System Description

SIGMA®-tronic b
System for
Industrial Controls

Order Number
GATS 1301 01 R2001

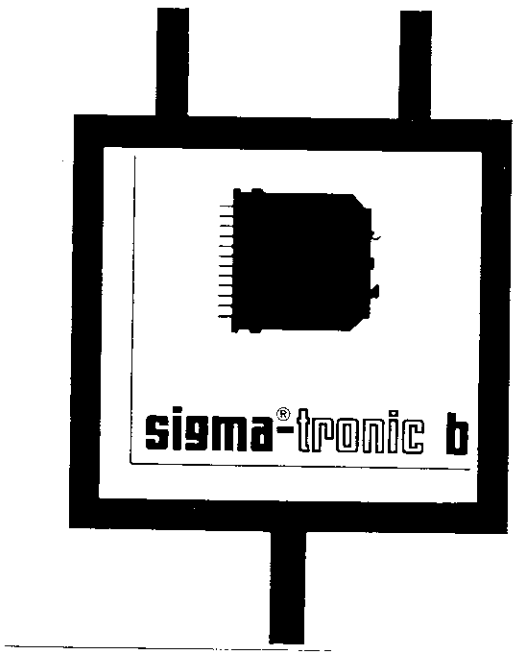

**ABB Schalt–
und Steuerungstechnik**

Regulations
Concerning the Setting up of Installations

Apart from the basic "Regulations for the Setting up of Power Installations" DIN VDE* 0100 and for "The Rating of Creepage Distances and Clearances" DIN VDE 0110 Part 1 and Part 2 the regulations "The Equipment of Power Installations with Electrical Components" DIN VDE 0160 in conjunction with DIN VDE 0660 Part 500 have to be taken into due consideration.

Further attention has to be paid to DIN VDE 0113 Part 1 and Part 200 in case of the control of working and processing machines. If operating elements are to be mounted near parts with dangerous contact voltage DIN VDE 0106 Part 100 is additionally relevant.

If the protection against direct contact according to DIN VDE 0160 is required, this has to be ensured by the user (e.g. by incorporating the elements in a switch-gear cabinet). The devices are designed for pollution severity 2 in accordance with DIN VDE 0110 Part 1. If higher pollution is expected, the devices must be installed in appropriate housings.

The user has to guarantee that the devices and the components belonging to them are mounted following these regulations. For operating the machines and installations, other national and international relevant regulations, concerning prevention of accidents and using technical working means, also have to be met.

The ABB Procontic devices are designed according to IEC 1131 Part 2. Meeting this regulation, they are classified in overvoltage category II which is in conformance with DIN VDE 0110 Part 2.

For the direct connection of ABB Procontic devices, which are powered with or coupled to AC line voltages of overvoltage category III, appropriate protection measures corresponding to overvoltage category II according to IEC-Report 664/1980 and DIN VDE 0110 Part 1 are to install.

Equivalent standards:

DIN VDE 0110 Part 1 ≙ IEC 664
DIN VDE 0113 Part 1 ≙ EN 60204 Part 1
DIN VDE 0660 Part 500 ≙ EN 60439-1 ≙ IEC 439-1

* VDE stands for "Association of German Electrical Engineers".

ABB Schalt- und Steuerungstechnik GmbH Heidelberg

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January 1986, replaces D NG 3231 81 E
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Regulations

In addition to be basic regulations for the erection of switchgear, distributors, and controls, VDE 0100 and VDE 0110, the regulations of VDE 0160 together with VDE 0660, Part 5, apply to the switchgear combinations with electronic components. VDE 0113 also applies additional to controls for machine tools.

The user must ensure that the unit and its corresponding components are installed in accordance with these regulations, for example by installing in a switchgear cabinet.

Protective conductor connections and electronic reference potential must not be connected together (see also VDE 0160).

