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Module Description

Coupling Module

Serial interface for the station bus

Publication No.
D KWL 6312 96 E, Edition 04/96

87TS01–E/R12../R13../R15..

Application

Module 87TS01 is a coupling module for connecting computers or external systems to the PROCONTROL system.

For this purpose, the module is equipped with a serial interface type RS232c or RS422 through which a process operator station POS, a programming, diagnosis and display system PDDS, control diagnosis station CDS or another computer can communicate with the PROCONTROL system.

The module's scope of action extends over the entire PROCONTROL system.

The application of the various module versions is described in the relevant application descriptions.

Features

The module can be used in any station belonging to the PROCONTROL bus system using a redundant 24 V module supply (starting with 89MS01/R0200 or 89MS02/R0100). It is equipped with a standard interface for the PROCONTROL station bus.

This module requires 2 divisions for mounting space. It can be plugged into subrack slots with address wiring 1 through 58 for the station bus.

The module uses a standard interface for participating in data communication within the PROCONTROL system.

The telegrams received from the station bus are checked for error–free transmission.

Using a serial RS 232c interface, the module is capable of receiving instructions and data coming from a computer in accordance with a defined protocol, as well as transferring instructions and data to a computer.

Design of the module

The module essentially consists of:

– Station–bus interface

– Processing section

– Serial interface in accordance with RS 232c or RS 422

Station–bus interface

The station–bus interface is responsible for conditioning the telegrams to be received and transmitted through the station–bus interface.

The module uses two shared memories:

One 'receive shared memory' for the telegrams to be received and one 'send shared memory' for the telegrams to be sent.

The use of a standard station–bus interface limits the number of receive telegrams that can be received at the same time to a maximum of 230, using addresses 0...229 of the receive shared memory.

The number of send–location telegrams is limited to a maximum of 200 at addresses 0...199 of the send shared memory.

The exact number of receive or send–location telegrams is given in the application descriptions for the individual software versions.

The entire data exchange taking place between station–bus interface and processing section is handled by the shared memories.

Processing section

Technical features are described in the relevant application descriptions for the individual software versions.

Serial interface

Two 25−pole connectors, X1 and X2, both wired in parallel, are mounted on the module front.

They both contain one RS 232c interface and one RS 422 interface each. However, only one type of interface per connector can be active.

Each one of these two interfaces contains two channels: channel 1 and channel 2.

The RS 232c interface is used for connecting a computer to the module. This is done through channel 1 of the RS 232c interface. Either one of the two connectors, X1 or X2, can be used for this purpose.

Channel 2 of interface type RS 232c cannot be used for interfacing a computer.

The RS 422 interface serves the purpose of parallel−connecting up to five 87TS01 modules and connecting them jointly to the computer using an RS 232c interface.

For this purpose, the modules are given a certain module address specifically for the computer, a so−called coupling−module number.

The coupling−module number helps the computer to distinguish the modules jointly connected.

Connection of a computer or parallel connection of several 87TS01 modules requires the use of tailored standard cable sets.

Among other things, these cables contain circuitry for automatic changeover from the RS 422 to the RS 232c interface.

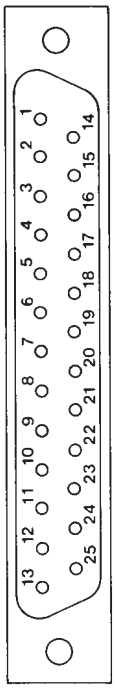
In the absence of a specific circuitry, in both connectors X1 and X2, interface type RS 422 will be active.

Changeover from interface type RS 422 to interface type RS 232c takes place via the ENABLE line which, in both connectors, is linked to contact 13.

As soon as the BUSEN signal from the ENABLE line is applied to GND, a changeover to the RS 232c interface will take place in the connector concerned.

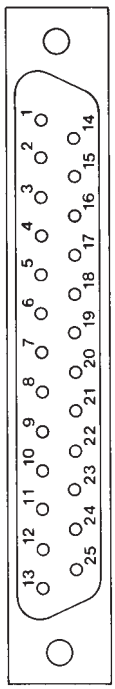
The following figures show the contact assignments of connectors X1 and X2 wired in parallel.

