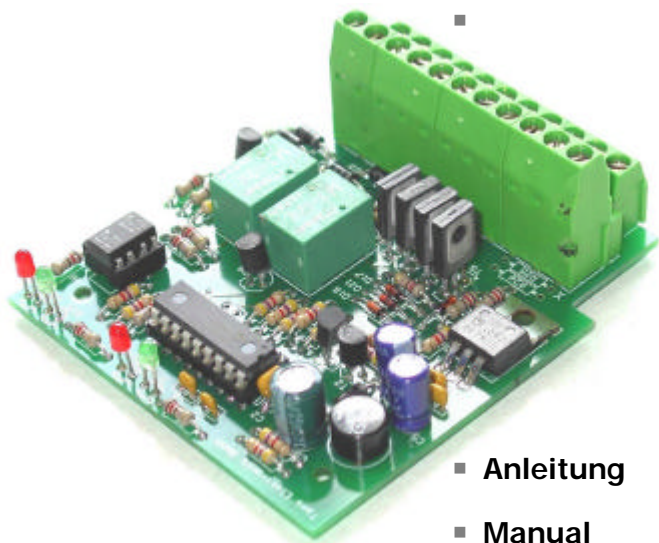


Schattenbahnhofsteuerung

Shadow-station Control



■ Anleitung

■ Manual

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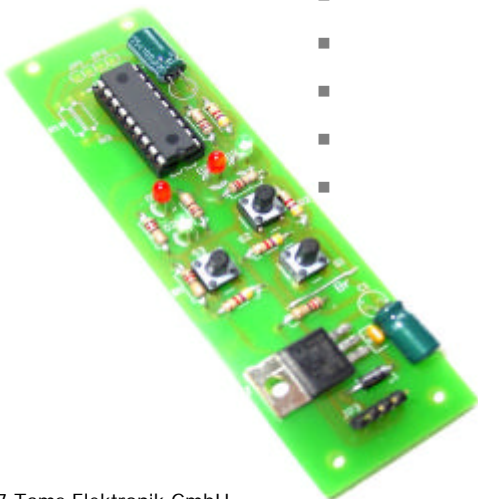
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(Pages I to VII in the centre of this handbook are removeable.)

## How to use this manual

If you have no specialist technical training, this manual gives step-by-step instructions for safe and correct assembly of the kit(s) or fitting of the ready-built module(s), and operation. Before you start, we advise you to read the whole manual, particularly the chapter on safety instructions and the FAQ chapter. You will then know where to take care and how to prevent mistakes which take a lot of effort to correct.

Keep this manual safely so that you can solve problems in the future. If you pass the kit(s) or the module(s) on to another person, please pass on the manual with it.

## Intended use



### Caution:

Integrated circuits are very sensitive to static electricity. Do not touch components without first discharging yourself. Touching a radiator or other grounded metal part will discharge you.

The kit(s) or the ready-built module(s) can be assembled or fitted using this manual. They are designed for use in model railways.

The shadow-station control allows you to supervise and to control up to 32 railway sidings and one thoroughfare rail. The shadow-station control is of modular design. It is composed of:

- one central module with an integrated rail module to control two railway sidings and one thoroughfare rail,
- one display and operating module,
- up to 15 further rail modules (optional).

The kit(s) and the ready-built module(s) are not suitable for children under the age of 14.

Reading, understanding and following the instructions in this manual are mandatory for the user.

Any other use of the kit is inappropriate and invalidates any guarantees.

## Safety instructions

### Mechanical hazards

Cut wires can have sharp ends and can cause serious injuries. Watch out for sharp edges when you pick up the PCB.

Visibly damaged parts can cause unpredictable danger. Do not use damaged parts: recycle and replace them with new ones.

### Electrical hazards

- Touching powered, live components,
- touching conducting components which are live due to malfunction,
- short circuits,
- connecting the circuit to a higher voltage than designed,
- impermissibly high humidity,
- condensation of water

can cause serious injury due to electrical shock. Take the following precautions to prevent this danger:

- Never perform wiring on a powered module.
- Only use low power for this module as described in this manual and only use certified transformers.
- Connect transformers and soldering stations only in approved mains sockets installed by an authorised electrician.
- Observe cable diameter requirements.
- After the condensation of water do not start working until after a minimum of 2 hours of acclimatisation.
- Mounting the module should only be done in closed, clean, dry rooms. Beware of humidity.
- Use only original spare parts if you have to repair the module.

### Fire risk

Touching flammable material with a hot soldering iron can cause life-threatening fire, burns and toxic smoke. Connect your soldering iron or soldering station only when actually needed. Use the correct soldering iron or station and never leave a hot soldering iron or station unattended.

## Thermal danger

A hot soldering iron or liquid solder accidentally touching your skin can cause skin burns. As a precaution:

- use a heat-resistant mat during soldering,
- always put the hot soldering iron in the soldering iron stand,
- point the soldering iron tip carefully when soldering, and
- remove liquid solder with a thick wet rag or wet sponge.

## Dangerous environments

A working area that is too small or cramped is unsuitable and can cause accidents, fires and injury. Prevent this by working in a clean, dry room with enough freedom of movement.

## Other dangers

Children can cause any of the accidents mentioned above because they are inattentive and not responsible enough. Children under the age of 14 should not be allowed to work with this kit or the ready-built module.

Little children can swallow small components with sharp edges. Life threatening! Do not allow components to reach small children.

In schools, training centres, clubs and workshops, assembly must be supervised by qualified personnel.

In industrial institutions, health and safety regulations applying to electronic work must be adhered to.

## EMC declaration

This product is developed in accordance with the European standards EN 55014 and EN 50082-1, tested corresponding to the EC - directive 89/336/EEG (EMVG of 09/11/1992, electromagnetic tolerance) and meets legal requirements.

