Module Description

Application

The bus coupling module is used within a PROCONTROL multi-purpose processing station.

It provides the connection between the station-bus and the local bus and, thus, the PROCONTROL bus system.

Features

The module can be plugged into every multipurpose processing station of the PROCONTROL bus system. It has a standard interface to the PROCONTROL station-bus and a standard interface to the local bus.

The connection between the local bus and station-bus will be established either via one module 88 FN01/FN02 and one module 88 TK02 (see Figure 1, Y configuration).

The bus coupling module 88 TK02 supports the connection of process operator station, programming, diagnostic and display system or another computer via a station-bus coupling module 87 TS01/R2340.

The module receives all telegrams transferred by the PROCONTROL bus system. Telegrams not destined for the station are not forwarded to the station-bus. The module thus has a filtering effect for incoming telegrams.

The module has a bidirectional input/output for deactivation of the local bus drivers. Non-interaction is guaranteed by potential isolation.

The module has three binary signal inputs and one binary signal output from and to monitoring equipment of the cubicle. All four are potential-isolated. This guarantees non-interaction between the process side and bus side.

Disturbances in data communication and on the module are each indicated by a light-emitting diode (ST, SKM) at the front of the module.

Disturbances on the local bus/remote bus are signalled with light-emitting diode QF at the front of the module.

Event annunciations are indicated at the front of the module by light-emitting diode ER.

Transmission to the local bus/remote bus is indicated at the front of the module with light-emitting diode TS.

The front side of the module also accommodates a test plug for servicing purposes.

Tasks

Serving as interconnection between the PROCONTROL multi-purpose processing station and the PROCONTROL local bus, the bus coupling module has the following tasks:

- To provide the connection between the PROCONTROL bus and the station-bus.

- To cooperate with the control module for station-bus (see module description "control module for station-bus", GKWE705170).

- To cooperate with the PROCONTROL bus system.

- To keep all telegrams not intended for the station away from the station-bus.

- To perform diagnostic functions.

These tasks are performed by a processor.
Functional sequences

The module address and the operating mode (Y configuration) are set automatically when the module is plugged into the appropriate slot within the multi-purpose processing station (module address GTA60 or GTA61).

The system and station address are the same for all modules of a station. They are set on the control module for station-bus. This module then transmits a data telegram which is received simultaneously by all modules of the station.

The bus coupling module stores the two addresses which are contained in the data field of the telegram.

REMOTE BUS COMMUNICATION

In the PROCONTROL bus system (local bus + remote bus), only the master station serves for bus control (comparable to the control module for station-bus of a multi-purpose processing station). A station connected to the bus takes the bus grant by the master station. Only after the bus grant is the station permitted to transfer telegrams via the bus coupling module. This method ensures that only one station transfers data to the bus at any one time.

There are two main modes of data communication:

- Cyclic mode
- Event mode

In cyclic mode, the master station successively calls the multi-purpose processing stations. This request for transfer of data telegrams is evaluated by the station-bus coupling module and forwarded to the station. The telegrams made available by the station in response to this request are sent by the coupling module to the bus.

In event mode, the coupling module is informed by the multi-purpose processing station, in the form of an event announcement, that modules would like to send data telegrams (also see section “Event generation” in the module description of the PROCONTROL input modules). This announcement is forwarded by the coupling module via the noise channel to the master station. This then identifies the requesting station and grants it permission to transmit the telegrams. Cyclic mode is interrupted for the duration of event transfer, but only at the end of a telegram block.

Data communication with the master station (e.g. event location, diagnostic status of the station) is carried out automatically by the bus coupling module without the aid of the station in order to relieve the additional burden on the station.

TRANSMISSION TO THE STATION

The bus coupling module receives all telegrams that are transmitted by the PROCONTROL bus system and checks their contents.

All source-location-addressed telegrams which do not contain the own station address are always forwarded to the station. Of the destination-addressed telegrams, only those which are intended for the station are passed on to it. These telegrams are recognized by comparing the system and station addresses provided by the control module.

Every telegram contains a number of security characters to protect the contents of the telegram (operation code, address, data). The coupling module checks every telegram received for errors on the basis of the security characters. If an error is detected in telegrams that are intended for the station, these telegrams are not passed on to the station by the coupling module. Instead, its prompts the master station via the noise channel to transmit the faulty telegram once more. The same occurs when the announcement “transmission disturbance” is sent by the local bus coupling module 88 FN01/FN02.

Certain destination-addressed telegrams transferred by the PROCONTROL bus system are exclusively destined for the bus coupling module. These are mainly telegrams for handling the modules 88 FN01/FN02 and 88 FT01 (also see figure 1). These telegrams are identified by comparing their addresses (system, station, module) and are also not passed on to the station-bus.

The module therefore has a filtering effect to keep unnecessary or incorrect telegrams away from the station.
When the coupling module receives an undisturbed telegram that is intended for the station, the module requests for bus grant to the station-bus handled by the bus control module for station-bus. The coupling module has the highest priority over all other modules of the station. Therefore, the control module interrupts the data communication within the station to allow the coupling module to transfer its telegram to the station-bus.

