

Bus Coupling Module Coupling to Protection System PROCONTROL-PS

88QT03-E/R2011

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Application

The 88QT03 bus coupling module is used to connect PROCONTROL P to the bus of the PROCONTROL-PS protection system. The following PROCONTROL-PS modules can be connected:

- 70EA01-ES/R1 Analog input module
(one data telegram per function unit)
- 70EA02-ES/R1 Analog input module
(one data telegram per function unit)
- 70EB02-ES/R4 Binary input module
(one data telegram per module)
- 70AB01-ES/R2 Binary output module
(one data telegram per module)
- 70PR03-ES/R2 Computing module
- 70BK03-ES/R2 Bus coupling module
(RS485 interface)
- 70BT01/R1 Bus isolation amplifier
- 70BV01-ES/R1 Bus control module

Connected to the station bus, the module behaves like a combined input/output module that is able to receive up to 255 telegrams from the station bus and send up to a maximum of 200 telegrams to the station bus.

In relation to the PROCONTROL-PS bus, the module acts as a processing module receiving and sending a total of up to 256 telegrams.

Features

This module can be plugged into any multi-purpose processing station of the PROCONTROL bus system. It requires a space of 2 divisions.

It uses:

- One SS standard interface for the station bus,
- One SEA standard interface for the PROCONTROL-PS bus,
- Connections provided for hardware inputs.

As with all the other station bus modules, the station bus address of this module is related to its place of installation.

However, the module may only be plugged onto even-numbered module addresses. The next higher (uneven) module address will be used automatically by the module, and needs not be wired. However, it must not be assigned to another station bus module.

It transfers data from PROCONTROL-PS station modules to the station bus.

It transfers data received from the station bus to modules connected to the PROCONTROL-PS bus.

The connected PROCONTROL-PS modules are monitored for proper functioning.

Disturbances are signalled to the PROCONTROL system in the form of diagnosis telegrams. They are annunciated additionally on the module front by means of light-emitting diodes (see "Annunciation functions").

The module is able to simulate output data destined for the PROCONTROL-PS bus (only admissible for servicing).

The module merely requires a 24V supply (voltages needed additionally, are generated inside the module itself).

With the help of the PDDS, user lists are loaded into an EEPROM.

Description

General basic functions

The module mainly comprises the following three function blocks (see "Function diagram"):

- Section for specific station bus functions (processor I)
- Processing section (processor II)
- Section for specific PROCONTROL–PS bus functions.

These function blocks cooperate with the aid of two shared memories. The station bus shared memory is assigned to the station bus, and the shared memory for the PROCONTROL–PS bus is assigned to the PROCONTROL–PS bus.

Section for specific station bus functions

This section is mainly designed to perform the following tasks:

- Handling of overall data communication with the station bus using the SS standard interface. The data transfer is handled following the instructions given by the 88TV01 station bus control module.
- Monitoring of module–internal functions and issuing the appropriate annunciation signals in the case of a disturbance (see "Annunciation functions")
- Handling of the internal data transfer between station bus and station bus shared memory.

The shared memory assigned to the station–bus–specific section is composed of a receiving shared memory and a sending shared memory.

The receiving shared memory is used to buffer all data telegrams received from the station bus. From here, they are forwarded to the processing section for further processing.

The sending shared memory is used to buffer all data telegrams provided by the processing section. When this module is called up, these telegrams are transferred from here to the station bus.

The tasks assigned to the station–bus–specific section are performed by processor 1.

Processing section

This section mainly performs the following functions:

- Marshalling, in telegrams or bits, of PROCONTROL–PS bus telegrams from the shared memory of the PROCONTROL–PS bus to the station bus sending shared memory,
- Marshalling, in telegrams or bits, of station bus telegrams from the station bus receiving shared memory to the shared memory of the PROCONTROL–PS bus,
- Input signal monitoring for data telegrams coming from the PROCONTROL–PS bus,
- Generation of (user–specific) limit–value telegrams from those analog telegrams received from the PROCONTROL–PS bus,
- Monitoring of plausibility limits (programmable) in the case of analog–value telegrams transferred from the PROCONTROL–PS bus to the station bus,
- Monitoring of internal module functions including the appropriate annunciation signals in the case of a disturbance (see also "Annunciation functions"),
- Simulating output data to be signalled to the PROCONTROL–PS bus,
- Event processing.

The tasks assigned to the processing section are carried out by processor II. For this purpose, this processor is given a user program defining all necessary user data.

The user program mainly contains (see also "Initialization"):

- Bus address list (BAL),
- Marshalling list "station bus/PROCONTROL–PS bus" (RAN),
- Marshalling list "PROCONTROL–PS bus/station bus" (RAN),
- Limit value list (GRE),
- Measuring range expansion list.

Upon entry of the user–specific address and limit–value data, the individual lists are generated automatically by the PDDS (programming, diagnostic and display system) and are all filed inside the module in a nonvolatile memory (EEPROM) (see also "Operating modes: initialization").

User data can be changed on–line in the user EEPROM from the PDDS.

Section for specific PROCONTROL–PS bus functions

This section is mainly designed to perform the following functions:

- Handling of data communication with the PROCONTROL–PS bus using the SEA standard interface. Data transfer is handled following the instructions given by the 70BV01 control module of the PROCONTROL–PS bus.
- Handling of internal data transfer between PROCONTROL–PS bus and the shared memory of the PROCONTROL–PS bus.

These functions are performed by a control section.

The shared memory of the PROCONTROL–PS bus is used to buffer all data telegrams which have to be transferred between PROCONTROL–PS bus and the processing section (in sending and receiving direction).

The individual module functions are described in detail in the following.

Initialization

Initialization puts the bus in a defined starting condition.

Initialization is initiated

- By voltage connection (when the module is plugged in),
- Upon reception of a "Reset processing" instruction telegram.