To guarantee the electromagnetic tolerance you must take the following precautions:

- Connect the transformer only to an approved mains socket installed by an authorised electrician.

- Make no changes to the original parts and accurately follow the instructions, circuit diagram and PCB layout included with this manual.
- Use only original spare parts if you have to repair the kit or the ready-built module.

## Operation overview

The shadow-station allows you to supervise and to control up to 32 railway sidings and one thoroughfare rail. The modular design of the shadow-station allows it to be adapted to individual needs. It is composed of:

- one central module with an integrated rail module to supervise and to control two railway sidings and one thoroughfare rail,
- one display and operating module,
- up to 15 further rail modules (optional).

The following operating modes can be set:

- first-in-first-out-operation
- random operation or
- manual operation.

The current operating mode is saved and is automatically set when the model railway is started the next time.

The modules automatically control the connected points: As soon as a train has arrived in a siding, the connected points turn to "thoroughfare". When the train has departed out of the railway siding and as soon as the module has detected the siding to be vacant (i.e. there are no current consumers left on the siding) the connected points are set to "entrance into railway siding".

If all railway sidings are occupied a further train coming into the shadow-station is automatically guided on to the thoroughfare rail.

As soon as the departure of a train from a railway siding is initiated, the siding will be provided with power supply for ca. 10 seconds. If a current consumer is detected on the railway siding afterwards (e.g. a torn-off carriage with lighting) the module indicates a malfunction. The

malfunction will be automatically removed 5 to 6 seconds after the current consumer has been taken off the rails.

The shadow-station control can be used in a.c. or d.c. systems as well as in digital operation.

## Technical specifications

Supply voltage	16 - 18 Volt a.c. voltage
Current consumption	ca. 15 mA
Protected to	IP 00
Ambient temperature in use	0 - + 60° C
Ambient temperature in storage	-10 - + 80° C
Comparative humidity allowed	max. 85 %
Dimensions (SBS-GZ-1)	ca. 72 x 83 mm
Dimensions (SBS-AB-1)	ca. 32 x 105 mm
Weight (SBS-GZ-1)	ca. 70 g
Weight (SBS-AB-1)	ca. 19 g

## Choosing a power supply

The module is designed for connection to a model railway power source, i.e. 16-18 Volt alternating (a.c.) voltage.

## Checking the package contents

Check the contents of the package for completeness:

### Basic pack shadow station control SBS-B-1

- 1 kit "Central module" SBS-GZ-1, containing the components listed in the parts list "Central module" and one PCB or
- 1 ready-built central module,
- 1 kit "Display and operating module" SBS-AB-1, containing the components listed in the parts list and one PCB or
- 1 ready-built display and operating module
- 1 manual.



## Addition pack rail module SBS-G-1

- 1 kit " Rail module" SBS-GZ-1, containing the components listed in the parts list "Rail module" and one PCB or
- 1 ready-built rail module,
- 1 manual.

## Required tools and consumables

Make sure you have the following tools, equipment and materials ready for use:

- a heat-resistant mat
- a soldering iron stand with tip-cleaning sponge
- a small side cutter and wire stripper
- a pair of tweezers and long nose pliers (not necessary for the ready-built module)
- an electronic soldering iron (max. 30 Watt) with a fine tip
- tin solder (0,5 mm. diameter)
- wire (diameter:  $\geq 0,22 \text{ mm}^2$  for all connections)
- two lamps for testing the central / rail module
- two points for testing the central / rail module

## Safe and correct soldering



### Caution:

Incorrect soldering can cause fires (through excessive heat). Avoid this danger by reading the chapter **Safety instructions** again and following the directions given.

If you have had training in soldering you can skip this chapter.

- Use a small soldering iron with max. 30 Watt. Keep the soldering tip clean so the heat of the soldering iron is applied to the solder point effectively.

- When soldering electronic circuits never use soldering-water or soldering grease. They contain acids that can corrode components and copper tracks.
- Only use electronic tin solder with flux.
- Solder fast: long soldering can destroy components and copper tracks, and damages through plated holes.
- Observe correct polarity orientation of semi-conductors, LEDs electrolytic capacitors and integrated circuits before soldering and ensure that the solder time does not exceed 5 seconds, otherwise components can be damaged.
- Apply the soldering tip to the soldering spot in such a way that the part and the soldering spot are heated at the same time. Simultaneously add solder (not too much). As soon as the solder becomes liquid take it away. Hold the soldering tip at the spot for a few seconds so that the tin solder finds its way, then remove the soldering iron.
- Do not move the component for about 5 seconds after soldering.
- To make a good soldering joint you must use a clean and unoxidised soldering tip. Clean the soldering tip with a damp piece of cloth, a damp sponge or a piece of silicon cloth.
- Cut the wires after soldering directly above the PCB solder side with a side cutter.
- After placing the parts, please double check for correct polarity. Check the PCB tracks for solder bridges, short circuits created by accident. This would cause faulty operation or, in the worst case, damage. You can remove excess solder by putting a clean soldering tip on the spot. The solder will become liquid again and flow from the soldering spot to the soldering tip.

## Assembling the kit

You can skip this part if you have (a) ready-built module(s).

### Preparation

Put the sorted components in front of you on your workbench. An explanation of the separate electronic components follows:

#### Resistors



A resistor will "brake" the current. Mounting orientation is of no importance. Because resistors are very small there is no readable information on them, but their value is given with colour rings.

Key:

Value	Colour ring
120 $\Omega$	brown - red - brown (gold)
1,5 k $\Omega$	brown - green - red (gold)
4,7 k $\Omega$	yellow - violet - red (gold)

The colour ring in brackets indicates the tolerance of the resistor and is of no importance here.

#### Capacitors



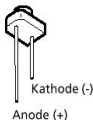
There is a difference between "normal" capacitors and electrolytic capacitors which have to be placed in a certain direction. They have a very bright line at one end marked with the minus (-) sign. That end must always be connected to minus.