TRANSFER FROM THE STATION

The bus coupling module only transfers data telegrams from the station after a request from the master station. If the coupling module recognizes telegrams on the station-bus while there is no request from the master station, these station-internal telegrams are not transferred to the remote bus. This prevents simultaneous telegram transfer to the remote bus by more than one station.

In cyclic and event modes, the request is passed on by the coupling module to the control module. The data telegram(s) from the station are checked for formal validity and correct contents by the coupling module and then transferred to the remote bus. If a telegram is invalid, transfer of this telegram is blocked, and the coupling module sends a substitute telegram (diagnosis telegram giving the reason for telegram blocking) instead.

All telegram blocks transferred from the station are buffered by the coupling module until the next request arrives. Thus, they can be repeated if they are received incorrectly or not at all by the master station.

If there is an event, the coupling module sends a request for bus grant via the noise channel to the master station. As this is a common annunciation of all stations, the master station begins an abbreviated scan of all connected stations. In this way, the station with events is selected and will get bus grant.

Note:

Of the three inputs GI2, G22 and G32, input GI2 (MW on 89 NU01) operates on the closed-circuit principle. The other two inputs operate, however, on the open-circuit principle.

RESET OF THE STATION

A reset telegram can be transferred by the diagnostic station to the bus coupling module of a multi-purpose processing station. Although the telegram is only addressed to the coupling module, it also acts within the station. As a result of this telegram, the coupling module generates a short reset signal and transfers it to the station bus, thus initiating the reset procedure in the station. The control module for station-bus takes over this signal and completes the reset procedure. During this procedure, the microprocessor components of all modules connected to the station are set to a defined initial state, with no influence on processing.

Furthermore, all bus driver stages (i.e. the circuit sections of the module which transfer signals on the station-bus) are switched off. This reset telegram has the same effect as pressing the reset pushbutton on the control module for station-bus.

Signal input

The module has three potential-isolated signal inputs for external disturbance annunciations.

The information signal from the monitoring unit of the cubicle power supply is connected to input GI2. It indicates whether the central voltage supply for the modules of the station has failed.

The information signal from the cubicle thermostat is connected to input G22. This input is activated when the cubicle temperature exceeds the maximum permitted value.

The information signal concerning the position of the door contacts is connected to input G32. It indicates whether any of the cubicle doors in a station is open.

These three information signals do not come directly from the monitoring equipment, but are provided by the monitoring and flashing signal generator module 89 NU01 (see "Connection diagram").

All three signals are stored in the diagnosis register and directly activate the cubicle disturbance annunciation lamp via module 89 NU01. Neither disturbance annunciation lamp (ST) is set (see "Diagnostics") nor the signal "General disturbance station".
The local bus drivers can be deactivated via a bidirectional potential-isolated input/output (XII, GTA0).

Signal output

The module is provided with a potential-isolated binary signal output MST. With this output, in connection with the module-internal signal "General disturbance station" (see "Diagnostics"), the cubicle disturbance annunciation lamp is activated by the monitoring and flashing signal generator module 89 NU01.

Mode of connection

The multi-purpose processing station is connected to the two-fold redundant remote bus system (Figure 1, Y configuration) via three modules.

Dependent upon the configuration, the coupling modules of one or more stations connect the relevant station-bus to the local bus. Two-fold redundant connection between the local bus and the remote bus system (Y configuration) is performed by means of the local bus coupling module (88 FN01 or 88 FN02) and two station frequency modules (88 FT01).

It is possible to connect several station-bus coupling modules to one and the same local bus.

In addition to this mode of connection, the coupling module 88 TK02 can also be connected to the local bus of the master station via module 88 VK01.
Diagnostics

The bus coupling module is provided with a diagnosis register in which diagnostic results are entered. The following disturbances are recorded:

1 = Module-internal disturbances and disturbances of data communication.

2 = Disturbance annunciation of the other modules of the station (their disturbance annunciation signal "General disturbance station").

3 = External disturbances.

Disturbances of type 1 are indicated on the front of the module. All types of disturbances (1 - 3) are indicated by the coupling module by activating the cubicle disturbance annunciation lamp (see "Annunciation functions").

The contents of the diagnosis register are transferred as the first data telegram whenever data are transferred to the bus system (cyclic mode or event mode). On the basis of the signal "General disturbance station" contained in the telegram (and generated from the individual signals "General disturbance station" of the modules of the station), the process control communication system can select and read out the specific diagnosis registers of the individual modules.

Test functions

A test plug X1 at which buffered processor and peripheral signals can be measured for servicing purposes is located at the front of the module.

Operating functions

A switch SGA is provided at the front of the module.