Contact assignments connectors X1 and X2:



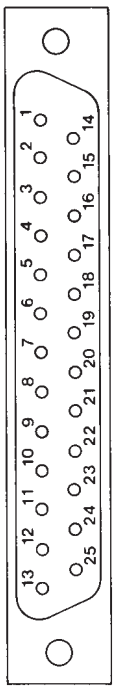
SAL	Screen conductor *)
+5 V	+5 V voltage supply (max. 1 A)
TxD−1	TRANSMIT DATA CHANNEL 1 acc. to RS232c
TxD−2	TRANSMIT DATA CHANNEL 2 acc. to RS232c
RxD−1	RECEIVE DATA CHANNEL 1 acc. to RS232c
RxD−2	RECEIVE DATA CHANNEL 2 acc. to RS232c
+ CD−1	CARRIER DETECT CHANNEL 1 acc. to RS422 (+)
− CD−1	CARRIER DETECT CHANNEL 1 acc. to RS422 (−)
+ CTS−1	CLEAR TO SEND CHANNEL 1 acc. to RS422 (+)
− CTS−1	CLEAR TO SEND CHANNEL 1 acc. to RS422 (−)
+ DTR−1	DATA TERMINAL READY CHANNEL 1 acc. to RS422 (+)
− DTR−1	DATA TERMINAL READY CHANNEL 1 acc. to RS422 (−)
GND	0 V
GND	0 V
+ RTS−1	REQUEST TO SEND CHANNEL 1 acc. to RS422 (+)
− RTS−1	REQUEST TO SEND CHANNEL 1 acc. to RS422 (−)
+ TxD−1	TRANSMIT DATA CHANNEL 1 acc. to RS422 (+)
− TxD−1	TRANSMIT DATA CHANNEL 1 acc. to RS422 (−)
+ RxD−1	RECEIVE DATA CHANNEL 1 acc. to RS422 (+)
− RxD−1	RECEIVE DATA CHANNEL 1 acc. to RS422 (−)
+ TxD−2	TRANSMIT DATA CHANNEL 2 acc. to RS422 (+)
− TxD−2	TRANSMIT DATA CHANNEL 2 acc. to RS422 (−)
+ RxD−2	RECEIVE DATA CHANNEL 2 acc. to RS422 (+)
− RxD−2	RECEIVE DATA CHANNEL 2 acc. to RS422 (−)
/BUSEN	ENABLE RS422 −−> RS232c, RS232c −−> RS422

Active contact assignments for interface type RS 232c:



SAL	Screen conductor *)
TxD−1	TRANSMIT DATA CHANNEL 1 acc. to RS232c
TxD−2	TRANSMIT DATA CHANNEL 2 acc. to RS232c
RxD−1	RECEIVE DATA CHANNEL 1 acc. to RS232c
RxD−2	RECEIVE DATA CHANNEL 2 acc. to RS232c
GND	0 V
/BUSEN	ENABLE RS422 −−> RS232c, RS232c −−> RS422

Active contact assignments for interface type RS 422:



SAL	Screen conductor *)
+5 V	For bus termination 89IP04, 1 A fuse on module
+ CD−1	CARRIER DETECT CHANNEL 1 acc. to RS422 (+)
− CD−1	CARRIER DETECT CHANNEL 1 acc. to RS422 (−)
+ CTS−1	CLEAR TO SEND CHANNEL 1 acc. to RS422 (+)
− CTS−1	CLEAR TO SEND CHANNEL 1 acc. to RS422 (−)
+ DTR−1	DATA TERMINAL READY CHANNEL 1 acc. to RS422 (+)
− DTR−1	DATA TERMINAL READY CHANNEL 1 acc. to RS422 (−)
GND	0 V
GND	0 V
+ RTS−1	REQUEST TO SEND CHANNEL 1 acc. to RS422 (+)
− RTS−1	REQUEST TO SEND CHANNEL 1 acc. to RS422 (−)
+ TxD−1	TRANSMIT DATA CHANNEL 1 acc. to RS422 (+)
− TxD−1	TRANSMIT DATA CHANNEL 1 acc. to RS422 (−)
+ RxD−1	RECEIVE DATA CHANNEL 1 acc. to RS422 (+)
− RxD−1	RECEIVE DATA CHANNEL 1 acc. to RS422 (−)
+ TxD−2	TRANSMIT DATA CHANNEL 2 acc. to RS422 (+)
− TxD−2	TRANSMIT DATA CHANNEL 2 acc. to RS422 (−)
+ RxD−2	RECEIVE DATA CHANNEL 2 acc. to RS422 (+)
− RxD−2	RECEIVE DATA CHANNEL 2 acc. to RS422 (−)
/BUSEN	ENABLE RS422 −−> RS232c, RS232c −−> RS422

*) Screen conductor SAL is effective only if the front panel of the module is screw−connected to the subrack.