#### Diodes



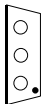
Diodes allow current to flow in one direction only and have to be placed in that direction. The characteristic for a diode is the ring at one end. Place them as drawn in the PCB layout.

## LEDs



LEDs are a special diode. When they are used in the current direction they light up. They are available in diverse forms (colour, shape, max. current, size, luminosity, etc. etc.). The long wire of an LED is the anode (plus) side.

## Transistors



Transistors are in fact power switches. They also have to be placed in a certain direction. The PCB layout will help you to place the transistor. The point in the PCB layout indicates the lettered side of the transistor.

## ICs



Depending on their type, ICs can take over different functions. Some types are programmable and can be adjusted to special requirements of a circuit. The notch on the IC shows the mounting orientation. The PCB layout shows this marking.

## Voltage regulator



Voltage regulators are ICs in a transistor housing. They transform a varying uncontrolled input voltage into a unvarying output voltage.

## Relais



Relais are electronic change-over switches. The mounting direction is preset by the order of the pins.

## Rectifiers



Rectifiers convert alternating (a.c.) into direct (d.c.) voltage. They should be inserted according to the polarity shown on the PCB Layout.

## Terminal strips

Terminal strips are solder-in screw-type terminals. They provide a solder-free and safe connection of the cables to the circuit.

## Assembling the central / rail module

The PCBs for the central and the rail module are identical. The two kits only differ with regard to the components.

### **Caution:**

You must pay attention to the differences when mounting the PCBs. If you don't then the module will not have the wanted function.

Start the assembly with the resistors and the diodes. First solder the components on the solder side of the PCB and then cut the excess wires with the side cutter as short as possible. Next solder the IC-sockets. Continue with the capacitors, the LEDs and the transistors.

### **Caution:**

Electrolytic capacitors, transistors, diodes, ICs and rectifiers must be placed in the right direction! If you solder them the wrong way the affected parts can be damaged when you connect the power. In the worst case the whole circuit can be damaged. In any case, a wrongly connected part will not function.

Continue with the rectifier and the voltage regulator IC2. Then solder the relais and the terminal strips. Assemble the terminal strips before mounting them. Finally, insert the ICs into the already soldered-in IC-socket. The ICs must be inserted as shown on the PCB.

### **Caution:**

Do not touch the IC without first discharging yourself by touching a radiator or other grounded metal parts. Do not bend the "legs" of the IC.

### **Caution:**

All kits contain one IC PIC16F627 (IC-1). They are differently programmed for the central module, the rail module and the display and operating module. You should be careful not to mix up these Ics .

## Assembling the display and operating module SBS-AB-1

Start the assembly with the resistors and the diodes. First solder the components on the solder side of the PCB and then cut the excess wires with the side cutter as short as possible. Make the wire bridge Br next. Use the cut-off wires or the resistors. Then solder the socket for the IC.

Continue with the capacitors, the LEDs and the voltage regulator IC2. If you intend to mount the soldered PCB into a housing all elkos should be soldered horizontal to the PCB. (You might have to extend the legs to enable this.)



### Caution:

Electrolytic capacitors, transistors, diodes, ICs and rectifiers must be placed in the right direction! If you solder them the wrong way the affected parts can be damaged when you connect the power. In the worst case the whole circuit can be damaged. In any case, a wrongly connected part will not function.

Continue with the push-button and the solder pin JP3. Finally, insert the IC into the already soldered-in IC-socket. The ICs must be inserted as shown on the PCB.



### Caution:

Do not touch the IC without first discharging yourself by touching a radiator or other grounded metal parts. Do not bend the "legs" of the IC.



### Caution:

All kits contain one IC PIC16F627 (IC-1). They are differently programmed for the central module, the rail module and the display and operating module. Be careful not exchange these ICs otherwise the modules will not operate correctly

There are some components shown on the PCB-layout of the display and operating module which are not necessary for the basic version of the display and operating module SBS-AB-1. These components are not included in the basic pack:

- resistors R9, R10
- diode D3
- socket pins JP1 and JP2

These components are to be used together with a LCD-display and are part of the LCD-convertible pack.

## Performing a visual check

Even if you have (a) ready-built module(s) you must perform a visual check that screws, plugs and other fasteners are firm and tight to exclude transport damage.



### **Caution:**

Do not power up the module(s) yet.

Damaged material and/or incorrect handling of parts can always be a danger. After assembling the kit, perform a visual inspection.

Check all nuts, pins and connections as well as the mechanical connections for correct assembly.

Remove all loose parts, wire ends or drops of solder from the PCB. Remove all sharp wire ends.

Check solder spots that are too close to each other for short circuits. Check that all components are polarised correctly. When you have taken all these precautions, go on to the next part.

## Display and operating elements of the modules

This chapter is meant to familiarize you with the operating elements of the modules. Before connecting the modules and setting them into operation you must perform the required functional tests.

### Operating elements of the display and operating module

By using the push-button S3 you can switch between programming and operation mode. The attached diodes D23 and D24 show the set mode, and indicate the following:

D23 (green)	operation mode
D24 (red)	programming mode

In the programming mode you can switch between the operating modes with the push-buttons S1 (down) and S2 (up). The set operating mode is shown by the diodes D25 and D26 as follows:

D25 (red) + D26 (green)	manual operation
D25 (red)	first in first out operation
D26 (green)	random operation

### Operating elements of the central module and the rail modules

The diodes D23 and D24 show the state of rail 1, and diodes D25 and D26 that of rail 2, as indicated below:

D23 resp. D25 (green)	Rail vacant, attached points set to "entrance into railway siding"
D24 resp. D26 (red)	Rail occupied, attached points set to "thoroughfare"
D23 (green) + D24 (red) / D25 (green) + D26 (red) light together	Departure of the train from the railway siding
D23 (green) + D24 (red) / D25 (green) + D26 (red) flash by turns	Malfunction on the rail (e.g. derailment)



By pushing the buttons of the central or the rail module you can initiate the following actions:

push-button between X10 and X11	Departure of the train from the railway siding 1 (only in manual operation, in „first in first out“ operation and in random operation pushing the button has no effect.)
push-button between X22 and X11	Departure of the train from the railway siding 2 (only in manual operation, in „first in first out“ operation and in random operation pushing the button has no effect.)
push-button between X2 and X11 of the central module	Emergency stop. The central module and all rail modules set the connected points to "thoroughfare". The shadow station control can only be re-activated by switching it off and on again.

