Application

The coupling module for monitoring station is used within a PROCONTROL master station.

The processor of the master station exchanges information with the coupling module. It receives permission from the coupling module to carry out data transfer and reports the end of the transfer cycle to the module. The release of data transfer is dependent on certain conditions in the total system.

The module is available in two versions:

88 VU01-E/R1010: Equipped with function PROM for use in master station A
88 VU01-E/R1011: Equipped with function PROM for use in master station B

Features

The module can be plugged into each of the two master stations of the PROCONTROL bus system, but is only available once for each station. It is provided with one standard interface to the bus of the master station as well as with interfaces to the monitoring station (88 UB01, 88 UM01) and to the coupling module for monitoring station of the second (redundant) master station.

Six light-emitting diodes are provided at the front of the module. They serve to indicate disturbances (both module-internal and system disturbances) that have been detected. Furthermore, they indicate whether data transfer is taking place on the connected bus system (see "Annunciation functions").

Description

The most important functions of the coupling module are described below (see "Functional diagram"). These functions are valid no matter in which of the two master stations the module is used.

CONTROL OF THE DATA TRANSFER

The entire bus system is duplicated. There are two master stations and two remote bus channels. Every individual multi-purpose processing station is connected in parallel to both remote bus channels. As a result, data transfer can take place only on one of the two remote bus channels at a time.

The processor of the master station (consisting of the modules 88 VA01/VA02, 88 VP01/VP02, 88 VT01/VT02) handles the data communication on the connected bus system. However, it is only authorized to do so when permitted by the higher-level coupling module 88 VU01.

The main task of the coupling module is to grant the master station processor permission for data communication or to withdraw such permission. Normally, one complete system cycle is performed by every master station in alternate succession (i.e., complete data exchange from and to all stations connected to the bus system). The exchange of information between coupling module 88 VU01 and the master station processor is performed by way of the master station bus interface. First, the coupling module switches off signal MRST (Master Reset). Now the processor can ask the coupling module permission to start data transfer on its bus system. The coupling module then grants such permission (as "START CYCLE"-command), authorizing the processor to perform the system cycle. The processor signals the beginning of this cycle to the coupling module (as "BEGIN CYCLE"-annunciation).
The processor signals the end of the system cycle to the coupling module (as "END CYCLE"- annunciation). This cancels permission for the processor (as "STOP CYCLE"- command) to continue data transfer. At the same time, signal MRST is output. This ensures that the processor is positively switched off.

REMOTE BUS CHANGEOVER

Since data transfer in the PROCONTROL bus system is only allowed to take place cyclically in alternate succession through one of the two systems, provision must be made for changeover between these systems.

In order to ensure changeover, the coupling modules 88 VU01 of the two master stations are electrically interconnected but potential-isolated from each other. The modules exchange information with each other.

Via the two-pole signal lines ESX/ESXR, the coupling module signals the beginning and end of the system cycle in its system (the signals being derived from the annunciations of the processor of the master station). The coupling module of the second master station evaluates this information through inputs EEX/EEXR and controls the processor of its master station accordingly. These inputs are potential-isolated (hence two-pole signal transfer). For safety reasons, the information is transferred three times in parallel (x = 1, 2, 3). A monitoring section checks whether the same signalling status exists at any time on all three lines (see "Monitoring functions").

OPERATING MODES IN THE SYSTEM

As a result of the redundant design of the system, various operating modes are possible. These can be set on the selection module 88 UB01 (see module description "Selection module for remote bus operation 88 UB01", GKWE 70S 192).

Basically, there are three operating modes, with the third one offering two alternatives:

Operating mode A: Data transfer only on remote bus system A (inputs AABSX)
Operating mode B: Data transfer only on remote bus system B (inputs BABSX)
Operating mode AUX: Data transfer with automatic cyclic alternation between remote bus system A and B.

The third operating mode is yet again subdivided into:

Operating mode AUT: Data transfer with automatic cyclic alternation, with consideration of priority (inputs AUTOX)
Operating mode AUP: Data transfer with automatic cyclic alternation, without consideration of priority (inputs AUPX).

The coupling module receives the information concerning the selected operating mode on two parallel lines (x = 1, 2) via the above-mentioned inputs (see "CONTROL SECTION").