The position of the switch (up = "1") is communicated to the rest of the bus system via the diagnosis register. This permits servicing operations to be coordinated in the multi-purpose processing station with the other control equipment.
Annunciation functions

ANNUNCIATIONS ON THE MODULE

A red light-emitting diode ST is provided at the front of the module. It emits a steady light when disturbances occur on the module or during data communication. ST is also set during initialization of the module and as long as the interconnection between the local bus and station-bus is not ready for transfer.

Light-emitting diode ST is also set when switch SGA is in position "1".

Two other red light-emitting diodes SKM and SKR supplement the light-emitting diode ST.

SKM lights steadily when the coupling local bus/station-bus is disturbed, when the coupling module receives no transmit grant in the multi-purpose processing station, when response telegrams are disturbed or during initialization of the module.

SKR lights steadily
- during initialization of the module
- during internal or external disturbances.

In normal operation it is de-energized and has no indicating function. It is designed for use in the event of system expansion at a later date.

The green light-emitting diode TS always lights steadily during data communication from the station (transmission to the local bus).

The green light-emitting diode ER lights if events are recognized.

The red light-emitting diode QF flashes if errored telegrams are received by the local bus. The error pulse is prolonged to approximately 100 ms via a monostable timer for this purpose.

ANNUNCIATIONS TO THE LOCAL BUS

Whenever the coupling module transfers data telegrams, after having been called by the master station, the contents of its diagnosis register are transferred in the first response telegram to the local bus or to the remote bus respectively.

ANNUNCIATION TO THE CUBICLE LAMP

Whenever a disturbance occurs within the station, a binary "1" signal appears at module output MST. It is used to activate the cubicle disturbance annunciation lamp of the multi-purpose processing station (see "Connection diagram").
Functional diagram

Connection designations: the module consists of two printed circuit boards (see "Mechanical design"). The interface board is equipped with connectors X11 and X12. Connector X11 incorporates the voltage supply for the printed circuit board, the standard interface to the station-bus.

Connector X12 incorporates the standard interface to the local bus as well as the terminals for the four potential-isolated binary signals. The processing board with the processor is equipped with connectors X21 and X1. Connector X21 incorporates the voltage supply for this printed circuit board. Connector X1 contains module-internal signals for test purposes.
Connection diagram

*Note: These connections are marked with ZM on the backplane for the 88 TK02.
Mechanical design

Board size: 6 units, 2 divisions, 160 mm deep

Connector: according to DIN 41 612

- 3 x 48-pole, edge-connector type F
- 1 x 37-pole, plug HDP 20

Weight: approx. 0.98 kg

Both printed circuit boards are connected with each other mechanically and electrically.
POSITION OF SWITCH AND MEMORY MODULES ON PRINTED CIRCUIT BOARD 2 AND FRONT SIDE

Important: Switch SGA in position 1 signal intervention in the station.

Explanation: ① = Interface board
② = Processing board

Memory modules:

Order number: (PROM programmed)

① = A49  GJR2353206Pxxxx
② = A48  GJR2353205Pxxxx
③ = A47  GJR2353204Pxxxx
④ = A46  GJR2353203Pxxxx
⑤ = A45  GJR2353202Pxxxx
⑥ = A44  GJR2353201Pxxxx

Note on individual PROMs:

All PROMs required by the module for the basic program are supplied as a set, order specification 88 TK02.

Note:
The mounting position of the components is marked by an imprint on the printed circuit board, next to components.
xxxx = position number corresponding to the appropriate revision level.
Technical data

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

POWER SUPPLY

Operating voltage bus section \( U_{D+} = +5 \text{ V} \) (4.75 \( \ldots \) 5.25 V)
Current consumption \( I_D = 2.5 \text{ A} \) (2.3 \( \ldots \) 2.7 A)
Power dissipation typ. \( P_V = 11 \text{ W} \) (9.4 \( \ldots \) 12.8 W)
Reference potential process section \( Z = 0 \text{ V} \)
Reference potential bus section \( Z_D = 0 \text{ V} \)

INPUT VALUES

G12 - Disturbance in cubicle power supply * \( I_e = 5 \text{ mA} \)
G22 - Thermostat responded \( I_e = 5 \text{ mA} \)
G32 - Cubicle door open \( I_e = 5 \text{ mA} \)
UM - Annunciation voltage \( U_M = 24 \text{ V} \)
GTA0 - Setting of module address \( U_B = 0 \text{ V} \ldots 5 \text{ V} \)

* The input operates on the closed-circuit principle

OUTPUT VALUES

MST - Common disturbance station \( I_a = 6 \text{ mA} \)

STANDARD CONNECTIONS

SS - Standard interface to the station-bus
NSS - Standard interface to the local bus

ENVIRONMENTAL SPECIFICATIONS

Temperature \( T_u = 0 \ldots +70 \text{ °C} \)
Relative humidity \( H = 95 \% \text{ at } T_u = 40 \text{ °C} \)

ORDERING DATA

Complete module:
Type designation: 88 TK02/R1040 *
Order number: GJR2370400R1040 *

* 88 TK02/R1040 supersedes 88 TK01/R1110/R1140.

Technical data are subject to change without notice!