

Module Description

PROCONTROL P

Binary and Analog Control

Control Modul for Single Functions with Operator's Console and Switching Output

83SR03 – E/R13..

Publication No.

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Application

The module is used for stored-program binary and analog control tasks on the drive and group control levels. It can be used for the following applications:

- 3-step control
- Binary function group control (sequential and logic)
- Signal conditioning

The module is equipped with a specific set of memories for every application. Therefore, the following module versions are available:

83SR03–E/R1325 Binary group control
/R1335 Step control
/R1336 Step control
/R1337 Step control
/R1338 Step control
/R1350 Signal conditioning
/R1352 Signal conditioning

The basic module version is described in this module description. The capabilities of the individual versions are dealt with in the relevant application descriptions and the functional block descriptions.

Features

The module address is set automatically by plugging the module into the slot provided within the multi-purpose processing station.

The telegrams received via the station-bus are checked by the module for error-free transfer on the basis of their parity bits.

The telegrams sent from the module to the stationbus are provided with parity bits to ensure error free transfer.

The module requires the following voltages for communication with the operator's console, the process and the switchgear:

- US Operating voltage +24 V
branched internally to supply the following elements:
US1 Pushbuttons, operator's console
US2 Process contact transmitters (e.g. limit switches)
US3 Torque monitors of actuator
UV Auxiliary voltage –24 V for increasing the communication voltage for contact inputs
UM +24 V annunciation voltage for monitoring and signalling operating or communication voltage failure.

The module terminals connected to UM are short-circuit-proof. Therefore, this voltage is not fuse-protected in the module.

If UV or UM fails, the function of the module remains fully effective. The voltages US2 and US3 are protected in the module by PTC resistors and, therefore, do not require separate fuses.

The operating voltage US and the external logic signals are related to conductor Z. The operating voltage UD+ is related to conductor ZD.

The following annunciations are indicated at the front of the module via light-emitting diodes:

- Simulation SIM
- Module disturbance ST
- Fuse failure for US1, USP1, UVP1
- Annunciations to operator's console:
 - Annunciation OFF/MANUAL (L10)
 - Annunciation ON/AUTOMATIC (L20)
 - Annunciation MANUAL (Group control) (LH)
 - Disturbance annunciation (LM)

The function of the annunciation lamp LM is not affected if the voltage US fails. One connector X1 provided at the front of the module permits connection of the following units:

- Battery pack 89NB02
(Order No. GJR2355100R0100)
for backing module-internal RAM
- RAM erasing device 89PL01
(Order No. GJR2386000R0100)
for erasing module-internal RAM.

Module design

The module essentially consists of the following:

- Process interface
- Control room interface
- Station–bus interface
- Processing section

Process interface

In the process interface, the process signals are adapted to the module–internal signal level.

Control room interface

In the control room interface, the pushbutton commands are adapted to the module–internal signal levels, and the module–internal signal levels to the annunciation lamps in the control room.

Station–bus interface

In the station–bus interface, the module signals are adapted to the bus. This essentially involves a parallel/serial conversion.

Processing section

In order to process the signals coming from the process, the control room and the bus, the module is provided with a microprocessor which works in conjunction with the following memory areas via the module–internal bus:

- Memory for operating program
- Memory for module input and output signals (shared memory)
- Memory for standard functions
- Memory for user program
- Memory for parameters and historic values
- RAM for structure list and limit value list

The operating program enables the microprocessor to perform the basic operations of the control module.

The exchange of information with the bus system takes place via the memory for the module input and output signals. It is used to buffer the signals.

The memory for the standard functions contains ready programs for implementing the various module functions.

The set of standard functions selected and filed in the memory determines the basic applications of the module.

The filed set of standard functions is selected in such a way that the specified task can be performed without additional modules. For instance, a higher–level setpoint control can be implemented in the step control function, in addition to the actual control function.

All standard functions contained in the module together with their inputs and outputs can be called by the user via the control system operator station.

The memory for the user program contains information as to:

- how the standard functions are interconnected
- which module inputs and outputs are allocated to the inputs and outputs of the standard functions
- which constants are specified to the individual inputs of the standard functions
- which parameters are specified to the individual inputs of the standard functions
- which plant signals are allocated to the module inputs and outputs
- which sets of limit values are allocated to the analog values (applicable only to versions R1337, R1338 and R1352).