Power supply units 07 NG 32 to 07 NG 36

Technical Data

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System features

Purpose

Increasing wages and growing shortage of experienced manpower make it obligatory for machine engineering and processing technics to switch over to automatic systems. Continuously increased operating speed and higher functional reliability are the required features. The controls of such systems are required to fulfill the same demands. Electronic components are often best suited for this purpose.

Low costs

The SIGMA-tronic system represents the perfect system for the control gear engineer, ensuring economic solution of the tasks on hand. For designing, construction, commissioning and modification of controls various equipment and accessories are available. Time and cost for this work are thus cut down by a considerable amount.

Combined design

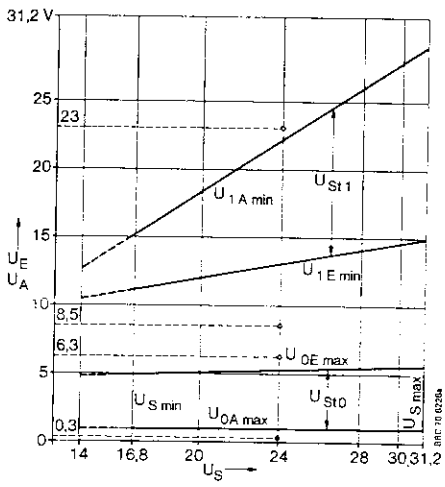
The basic part of a control, that is, the logic, programming, storage units and the interlocking elements can be economically built up from SIGMA-tronic modules. Input and output units are, however, often of the electromagnetic type such as switches, relays, contactors etc. SIGMA-tronic units are mechanically and electrically so designed that their combination with electromagnetic components offers no problems.

Operating voltage

The SIGMA-tronic system requires only one operating voltage of 24 V DC. This value can have a tolerance of ± 30 % i.e. 16.8 to 31.2 V. A ripple up to a peak amplitude of 4 V is permissible. Stabilizing of the operating voltage is therefore not required.

Static signal processing

The ON status (1-signal) is represented by a positive voltage, the OFF state (0-signal) by zero voltage. Also with time dependent and storage elements, only the magnitude of the voltage and not their speed of change is relevant.

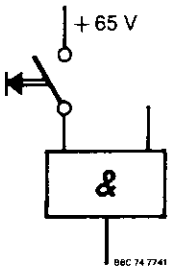


Noise suppression

In addition to the wide voltage range for 0- and 1-signals, built-in delay elements in the storage, timing, counting and register units serve to increase the safety against noise. Even voltage peaks occuring in disconnecting inductive loads will not cause any disturbance.

The permissible voltages at the input or at the output of the units for 0- and 1-signals are plotted in the diagram opposite. The solid lines show the so called "worst case" values for the system, the points marked "o" the typical values for a unit. The minimum screening clearances for 0-and 1-signals are shown as V_{St0} or V_{St1}.

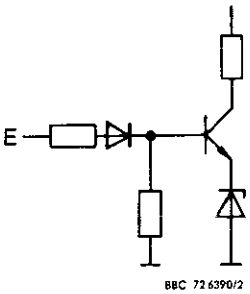
The delay of the storage, timing, counting and register elements amounts to some ms (for exact values see the individual data sheets). This will give a maximum working frequency of about 100 Hz.



Contact reliability

The contact reliability increases with impressed voltage. The inputs of SIGMA-tronic units will tolerate a permanent voltage of max. 65 V. For this reason electromechanical transmitter elements can be operated with this relatively high low voltage and be connected to the inputs.

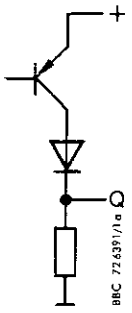
To increase the current of a 24 V– input signal we recommend the use of an input element. This raises the input current to the common industrial value of 5 mA.



1 load ≦ 1.3 mA

Input load

Every SIGMA-tronic input means a load on the zero busbar for the series connected unit. With a rated voltage of 24 V, a current of ≦ 1.3 mA will flow at the input of the device. This is referred to as one load.