## Operation of the modules

This chapter is meant to familiarize you with the operation of the modules. Before connecting the modules and setting them into operation you should perform the required functional tests.



### Caution:

Before switching on the shadow station control you should switch on the power supply for the track, otherwise the data transferred to the modules during the „rail occupied“ check is incorrect.

### Operation of the display and operating module

When switched on, the display and operating module is set to the last activated operation mode (the green LED D23 lights). The push-buttons are kept blocked until as the diodes D23 and D24 have flashed twice. This is the signal that the central modul has taken over the necessary data and regular operation has started.

## **Change of the operating mode**

To change the operating mode you should switch to the programming mode. Push the button S3. Now the red LED D23 and the green LED D24 light together. Keep the button pushed until only the red LED lights. By pushing the buttons S1 and S2 you can now switch between the different operating modes.

Confirm the choice of the operating mode by pushing the button S2 again. Keep the button pushed until only the green LED lights. Next the diodes D23 and D24 flash in turn three times. The first double flashlight shows that the operating mode has been saved in the display and operating module, the next two double flashlights confirm that the setting of the operating mode has been transferred to the central module.

## **Initiating the departure of a train in random operation and in „first in first out“ operation**

In random operation and in „first in-first out“ operation you can manually initiate the departure of a train. Push the buttons S1, S2 and S3 one after the other and then push them simultaneously. As soon as you release them the departure of the train is initiated.

## **Operation of the central module**

When switched on, the central module first checks:

- how many additional rail modules are connected
- if the display and operating module are properly connected (if no display and operating module is found the central module automatically sets to manual operation)
- which operating modus was active before switching off.
- which rails are occupied.

As soon as the check is completed the LEDs D23 and D24 flash in turn twice. Next the central module transfers the data to the display and operating module. This confirms the data reception by double flashing each of the LEDs D23 and D24 in turn. Then the central module checks if the track sections connected to it are occupied and shows accordingly

the occupied state at the diode pairs D23/D24 and D25/D26. If necessary it switches the connected points into the correct position.

### Operation of the rail modules

When switched on, the rail modules check if the connected railway sidings are occupied and indicate this at the diode pairs D23/D24 and D25/D26. If necessary they switch the connected points into the correct position.

While the central module checks the number of the connected rail modules all four LEDs light at one rail module after the other. As soon as the check is completed the occupied state of the railway sidings is shown again.

## Connecting the modules and performing functional tests

If you have purchased a ready-built module, please check all functions. As transport damage can never be completely out ruled.

### **Caution:**

The modules should not be connected to the powersupply when wiring is being carried out!

Follow the connections diagramm Fig. 3!

First connect the connection points of the display and operating module with the terminal strips on the central module as follows:

Display /operating module	Central module
JP3/1	X11
JP3/2	X20
JP3/3	X13
JP3/4	X3

Continue with the following connections on the central module:

Central module	Central module
X1	X7
X1	X18

Next make the following connections for the testing assembly:

Central module	Testing assembly
X9 and X12	lamp 1
X21 and X12	lamp 2
X4	testing points 1: terminal for "thoroughfare"
X5	testing points 1: Central (yellow) terminal
X6	testing points 1: terminal for "entrance into railway siding"
X15	testing points 2: terminal for "thoroughfare"
X16	testing points 2: central (yellow) terminal
X17	testing points 2: terminal for "entrance into railway siding"
X10 und X11	push-button for railway siding 1
X22 und X11	push-button for railway siding 2

Tip: The terminal strips X4 to X10 (lower row) are associated with railway siding 1, the terminal strips X15 to X19, X21 and X22 (upper row) with railway siding 2.

### Explanation of the testing assembly

The lamps connected to the terminal strips X9 and X12 or X21 and X12 simulate two trains stopping on the attached railway sidings. As soon as the departure of a train out of a railway siding is initiated, the attached lamp lights. Approx. 10 seconds later the lamp goes off and a malfunction is shown for the railway siding (as the supposed train has not left the railway siding). By disconnecting the lamps on the terminal strips X9 or X21, the departure of a train out of the railway sidings 1 or 2 can be simulated and this way the malfunction is eliminated.

## Switching on the shadow station control

Connect the central module to the power supply according to the connection diagram fig. 3. The display and operating module is supplied via the central modul.

Central module	Power supply
X1 and X12	transformer

The LEDs D23 and D24 on the central module and the LEDs D23 and D24 on the display and operating module should now flash several times (see chapter "Operation of the modules"). The flashing of the LEDs confirms that the power supply to the two modules and the data transfer between the modules works. When this flashing stops the LEDs should light as follows:

Central module	D24 (red) and D26 (red) → railway siding 1 and 2 are occupied
Display and operating module	D23 (green) → operating mode
Display and operating module	D25 (red) and D26 (green): optional

## Testing the display and operating module

First perform a test of the display and operating module. Refer to the chapters "Operating elements of the modules" and "Operation of the modules".

Start with switching the programming mode (the red LED D24 must light). Then switch between the operating modes

- manual operation (the red LED D25 and the green LED D26 light together)
- first in first out operation (the red LED D25 lights) and
- random operation (the green LED D26 lights).