During the initialization phase the STEA disturbance light-emitting diode is flashing for approx. 4 seconds.

Loading and saving user lists

By use of the PDDS, the user loads the desired marshalling, limit-value, and measuring-range expansion lists into the RAM of the module using the bus connection. The relatedness of the lists is checked by the PDDS. After further plausibility checks, the module begins to process the user data from the RAM.

On the PDDS, the type designations of the modules belonging to the PROCONTROL-PS protection system are indicated without an "S". Modules 70BT01 and 70BV01 are not configurable from the PDDS.

In order to file the user data in the nonvolatile EEPROM, a "Save" (SAV) instruction is used on the PDDS for transferring the user program from the RAM into the EEPROM. Then, the module continues working with the lists filed in the EEPROM. Now, it is possible to make changes or additions in the RAM.

Connecting modules to the PROCONTROL-PS bus

The 88QT03 bus coupling module as well as the modules of the PROCONTROL-PS bus may be plugged in during operation.

When the bus coupling is plugged in, it is initialized automatically (if user lists have already been loaded into the EEPROM), and the PROCONTROL-PS bus is coupled to the station bus after initialization is completed.

Processing

The processing section is the central part of the module, employing microprocessor II. The station bus shared memory and the shared memory of the PROCONTROL-PS bus serve as internal interface. Transmission time between the two memories is ≤ 20 ms (≤ 10 ms without limit-value generation or measuring range expansion).

For data transfer between the two shared memories, generally the following applies:

- The station bus receiving shared memory (for data transfer from station bus to PROCONTROL-PS bus) uses 255 free registers.
- The station bus sending shared memory (for data transfer from PROCONTROL-PS bus to station bus) uses 200 free registers.
- The shared memory of the PROCONTROL-PS bus uses (for both directions of transfer) a total of 256 free registers.

The addresses of the PROCONTROL-PS bus (input and output) telegrams and the register addresses of the shared memory of the PROCONTROL-PS bus are identical. Use, however, is arbitrary.

Additionally, the processing section performs the following (user-specific) functions:

- a) In the input direction
(from PROCONTROL-PS bus to station bus)
 - Binary-value telegrams:

Marshalling, in telegrams, from shared memory of the PROCONTROL-PS bus to an arbitrary register of the station bus sending shared memory; event processing. Marshalling may be either in telegrams or in bits.
 - Analog-value telegrams:

Marshalling from the shared memory of the PROCONTROL-PS bus to an arbitrary register of the station bus sending shared memory; input signal monitoring; limit-value generation; modification of plausibility limits; event processing.
- b) In the output direction
(from station bus to PROCONTROL-PS bus)
 - Binary-value telegrams:

Marshalling from the station bus receiving shared memory to an arbitrary register of the shared memory of the PROCONTROL-PS bus (= output address of PROCONTROL-PS bus). Marshalling may either be in telegrams or in bits.
 - Analog-value telegrams:

Marshalling from the station bus receiving shared memory to an arbitrary register of the shared memory of the PROCONTROL-PS bus (= output address of PROCONTROL-PS bus). A measuring-range expansion may be programmed for each analog value.

A data telegram (analog or binary) received from the station bus may be put out on several PROCONTROL-PS bus outputs (= output addresses of PROCONTROL-PS bus) at the same time, depending on user-specific programming.

Input signal monitoring

The analog values of the analog input modules connected to the PROCONTROL-PS bus are generally not monitored for plausibility.

Monitoring for plausibility may be programmed for the 70EAXx modules, depending on the user-specific requirements, individually for each input signal.

As soon as the monitoring function is activated, bit 14 is set in diagnosis register 246 (indicating a disturbance of the process).

The disturbed measured value, however, is transferred together with the set disturbance bit. Additionally, disturbance light-emitting diode ST is energized.

Limit signal generation

Up to four limit signals can be generated in the processing section for every analog value received from the PROCONTROL-PS bus.

The limit-value telegram, thus generated, is written into that register of the station bus sending shared memory which follows the analog register.

This is to ensure a logic allocation of analog-value telegrams and limit-value telegrams in the PROCONTROL bus system.

Limit-value telegrams are composed in correspondence with data type 3.

A maximum of three values may be programmed for limit signal generation, depending on the user-specific requirements:

- The actual limit value (0 % - 110 % of the measuring range selected),
- One of four possible hysteresis values per limit value,
- Alternatively maximum-value or minimum-value selection for each limit value.

These values are filed in the user EEPROM.

Each individual limit value may be assigned one of the four following hysteresis values:

- HY1 = 0.39 %
- HY2 = 1.56 %
- HY3 = 3.12 %
- HY4 = 6.25 %

The hysteresis may be above or below the limit value depending on whether a selection has been made for underrunning the minimum value or overrunning the maximum value (see figure 1).

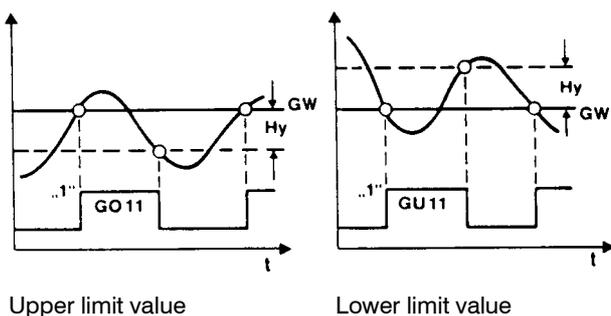


Figure 1: Possible limit value settings

Any change of a limit signal will be indicated to the station bus as an event.

As soon as the input signal monitoring is activated, all limit signals (GOXX, GUXX) assigned to the measured variable will be set to "0" and the disturbance bits (MXX, SMX) will be set to "1" (see also "Telegram assignment").

Generally, in the station bus sending shared memory one successive register each will be used for analog value and limit values (even if no other limit values have been programmed). For this purpose, the analog values are always written into registers with even-numbered addresses, the limit signals are written into the next odd-numbered register. Unprogrammed limit values are not sent to the station bus.