Note

The electrical interface type is selected by means of a jumper mounted in the connector:

− Jumpers 13 − 20 −> interface RS 232 active

− No jumper −> interface RS 422 active

Annunciation functions

Faults within the module or communication errors are detected by the module and are signalled accordingly.

For this purpose, the module can use two ways of fault annunciation:

– Visual fault annunciation on the module by means of LEDs on the front panel of the module.

– Fault message transferred over the station–bus line as 'General station disturbance SST' of the station bus.

Annunciations on the module

On the module front, two red and two green LEDs are located:

– Light–emitting diode ST

  Red light–emitting diode ST emits a steady light whenever a disturbance has been detected in the area of the station–bus interface.

– Light–emitting diode STV

  Red light–emitting diode STV emits a steady light whenever a disturbance has been detected on the processing section of the module.

Light–emitting diodes ST and STV are operated by the station–bus interface.

ST or STV are put out to the station bus in the form of a 'General disturbance' signal transmitted over SST bus line.

Green LEDs M1 and M2 indicate operating states of the processing section and are operated by the processing section.

M1 indicates that the serial output is activated. M2 indicates that job processing is activated.

For disturbance signalling on the station bus, the 'General disturbance' signal is put out to the station bus via the SST bus line.

Diagnosis

Throughout the entire PROCONTROL system, it is possible to diagnose and indicate the status of any module within this system from a control diagnosis station.

Module settings

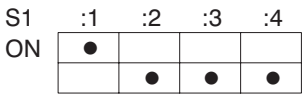
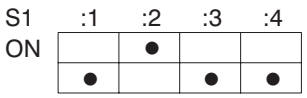
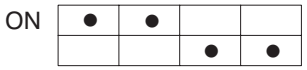
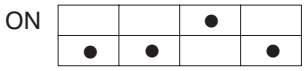
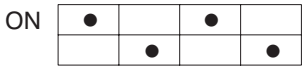
All module–specific and application–specific settings are implemented on the module either by using dual in–line switches or jumpers, i.e. either plug–in type jumpers or wire–wrap connections are used.

Setting the coupling–module numbers

Up to five 87TS01 modules can be connected in parallel to the serial interface.

The coupling–module numbers are used by the computer to identify the individual modules. This number may be assigned only once per computer.

The numbers are set at switch S1 using contacts 1 through 4.

Coupling module no.	Switch positions
1	
2	
3	
4	
5	

Setting the baud rate

The serial interfaces are capable of operating at different baud rates.

The basic factory setting for both channels is 9600 baud.

Both channels of the serial interface can be set separately, the respective setting then also being effective for the appropriate channel of the RS 422 interface.

Jumpers X7 (wire−wrap connection) and X16 (plug−in jumper) apply to channel 1.

Possible settings for channel 1:

Baud rate [baud]	Jumper X16/1 − X16/2	Wire−wrap connection
300	open	X7/9 − X7/6
600	open	X7/9 − X7/5
1200*	open	X7/9 − X7/4
1200	closed	X7/9 − X7/6
2400*	open	X7/9 − X7/3
2400	closed	X7/9 − X7/5
4800*	open	X7/9 − X7/2
4800	closed	X7/9 − X7/4
9600	closed	X7/9 − X7/3
19200	closed	X7/9 − X7/2

Jumpers X7 (wire−wrap connection) and X15 (plug−in jumper) apply to channel 2.

Possible settings for channel 2:

Baud rate [baud]	Jumper X15/1 − X15/2	Wire−wrap connection
300	open	X7/11 − X7/6
600	open	X7/11 − X7/5
1200*	open	X7/11 − X7/4
1200	closed	X7/11 − X7/6
2400*	open	X7/11 − X7/3
2400	closed	X7/11 − X7/5
4800*	open	X7/11 − X7/2
4800	closed	X7/11 − X7/4
9600	closed	X7/11 − X7/3
19200	closed	X7/11 − X7/2

* Both settings possible.