### **Caution:**

If a component gets too hot, disconnect the central module from the mains **immediately**. Possible short circuit! Check the assembly.

## Testing the central module

Refer to the chapters "Operating elements of the modules" and "Operation of the modules".

Set the operating mode to first in first out operation at the display and operating module and confirm the setting. Initiate the departure of a train at the display and operating module.

One of the lamps connected to the central module should now light. About 10 seconds later the lamp goes off. The pair of LEDs D23/D24 or D25/D26 should flash in turn. Continue by disconnecting the lamp that just lit, from X9 or X21. Five to six seconds later the attached green LED D23 or D25 should light and the attached points should switch to "entrance into railway siding".

Connect the lamp again. The red LED should light and the attached points should switch to "thoroughfare".

Set the operating mode to manual operation at the display and operating module. Perform the test as described before for the second lamp and the second points. Initiate the departure of a train for the appropriate railway siding by pushing the button between X10 and X11 or between X22 and X11 on the central module.

### **Caution:**

If a component gets too hot, disconnect the central module from the mains **immediately**. Possible short circuit! Check the assembly.

If you intend to test further rail modules after testing the central module you should mount the resistor R29 according to the connection diagram fig. 3. Otherwise correct data transmission between the modules cannot be guaranteed.

## Testing the first rail module

First disconnect the central module from the power supply and if necessary disconnect the lamps and the points connected to the central module for the test. Connect the rail module to the central module, according to the connection diagram Fig. 3 as follows:

Rail module	Central module
X1	X1
X12	X12
X11	X11
X3	X3
X13	X13

Next make the following connections for the testing assembly:

Rail module	testing assembly
X9 and X12	lamp 1
X21 and X12	lamp 2
X4	testing points 1: terminal for "thoroughfare"
X5	testing points 1: central (yellow) terminal
X6	testing points 1: terminal for "entrance into railway siding"
X15	testing points 2: terminal for "thoroughfare"
X16	testing points 2: central (yellow) terminal
X17	testing points 2: terminal for "entrance into railway siding"
X10 und X11	push-button for railway siding 1
X22 und X11	push-button for railway siding 2

Connect the central module to the power supply. After checking if the modules are ready for operation and the occupied state of the points on the central module, the red diodes D24 and D26 on the rail module should light. They show that both railway sidings are occupied.

Set the operating mode to manual operation on the display and operating module. Perform the test for the two lamps and the two points as described in the chapter "Testing the central module".



### Caution:

If a component gets too hot, disconnect the central module from the mains **immediately**. Possible short circuit! Check the assembly.

### Testing further rail modules

First disconnect the central module from the power supply and disconnect if necessary the lamps and the points connected to a rail module for the test. Connect the rail module according to the connection diagram Fig. 3 to the respective last rail module as follows:

New rail module	So far last rail module
X1	X1
X12	X12
X11	X11
X3	X3
X13	X14

Continue making the connections for the testing assembly as described for the first additional rail module. Connect the central module to the power supply. After checking if the modules are ready for operation and the occupied state of the points at the central module, the red diodes D24 and D26 on the rail module must light. They show that both railway sidings are occupied.

Set the operating mode to manual operation at the display and operating module. Perform the test for two lamps and two points as described in the chapter "Testing the central module".



### Caution:

If a component gets too hot, disconnect the central module from the mains **immediately**. Possible short circuit! Check the assembly.

After performing successful function tests on all modules, disconnect the central module from the power supply. Disconnect all connections made for the test. Continue with the wiring up of the modules.



## Tracks within the reach of the shadow station control

The rails within the reach of the shadow station control must be divided into three sections for each railway siding (see fig. 5). The entrance and the departure rail as well as the thoroughfare rail must be connected electrically to the rest of the model railway. The other sections (part A and part B of the railway siding should be cut off electrically from the rest of the model railway. If the model railway is separated into block sections the complete shadow station must be one block section.

Section 1 = entrance rail with entrance points and departure rail with departure points: These are parts of the model railway and are powered constantly.

Section 2 = Part A of the railway siding: This section is also powered constantly, but is supervised by the shadow station control. This section must be as long as the longest train.

Section 3 = Part B of the railway siding: This section is not powered when a train enters into the railway siding. When the departure is initiated the section is powered for ca. 10 seconds and then disconnected again from the power supply. When constructing this section you have to take care that the incoming trains stop before reaching the next section. The required length depends on the driving characteristics and the speed of the incoming locomotives, and on the number and mass of the connected carriages.

## Connecting the shadow station control



### Caution:

Don't connect the module to power until the wiring is complete!

Follow the connections diagramm Fig. 4!

Tip: The connections of the display and operating elements (push-buttons and LEDs) can be extended according to the individual needs and can be integrated into a „layout orientated“ switching desk.

Tip: All modules are prepared for housing.

### Connecting the display and operating module to the central module

First connect the connecting points of the display and operating module to the terminal strips of the central module as follows:

Display and operating module	Central module
JP3/1	X11 (Ground)
JP3/2	X20 (+VCC)
JP3/3	X13 (Clock)
JP3/4	X3 (Data)

### Connecting the central module

Tip: The terminal strips X4 to X10 (lower row) are associated with railway siding 1, the The terminal strips X15 to X19, X21 and X22 (upper row) with railway siding 2.

First make the connection from the central module to the power supply. Keep the module switched off!

Central module	Power supply
X1 and X12	transformer

Next connect the points to the central module. (These connections are identical to the rail module connections.)

Central / rail module	Points
X4	points 1: terminal for "thoroughfare"
X5	points 1: central (yellow) terminal
X6	points 1: terminal for "entrance into railway siding"
X15	points 2: terminal for "thoroughfare"
X16	points 2: central (yellow) terminal
X17	points 2: terminal for "entrance into railway siding"

Then connect the rails to the central module. (These connections are identical to the rail module connections.) In 2-rail-d.c.-systems you should pay attention to the polarity of the rails (see fig. 5).