Event processing

Since PROCONTROL-PS bus modules are not provided with an event feature, this function will be carried out by the processing section of the module.

Normally, the coupling module is prompted cyclically by the PROCONTROL bus system to send its data. If these values change within the given cycle time, this is going to be treated as an "event".

The coupling module recognizes the following occurrences as an event:

With analog input signals:

- Change of limit signal
- Activation of input signal monitoring
- Change of a measured variable by an adjustable value within an adjustable time since the last transfer to the station bus (see "Operating modes").

With binary input signals:

- Change of any bit in the data telegram.

Whenever an event occurs, the new values are given priority when being transferred to the PROCONTROL bus system.

Measuring range expansion

When analog values are transferred from the station bus to the PROCONTROL-PS bus, a measuring range expansion is possible.

The processing section obtains the particular (user-specific) information required through expansion parameters X1 (= 0 %) and X2 (= 100 %) which are filed in the user EEPROM.

This way, it is possible to issue only the 10 mA (= X1) ... 15 mA (= X2) range of a 0 ... 100 % signal received from the station bus as a new 0/4...20 mA signal to the PROCONTROL-PS bus.

The following condition applies to the expansion parameters:

$$| X2 - X1 | \geq 6.25 \%$$

If this condition is not fulfilled, a diagnosis signal for "Parameter error" is given inside the module.

In the case of data transfer including measuring range expansion, the transmission time inside the module is increased, for all values transmitted, to a total of 20 ms.

Addressing and data communication

The data telegrams to be received from the station bus are user-specific and indicated by the module under their source addresses. They are written into the sink registers of the station bus receiving shared memory.

If no telegrams are received from the station bus, the module reacts as follows:

- In the case of marshalling telegram by telegram to the shared memory of the PROCONTROL-PS bus, either the last valid value or "zero" will be transmitted (see "Operating modes"). In the case of telegrams containing data types >0, the "general" disturbance bit (bit position 0) will be set additionally.
- In the case of marshalling bit by bit to the shared memory of the PROCONTROL-PS bus, either the last valid value or "zero" will be transmitted (see "Operating modes").

In case the general disturbance bit has been set in a data telegram received by the station bus, the response of the module will depend on the position number of the processing program: up to P0005, "zero" will be transferred to the shared memory of the PROCONTROL-PS bus, from P0006 on, the value remains unchanged.

If no telegrams are received by the PROCONTROL-PS bus, the missing station bus telegrams are not sent to the PROCONTROL bus system.

Telegram allocation

The following table shows the bit significances for all telegrams which are generated by the PROCONTROL-PS bus modules.

In the form shown (not marshalled), they are written (after user-specific marshalling from the shared memory of the PROCONTROL-PS bus) into the station bus sending shared memory. From there they are transferred (under the source addresses resulting from programming) into the PROCONTROL bus system as source data telegrams. In this case, the column for "Reg. no." refers to the (arbitrary) register address in the station bus sending shared memory (as a component part of the overall source address).

As to their composition and bit significance, analog and binary telegrams, which are generated (according to user or firmware programs) inside the module by the 70PR03 computing module or the 70BK03 coupling module connected to the PROCONTROL-PS bus, and which are transferred into the PROCONTROL bus system, correspond to the analog/binary structure shown in the following table.

Reg. no.	Information	Telegram																DA
		← Bit position →																
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
n	Analog value 70EA01 FEX (1...4)	VZ	100 %	50 %	25 %	12.5 %	6.25 %	3.125 %	1.56 %	0.78 %	0.39 %	0.195 %	0.097 %	0.048 %	0	0	SB	5
n+1	Limit value FEX (1...4)	0	0	0	GOX4	GUX4	MX4	GOX3	GUX3	MX3	GOX2	GUX2	MX2	GOX1	GUX1	MX1	SMX	3
n	Analog value 70EA02 FEX (1...4)	VZ	100 %	50 %	25 %	12.5 %	6.25 %	3.125 %	1.56 %	0.78 %	0.39 %	0.195 %	0.097 %	0.048 %	0	0	SB	5
n+1	Limit value FEX (1...4)	0	0	0	GOX4	GUX4	MX4	GOX3	GUX3	MX3	GOX2	GUX2	MX2	GOX1	GUX1	MX1	SMX	3
n	Binary value 70EB02 FE (1...16)	EB16	EB15	EB14	EB13	EB12	EB11	EB10	EB09	EB08	EB07	EB06	EB05	EB04	EB03	EB02	EB01 *)	**)

Explanation of the abbreviations used:

SMX = General disturbance bit for telegram
 SB = Disturbance bit for telegram
 MXX = Individual disturbance annunciation for limit value X
 VZ = Sign
 GOXX = Limit value X exceeded
 GUXX = Limit value X shortfall
 FEX = Function unit
 EBXX = Binary input signal XX
 DA = Data type in the station bus telegram

*) not usable for station bus ($\hat{=}$ general disturbance bit)
 **) in the case of marshalling telegram by telegram 0
 in the case of marshalling bit by bit 1

Diagnosis and annunciation functions

Disturbance annunciations on the module

Light-emitting diodes on the module front are intended for the following annunciations:

	Designation of LED
– Disturbance	ST
– Disturbance Input/output station	STEA

Light-emitting diode ST signals all disturbances of the module and of data transfer with the module.

The red light-emitting diode STEA may either be on, emitting a steady light or a flashing light the significance of which is:

- Steady light: Disturbances of the PROCONTROL-PS bus or of the PROCONTROL-PS bus interface inside the module.
- Flashing light: For approx. 4 s, either when voltage is connected or when data is copied internally from the EEPROM into the working memory (RAM). When STEA is off after approx. 4 s, the module is ready for operation. In case STEA continues to flash, a disturbance is present.