This information is specified by the user according to the plant involved, in a process which is known as structuring and addressing.

The user program is stored in an erasable PROM (EPROM).

The memory for parameters, limit values and historic values is used to file parameters (e.g. KP, TN, TV, etc.), limit values and important intermediate results from computing operations (e.g. setpoints).

The parameters are determined by the user and specified to the corresponding inputs for the standard functions during structuring.

For each analog value, the limit values are entered as limit value sets in the form of a limit value list (see "Limit value list").

A RAM with external back–up is used as memory. The parameters and limit values can thus be altered during operation (on–line).

The RAM for the structure list serves for simultaneous filing of the structure list. This permits on–line modifications to be made to the structure list (see Operating modes: RAM operation). The RAM with external back–up battery in which the parameters and historic values are also stored is here used as memory.

Structuring

During structuring, module inputs and outputs are allocated to the neutral inputs and outputs of the individual standard functions, or fixed values and parameters or outputs of other standard functions (calculated function results) are specified to the inputs of the standard functions. Structuring is performed on the basis of the data supplied by the user in the form of a so-called structure list. These data can be taken from a function chart to be created beforehand.

The following limit values for the module should be observed when creating the function chart:

- max. no. of module inputs 255
- max. no. of module outputs 255
- max. no. of calcul. function results 255
- max. no. of timers 64
- max. no. of parameters 64
- max. no. of lines in the structure list 1512
- max. no. of limit value sets 16
(only R1337, R1338, R1352)
- Length of historic values list (bytes) 256
- Design of shared memory (see "Addressing")

One line means one entry on the PDDS (programming, diagnostic and display system) or at the control system operator station. The proper procedure to be followed for structuring the standard functions is shown in the functional block descriptions.

Addressing

General

The signal exchange between the module and the bus system takes place via a shared memory. Here, incoming telegrams to be received by the module and calculated function results which are to leave the module are buffered.

The shared memory has source registers for telegrams to be transmitted and sink registers for telegrams to be received. Register numbers 0 to 63 are defined as source registers and register numbers 64 to 191 as sink registers.

The allocation of the module inputs and outputs to the shared memory registers is determined from the PDDS or the control system operator station on the basis of data supplied by the user.

The user data are in the form of address lists.

Address list for module inputs

In the address list for the module inputs, the source location address of the telegram to be received is allocated to each module input. The following data are for one module input:

Input	Address
EG1	1, 120, 54, 13, 7
where:	1st No. System no. 2nd No. Multi-purpose processing station 3rd No. Module no. 4th No. Register no. 5th No. Bit no.

If the address list is input from the control system operator station, the process-related KKS designation (Power plant designation system) can be given instead of the complete source location address.

In the case of module inputs which receive their signal via a hardware interface or from the process operator station, special signs (V or L see Functional block catalogue) are used in place of the source address.

The address list for module inputs thus obtained is translated by the control system operator station or the PDDS into two module-internal lists, a bus address list and an allocation list for module inputs. The bus address list contains the source location addresses of all telegrams which are to be received by the module.

Telegrams whose addresses are not included in the bus address list are ignored by the module. Received telegrams whose addresses are included in the bus address list are written to the sink register of the shared memory.

In the allocation list, each module input is allocated the shared memory sink register number, and, in the case of binary values, also the bit position of the shared memory under which the telegram meant for it is stored.

However, the microprocessor does not work directly with the allocation list, but rather with a duplicate which is stored in a random access memory.

Address list for module outputs

In the address list for module outputs, the complete source location address is specified for each calculated function result that is to leave the module.

Output	Address
AG1	1, 110, 24, 28, 11
where:	1st No. System no. 2nd No. Multi-purpose processing station 3rd No. Module no. 4th No. Register no. 5th No. Bit no.

If several information items are transferred via one output of a standard function in the form of a standard telegram, (see Functional block description), the bit no. is not specified in the address list, since this is already fixed in the standard telegram. The system, station, and module addresses are the same for all module outputs. This information is not taken into account when the address list is input since it is otherwise specified to the module (see Formation of address) and is only of interest for computeraided planning.

In this way, a module output allocation list is formed from the address list. In this allocation list, each module output is assigned a source register number and a bit number in the shared memory.

The allocation list has the following form:

Output	Address
AG10	28, 11
where:	1st No. Register no. 2nd No. Bit no.