Central / rail module	Rails
X9	rail section 1 of the railway siding 1
X8	rail section 2 of the railway siding 1
X7	rail section 3 of the railway siding 1
X21	rail section 1 of the railway siding 2
X19	rail section 2 of the railway siding 2
X18	rail section 3 of the railway siding 2

Afterwards connect the push-buttons to the central module.

X10 and X11	push-button for railway siding 1
X22 and X11	push-button for railway siding 2
X2 and X11	push-button for emergency-stop

### Connecting the first rail module

Tip: The terminal strips X4 to X10 (lower row) are associated with railway siding 1, the The terminal strips X15 to X19, X21 and X22 (upper row) with railway siding 2.

First make the connection from the first rail module to the central module. Keep the module switched off!

First rail module	Central module
X1	X1
X12	X12
X11	X11
X3	X3
X13	X13

Then connect the points and the rails to the rail module. Proceed as described in "Connecting the central module". Finally connect the push-buttons to the rail module.

X10 and X11	push-button for railway siding 1
X22 and X11	push-button for railway siding 2

If you intend to connect further rail modules beside the first rail module you should mount the resistor R29 according to the connections diagram fig. 4. Otherwise correct data transmission between the modules cannot be guaranteed. Otherwise correct data transmission between the modules cannot be guaranteed.

### Connecting further rail modules

You can connect up to 15 rail modules to the central module. This allows to supervise and to control up to 32 railway sidings. Connect the further rail modules to the existing previous rail module as follows:

New rail module	Previous rail module
X1	X1
X12	X12
X11	X11
X3	X3
X14	X13

Then connect the points and the rails to the rail module. Proceed as described in "Connecting the central module".

Finally connect the push-buttons as described in "Connecting the first rail module".

The resistor R29 should be mounted on the last module according to the connection diagram fig. 4. Otherwise correct data transmission between the modules cannot be guaranteed.

## FAQ

- Parts are getting too hot and/or start to smoke.



**Disconnect the system from the mains immediately!**

Possible cause: one or more components are soldered incorrectly.

→ Perform a visual check.

- The lamp(s) connected for the functional test of the module(s) does / do not light.

Possible cause: One or more components are soldered incorrectly.

→ Perform a visual check.

Possible cause: The power supply is interrupted.

→ Check the connection from the central modul to the transformer.

Possible cause: The lamp(s) is / are defective.

→ Check the lamp(s) by connecting it directly to the voltage supply.

- After switching on the shadow station control and the diode pairs D23/D24 on the central module have flashed, the diodes D23/D24 on the display and operating module do not flash.

Possible cause: The connections from the display and operating module to the central module are incorrect.

→ Check the connections.

- After switching on the shadow station control and the diode pairs D23/D24 on the central module have flashed, the diode pairs D23/D24 and D25/D26 on the connected rail modules do not flash.

Possible cause: The connections from the rail modules to the central module are incorrect.

→ Check the connections.

If you cannot find the problem, please return the module for repair (address on the cover page).

## Manufacturer's note

According to DIN VDE 0869, the person who builds this kit or brings the circuit into operation is the manufacturer of the product. If he sells the product to another person he is responsible for passing on all the relevant papers. Domestic appliances assembled from a kit are deemed industrial products and must comply with health and safety regulations.

## Certification

This product conforms with the EC- directive 89/336/EWG on electromagnetic radiation and is therefore CE certified.

## Conditional warranty

This product is guaranteed for two years. The warranty includes free repair if the problem is due to material failure or incorrect assembly of the ready-built module by us. Because we have no control over the assembly of the kit, we can only guarantee the quality of the components and the completeness of the kit.

Other claims are excluded. By law, we are not responsible for damages or secondary damages in connection with this product. We retain the right to repair, make improvements, supply spare parts or return the purchase price.

The following invalidate the warranty:

- using an unsuitable soldering iron, solder containing liquid acids or similar,
- if the kit is assembled and soldered poorly, or if damage is caused by not following the instructions in this manual or the circuit diagram,
- if the circuit has been altered and repair attempts have failed,
- if arbitrary changes in the circuit are made,
- if parts are stored incorrectly and if the wires to the switches, the power resistors, etc. are made incorrectly,
- if parts other than the original ones delivered with this kit are used,
- if the copper tracks or soldering points are damaged,
- if parts are placed incorrectly or the circuit is connected incorrectly,
- if damage occurs due to an overload of the circuit,
- if the wrong power or current is connected,
- if damaged by other persons,
- if damaged by the wrong use or abuse of the circuit,
- if parts are damaged due to static because they were touched before a discharge is performed.