SYSTEM PRIORITIES

Disturbances which may occur in the entire system are grouped into three priority levels:

Priority 1 = Disturbances at master station level (e.g. processor faulty or module not plugged in) and the local bus/remote bus transmission link
Priority 2 = Disturbances at multi-purpose processing station level (e.g. control module faulty or not plugged in)
Priority 3 = Disturbances at the level of input/output modules and processing modules.
Disturbances of priority 3 have no effect on the operating mode even if the switch is set to AUT or AUP.

Disturbances of priority 1 and 2, however, have an influence on the automatic operating modes.

Table 1 shows this influence for the various disturbance types in the whole system.

<table>
<thead>
<tr>
<th>Disturbance type</th>
<th>PRI0 1 A</th>
<th>PRI0 1 B</th>
<th>Activated selection function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUT/AUP</td>
<td>0</td>
<td>0</td>
<td>Cyclic alternation between A and B</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>Immediate selection A, with data transfer only there</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
<td>Immediate selection B, with data transfer only there</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Cyclic alternation between A and B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disturbance type</th>
<th>PRI0 2 A</th>
<th>PRI0 2 B</th>
<th>Activated selection function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating mode:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUT</td>
<td>0</td>
<td>0</td>
<td>Cyclic alternation between A and B</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>Selection A after end of cycle in B</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
<td>Selection B after end of cycle in B</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Cyclic alternation between A and B</td>
</tr>
<tr>
<td>AUP</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Explanation: "0" = Disturbance type is not present
"1" = Disturbance type is present

Note:

If no information concerning the selected operating mode is available from selection module 88 UB01 (module not plugged in or faulty), the coupling modules 88 VU01 automatically select the operating mode AUP (corresponding to maximum availability of the system).

To be able to perform these selection functions, the coupling modules of the two master stations must inform each other of any disturbances (and hence priority signals) that may exist. This information is transferred on a two-pole basis via outputs PRI01SX/PRI01SX and PRI02SX/PRI02SX. The coupling module of the second master station evaluates the information via inputs PRI01EX/PRI01EX and PRI02EX/PRI02EX. Also these inputs are potential-isolated (hence two-pole signal transfer). For safety reasons, both PRI0 information signals (PRI01, PRI02) are transferred over two parallel lines (x = 1, 2). A monitoring section checks whether the same signal status always exists on both lines.

CONTROL SECTION

The most important part of the two-fold coupling module is the control section. It is of dual redundant design (from the viewpoint of circuit configuration) therefore the information from the selection module for remote bus operation 88 UB01 is input twice. Its main function is to control the master station processor and the exchange of information with the redundant coupling module.

Every control section is provided with 2 PROMs: The operating mode PROM and the function PROM.

The selected operating modes (selected by 88 UB01) and a "Discrepancy"-signal generated module-internal are fed as input information (corresponding to the memory location address) to the operating mode PROM (see "Monitoring functions").
The control responses needed to react to the many different system conditions (operating modes, disturbances), are stored in the function PROM. The output data of the operating mode PROM are the addresses for the memory locations of the function PROM.

In addition, the control section incorporates a watchdog function (see "Monitoring functions"). This function supervises proper adherence to the cycle time by the master station processor (and hence the connected bus system). The cycle time is dependent on the configuration of the whole system and can be set with switches on the module (see "Module operating modes").

A second time function of the control section generates a waiting time. This helps determine whether data exchange on the bus system has been properly started by the second master station (see "Monitoring functions").

Monitoring functions

LINE MONITORING

The exchange of information between the coupling module 88 VUD1 of the two master stations is carried out over several parallel lines (two lines for the PRI0 information and three lines for the "BEGIN/END-CYCLE"-annunciation).

The module is equipped on its receiving side, with monitoring facilities for the signal lines. These are designed to check for every signal whether the signal levels are the same on all parallel lines.

Activation of the monitoring facilities is signalled by the module (see "Annunciation functions"). Any disturbance detected in this way has no influence on the functioning of the module.

The signal lines of the selection module for remote bus operation 88 UB01 are also monitored. Normally, a signal may only be present on one of the four operating mode lines. All other conditions are interpreted and signalled as a disturbance, but have no effect on the functioning of the module.

CONTROL SECTION MONITORING

The control section is of two-fold redundant design. A monitoring facility checks continuously whether the most important signals of the two control sections have the same signal levels at all times. If the signal levels are found to differ, the "Discrepancy"-signal mentioned earlier is generated. Such a control section disturbance results in a PRI01-signal being generated within the module, which initiates instantaneous changeover.

