Application

The monitoring module for station-bus control module is used within a PROCONTROL multi-purpose processing station.

It monitors the control of data transfer within the station which is carried out by two redundant station-bus control modules 88 TU01. If the station-bus control module currently controlling data exchange fails, the monitoring module switches over to the undisturbed station-bus control module. If both modules are without a present disturbance cyclic switchover between both station-bus control modules is performed by the monitoring module.

Features

The module can be plugged into every multi-purpose processing station of the PROCONTROL bus system. The task of the module is the listener function without signal output (except SST) to the standard interface of the PROCONTROL station-bus. The two station-bus control modules are activated through control connections which are wired via the module address terminals (see "Wiring of the modules").

Important: The module address terminals may not be wired in any way other than that specified (see "Wiring of the modules"), otherwise the control outputs are liable to be destroyed. Open inputs, however, do not lead to any malfunctions.

Module-internal disturbances are indicated by the light-emitting diode ST. The operation and disturbance states of the control modules and those of the station modules are also indicated by light-emitting diodes and by digital displays at the front of the module.

Tasks

The monitoring module continuously checks the two redundant station-bus control modules for proper function. The following main criteria are monitored:

- Presence of the central clock ZET with which the station modules synchronize to the transferred data telegrams.
- Generation of the status annunciation "Cyclic end" by the module. This annunciation must be initiated when the control module has allowed itself a maximum of 15 bus grants (e.g. for calling a station module), without any grant to the station module in between.
- Exceeding of the maximum time permitted between data transfers to a station-bus (only applies to autonomous stations without remote bus connection).
- Activation of the "Watchdog"-function of a station-bus control module.
- Behaviour of the control modules during a cold boot of the station.
- Agreement of the system and station addresses which are transmitted from the two control modules to the station-bus.

If any of the above-mentioned criteria is not met, the system is switched over to the redundant, undisturbed station-bus control module.
Functional sequences

CONDITIONING OF THE STATION

After plugging-in of the monitoring module and simultaneous actuation of the RST pushbutton of the control module 88 TV01 that is currently in operation (or after connection of supply voltage U0+) the monitoring module begins to check the cold boot operating sequences.

In doing so, it also checks the arrangement of the control modules.

If the monitoring module signals a disturbance immediately, the RST pushbutton of the 88 TV01 should be operated again after about 3 seconds. If module 88 TU01 continues to signal a disturbance, the program status and the positions of the plug-in jumpers of the control modules should be checked (see module description "Control module for station-bus 88 TV01", GKWE 705 170).

If there is no disturbance, the monitoring module releases control modules A and B in alternate succession. These now check their own bus drivers and also whether they have been correctly plugged into their assigned slots within the module subrack. If a control module is missing or if one of them discovers that it has a defect, the monitoring module switches over to the redundant control module.

After the control modules have completed their self-diagnosis, control module A is released by 88 TU01 to check the bus driver stages of all station modules. Faulty station modules are switched off by the control module. At the end of the check, the control module transfers a common telegram (to all station modules) containing the system and station addresses.

After completion of this procedure, control module B is released for the same check and for address transfer.

If the two addresses set on the control modules do not agree, the monitoring module indicates this fact by the red light-emitting diode ADF (address error) and switches over to module A. If module A has already been signaled as being disturbed, no switch-over takes place.

COMMUNICATION ON STATION-BUS

If the preparatory checks do not indicate any disturbance, control module B is released for normal data transfer. It now executes two station transfer cycles. The end of the second cycle is indicated to the monitoring module. This now blocks control module B and releases control module A which also executes two transfer cycles. When module A indicates the end of the second cycle, it is blocked by 88 TU01, and control module B is released again for the next two cycles. In each case, at the beginning of the double cycle, the control modules perform a bus driver check of the station modules.

However, switchover operations between the control modules are only effected if no "event external" announcements are present from the station and were transferred to the remote bus. If event announcements have occurred during a double cycle, the currently active control module remains released until the event transfer process is completed (since only this control module knows which station modules are signalling the event). Thereafter, the monitoring module switches over to the redundant control module.