# Gleismodul / Zentralmodul

## Rail module / Central module

SBS-GZ-1

### Stückliste - Parts list

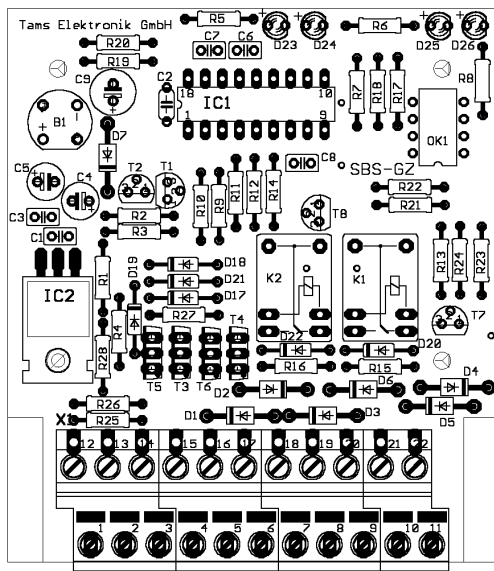
Kondensatoren - Condensers	C1, C2, C3, C6, C7	100 nF
	C8 <sup>(2)</sup>	100 nF
	C4, C5	100 µF / 25 V
	C9	220 µF / 25 V
Dioden - Diodes	D1 - D7	1N4002 *
	D17 - D22	1N4148 *
LEDs	D23, D25	grün - green
	D24, D26	rot - red
ICs	IC1	PIC 16F627
	OK1	PC827
IC-Sockel - IC-sockets	18-pol.	1 x
	8-pol.	1 x
Transistoren - Transistors	T1, T2 <sup>(1)</sup>	BC547B *
	T7, T8	BC547B *
	T3 - T6	BD679
Widerstände - Resistors	R1, R2 <sup>(1)</sup>	4,7 kΩ
	R9 - R14, R17 - R20, R29	4,7 kΩ
	R26 <sup>(2)</sup>	4,7 kΩ
	R3 <sup>(1)</sup>	1,5 kΩ
	R15, R16	1,5 kΩ
	R4 <sup>(1)</sup>	120 Ω
	R 5 - R8, R21 - R24, R27, R28	120 Ω
	R25 <sup>(2)</sup>	120 Ω
Spannungsregler Voltage regulator	IC2	7805

Gleichrichter - Rectifier	B1	B80 C1500
Relais	K1, K2	1xUm
Doppel-Anreihklemme Double terminal strip	X1	1 x 2-pol. 3 x 3-pol.
Taster - Button		2 x

\* oder ähnlich - or similar

- (1) nicht erforderlich beim Zentralmodul  
not necessary for the central module
- (2) nicht erforderlich beim Gleismodul  
not necessary for the rail module

### Bestückungsplan - PCB layout ■ ■ ■ Fig. 1.1





# Anzeige und Bedienmodul

## Display and operating module

SBS-AB-1

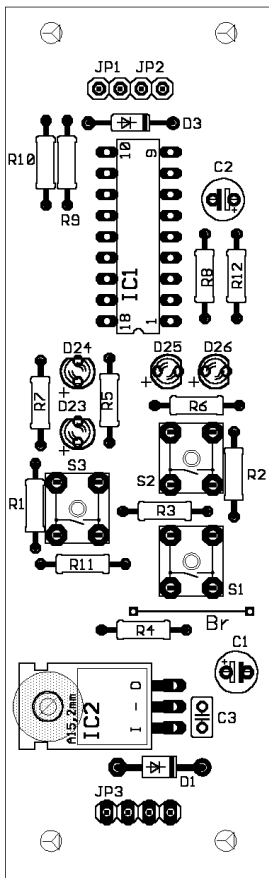
### Stückliste - Parts list

Kondensatoren - Condensers	C1, C2	100 $\mu$ F / 25V
	C3	100 nF
Dioden - Diodes	D1	1N4004 *
LEDs	D23, D26	grün - green
	D24, D25	rot - red
ICs	IC1	PIC16F627
IC-Sockel - IC-socket	18-pol.	1 x
Widerstände - Resistors	R1, R4 - R8	120 $\Omega$
	R2, R3, R11, R12	4,7 k $\Omega$
Spannungsregler Voltage regulator	IC2	7805
Stiftleisten - Solder pins	JP3	4-pol.
Taster - Button	S1 - S3	3 x

\* oder ähnlich - or similar - ou équivalent - of gelijkwaardig

## Bestückungsplan

### PCB layout ■ ■ ■ Fig. 1.2



## Bitte beachten Sie:

Folgende auf dem Bestückungsdruck des Bedien- und Anzeigemoduls dargestellten Bauteile werden für das Anzeige- und Bedienmodul SBS-AB-1 nicht benötigt und sind in der Basispackung nicht enthalten:

- Widerstände R9, R10,
- Diode D3,
- Stiftleisten JP1 und JP2.

Die betreffenden Bauteile werden bei Einsatz einer LCD-Anzeige benötigt und sind im LCD-Umrüstset enthalten.

## Please note:

There are some components shown on the PCB-layout of the display and operating module which are not necessary for the basic version of the display and operating module SBS-AB-1. These components are not included in the basic pack:

- resistors R9, R10,
- diode D3,
- socket pins JP1 and JP2.

These components are to be used together with a LCD-display and are part of the LCD-convertible pack.