Disturbance annunciation signal to the alarm annunciation system

From the bus, the alarm annunciation system and the CDS control diagnostic system receive disturbance signals issued by the bus coupling module.

Disturbance signals are stored and are indicated to the bus system, using the SS interface (SST data line), in the form of a general disturbance signal. In that event, the internal diagnosis registers of the module are read out by the bus system for further evaluation.

Status signals

Yellow light-emitting diode SIM will emit a steady light if at least one PROCONTROL-PS bus output value is simulated. It is also energized, in case user data (e.g. address list, limit values) have been changed on-line from the PDDS or when the module is using the lists filed in the RAM.

Green light-emitting diode EAVE emits a steady light as long as the 88QT03 module participates in the PROCONTROL-PS bus data transfer.

Diagnosis

Internally, the module can make use of a number of diagnostic functions which form part of the (cyclically operating) basic module program (firmware). These include:

- Function testing of the PROCONTROL-PS bus including the internal PROCONTROL-PS bus interface as well as monitoring of received PROCONTROL-PS bus telegrams.
- Mutual checking of microprocessors I and II.
- Checking of internally generated data lists by means of parity bits (internal data protection)
- Sink time monitoring function checking whether all station bus telegrams needed by the module (acc. to the bus address list) are received on a regular basis. In the event of absence of such telegrams, the sink time monitoring function is activated (as is the case with all other station bus modules).
- Annunciation of external disturbances.
The disturbance signal inputs SME1, SME2, SME3, SMS, and STX at the X21 connector are used for diagnosing external disturbance signals and are filed in the diagnosis register (register address 211) (see also figure 3).

When a disturbance occurs, the type of defect is filed in the diagnosis register and a disturbance annunciation signal is sent to the PROCONTROL system at the same time.

Upon request, the module sends a telegram containing the data stored in the diagnosis register (register 246) (see figure 2).

The contents of the diagnosis register, the signals from the general disturbance line, the annunciations on the CDS diagnostic system, and annunciation ST are shown in figures 2 to 4.

Connection of PROCONTROL-PS bus using 70BT01

The bus coupling module is connected to the PROCONTROL-PS protection system by means of the 70BT01 bus isolation amplifier. In this case the 89IQ10 connecting cable (of a max. length of 5 m) shall be used according to the connection diagram.

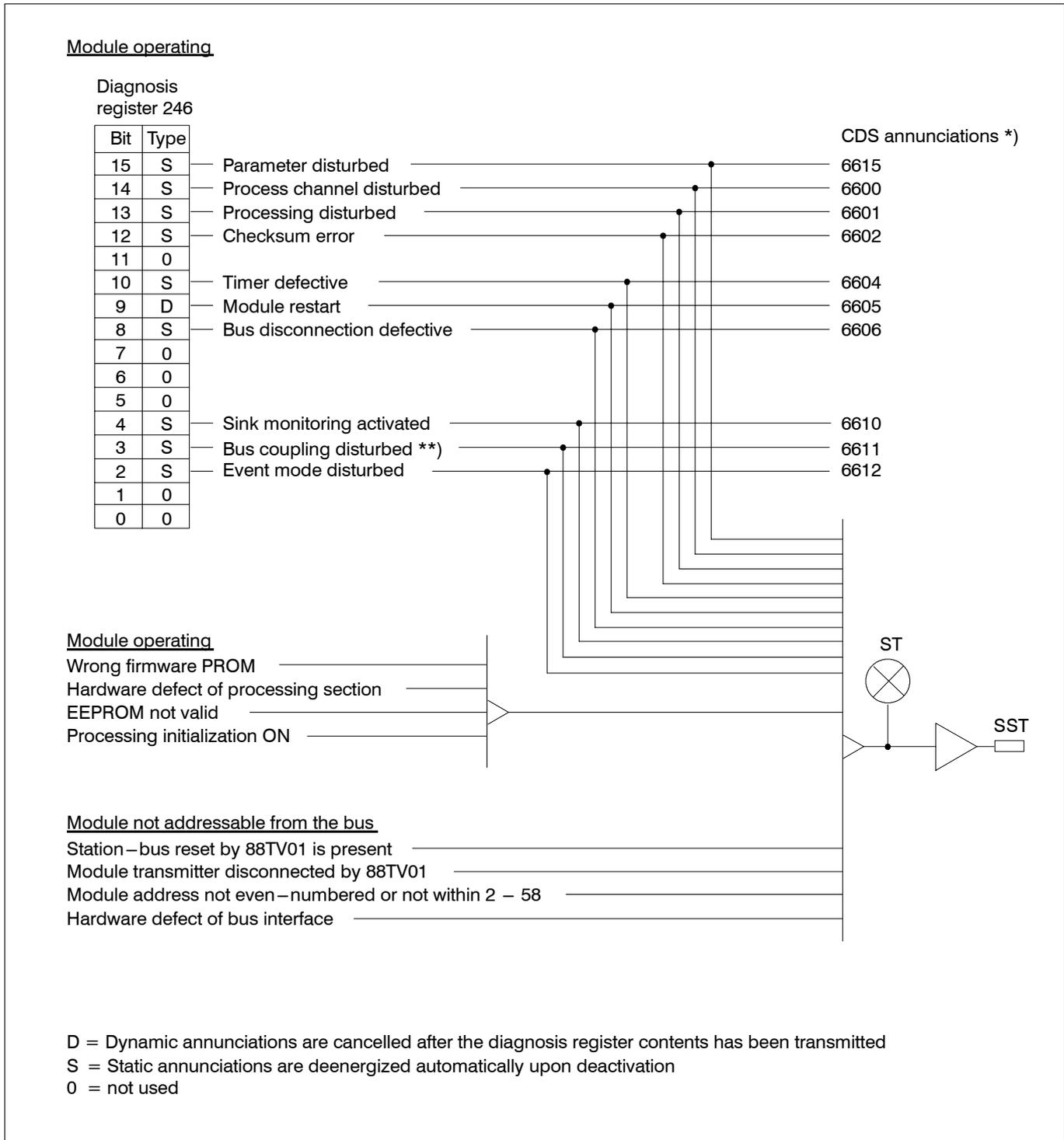


Figure 2: 88QT03 diagnosis signals, register 246

When "Process channel disturbed" is indicated in the diagnosis register, this may be due to the following reasons:

- Reception of a disturbed data telegram from the PROCONTROL-PS bus,
- Plausibility monitoring function activated.