Load capacity: 100 loads

Fan out

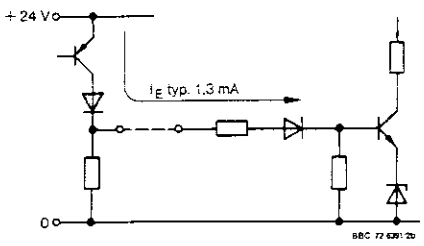
The output load capacity of the units is 100 loads unless stated otherwise. Due to this large number of possible inputs at the output of a device, counting the connected inputs will be superfluous in planning. Apart from this freedom in planning, this feature offers the advantage that a lamp, with a consumption of 0.5 watts, or a light emitting diode with a resistor connected in series can be directly connected for checking the state of signal.

Combination of outputs

The signal outputs of SIGMA-tronic units can be directly connected in parallel the same as with contactors and relays.

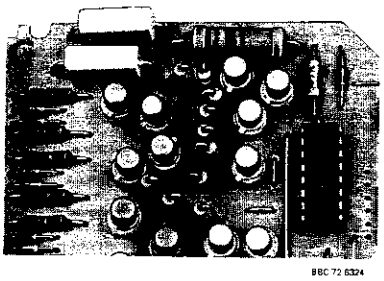
They will then form a logic OR element. In this case however, one must take care to avoid overloading any of these outputs. Every parallel connected output means an additional load of one load for every other output.

Parallel connection of lamp outputs Q_L (e.g. R 463) or outputs Q of output units (e.g. R 521) is inadmissible.



Functional reliability

With a 1-signal at the input a positive voltage will appear at the output. A current will flow into the input of the device on the load side. In case of an 0-signal there will be no voltage on the output of the device and no current will flow into the input of the device. This case is identical with an open input. The 1-state is therefore actively represented by voltage and current: active 1-technique. The SIGMA-tronic system renounces to a great extent, to signal reversing elements and a 1-signal consequently means an ON-state throughout the entire control, therefore also to a connected actuator. In addition to clearness in planning, commissioning, maintenance and trouble shooting, this method offers the advantage of high reliability. The most frequent faults, i.e. broken wires and earth faults of leads will thus automatically produce an 0-signal, consequently no actuator will be operated and any dangerous state will be avoided.



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Reliability

Carefully selected and continuously checked components such as silicon semi-conductors (transistors, diodes and integrated circuits in MOS technics) and dimensioning the circuits according to the worst case method (that is simultaneous consideration of all possible limit data which may occur) ensure the highest possible degree of reliability of the devices and, combined with the safe wiring technique, a reliable functioning of the control.

Ambient conditions

The SIGMA-tronic system is designed for reliable functioning under all service conditions encountered in practical applications.

According to DIN 40040 the SIGMA-tronic system must be classified in the following fields of application:

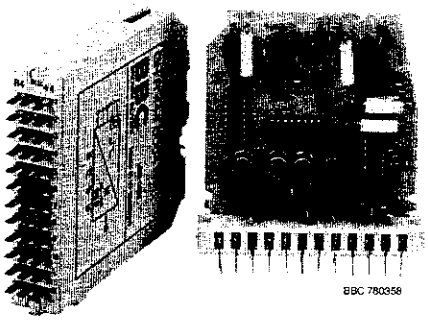
		Code letter
Low temperature limit	– 25 °C	H
Upper temperature limit (permanently admissible)	+ 70 °C	S
Upper temperature limit (storing and transport)	+ 85 °C	P
Moisture stress (relative humidity)	95 %	F
Mechanical stress: Suitable for operation in stationary installations, not free from vibrations, on vehicles and on ships		V
Special climatic stress: Air in industrial plants, chemically inactive dust		Z

Standards

GL

The SIGMA-tronic units comply with the regulations under VDE 0160 and VDE 0110. They are classified in the insulation group C under VDE 0110, VDE 160, part 1 § 146 is to be accounted for. The test voltage for devices with operating voltages under 60 V is 500 V. Devices with a rated voltage of 220 V are tested with 2500 V.