Plug−in jumper X11 refers to the transmission rate and must always be plugged in.

Memories and jumpers for memory interfacing

Diverse types of memories may be used on the memory positions A104 and A105.

For the various memory types, the appropriate jumpers are provided on the module for interfacing these memories.

For each position, the memory−specific jumper assignments are given below.

Position A401:

This position contains the memory for the bus program of the station−bus interface. There are no jumpers assigned to it.

Memory type:		Jumper:
27C512	EPROM 64 K x 8 bits	−−

Special settings

The two plug−in jumpers X4 are located on the module (cf. 'Mechanical design').

They have no application−related function and are used for factory−testing of the station−bus interface only.

Attention: During normal operation of the module, these two jumpers must always be plugged in.

Positions A107, A109:

These two positions are used for the variables memory (A107 low byte and A109 high byte) of the processing section. The assigned jumper is X6.

Memory type:		Jumper:
62256	RAM 32 K x 8 bits	X6/1 − X6/2 X6/3 − X6/4

Both positions need to be equipped with the same type of memory type.

Positions A106, A108:

These positions contain the program memory (A106 low byte and A108 high byte) of the processing section. The assigned jumpers are X8 and X9.

Memory type:		Jumper:
27C512	EPROM 64 K x 8 bits	X8/2 − X8/3 X9/2 − X9/3

Position A105:

This position contains the shared memory. There are no jumpers assigned to it.

Memory type:		Jumper:
6264	RAM 8 K x 8 bits	– –
62256	RAM 32 K x 8 bits	– –

Position A104:

This position contains the user memory. The assigned jumpers are X20 and X21.

Memory type:		Jumper:
27C256	EPROM 32 K x 8 bits	X20/2 – X20/1 X21/2 – X21/4
27C512	EPROM 64 K x 8 bits	X20/2 – X20/1 X21/2 – X21/1

For versions R13.. and R15.., this position remains unused.

Basic allocation of the memory positions

	R12..	R13..	R15..
A104	27C512	– –	– –
A105	6264	62256	62256
A106, A108	27C512	27C512	27C512–15
A107, A109	62256	62256	62256
A401	27C512	27C512	27C512

* Interface between station–bus interface and processing section.

Basic setting of the module and assignments of other jumpers and connectors

Connectors:

X1	Connector, 25–pole Serial interface acc. to RS 232c or RS 422
X2	Connector, 25–pole Serial interface acc. to RS 232c or RS 422
X3	Connector, 48–pole Standard station–bus interface SS
X4	Connector, 48–pole 24 V voltage supply
X40	Connector, 50–pole Testing of processing section and processor 80186
1 – 16*	Male testing connector, 16–pole Testing of station–bus interface
40*	Male testing connector, 22–pole Testing of station–bus interface
60*	Male testing connector, 20–pole Testing the station–bus interface

Jumpers:

No.	Meaning	R12../R15..	R13..
X4	Basic setting for station–bus interface (clock)	X4/1 – X4/2 X4/3 – X4/4	X4/1 – X4/2 X4/3 – X4/4
X5	Basic setting for processor 80186	X5/1 – X5/4 X5/1 – X5/5 X5/2 – X5/3 X5/2 – X5/12 X5/14 – X5/15	X5/1 – X5/4 X5/1 – X5/5 X5/2 – X5/3 X5/2 – X5/12 X5/14 – X5/15
X6	Variables memory (cf. memory interface)	X6/1 – X6/2 X6/3 – X6/4	X6/1 – X6/2 X6/3 – X6/4
X7	Baud rate of channel 1 and channel 2, 9600 baud each (cf. baud rate settings)	X7/9 – X7/3 X7/11 – X7/3	X7/9 – X7/3 X7/11 – X7/3
X8	Program memory (cf. memory interface)	X8/2 – X8/3	X8/2 – X8/3
X9	Program memory (cf. memory interface)	X9/2 – X9/3	X9/1 – X9/2
X11	Baud rate (always plugged in)	X11/1 – X11/2	X11/1 – X11/2
X15	Baud rate of channel 2 (cf. baud rate settings)	X15/1 – X15/2	X15/1 – X15/2
X16	Baud rate of channel 1 (cf. baud rate settings)	X16/1 – X16/2	X16/1 – X16/2
X20	User memory (cf. memory interface)	X20/2 – X20/1	X20/2 – X20/3
X21	User memory (cf. memory interface)	X21/2 – X21/4	X21/2 – X21/4

Function diagram

The module consists of a printed−circuit board with a sub−board (cf. 'Mechanical design').