*) The control diagnostic system (CDS) provides a description for each annunciation number, containing for instance:

- Explanations regarding cause and effects of the disturbance,
- Recommendations regarding remedies.

This makes for fast disturbance elimination.

***) If "Bus coupling disturbed" is indicated in the diagnosis register, the cause of the disturbance is located in the PROCONTROL-PS bus and is annunciated in the additional diagnosis register (register 211) (see also figures 3 to 4).

Diagnosis
register 211

Bit	Typ
15	S
14	S
13	S
12	S
11	0
10	0
9	0
8	0
7	0
6	0
5	0
4	S
3	S
2	S
1	S
0	S

0 \

0

0

1

Error code 1: SM. is set

In this case:

SMS – General annunciation "Simulation"

SMX – General disturbance "XY monitoring"

SME3 set

SME2 set

SME1 set

CDS annunciations *)

6616

Diagnosis
register 211

Bit	Typ
15	S
14	S
13	S
12	S
11	0
10	0
9	0
8	0
7	0
6	0
5	0
4	0
3	S
2	S
1	0
0	S

0 \

0

1

0

Error code 2:

In this case:

EEPROM defective

RAM defective

Module PROM defective

6659

6638

6636

S = Static annunciations are cancelled automatically upon deactivation

0 = not used

Figure 3: 88QT03 diagnosis signals, register 211

*) The control diagnostic system (CDS) provides a description for each message number, containing for instance:

- Explanations regarding cause and effect of the disturbance
- Recommendations of remedies.

This makes for fast disturbance elimination.

If several errors are present at the same time, the error assigned the highest error code will be annunciated.

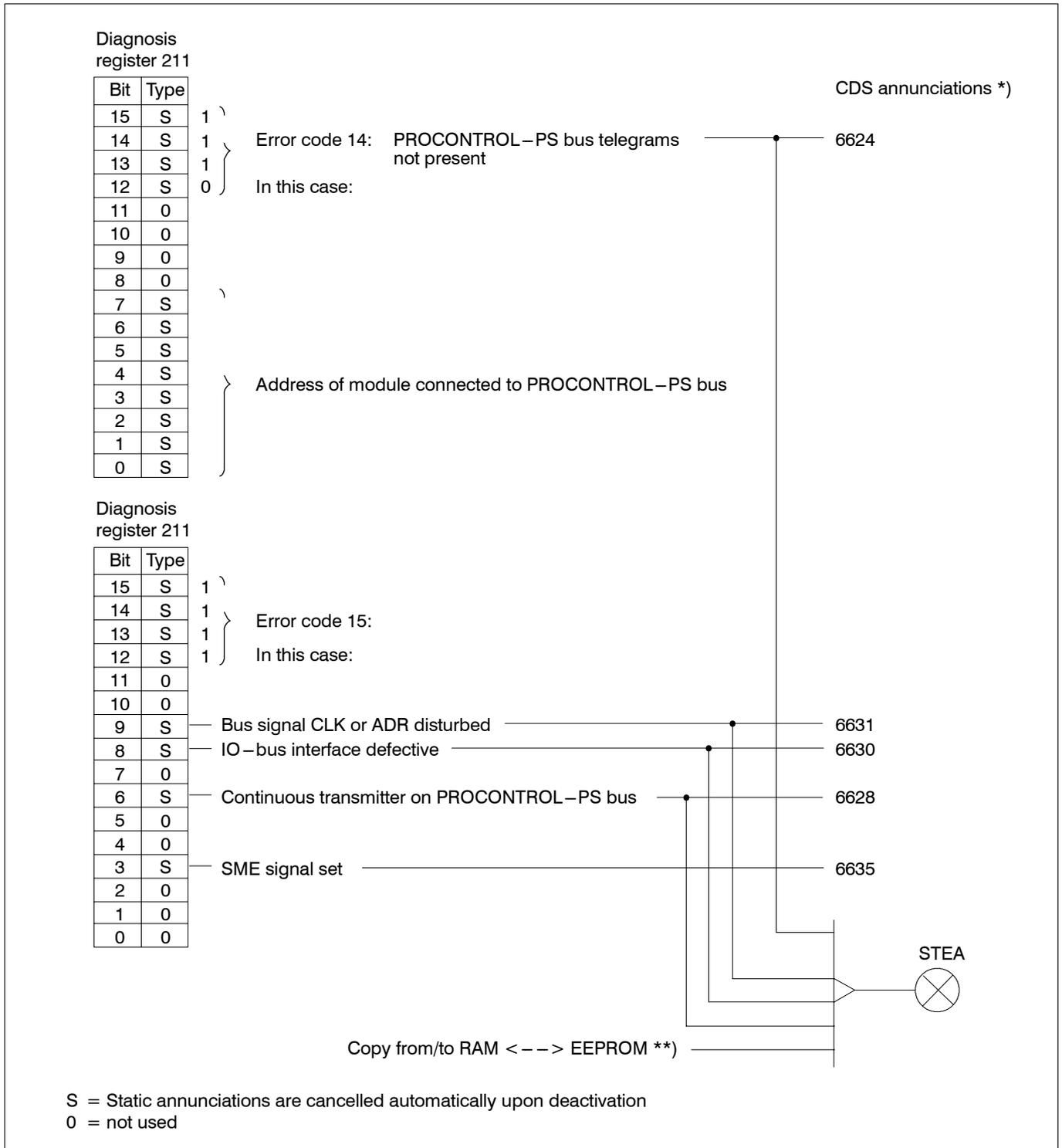


Figure 4: 88QT03 diagnosis signals, register 211

*) The control diagnostic station (CDS) provides a description for each annunciation number, containing for instance:

- Explanations regarding cause and effect of disturbance
- Recommendations of remedies.