Formation of address

The system and station address is specified jointly for all modules of a multi-purpose processing station by means of a station-bus control module. The module address is set automatically by plugging the module into the slot provided within the multi-purpose processing station.

Limit value list

A limit value list is provided only in module versions R1337, R1338 and R1352. It contains the limit value sets for up to 16 sets of analog values. It is stored in the user PROM as part of the user program. During operation, the module operates with a copy of this list stored in a RAM (the same RAM as for the parameter list). This allows on-line changes at all times by way of the process operator station or control system operator station. An on-line change in a limit value set is interpreted by the module as simulation.

Formation of event

The module is normally requested cyclically by the PROCONTROL system to transmit the information filed in the source registers of the shared memory.

If values change within the cycle time, this is treated as an "Event".

The module recognizes the following occurrences as an event:

- Change of status in the case of binary values
- Change of an analog value by a permanently set threshold value of approx. 0.4 % and elapse of a time delay of 200 ms since the last transfer (cyclic or event mode).

If an event occurs, cyclic operation is interrupted and the new values are transferred to the bus with priority.

Diagnosis

The received telegrams and the formation of the telegrams to be sent as well as the internal signal processing are monitored in the processing section of the module for error-free operation (self-diagnosis).

In the event of a disturbance, the type of disturbance is filed in the diagnosis register and a disturbance announcement is simultaneously sent to the PROCONTROL system. The module transfers a diagnosis telegram with the data stored in the diagnosis register after the bus grant.

It is also possible to scan the current status of the module and the data at any time from the control system operator station.

The diagnosis register can be called under the complete address. The diagnosis register has the register number 246 and the data type 0.

Disturbance bit

The telegrams supplied via the bus are partly provided with a fault flag on bit position 0. This fault flag is generated by the source module on the basis of plausibility checks and disturbance bit is set to "1" in the event that specific disturbances are present (see Functional block descriptions).

In order to be able to recognize errors during signal transfer, the module also incorporates a feature that monitors the input telegrams for cyclic renewal. If a telegram has not renewed within a certain time, (e.g. due to failure of the source module), bit 0 is set in the allocated sink register of the shared memory. In binary value telegrams, all the binary values are simultaneously set to "0". In the case of analog values, the previous value is retained. By setting the fault flag in analog values, the module is prevented from working with a historic value.

A set disturbance bit does not automatically involve a reaction in the sink module. If the disturbance bit of a telegram is to be evaluated, it must be allocated to a binary input of a standard function during structuring or to a module input during addressing.

External power supply to the RAM

The following means are available for external power supply to the RAM:

- Capacitor for short-term voltage failures (forms part of the module)
- For long-term power supply (module withdrawn), the battery pack 89NB02 can be plugged into the module front (connector X1).

Erasing of the RAM is possible by means of RAM erasing device 89PL01 which can be plugged into the module front (connector X1).

Important:

Battery backup for the RAM of the module is only effective in the event of a power failure if the battery pack 89NB02 is in place.

Command functions

Actuation by pushbuttons

The module is controlled from the operator's console by pushbutton commands T10, T20 and TH. The internal processing of the pushbutton commands depends on the activated standard function.

Actuation by higher-level automatic system

A higher-level automatic system controls the module via the station-bus standard interface SS.

Release and protective commands

The logic combinations for release and protective commands are specified as required for the plant involved. Input signals are input via the station-bus standard interface.

Acknowledgement

The module determines any differences between the setpoints and actual values and indicates these through the lamps in the operator's console. With binary control, error signals can be acknowledged individually by pressing pushbutton T10 or T20. With analog control, error signals can be acknowledged individually by pressing pushbutton TH.

Command output

The commands are output via relay outputs B10 and B20. These actuate, in conjunction with command output BV common to both relay outputs, a coupling relay on a two-pole basis.

The switching current for the command outputs is derived from voltage US1. The outputs B10 and B20 incorporate a protective circuit internal to the module.

Note: The expected service life of the relay output stages (relay outputs B10 and B20) is approx. 20 million switching cycles.

Annunciation functions

Annunciations to the operator's console

A maximum of four lamps can be connected to the operator's console via outputs L10, L20, LM and LH through a direct connection. Output LH is only needed when the module is used as a binary group control module. The direct connection includes input BLS to which the appropriate flashing voltage is connected for the flashing disturbance light. The voltage for running light BLL is derived from BLS within the module.