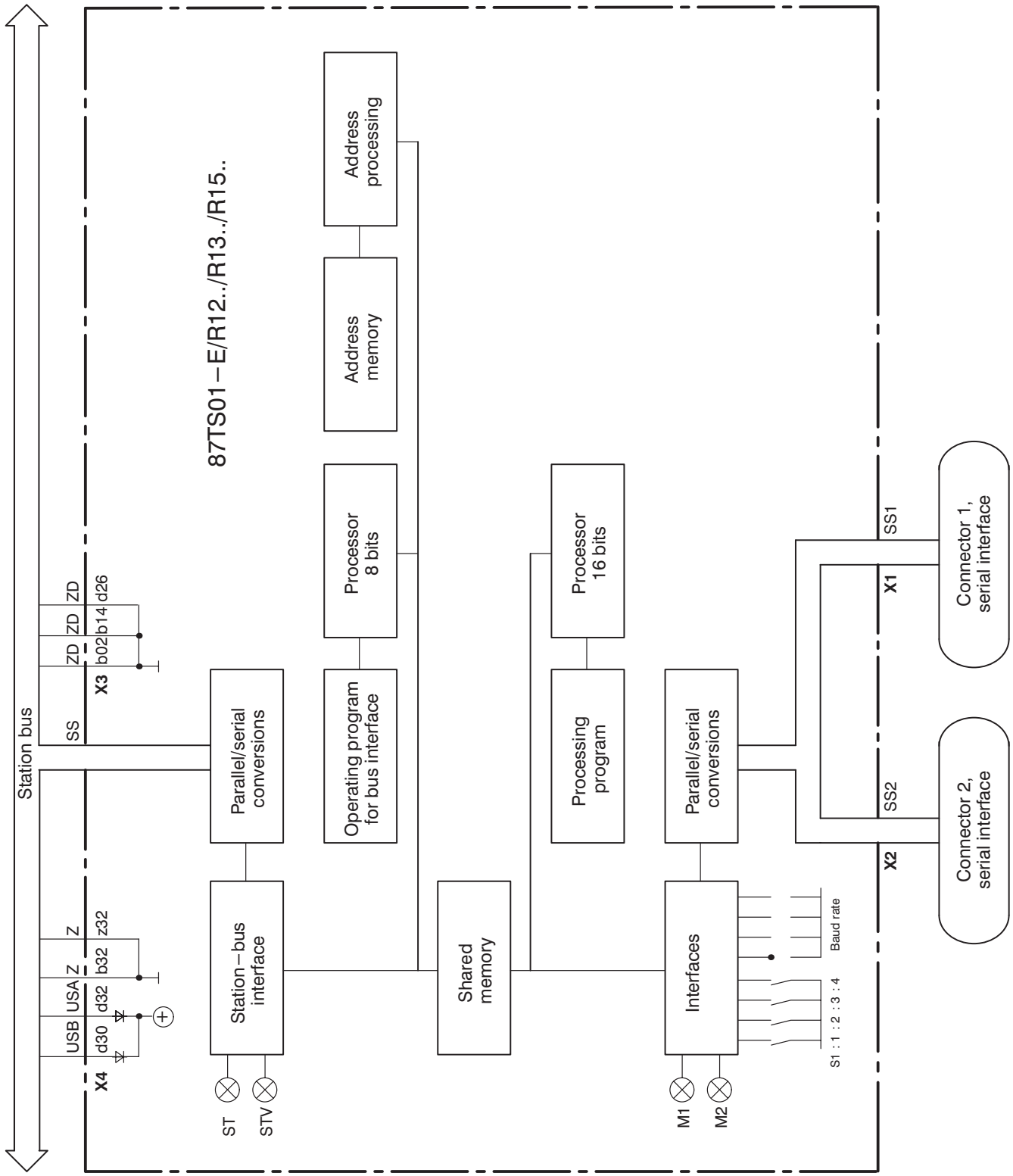
Terminal designations

For communication purposes, the module uses a total of four connectors.

Both connectors, X1 and X2, are located on the module front. They contain the serial interface and are given the designations SS1 and SS2.

Connectors X3 and X4 are located on the module rear.