If the two control sections receive differing or incorrect signals from the selection module for remote bus operation 88 UB01, this is recognized and signalled (see "Line monitoring"). In such a case, the two control sections output different control signals. This is recognized by the control section monitoring facility which outputs in addition a "Discrepancy"-signal with the consequences mentioned earlier.

CYCLE TIME MONITORING

The "BEGIN CYCLE"-annunciation of the master station processor starts an adjustable time counter. If the "END CYCLE"-checkback signal does not arrive from the processor within the set time, this is detected by the two redundant watchdogs.

The coupling module 88 VUD1 then stops the processor by an MRST and "STOP CYCLE"-command and switches data transfer to the other master station.

If only one of the watchdogs responds, this is detected by the control section monitoring facility. The "Discrepancy"-signal generated internally then initiates an instantaneous PRI01 changeover operation.
WAITING TIME MONITORING

When one bus system has completed its system cycle, the associated coupling module informs the other one accordingly. At the same time, a time counter is started. Normally, one coupling module receives from the other the "START CYCLE" signal. If the bus system taking over cannot start its cycle due to a disturbance, within a specified time (set to 250 μs), this is detected by the monitoring facility ("START CYCLE" signal fails to arrive). Therefore, the processor of the transferring master station again starts data transfer at the request of the coupling module.

After every system cycle, an attempt is made to switch data transfer over to the other master station. If these attempts are unsuccessful, the undisturbed bus system operates continuously in the automatic mode. In this case, no special disturbance annunciation is output by the module.

If only the waiting time watchdog of one control section responds, the "Discrepancy" signal is generated, causing a PRIOL changeover to the other system.

Operating modes

SETTING OF THE CYCLE TIME

The cycle time monitoring facility checks whether the system cycle is completed by the master station processor within the permissible time. The required cycle time is dependent on the system design (number of the connected stations and their modules).

The required cycle time is set by means of switches. The position and designation of the switches on the module are specified under "Mechanical design".

Since the module has two redundant control sections, also two switches are provided. They are designated ZTW1 and ZTW2 on the printed circuit board. Every switch has 5 contacts. The time setting must be same on both switches. The following Table 2 shows, for both switches, the possible contact combinations and the times set with them. With contact 5, two basic times can be set:

| Basic time a = 1 s |
| Basic time b = 0.5 s |

Therefore, the columns "Contact 5" and "set time" in the table are also subdivided into the columns a and b.

Generally: "0" = contact open,
"1" = contact closed
(position ON on switch casing).

<table>
<thead>
<tr>
<th>ZTW1/2</th>
<th>:1</th>
<th>:2</th>
<th>:3</th>
<th>:4</th>
<th>:5</th>
<th>Set time [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1 1 1 1 0 1</td>
<td>15.2</td>
<td>7.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 1 1 1 0 1</td>
<td>14.15</td>
<td>7.076</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 0 1 1 1 0 1</td>
<td>13.1</td>
<td>6.552</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 0 1 1 1 0 1</td>
<td>12.5</td>
<td>6.028</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1 0 1 1 0 1</td>
<td>11</td>
<td>5.503</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 0 1 1 0 1</td>
<td>9.95</td>
<td>4.979</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 0 0 1 1 0 1</td>
<td>8.91</td>
<td>4.455</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 0 0 1 1 0 1</td>
<td>7.86</td>
<td>3.931</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1 1 0 0 0 1</td>
<td>6.81</td>
<td>3.407</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 1 0 0 0 1</td>
<td>5.76</td>
<td>2.882</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 0 1 0 0 0 1</td>
<td>4.71</td>
<td>2.358</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 0 1 0 0 0 1</td>
<td>3.66</td>
<td>1.834</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 1 0 0 0 0 1</td>
<td>2.62</td>
<td>1.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 1 0 0 0 0 1</td>
<td>1.57</td>
<td>0.786</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 0 0 0 0 0 1</td>
<td>0.524</td>
<td>0.262</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 0 0 0 0 0 1</td>
<td>illegal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SWITCHING-OFF OF TRANSMITTER

The module generates the output signal SA. This signal is used to switch the remote bus transmitters on the associated frequency module for master station 88 V01 on and off via the coupling modules for master station 88 V01.

However, this applies only for the system operating modes "Only A" (A = absolute) or "Only B" (B = absolute). The signal is generated in the non-selected system by coupling module 88 VU01, and all remote bus transmitters of the frequency modules 88 V01 are switched off.