Certificates of approval for using SIGMA-tronic units aboard ships have been granted by the Germanische Lloyd and by Lloyd's Register of Shipping.



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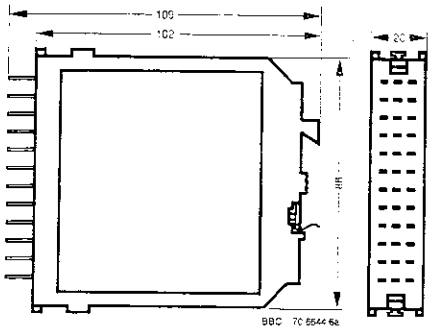
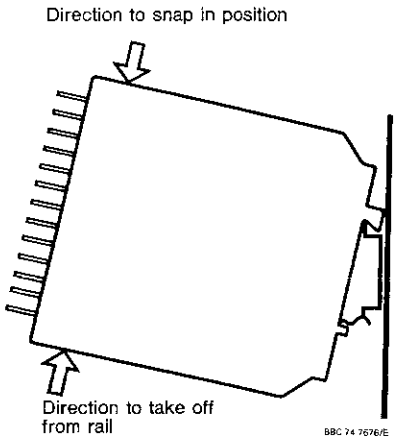
Construction

The components of the SIGMA-tronic units are mounted on printed circuit boards. These are protected by an insulating enclosure. The enclosures are suitable for fitting to DIN rail 35 according to DIN 46277, sheet 3. Louvers on the top and at the bottom ensure adequate cooling of the components.



Dimensions (in mm)

For dimensions of a units in single width see sketch. There are, however, units with multiple widths, that is a width amounting to a multiple of 20 mm.



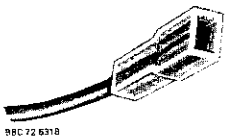
Mounting

The SIGMA-tronic modules are fastened side by side on a DIN rail as per DIN 46277, sheet 3. For this purpose they are provided with a recess on the back and a spring loaded clip for locking. The devices are mounted by simply pressing them on to the bar, not tool being required for this.

The vertical spacing of the DIN rails should be at least 150 mm. It will then be assured that plastic trunking can be easily mounted for wiring.

Removal from mounting rail

Simply press the device off the bar in the direction as indicated in the sketch.

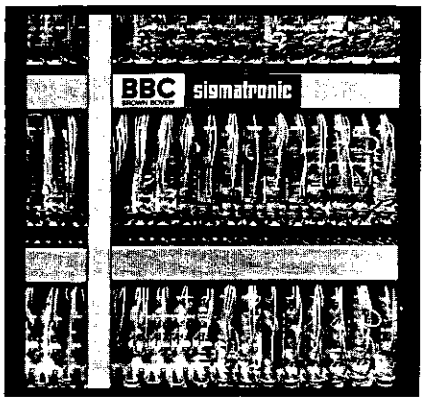


Wiring

The units are interconnected via plug-on connectors. Every unit terminal has a triple tab with the dimensions 2.8 x 0.8 mm (flat connectors A 2.8 x 0.8 DIN 46244).

The inputs and outputs of the units are connected with grey cables. These are available in different lengths with attached insulated receptacles (receptacles B 2.8 x 1 mm DIN 46247).

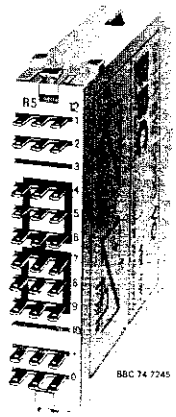
Tabs and receptacles are tinned and offer thus adequate protection also in corrosive atmospheres.



Wire ducting

The feeders for the operating voltage are directly looped from unit to unit.

Signal lines between the units or from and to the inputs and outputs are laid in moulded cable trunking. This trunking is screwed on carriers which can be snapped on supporting bars.