The kind of annunciation by steady light, running light and flashing disturbance light is given for each module function in the functional block descriptions. It is independent of whether these functions are implemented on the control room coupling module or on the control module itself.

Disturbance annunciations on the module

A light-emitting diode ST is provided at the front of the module to indicate 'Module disturbance'. It is used to indicate module disturbances that are filed simultaneously in the diagnosis register.

The blowing of the fuse for US1 is signalled by another light-emitting diode.

The light-emitting diodes L10, L20, LM and LH are activated simultaneously with the corresponding annunciation lamps in the operator's console.

Disturbance annunciations to the alarm annunciation equipment

The alarm annunciation equipment or the facility for communication between the operator and the control system receive disturbance annunciations from the control module via the bus.

Generation of disturbance annunciations

The disturbance annunciations are generated by the microprocessor according to a program specification. This is explained in the functional block descriptions for each module task.

Operating modes

Normal operation

In normal operation, signals arriving via the bus, the process and control room interface are processed according to the data in the structure list.

Depending on these data, commands are output to the switch-gear, and checkback signals identifying the process status are sent via the bus.

Simulation

The control system operator station permits constant values to be specified to the module for individual module input signals arriving from the transfer system in normal operation. In this case, the information specified in the allocation list for module inputs is overwritten in the allocation list duplicate by constants which are filed in a simulation list.

The process signals PRO and the signal VOH of the drive control functions cannot be simulated.

Simulation of signals or limit values is indicated at the front by the light-emitting diode SIM.

The light-emitting diode SIM is also set when a "1" signal is present at input VOH of a drive control function or at input S of a pushbutton selection function.

Operation with structure list on RAM

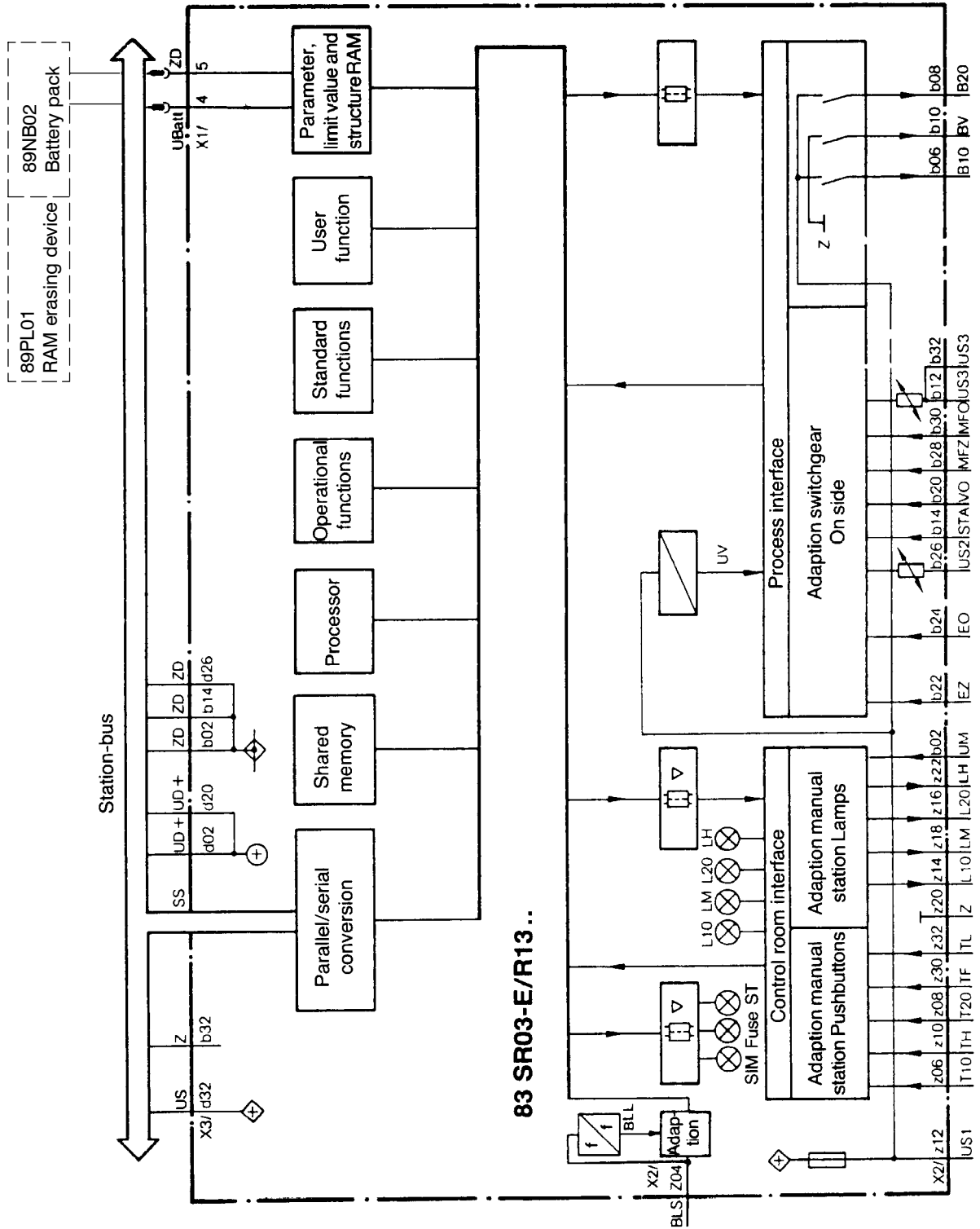
An instruction given via the control system operator station or the PDDS allows the structure list stored on the PROM to be duplicated onto the RAM with external power supply. The microprocessor of the control module can also be instructed to work with the RAM instead of the PROM. Modifications and amendments can then be made in the structure list via the control system operator station or the PDDS. The light-emitting diode SIM at the front of the module is also set in this operating mode.