The signal SA is not generated in the operating modes AUT or AUP. Here, all bus transmitters remain always switched on.

Signal SA is only output when jumper X2 is in place. The remote bus transmitters remain always switched on when jumper X2 is removed.

SETTING OF STATION

The coupling module is used both in master station A and in master station B. To enable it to operate properly, the module must be informed in which master station it is installed.

This purpose is served by the two plug-in jumpers X3 and X4 which must be in the same position, depending on the place of installation. The plugs of both jumpers must be in position A for master station A or in position B for master station B. The jumpers are designated by the imprints A and B on the printed circuit board.

PRIO 1-PROCESSING

Two plug-in jumpers X5 and X6, each with two plug positions, are provided on the module. They are used for module-internal processing of the PRIO 1-signals.

Both plug-in jumpers must be generally plugged into position "0".

This position is marked by an imprint at both plug-in jumpers on the printed circuit board.

MRST BLOCKING

Signal MRST (Master Reset) is used to switch off the master station processor in the automatic mode while the other master station is executing its system cycle.

Signal MRST is not output when the plug of the plug-in jumper X7 is removed.

Plug-in jumper X7 has been provided to allow any later expansion of the functions of the master station processor. While one master station is carrying out data transfer, the other processor can perform tasks within the master station which do not require the bus system for data transfer.

START/STOP BIT OUTPUT

The master station processor receives the start/stop commands from the coupling module 88 VU01 in the form of a certain bit pattern.

Two plug-in jumpers X8 and X9 (STA) with two plug positions each are provided on the module. With these jumpers, it is possible to set two output modes for the start/stop commands:

- Cyclic output of the commands by the control section with dual channel system configuration. The jumper plug must in this case be inserted in position "1" at X8 and in position "2" at X9.

- Continuous output of the commands with single-channel system configuration. In this case, the jumper plug must be inserted in the other (not marked) position at X8 and X9.

The numbers "1" and "2" are imprinted at both plug-in jumpers on the printed circuit board.
Annunciation functions

ANNUNCIATIONS TO THE MODULE

The coupling module receives disturbance annunciations from various other modules of the master station.

It receives the disturbance annunciation SST from the telegram handling module 88 VT01/VT02 via the master station bus (CRC error during telegram transfer).

The module receives up to 8 further disturbance annunciations from the bus coupling modules remote bus/local bus 88 FN01/FN02 via further 8 inputs SST of connector X13 (monitoring of transfer and noise levels).

The processor module signals disturbances that have been detected in the modules and the bus data lines of the master stations via the command lines of the master station bus (see module description "Master station processor module 88 VP01/VP02", GKWE 705 180). These disturbances generate the PRI01-signal within the module.

ANNUNCIATIONS ON THE MODULE

One green and five red light-emitting diodes are provided on the front of the module.

The red light-emitting diode ST is set when the control section monitor recognizes a difference.

The red light-emitting diode STU is set when the monitoring facilities for the connecting lines to the second coupling module 88 Vu01 and to the selection module for remote bus operation 88 UB01 respond.

The three red light-emitting diodes PRI 1, PRI 2 and PRI 3 are set when the corresponding system disturbances of priorities 1 to 3 are detected.

The green light-emitting diode SYS is set as long as the system cycle for data transfer is proceeding in the associated master station.

ANNUNCIATIONS FROM THE MODULE

The module is provided with the potential-isolated annunciation output MST. Both the SST disturbance annunciations of the 88 VT01/VT02 and the SST disturbance annunciations of the up to eight 88 FN01/FN02 are transferred via this output. Also, the module-internal control section's "Discrepancy" annunciation is signalled via this output. Output MST serves to activate the cubicle disturbance lamp via module 89 NU01.

The outputs AN+ and AN- on the selection module for remote bus operation 88 UB01 are used to activate the system light-emitting diode simultaneously with the SYS light-emitting diode on the coupling module itself.

In addition, the coupling module is connected with the monitoring station annunciation module 88 UM01 via two-pole signal lines. The annunciation module 88 UM01 receives the following information over these lines (which are potential isolated):

- detected priority disturbances via the PRIO/PRIOR lines
- activation of line monitoring via STU/STUR
- the information whether the system is active or not (same annunciation as AN+/AN-) via SYA/SYAR
- information on the operating mode (ABS = only 1 channel, AUTO = both channels cyclically alternating) via ABS/ABSR and AUTO/AUTOR.