Connector X3 includes the SS standard interface and earth connections (ZD) for the station bus.
Connector X4 is located on the sub−board and includes the 24 V voltage supply for the module.



Standard accessories

The standard cables and connectors listed below are accessories of the 87TS01 module.

Correct functioning of the possible module combinations is guaranteed only if the standard accessories are used.

89IP03 connecting cable

The 89IP03 connecting cable is used for connecting two 87TS01 modules to the bus. The cable length is 40 mm.

The cable is plugged onto connector X1 or X2 on the module front.

For this purpose, the cable is provided with two 25−pole screw−on D−pin connectors.

RS 422 is the type of interface to be used in combination with the 89IP03 cable.

89IP04 resistor array

The 89IP04 resistor array is designed to ensure a defined signal level when several 87TS01 modules are connected in parallel.

The 89IP04 resistor array consists of 20 resistors which are mounted on a miniature p.c.b..

This miniature p.c.b. is accomodated in a 25−pole screw−on D−pin male connector with a protective cover. The pin−connector is screwed onto the last free connector, X1 or X2, of the module configuration used.

89IP05 connecting cable

The 89IP05 connecting cable serves as the connection between a 87TS01 module and an RS 232c interfacing unit.

The cable is linked to the module by means of a screw−on 25−pole D−pin connector.

Contact with the computer is established by means of a screw−on 25−pole D−jack connector.

The connecting cable is available in four cable lengths:

Designation	Cable length
89IP05/R0005	5 m
89IP05/R0010	10 m
89IP05/R0015	15 m
89IP05/R0020	20 m

Due to the special cable design, changeover to the RS 232c interface is made automatically.

Mechanical design

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

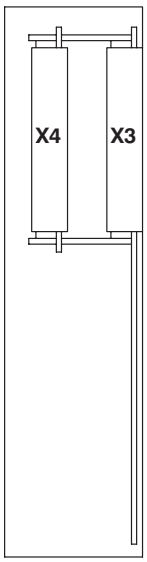
Connector: to DIN 41 612

2 x for station−bus connection and supply
48−pole edge connector, type F
(connector X3 and X4)

2 x for serial interface
25−pole edge connector, type D
(connectors X1 and X2)