Marking

Every device bears a type identification label on one side specifying the complete order code and layout of the enclosed circuit in the form of a functional drawing as per DIN 40700, sheet 14.

The type designation and the number of connections is printed on the front face on the device. The labels have different colours according to the various logic function graps. The two bottom terminals are always marked + und 0 and are used for connecting the supply voltage. The other terminals are marked 1 · · · 10 starting from the top or, on devices with multiple widths continuing from 11 · · · 20 etc. Outputs are identified by a black mark around the terminal, auxiliary connections or outputs with reduced load capacity by a hatched mark.

Space is provided on the designation label for identification of the device below the supply voltage terminals in compliance with the signal flow diagram (position marking or similar).

A plate carrier for markings of this kind can be slipped on here.

Power supply

Mains voltage	U_N = 220 V, single phase or U_N = 380 V, 415 V } three- = 440 V, 460 V } phase = 500 V
Tolerance	− 15 % . . . + 10 %
Frequency	48 . . . 63 Hz

Supply voltage

Rated voltage	U_S = 24 V–
Tolerance	± 30 %
Ripple	U ≦ 4 V

Signal definition

0-signal at input	typically	0 . . . + 5 V–
1-signal at input	typically	+ 11.2 . . . + 65 V–

Signal to noise level

0-signal	U_{ST0} = 5 V = const.
1-signal	$U_{ST1} \geqq 0.75\ U_S - 9$ V

Impulse burden

Peak value of noise interference voltage, impulse duration ≦ 0.5 µs and pause duration ≧ 0.5 ms at the input	typically	± 500 V

Cutoff frequency — approx. 100 Hz

Loads

Current flows from output through load to zero bus bar	
Output current	≦ 130 mA ≙ 100 loads
Output load	100 inputs
Current consumption per input	≦ 1.3 mA ≙ 1 load
	(Exceptions given on data pages)

Ambient conditions and areas of application

The SIGMA-tronic system is suitable in the following areas of application:

		Code letter
Low temperature limit	− 25 °C	H
Upper temperature limit (perm. admissable)	+ 70 °C	S
Upper temperature limit (storage and transport)	+ 85 °C	P
Relative ambient humidity	95 %	F
Mechanical stress: Suitable for operation in stationary installations, not free from vibrations, on vehicles and on ships		V
Special climatic stress: Air in industrial plants, chemically inactive dust		Z

Standards

The SIGMA-tronic modules comply with the regulations under VDE 0160 and VDE 0110

Classification	Insulation group C
Test voltage for components	
with operation voltage < 60 V	500 V
with operation voltage 220 V	2500 V
Grade of radio noise suppression	N
Certificates of approval	Germanischer Lloyd GL Lloyds Register of Shipping

Explanations of data sheets

The data relating the devices is accompanied by symbols, functional diagrams, power consumption and particulars regarding inputs and outputs. All given values refer to the rated voltage $V_S = 24$ V.

Functional diagrams

The signals at the inputs and outputs are represented in the functional diagrams in their chronological order. The horizontal time axis is normally not numbered. The extent of the time intervals is in this case of no importance as long as they are above the internal time lags of the units. In the case of storage, timing counting and register elements, the time sequence of the signal states must, however, be observed.

The 1-state of the signals corresponding to the high voltage level in the SIGMA-tronic system, is shown in the diagrams as upper value. The 0-state, corresponding to the low voltage level, is shown as low value. The transition from one signal state to the other is plotted without time delay. Since the change-over delays of the units lie in the nano second range and are therefore exceedingly small as compared with the effective signal times of at least some milli-seconds, this representation for the output signals corresponds to actual practice. The input signals which can come from different sources may have any transition delays, as far as no specific demands are made.