A test signal is transferred by annunciation module 88 UM01 via the potential-isolated input TEST/ESTT. This signal causes the coupling module 88 Vu01 to output a signal to the 88 UM01 simultaneously on all above mentioned signal lines. In this way the lines are monitored by the annunciation module (see module description "Annunciation module 88 UM01", GKWE 705 195).
Functional diagram

Terminal designations: the module consists of two printed circuit boards (see "Mechanical design"). Printed circuit board 1 is equipped with the two connectors X10 and X11. Printed circuit board 2 is equipped with the connectors X12 and X13. Both printed circuit boards are supplied via the master station bus (X10 and X12).
Connection diagram in the master station

- Monitoring module for master station 88 VU02
- Telegram handling module 88VT01/VT02
- Control module for transfer procedure 88 VA01/VA02
- Master station processor module 88 VP01/VF02
- Coupling module for master station (1) 88 VK01
- Coupling module for master station (8) 88 VK01

GSS for monitoring station

Local bus 1

to the modules 88PN01

Local bus 8

Master station bus
Mechanical design

Board size: 6 units, 2 divisions, 220 mm deep

Connector: according to DIN 41 612
4 x 48-pole, edge connector type F
(for X10 to X13)

Weight: approx. 0.86 kg

Both printed circuit boards are connected with each other mechanically and electrically.

POSITION OF THE PLUG-IN JUMPERS ON PRINTED CIRCUIT BOARD 2

88VU01-E
Explanation: ① = mother board  ② = sub-board

Memory modules:

1 = Operating mode PROM
2 = Operating mode PROM
3 = Function PROM Channel A (version R1010)
Channel B (version R1011)
4 = Function PROM Channel A (version R1010)
Channel B (version R1011)

Order number: (component)
GJTN160053P1
GJTN160053P1
GJTN160053P1
GJTN160053P1

Order number: (PROM programmed)
GJR2352101Pxxxx
GJR2352101Pxxxx
GJR2352102Pxxxx
GJR2352103Pxxxx
GJR2352102Pxxxx
GJR2352103Pxxxx

Note:
xxxx = Position numbers corresponding to the appropriate revision.
Technical data

In addition to the system data the following values apply:

POWER SUPPLY

- Operating voltage $U_{D^+} = +5\,\text{V}$
- Current consumption $I_D = 2.5\,\text{A}$
- Power dissipation typ. $P_V = 12.5\,\text{W}$
- External annunciation voltage $U_M = +24\,\text{V}$
- Reference potential (BUS) $Z_D = 0\,\text{V}$
- Reference potential for UM $Z = 0\,\text{V}$

INPUT SIGNALS

- Priority annunciations "1" (from 88 VU01) from the redundant system
- Priority annunciations "2" (from 88 VU01)
- Start/stop cycle annunciations (from 88 VU01)
- System A absolute (from 88 UB01)
- System B absolute (from 88 UB01)
- Automatic with priorities (from 88 UB01)
- Automatic without priorities (from 88 UB01)
- Priority annunciations "1" (from the bus)
- Priority annunciations "2" (from the bus)
- Priority annunciations "3" (from the bus)
- Hardware disturbance (from the bus)
- Hardware disturbances (from the 88 FN01)
- Line test signal (from 88 UM01)

OUTPUT SIGNALS

- Priority annunciations "1" (to 88 VU01) to the redundant system
- Priority annunciations "2" (to 88 VU01)
- Start/stop cycle annunciations (to 88 VU01)
- System lamp output (to 88 UB01)
- Master Reset signal (to 88 VP01)
- Remote bus transmit. off signal (to 88 VK01)
- Disturbance annunciation output (for cubicle lamp) 2 NL
- Operating mode "Automatic" (to 88 UM01)
- Operating mode "Absolute" (to 88 UM01)
- System active (to 88 UM01)
- Transfer error (to 88 UM01)
- Priority annunciations (to 88 UM01)

With the exception of signal MST, the signal exchange between the modules with TTL signal levels is carried out via optocouplers.

ORDERING DATA

Type designation: 88 VU01-E/R1010 (for master station A) 88 VU01-E/R1011 (for master station B)

Order number: GJR2326500R1010 GJR2326500R1011

With a single-channel configuration of the bus system, one coupling module 88 VU01-E/R1010 (for master station A) is used.

Technical data are subject to change without notice.