/R5010 modules are used for connecting a Advant Power system, only one of the modules is to be used as the time master.

Time synchronization for the Advant Power system is done by the internal clock of the 87TS50 which is constantly synchronized to the PROCONTROL system clock (87TS01/R2313) by cyclic reception of time telegrams. If the PROCONTROL system clock should fail, the clock inside the 87TS50 will continue running without being synchronized.

Monitoring the module functions

The monitoring function monitors data communication from/to the PROCONTROL/Advant Power system as well as the internal processing operations. Monitoring the internal processing makes sure that an automatic restart of the 87TS50 takes place if a disturbance should occur.

Monitoring of data communication includes the following areas:
- All the listen-in telegrams are checked for fault-free condition (CRC check code), and the send telegrams are given a CRC check code.
- A receive monitoring function is used on all of the listen-in data. (Exception: destination telegrams).
- Disturbances of data communication are recorded in the form of system messages.
- Station-bus failure, remote-bus failure, Advant Fieldbus 100 failure.

Monitoring of internal processing includes the following areas:
- Monitoring of all processing functions in conjunction with a hardware watchdog.
- Storage of the internal user data in parity-controlled memories.
- CRC protection of the module programs.
- Temperature monitoring on the 87TS50 module.
  The temperature monitoring function issues a warning signal for temperatures in the range from <5 °C to >55 °C, and a fault signal for temperatures in the range from <0 °C to >60 °C.
- Generation of system messages in the case of malfunction or unexpected conditions.

Service and configuration interface

For configuring and servicing, the 87TS50 module is equipped with a menu-based interface (user monitor) that can be used to configure the module and to read out and display internal module statuses and data. The user monitor is started up automatically when the 87TS50 is plugged in, provided the module has reached at least operating state ‘6’ (‘Waiting for configuration list’).

The information can be displayed - using the RS232 serial interface (9-pole connector X1 on the module front) - on a terminal (VT100 and higher) or a computer with terminal emulation, or by using the Ethernet interface (BNC jack, connector X2) in conjunction with a monitor program.

The Ethernet interface is connected via a 50 Ω thin-wire coax cable. The distance from the last connection must not exceed 180 m. The distance between 2 participants must be 0.5 m at least. In the factory, the modules are given fixed, unique Ethernet addresses. The Internet address needed for connecting the module with a computer is set at the user monitor.

The terminal can be plugged in or withdrawn during operation.

The following data/functions can be called up:
- Connect status
- Internal 87TS50 module time and its status
- PROCONTROL bus cycle time
- Range and contents of the listen-in and send data
- Loading/storing/displaying the configuration list
- Processing parameters:
  thresholds for time and value changes
- Number of telegrams in the FIFO
- Number of value changes of the listen-in data per second
- Module diagnosis
- Contents of the 87TS50 system registers
- System messages
- Current Ethernet and Internet addresses
- Current hardware stamp
Redundant applications

To be able to operate the module in redundant stations, the following settings can be made:

- Redundant coupling modules must be loaded with the same configuration list.
- Assigning the privilege for configuring the send data elements on the Advant Fieldbus 100 for a coupling module. For this purpose, the Internet addresses for a redundant pair of coupling modules must be even-numbered and odd-numbered (e.g. 138.222.70.10 and 138.222.70.11). The module with the even-numbered Internet address is given the privilege to configure the send data elements on the Advant Fieldbus 100 (data element owner).

Procedure of starting up the modules for the first time:

- First module
  - Plug the module into the passive PROCONTROL station and connect it to the Advant Fieldbus 100.
  - Program the even-numbered Internet address on the module.
  - Start the module (will indicate the 'Waiting for configuration list' state).
  - Load the configuration list.
  - Activate the configuration list.

- Second module
  - Plug the module into the active PROCONTROL station and connect it to the Advant Fieldbus 100.
  - Program the odd-numbered Internet address on the module.
  - Start the module (will indicate the 'Waiting for configuration list' state).
  - Load the configuration list.
  - Activate the configuration list.

Procedure of restarting the modules:

- Since, in this case, the modules already have preconfigured Internet addresses and configuration lists, the module with the even-numbered Internet address is to be plugged into the passive station first. After this module has reached the 'Processing active' state, the second module can be plugged into the active station.

Procedure of replacing a module:

- The module that is to be replaced must be in the passive station at the time. If this should not be the case, stop the processing operations (from the user monitor) to force a redundancy changeover. Now, the module may be exchanged for a new one which, of course, needs to be configured with the same Internet address as the former module. After that, load the same configuration list that is being used in the partner module.