Current consumption

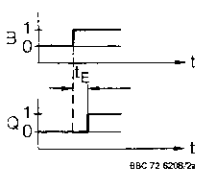
With all SIGMA-tronic modules, drawing current from the power supply pack, the current consumption is specified in the data sheets. The specified value indicates the current with the outputs in no load state and is valid for all functional units of a device. If the current consumption is a function of the state of control, the values for the 0- and 1-states are given separately.

In case of a 1-signal an output supplies a current of $\leqq 1.3$ mA to every connected input. To determine the maximum current demand, all input currents must be added to the above mentioned current consumption value.

Power loss

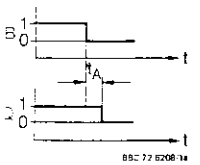
The specified power loss is calculated by multiplying the current consumption by the supply voltage.

The power loss can be used for determining the temperature rise within a switchboard.



Making (setting) delay

The output signals appear with a delay as compared with the input signals, above all with storage, timing, counting and register units. The making delay t_E indicates the delay by which an 1-signal will appear at the output after the trigger signal at the input takes effect.



Breaking (clearing) delay

The output signals appear with a delay as compared with the input signals above all, with storage, timing, counting and register units. The breaking delay t_A indicates the delay, by which an 0-signal will appear at the output after the trigger signal at the input takes effect.

Cabling information

In electronic industrial controls the power supply from components must be cabled to meet the current requirements of individual module groups. The cabling of such a module group is taken from a central point of the control board (power supply or busbar), for both the + and 0 Volt, in a ring main; i.e. a group has for both 0 and + Volt two feeds (beginning and end).

The connection leads between the power supply and the control should be kept as short as possible. The power supply should be mounted in the region of the components to be supplied. In the case that power supplies are separated from one another the cabling to the central reference point of the equipment (0 Volt) must be made with min. 16 mm^2 cable.

For components of the SIGMA-tronic b range the following general recommendations should be followed:

The cabling is, as a rule, carried out with SIGMA-tronic cabling – red and blue (cross sectional area 0.75 mm^2). Thereby the various module groups to be supplied with + 24 V should be protected by 4 A (max.) group fuse which for indicating devices and lamp leads has at least medium slow tripping characteristics. The fusing of individual groups can be left out in small or medium sized equipments. Fuses can, if required, be replaced by K characteristic mcb's.

The 0 Volt leads of the numerous module groups should be meshed (interconnected) where practicable.

Module groups differentiated are to module types.

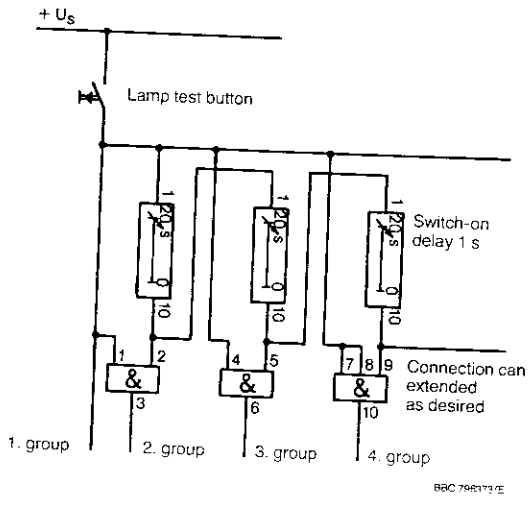
Module type	Number/groups	Notes
Logic modules	40–50 modules	without output load
Signalling modules	10–15 modules	for maximum lamp load
Lamp operators	4– 5 modules	for maximum lamp load
Relay output unit	20–30 functions	without contact lead
Transistor output unit	2– 3 modules	supply to terminals 8 and 9
Transistor output unit	40–50 modules	supply to terminals + and 0