Switchover between the control modules is continued until the monitoring module detects a disturbance. If a disturbance occurs, the control module switches over immediately to the redundant control module, and the disturbed control module is immediately switched off via a separate control line (i.e., its driver stages are disconnected from the station-bus). The control module just activated again starts executing its program and the driver check.

If a control module is detected to be disturbed, no further changeover is effected following the changeover operation initiated by the disturbance even if the activated module should also prove to be disturbed. In this case, data transfer on the station-bus is no longer possible.

If the monitoring module is withdrawn, the system is permanently switched to control module A via the subrack wiring.

Note:
This, however, applies only to control modules 88 TV01 from version e. When control modules up to version d are used, the monitoring module may only be withdrawn if control module A is activated.
If a control module detects an invalid telegram during the cyclic or event transfer mode (e.g. incorrect station address), this telegram is blocked and thus prevented from reaching the remote bus. The address of the module which has sent the incorrect telegram is indicated by the seven-segment display of the monitoring module. By pressing pushbutton QT, the current display can be deleted. The display is updated continuously. A module that does not respond when being called after a bus grant is displayed in the same way.

If incorrect telegrams arrive simultaneously from several modules, the display indicates the addresses of these modules in quick succession.

**SELF-DIAGNOSIS**

After a cold boot (connection of supply voltage or operation of pushbutton RST of an undisturbed control module) the monitoring module, in response to a command from the control modules, performs a short test in which only the test stages of the two user-programmable logic modules are monitored. If it detects a disturbance, the module switches off its control lines and signals this disturbance by a disturbance announcement signal ST and by setting SST. Other checks are not carried out.

Two Field Programmable Logic Arrays (FPLA-circuits see also "Mechanical design") contain the entire functional program for monitoring module 88 TU01.

**Operating modes**

**WIRING OF THE MODULES**

To enable the monitoring module to perform its tasks and to control the control modules, it must be linked with these control modules via control lines. However, these lines do not form part of the station-bus backplane, they have to be wired separately. The following table shows these special connections between the monitoring module and both control modules, with the cable 89 IT01.

<table>
<thead>
<tr>
<th>88 TV01-A</th>
<th>88 TV01</th>
<th>88 TV01-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Output</td>
<td>Input</td>
</tr>
<tr>
<td>b 14</td>
<td>b 14</td>
<td>(open = logic 1)</td>
</tr>
<tr>
<td>d 26</td>
<td>d 26</td>
<td>Screen</td>
</tr>
<tr>
<td>d 22</td>
<td>d 22</td>
<td>Screen</td>
</tr>
<tr>
<td>b 22</td>
<td>b 22</td>
<td>Preparation RUN A</td>
</tr>
<tr>
<td>z 22</td>
<td>z 22</td>
<td>Central clock OFF A</td>
</tr>
<tr>
<td></td>
<td>z 26</td>
<td>Preparation RUN B</td>
</tr>
<tr>
<td></td>
<td>b 24</td>
<td>Central clock OFF B</td>
</tr>
<tr>
<td></td>
<td>z 24</td>
<td>EMERGENCY OFF B</td>
</tr>
</tbody>
</table>

In addition, the following connections must be established for the control modules:

88 TV01-B: from b22 via 390 ohms to UD+ (d02 or d20)
88 TV01-A: from b22 via 390 ohms to UD (b62, b14 or d26).

These connections are established via two identical plug-in resistors (GVR1939332). The resistors are supplied together with module 88 TU01.

**SEQUENCE WHEN REPLACING MODULES**

We must distinguish between four cases:

1. 88 TV01-A disturbed (STB lamp on 88 TU01) 88 TV01-B not disturbed.
   Replace the disturbed module 88 TV01-A by the completely equipped reserve module (check the station address beforehand). Do not transfer the PROM set from the disturbed module to the new module. After the module is connected, immediately press the Reset key on 88 TV01-A.

2. 88 TV01-B disturbed (STB lamp on 88 TU01) 88 TV01-A not disturbed.
   The procedure for the 88 TV01-B is analogous to that described in section 1. The Reset key must be pressed on the 88 TV01-A.

3. 88 TU01 disturbed (88 TV01-A active, ST lamp on 88 TU01).
   Replace by the reserve module 88 TU01 and immediately press the Reset key on the 88 TV01-A.