Procedure of starting the modules if a configuration has been changed:

- Stop the module holding the configuration privilege (user monitor: Configuration list stop). A redundancy changeover may take place.
- Stop the module not holding a configuration privilege.
- Load and start the module that is given the configuration privilege.
- Load and start the module without configuration privilege.

Please note:

When being operated in redundant mode, the module pair uses two consecutive Advant Fieldbus 100 station addresses. The module having the configuration privilege for the send data elements is given a station address as defined in the configuration list, and the module without configuration privilege is given the following station address (in ascending order). Assigning two Advant Fieldbus 100 station addresses to a module pair authorizes each one of the modules to configure and send its own Advant Fieldbus 100 station status.

The module holding the configuration privilege for the send data elements shows the decimal point (additive) on its operating-status display.

The PROCONTROL system inhibits a redundancy changeover when the first module is being plugged in. Data processing between the bus systems does not take place unless both modules have reached the 'Processing active' state. There will be no redundancy changeover from the PROCONTROL system.

It is not possible to reconfigure a redundant module pair 'online' with an extended or reduced configuration list (by adding or taking off Advant Power signals).

Furthermore, the marginal application conditions for redundant operation need to be considered.

Diagnosis and annunciation functions

Module- or interface-related faults or errors are detected by the monitoring function and are indicated.

Disturbance signals sent to the control system

Disturbance signalling is done by means of diagnosis telegrams that are sent to the PROCONTROL system. Additional diagnosis registers (background registers) can be read from the module upon request.

Diagnosis on the service and configuration interface

This interface allows to indicate the following diagnostic data of the module:

- PROCONTROL module diagnosis
- Diagnostic data on the Advant Power interface
- Contents of the diagnosis registers (system registers)
- System messages
Annunciations on the module

Four red LEDs and two green LEDs as well as a green operating-status display are located on the module front:

- **FAULT light-emitting diode**
  The red FAULT light-emitting diode is illuminated when the Advant Fieldbus 100 interface has detected a disturbance.

- **RUN light-emitting diode, on the left**
  The green RUN light-emitting diode is illuminated when the Advant Fieldbus 100 interface is in the processing state.

- **ST and SG light-emitting diodes**
  The red light-emitting diodes ST and SG emit a steady light when a disturbance has been detected within the area of the station-bus interface, the Advant Fieldbus 100 interface or the processing section, or if the 'Processing active' state has not yet been reached.

- **HLT light-emitting diode**
  The red HLT light-emitting diode emits a steady light when the processor is at a halt.

- **RUN light-emitting diode, on the right**
  The green RUN light-emitting diode is illuminated when the processing section is active. The brightness depends on the processor workload.

- **Operating-status display**
  Indicators 0-9 and A-F of the green operating-status display are used for additional error and status indications. Indicators 1-5 operate dynamically. In the case of a fault, the respective indicator flashes for approx. 5 sec. The watchdog forces the processing section to run through a restart procedure after the programmed waiting time has expired.

- **0** Boot monitor active
- **1** Processing self-test *)
- **2** Testing the station-bus interface *)
- **3** Initializing the station-bus interface *)
- **4** Testing the Advant Fieldbus 100 interface *)
- **5** Initializing the Advant Fieldbus 100 interface *)
- **6** Waiting for configuration list *)
- **7** Configuring the station-bus interface *)
- **8** Configuring the Advant Fieldbus 100 interface *)
- **9** Processing active *)
- **A** Address error; causing restart *)
- **B** Bus error; causing restart *)
- **C** Parity error; causing restart *)
  CRC error; no restart *)
- **D** Runtime error; causing restart *)
- **E** Exception error; causing restart *)
- **F** Temperature error detected; no restart *)

*) For redundant applications possibly with additive decimal point (cf. notes under 'Redundant applications').

Advant Fieldbus 100 station status

In the 'Processing active' state, the module sends its station status together with the configured Advant Power station address to the Advant Fieldbus 100. In redundant mode and depending on the configuration privilege for the send data elements, instead of the preconfigured one, the module can assign another station address for sending the station status message, i.e. it can use the next station address (in ascending order).