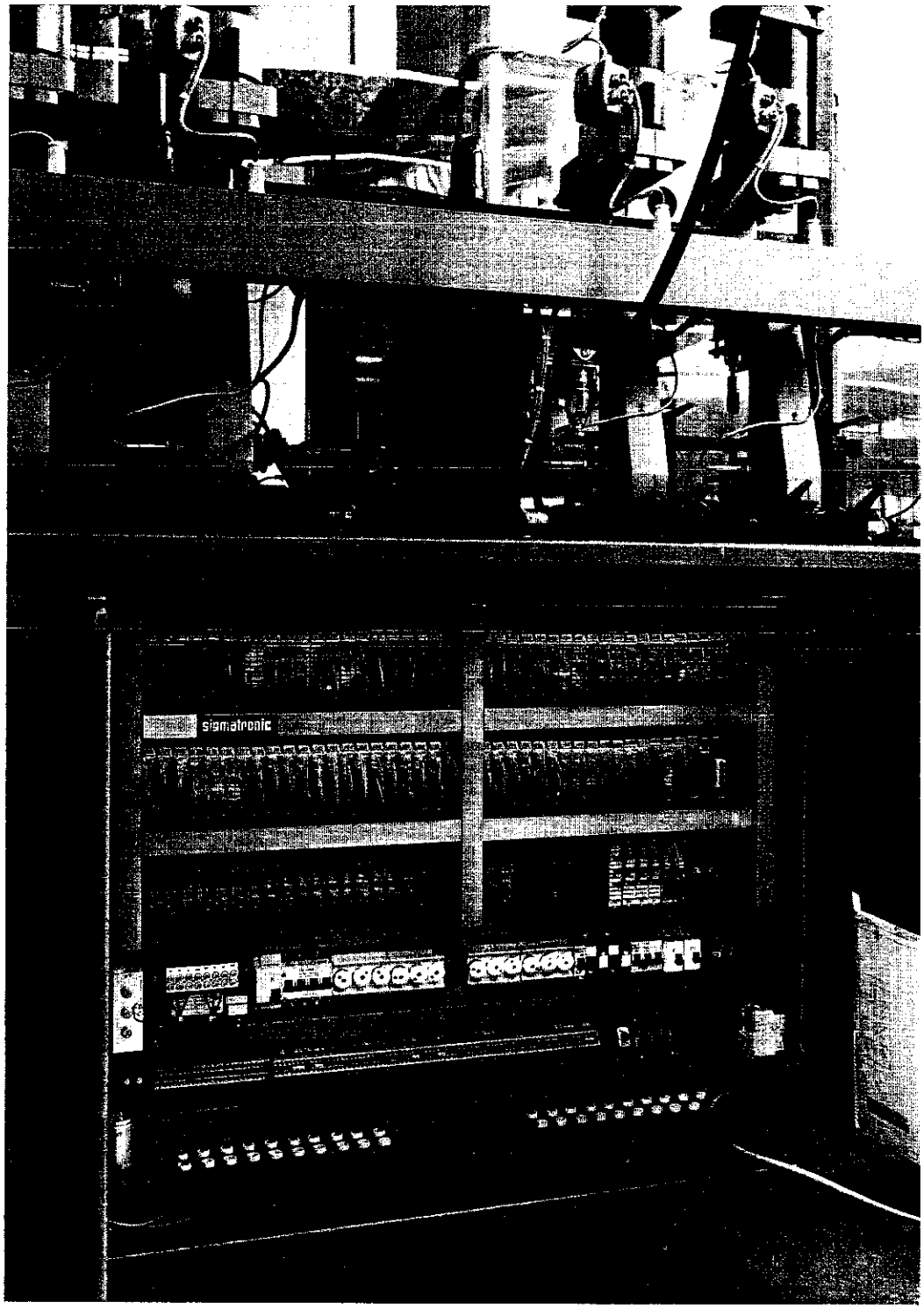
Lamp testing

In the case of signalling modules the lamp testing of individual module groups should be connected to give timed steps (see connection suggestion).

For transistor output units the supply + and 0 Volt (logic) as well as the power connections 8 (+) and 9 (0 Volt) from the power supply must be separately cabled.

Control of lamp testing inputs for signalling modules:





Panel with SIGMA-tronic control

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