This makes for fast disturbance elimination.

***) Flashing light

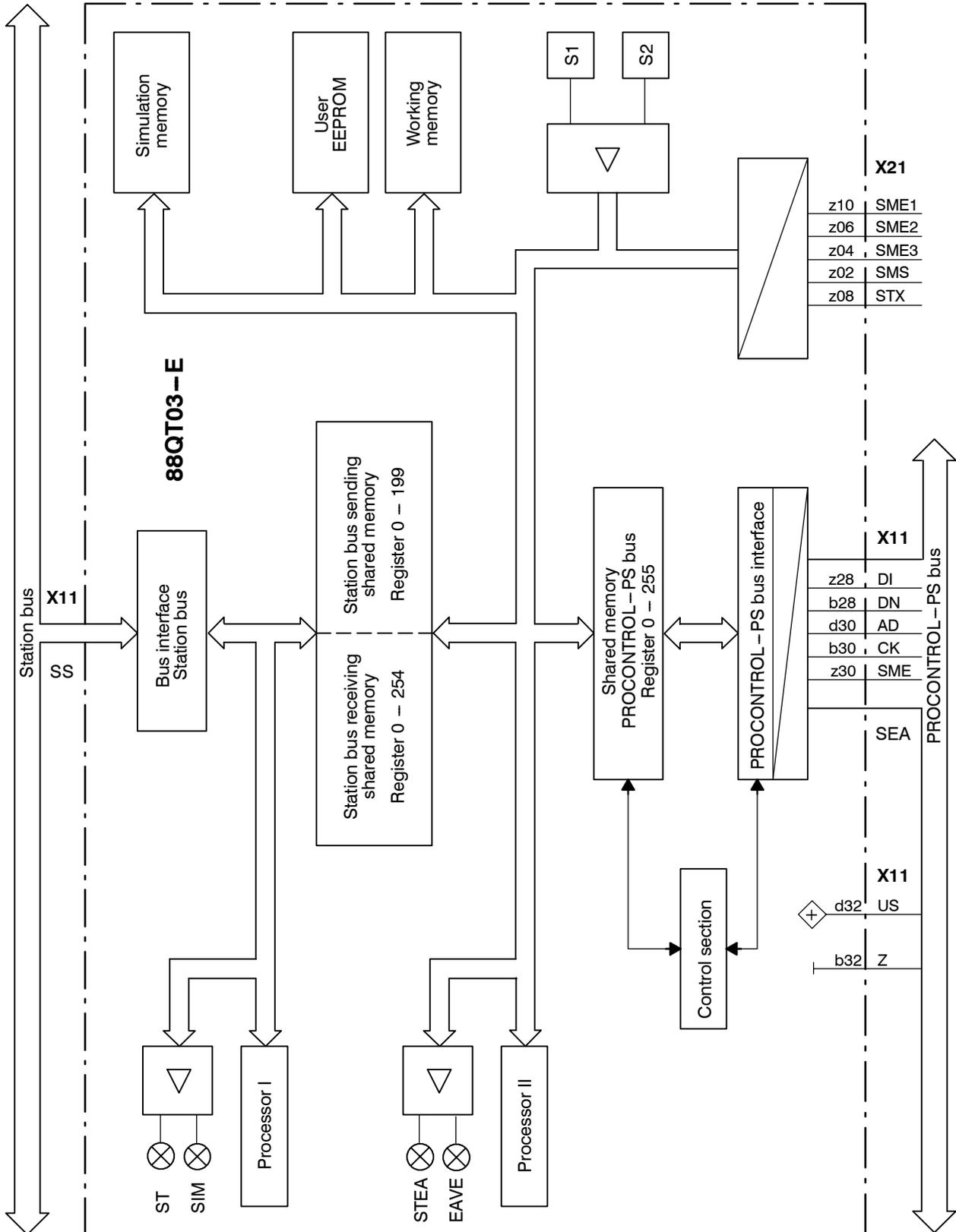
In case several errors are present at the same time, the error assigned the highest error code will be annunciated.