**Contents of the station status message**:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ACT</td>
<td>Processing active</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ARM</td>
<td>Active redundancy</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>OWN</td>
<td>Module is given configuration privilege</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>CHK</td>
<td>Checksum of the configuration list.</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td>Checksum is shown in a special format:</td>
</tr>
<tr>
<td>26</td>
<td>CHK</td>
<td>The checksum is shown in a special format:</td>
</tr>
<tr>
<td>27</td>
<td>CHK</td>
<td>Format:</td>
</tr>
<tr>
<td>28</td>
<td>CHK</td>
<td>Addition of the individual digits of the</td>
</tr>
<tr>
<td>29</td>
<td>CHK</td>
<td>checksum of the configuration list.</td>
</tr>
<tr>
<td>30</td>
<td>CHK</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>CHK</td>
<td></td>
</tr>
</tbody>
</table>

**Contents of the diagnosis register**

The diagnostic messages sent to the PROCONTROL system are shown below:
Module operating

Diagnosis register 246

<table>
<thead>
<tr>
<th>Bit</th>
<th>Type</th>
<th>Description</th>
<th>CDS messages *)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>0</td>
<td>Processing fault</td>
<td>6601</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>Checksum error detected</td>
<td>6602</td>
</tr>
<tr>
<td>13</td>
<td>S</td>
<td>Timer defective</td>
<td>6604</td>
</tr>
<tr>
<td>12</td>
<td>S</td>
<td>Module restart executed</td>
<td>6605</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>Receive section fault</td>
<td>6606</td>
</tr>
<tr>
<td>10</td>
<td>S</td>
<td>Bus deactivation defective</td>
<td>6607</td>
</tr>
<tr>
<td>9</td>
<td>D</td>
<td>Receive monitoring responded</td>
<td>6610</td>
</tr>
<tr>
<td>8</td>
<td>S</td>
<td>Bus coupling fault</td>
<td>6611</td>
</tr>
<tr>
<td>7</td>
<td>S</td>
<td>Event mode fault</td>
<td>6612</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Module not operating

Initialization of processing section active
Waiting for configuration list
Firmware invalid or missing
Hardware defect of processing section

Module not accessible from bus
Init. bus interface running
Module address 0-56
Module transmitter ON
Station address received
No bus program
Hardware defect of bus interface

D = Dynamic annunciations are canceled after the contents of the diagnosis register has been transmitted
S = Static annunciations disappear automatically upon deactivation
0 = Not used

*) The control diagnosis system (CDS) gives a description for every message number. This description comprises:
- Information on cause and effect of the disturbance.
- Recommendations for elimination.
Thus, fast disturbance elimination is ensured.
Cause for 'Processing unit fault' (reg. 227 / bit 15)

Background diagnosis register 211

<table>
<thead>
<tr>
<th>Bit</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>S</td>
</tr>
<tr>
<td>0</td>
<td>S</td>
</tr>
</tbody>
</table>

- Redundant partner module missing ≥ 1
- CI520 not ready for operation
- Advant Fieldbus fault

Cause for 'Bus coupling fault' (reg. 246 / bit 3)

Background diagnosis register 227

<table>
<thead>
<tr>
<th>Bit</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>S</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>S</td>
</tr>
<tr>
<td>9</td>
<td>S</td>
</tr>
<tr>
<td>8</td>
<td>S</td>
</tr>
<tr>
<td>7</td>
<td>V</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>V</td>
</tr>
<tr>
<td>1</td>
<td>V</td>
</tr>
<tr>
<td>0</td>
<td>V</td>
</tr>
</tbody>
</table>

- Station bus failure
- Remote bus failure
- Module transmitter OFF

Current signalling status (reg. 246 / bit 3)

History values

V = History values are deleted only upon restart of the module
S = Static annunciations disappear automatically upon deactivation
0 = Not used
Connection diagram

In the station subrack, the 87TS50/R5010 modules and the modem support are mounted right next to each other. The rest of the station subrack can be equipped arbitrarily either with more 87TS50/R5010 modules or with other PROCONTROL modules.

For redundant applications, other module types must not be operated together with the 87TS50/R5010 modules in one and the same station subrack (cf. Section ‘Redundant applications’).

When connecting the module, attention must be paid to the fact that X3 is to be connected via the modem using cable 1 (red) and X4 is to be connected via the modem using cable 2 (blue) of the Advant Fieldbus 100.