Functional diagram

Terminal designations

The printed circuit board is equipped with connectors X2 and X3. Connector X2 contains all process inputs and outputs.

Connector X3 contains the station-bus interface and the operating voltages US and UD+.



Mechanical design

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

Connector: to DIN 41 612

1 x for station–bus connection,
48–pole, edge–connector type F
(connector X3)

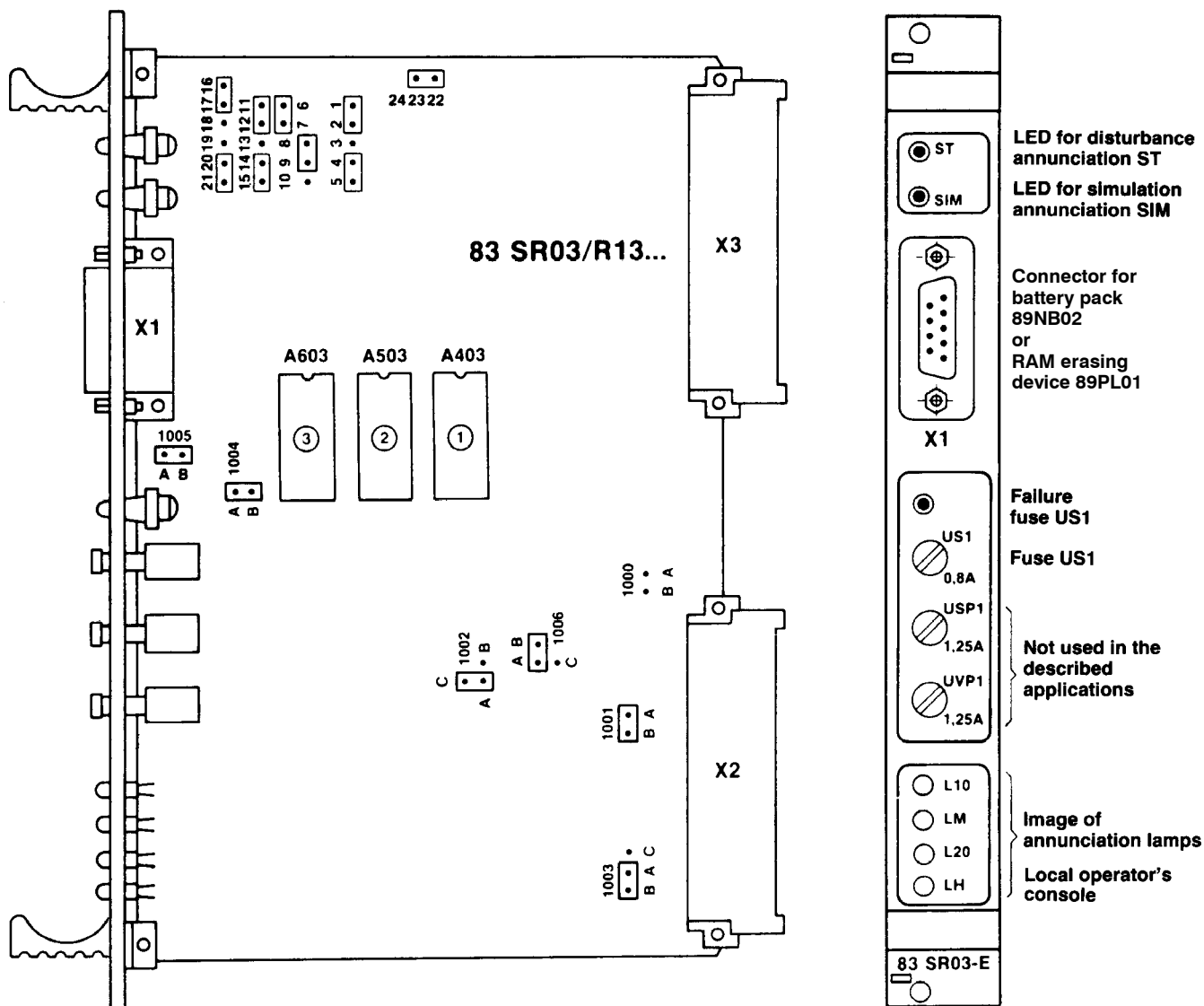
1 x for process connection,
32–pole, edge–connector type F
(connector X2)