Function diagram

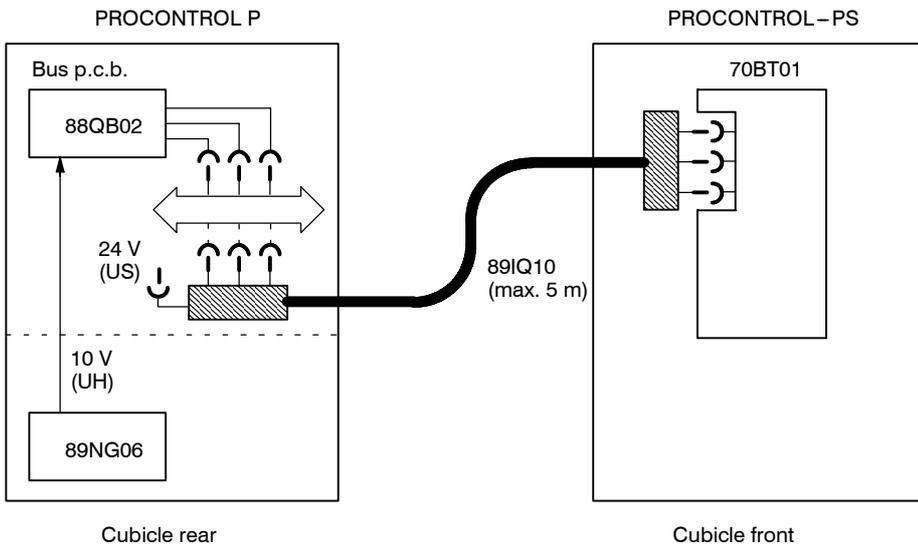
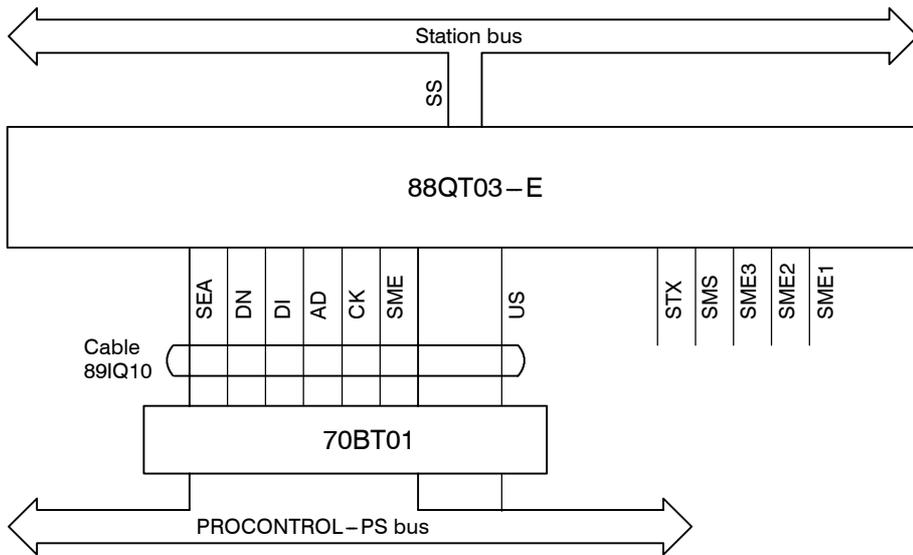
Terminal designations

The module includes two connectors, X11 and X21. X11 con-

taining the standard SS interface with the station bus as well as the standard SEA interface with the PROCONTROL-PS bus. X21 incorporates five binary inputs which may be used for transmitting individual disturbance annunciation signals to the PROCONTROL bus system.



Connection diagram



Mechanical design

View of connector side:

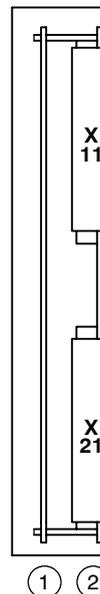
Board size: 6 units, 2 divisions, 160 mm deep

Connector: 1 x for connecting station bus and PROCONTROL-PS bus
48-pole, edge-connector type F (connector X11)

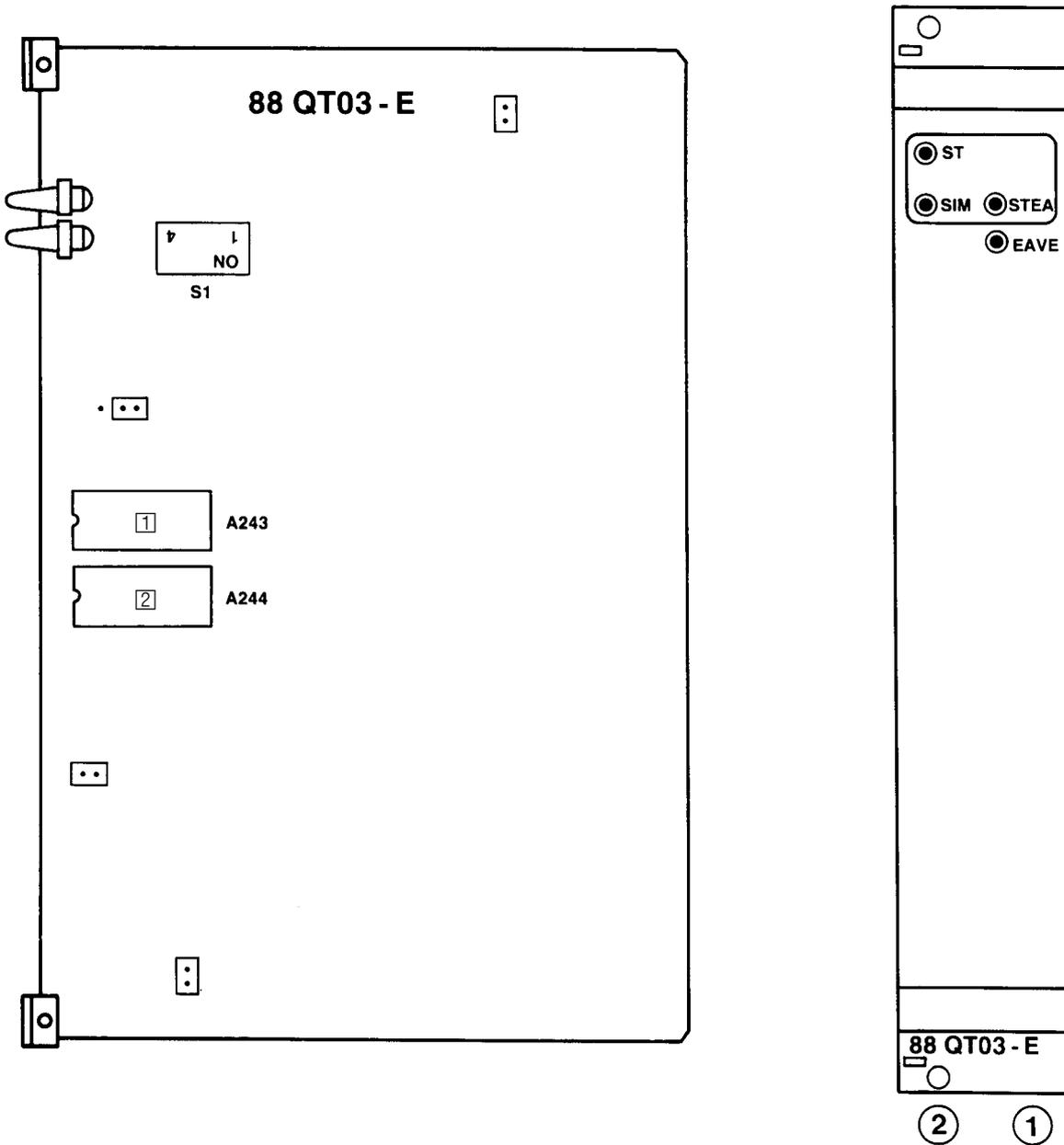
1 x for external disturbance signals
32-pole, edge-connector type F (connector X21)