Mechanical design

Board size: 6 units, 3 divisions, 160 mm deep
Connectors: to DIN 41 612
  1 x for power supply
    48-pole edge connector type F
    (connector X11)
  1 x for station bus connection
    48-pole edge connector type F
    (connector X12)
  1 x for V24 interface,
    9-pole edge connector type D
    (connector X1)
  1 x for Ethernet interface,
    BNC jack
    (connector X2)
  2 x for RS485 interface,
    9-pole edge connector type D
    (connector X3, X4)
Weight: approx. 1.2 kg

View of connector side:
Side view of the right division and view of the module front

The left division of the module includes the AF100 interface

Position of jumpers must not be changed.
Side view of the left division

Position of jumpers must not be changed.

Cable connections / pin assignments

Cable connection 87TS50 → VT100

Cable connection 87TS50 → IBM-PC COMx
Configuring the Ethernet interface

Connecting the Ethernet interface to a network is optional. For redundant applications, assigning an Internet address is mandatory.

The network address is composed of the Ethernet address and the Internet address. The Ethernet address is fixed on every 87TS50.

The Internet address has to be adjusted for each individual project, if the module is to be connected to a network, and needs to be entered in the 87TS50 modules and in the computer. In a network, all of the modules connected must have a different Internet address.

Please consider:
- Handling of the Internet addresses is centralized.
- By setting the Internet address, a configuration list that might exist in the FLASH PROM will be lost. It is therefore advisable to configure the Ethernet interface first when commissioning the module.
Technical data

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

**Power supply**

- Operating voltage, module USA/USB = 24 V
- Current consumption \( I_S = 1.04 \, \text{A} \)
- Power dissipation \( P_V = 25 \, \text{W} \)
- Reference potential on the bus side \( Z_D = 0 \, \text{V} \)

**Ambient conditions**

- Temperature \( T = 0 \ldots 70 \, ^\circ \text{C} \)
- Relative humidity \( F = 95 \% \, \text{E} \) without condensation

**Interference immunity**

- ESD acc. to IEC 801/2 \( 8 \, \text{kV} \) to front panel
- EMC acc. to IEC 801/4 \( 0.5 \, \text{kV} \) Ethernet and serial interfaces

**Module interfaces**

- X1: Serial interface acc. to RS232
- X2: Ethernet interface acc. to IEEE 802.3
- X3, X4: Advant Fieldbus 100 interface acc. to RS485
- X11: Power supply for Advant Fieldbus 100 interface
- X12: Station-bus interface

**Ethernet interface acc. to IEEE 802.3**

- Application: Interface (user monitor)
- Transmission protocol: TCP/IP
- Transmission rate: 10 Mbits/sec
- Transmission distance: Up to 180 m (without line amplifier)
- Minimum distance between participants: 0.5 m
- Cable type and connector: 50 \( \Omega \) coaxial precision cables for thin-wire Ethernet systems acc. to IEEE 802.3-10BASE2. GKWN 000 270

**Serial interface acc. to RS232**

- Application: Interface (user monitor)
- Transmission protocol: Serial acc. to RS232
- Transmission rate: 9600 baud
- Transmission mode: 8 data bits, 1 stop bit, no parity bit, XOFF protocol
- Transmission distance: Up to 15 m (without line amplifier)
- Terminal setting: Automatic wraparound, text transmission per line, waiting for poll, sending text file: Clear upon CR LF.

**Quantities**

- Max. number of destination telegrams to be received: 256
- Max. number of listen-in telegrams: 6000
- Max. number of listen-in data elements: 6000
- Max. number of send telegrams: 800
- Max. number of send data elements: 400
Ordering data

Order no. for complete module: GKWE857800R5010

Includes:  
1 87TS50-E/R5010 module  
1 modem support  
2 modems TC625  
2 modified TK515 cables

Order nos. for plug-in memory modules

<table>
<thead>
<tr>
<th>Memory module</th>
<th>Position</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus-interface section</td>
<td>IC09</td>
<td>GKWE857861Pxxxx</td>
</tr>
<tr>
<td>Processing section low/low</td>
<td>IC20</td>
<td>GKWE857862Pxxxx</td>
</tr>
<tr>
<td>Processing section low/high</td>
<td>IC14</td>
<td>GKWE857863Pxxxx</td>
</tr>
<tr>
<td>Processing section high/low</td>
<td>IC07</td>
<td>GKWE857864Pxxxx</td>
</tr>
<tr>
<td>Processing section high/high</td>
<td>IC03</td>
<td>GKWE857865Pxxxx</td>
</tr>
</tbody>
</table>

Pxxxx = Position number indicating the applicable program version.

Technical data are subject to change without notice!