4. Replace the complete module set 88 TV01 and 88 TU01, whereby there is no disturbance in accordance with points 1...3.
   a. Withdraw 88 TU01,
   b. withdraw 88 TV01-B,
   c. replace 88 TV01-B,
   d. replace 88 TU01 press Reset on 88 TV01-A, then
   e. replace 88 TV01-A
SETTING OF SWITCH

A dual inline switch with four contacts is provided on the module. The position and designation of the switch is specified under "Mechanical design".

Contacts 1 - 4 of this switch Sl are used to set the maximum number of permissible bus grants by the control modules (see "Tasks").

The four contacts have binary significance, thus allowing the settings 0 - 15.

Number 11 must be permanently set for use in the PROCONTROL multi-purpose processing station.

For setting, it should be noted that the required contacts must be in position "OFF". The following diagram shows the contacts-significance relationship and the setting of number 11.

<table>
<thead>
<tr>
<th>Contacts</th>
<th>1</th>
<th>1</th>
<th>2</th>
<th>1</th>
<th>4</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binary</td>
<td>2^0</td>
<td>2^1</td>
<td>2^2</td>
<td>2^3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Set number 11 ON

Example:

11_{Dec} = 2^0 + 2^1 + 2^3 = 1 + 2 + 8,

therefore contacts 1, 2 and 4 in position "OFF".

Operating functions

The acknowledgement pushbutton QT is provided at the front of the module. It can be used to cancel the 7-segment display (address of modules which transfer incorrect telegrams) at the module front. The display is cancelled after actuation of the pushbutton.

The acknowledgement pushbutton has no effect on the other module signalling functions (see "Annunciation functions").

Annunciation functions

ANNUNCIATIONS ON THE MODULE

Six light-emitting diodes and two 7-segment displays are provided at the front of the module.

The red light-emitting diode ST is set when a disturbance occurs on the monitoring module itself.

The red light-emitting diode STA is set when control module A is disturbed.

The green light-emitting diode TVA is set when control module A is switched on.

The red light-emitting diode STB is set when control module B is disturbed.

The green light-emitting diode TVB is set when control module B is switched on.

The red light-emitting diode ADF is set when the addresses set on the two control modules do not agree, if only control module B is plugged in, or if two control modules are plugged in with the program of control module B.

The 7-segment displays indicate the address of the module causing a disturbance. The upper display denotes the significance 10, the lower display denotes the significance 1 of the address. Display is continuous, i.e. the module address detected last is indicated.

ANNUNCIATIONS TO THE STATION-BUS

The red light-emitting diode ST for internal disturbances is connected with the bus line for general disturbance SST to the station-bus.

It emits a steady light when a disturbance annunciation is transferred.
Functional diagram

Terminal designations: The module consists of a printed circuit board equipped with connector X1. It incorporates the voltage supply and the standard interface to the station-bus.

Note:
The outputs for the control signals are a part of the standard interface. All signal outputs have TTL levels and may only be used for wiring the TTL inputs of the control modules.
Mechanical design

Board size: 6 units, 1 division, 160 mm deep

Connector: according to DIN 41 612
48-pole, edge-connector type F

Weight: approx. 0.3 kg

POSITION OF THE SWITCH, THE FPLA CIRCUITS AND FRONT VIEW

FPLA circuits: Order number: Order number:
(component) (FPLA programmed)

1 = A 405 GJT110007P1 GJR2344330R1
2 = A 406 GJT110007P1 GJR2344331R1

Note: The mounting position of the components is marked on the printed circuit board. The module is delivered with two resistors GVR1939332.
Technical data

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

POWER SUPPLY

Operating voltage bus section  \( U_{D^+} = +5 \) V
Current consumption  \( I_D = 0.56 \) A
Power dissipation typ.  \( P_V = 2.8 \) W
Reference potential bus section  \( Z_D = 0 \) V

SS - Standard interface to the Station-bus

ORDERING DATA

1. Complete module:

Type designation: 88 TU01-E/R1000  Order number: GJR2344300R1000

2. FPLA circuits: see "Mechanical design"

Technical data are subject to change without notice!