Weight: approx. 0.55 kg

View of connector side:



Positions of jumpers (as-delivered) and memory modules as well as the module's front panel



- ① Memory module A403 for user program (Structure and addresses)
- ② Memory module A503 for operating program and standard functions
- ③ Memory module A603 for operating program and standard functions

Note: A PROM of type 2764 is used as the memory module for the user program. The position of the plug-in jumpers is shown on the printed circuit board.

Technical data

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

Power supply

Operating voltage process section	US = +24 V
	UM = +24 V
Operating voltage bus section	UD+ = + 5 V
Reference potential process section	Z = 0 V
Reference potential bus section	ZD = 0 V

Input values

Direct connections

BLS – Flashing disturbance light		0.5 NL
E10 – Process checkback signal	CLOSED	5 mA at 48 V
E20 – Process checkback signal	OPEN	5 mA at 48 V
MFZ – Torque monitor	CLOSED	5 mA at 48 V
MFO – Torque monitor	OPEN	5 mA at 48 V
STA – Disturbance in switchgear		5 mA at 48 V
T10 – Pushbutton command	OFF/CLOSE	1 NL
T20 – Pushbutton command	ON/OPEN	1 NL
TF – Pushbutton command/Release		1 NL
TH – Pushbutton command	MANUAL/AUTOMATIC	1 NL
TL – Pushbutton command	Lamp test	1 NL
VO – Local intervention		5 mA at 48 V

Output values

		Loading capacity
B10 – Command output for	CLOSE	$IS \leq 0.3 \text{ A}, \leq 10 \text{ W}$
B20 – Command output for	OPEN	$IS \leq 0.3 \text{ A}, \leq 10 \text{ W}$
BV – Common command output		$IS \leq 0.3 \text{ A}, \leq 10 \text{ W}$
for B10/B20 (wired return line)		
Service life of the relay output stage		20 million switching cycles
L10 – Lamp	MANUAL/OFF	100 mA
L20 – Lamp	AUTOMATIC/ON	100 mA
LM – Annunciation lamp		100 mA
LH – Lamp Manual		100 mA

ORDERING DATA

Order No. for complete module:

Application	Type Designation	Order number
Control module for simple functions, with operator's console and switch output "1TE"	83SR03–E/R13..	GJR2342800R13..
Signal conditioning without process interface	83SR03–E/R1352	GJR2342800R1352

Note to complete module:

The module is supplied with all blank PROMs for the basic and user program under type designation 83SR03/R1300, Order number GJR2342800R1300. The blank PROMs are not plugged in.

Note on single PROMs:

All the programmed PROMs required for the module for the basic program and all blank PROMs for the user program are supplied under type designation 83SR03/R00xx, Order number GJR2342800R00xx; xx denotes the appropriate software version.

Technical data are subject to change without notice!



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