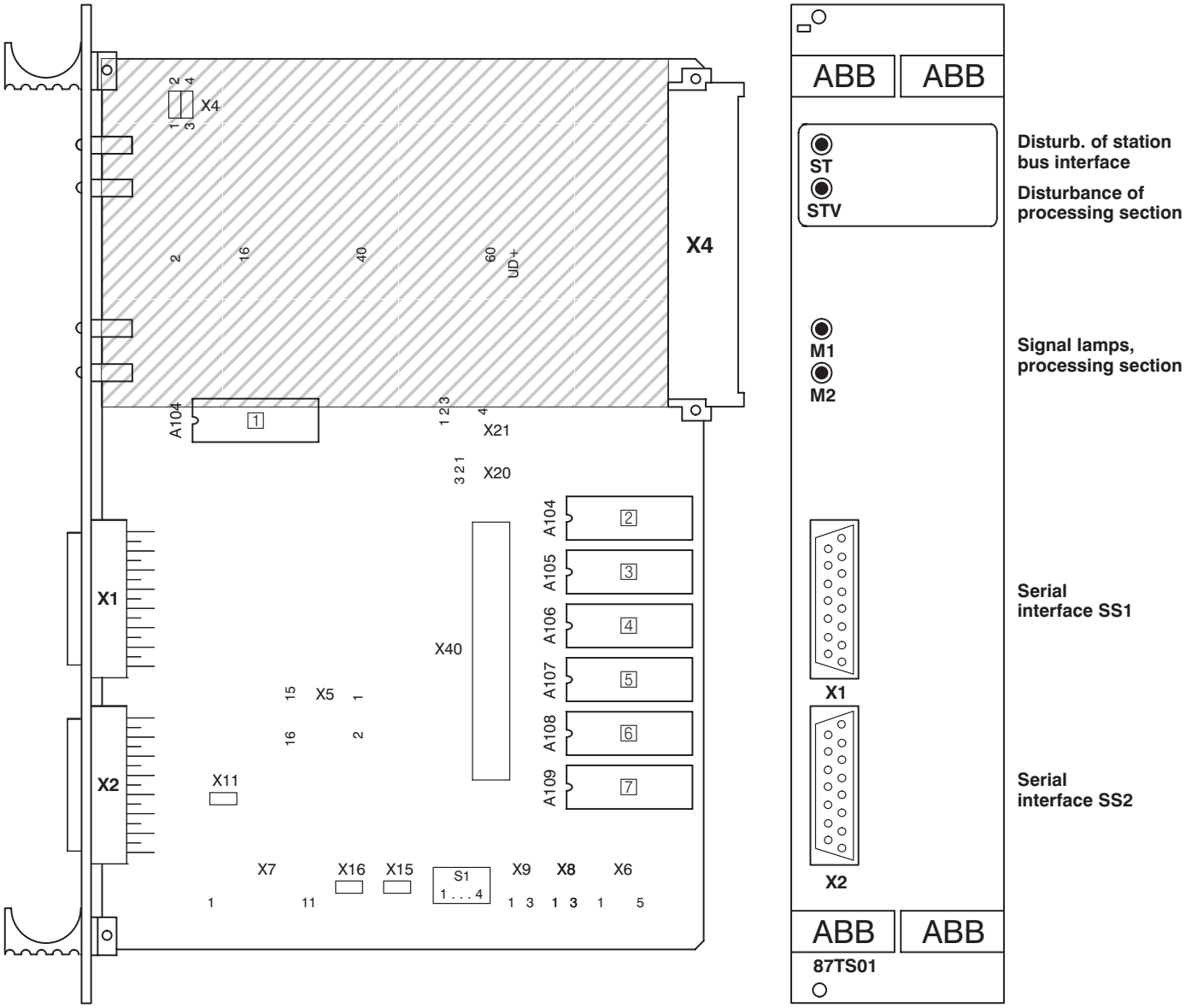
Weight: approx. 0.55 kg

View of connector side:



Positions of adjustable components and memory modules

View of module side and module front



For state and position of jumpers, cf. 'Basic module settings'.

Memory modules (for order numbers cf. 'Application description')

1	Memory module A401 (EPROM)	Bus program for station–bus interface	
2	Memory module A104 (EPROM)	User program	
3	Memory module A105 (RAM)	Shared memory	
4	Memory module A106 (EPROM)	Operating program for processing section,	low byte
5	Memory module A107 (RAM)	Variables memory for processing section,	low byte
6	Memory module A108 (EPROM)	Operating program for processing section,	high byte
7	Memory module A109 (RAM)	Variables memory for processing section,	high byte

Technical data

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

Power supply

Operating voltage:	UD+	= +24 V
Current consumption, typical:	IDtyp	= 340 mA
Power dissipation:	Pvtyp	= 8.2 W
Reference potential, process side:	Z	= 0 V
Reference potential, station bus:	ZD	= 0 V

Module interfaces

SS – Standard interface for station bus, connector X3
SS1 – Serial interface acc. to RS 232c or RS 422, connector X1
SS2 – Serial interface acc. to RS 232c or RS 422, connector X2

Serial interface acc. to RS 232c

Application:	Interfacing a computer
Transmission:	Serial acc. to RS 232c
Transmission rate:	300 – 19200 baud
Transmission distance, max.:	20 m

Input and output values of the serial interface acc. to RS 232c

Input voltage, max.:	+/– 25 V
Output voltage, max.:	+/– 12 V
Output current:	10 mA
Short–circuit current, max.:	150 mA

Admissible temperature ranges

Operating temperature:	0 ... 70 °C
Storage temperature:	–40 ... +85 °C

Technical data are subject to change without notice!

ORDERING DATA GERÄT 87TS01

Type designation:	Order number:
87TS01–E/R12..	GJR2368900R12..
87TS01–E/R13..	GJR2368900R13..
87TS01–E/R15..	GJR2368900R15..

Note:

These ordering data refer to the basic module firmware. Functional differences are described in the individual application descriptions.

ORDERING DATA FOR STANDARD ACCESSORIES

89IP03 connecting cable

Type designation:	Order number:
89IP03/R0040	GJR2363100R0040

89IP04 resistor array

Type designation:	Order number:
89IP04/R0100	GJR2363200R0100

89IP05 connecting cable

Type designation:	Order number:
89IP05/R0005...R0020	GJR2363300R0005...R0020

Designation of version depending on cable length, cf. page 8.