Weight: approx. 0.83 kg

Both boards are mechanically and electrically connected.



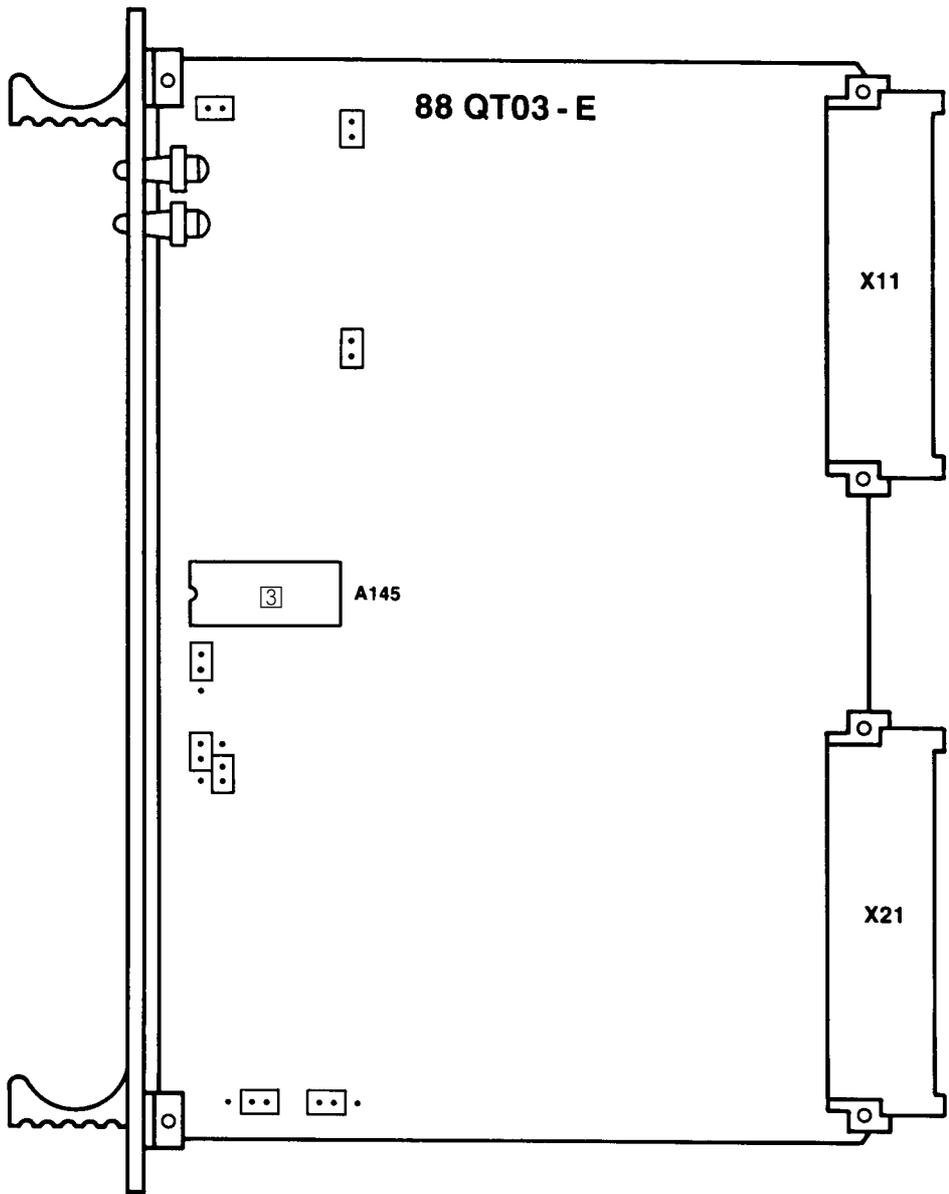
Position of switches, jumpers, memory modules on p.c.b. 1 and front



Memory modules:	Order number: (Memory module programmed)
① Processing program, A243 (low-byte)	GKWE 857 012 Pxxxx
② Processing program, A244 (high-byte)	GKWE 857 013 Pxxxx

xxxx = Position number depending on the applicable module version.

Position of jumpers and memory module on p.c.b. 2



Memory module:	Order number: (Memory module programmed)
③ Station bus program, A145	GKWE 857 011 Pxxxx

xxxx = Position number depending on the applicable module version.

Technical Data

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

Power supply

Operating voltage	US = 24 V
Current consumption	IS = 0.5 A
Power dissipation, typ.	P = 12 W
Reference potential	Z = 0 V

Module interfaces

SS – Standard interface with station bus
SEA – Standard interface with PROCONTROL–PS bus

Input values

SME1, SME2, – Annunciations of external disturbances	1 input each
SME3, SMS, STX	

ORDERING DATA

- Complete module:
Type designation: 88QT03–E/R2011 Order number: GJR2374500R2011
- Appropriate cable:
Type designation: 89IQ10 Order number: GKWE602215Rxxxx
(xxxx = length in cm)
- Memory modules:
see "Mechanical design"

Technic data are subject to change without notice!



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