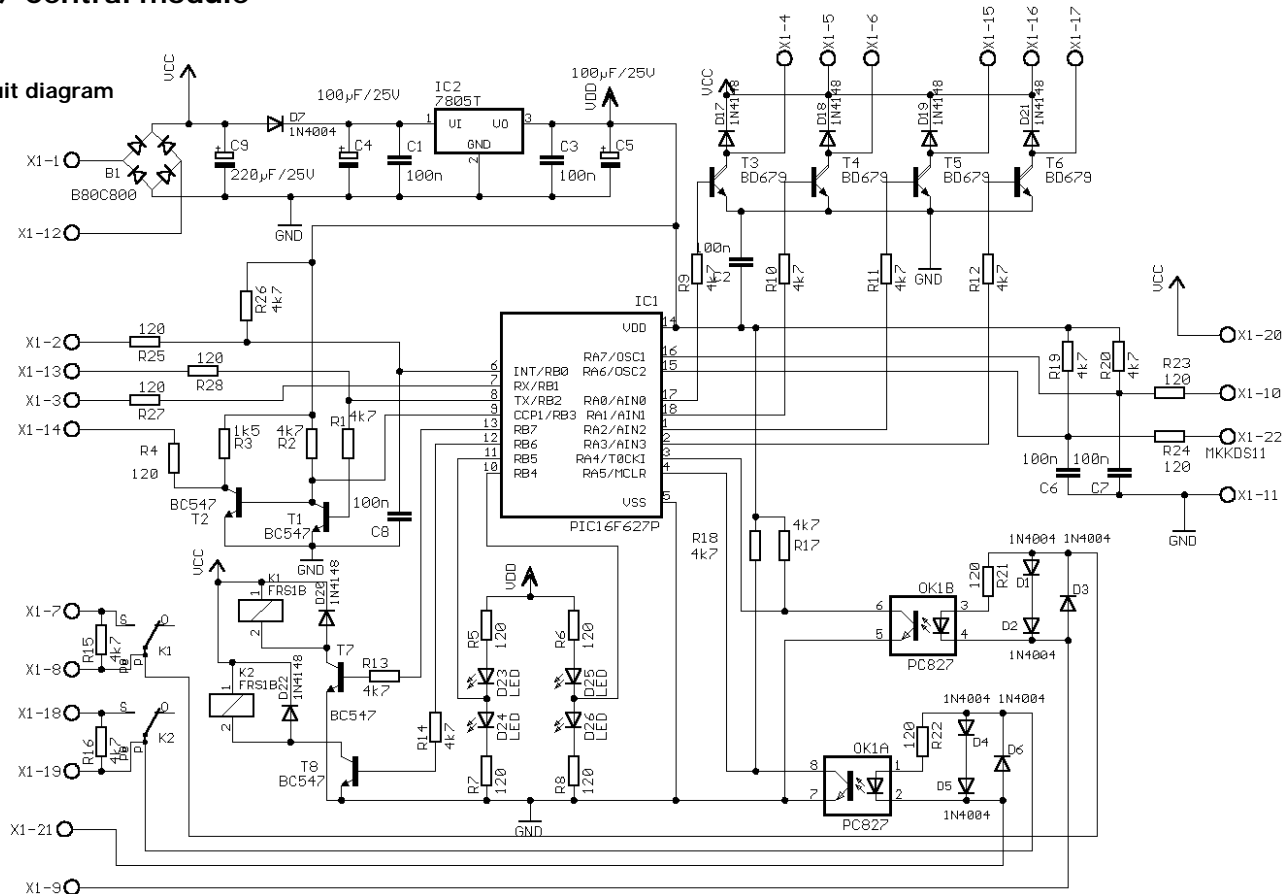
# Gleismodul / Zentralmodul

## Rail module / Central module

### SBS-GZ-1

#### Schaltplan - Circuit diagram

■ ■ ■ Fig. 2.1



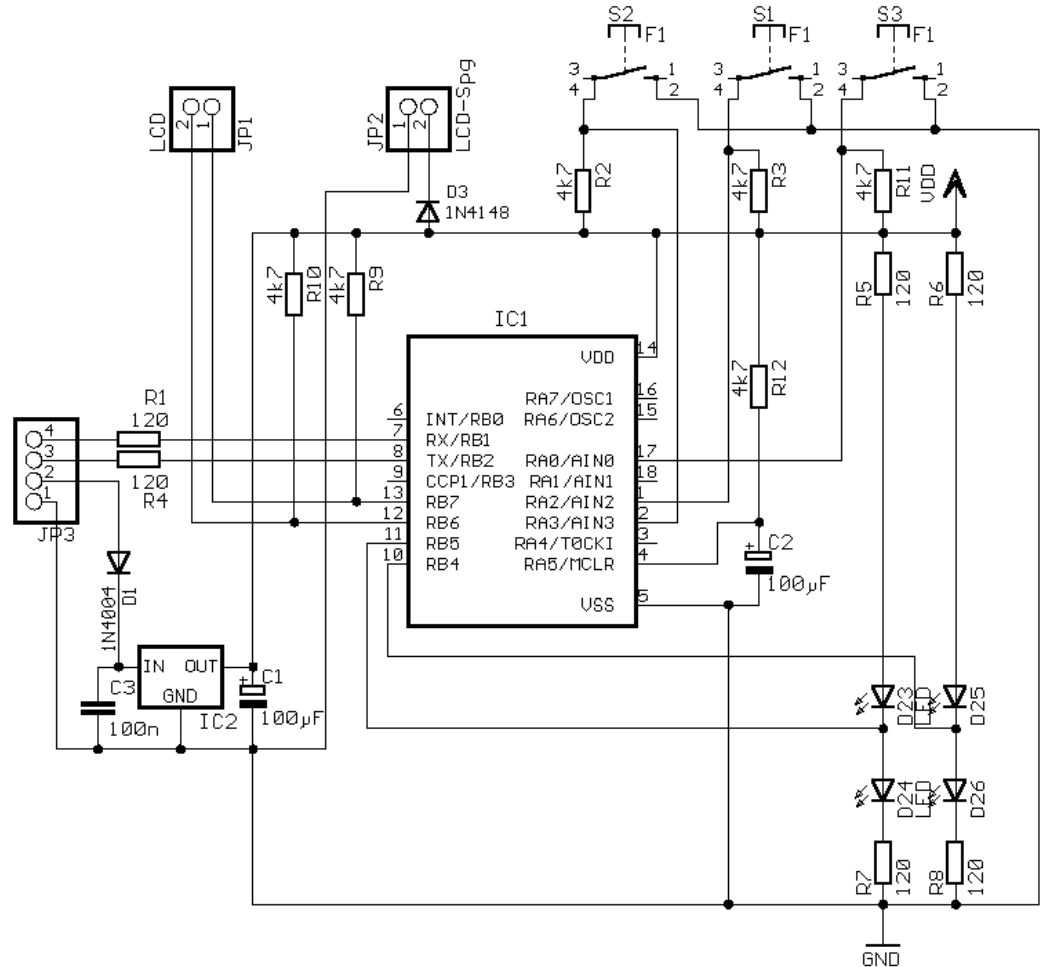
# Anzeige- und Bedienmodul

## Display and operating module

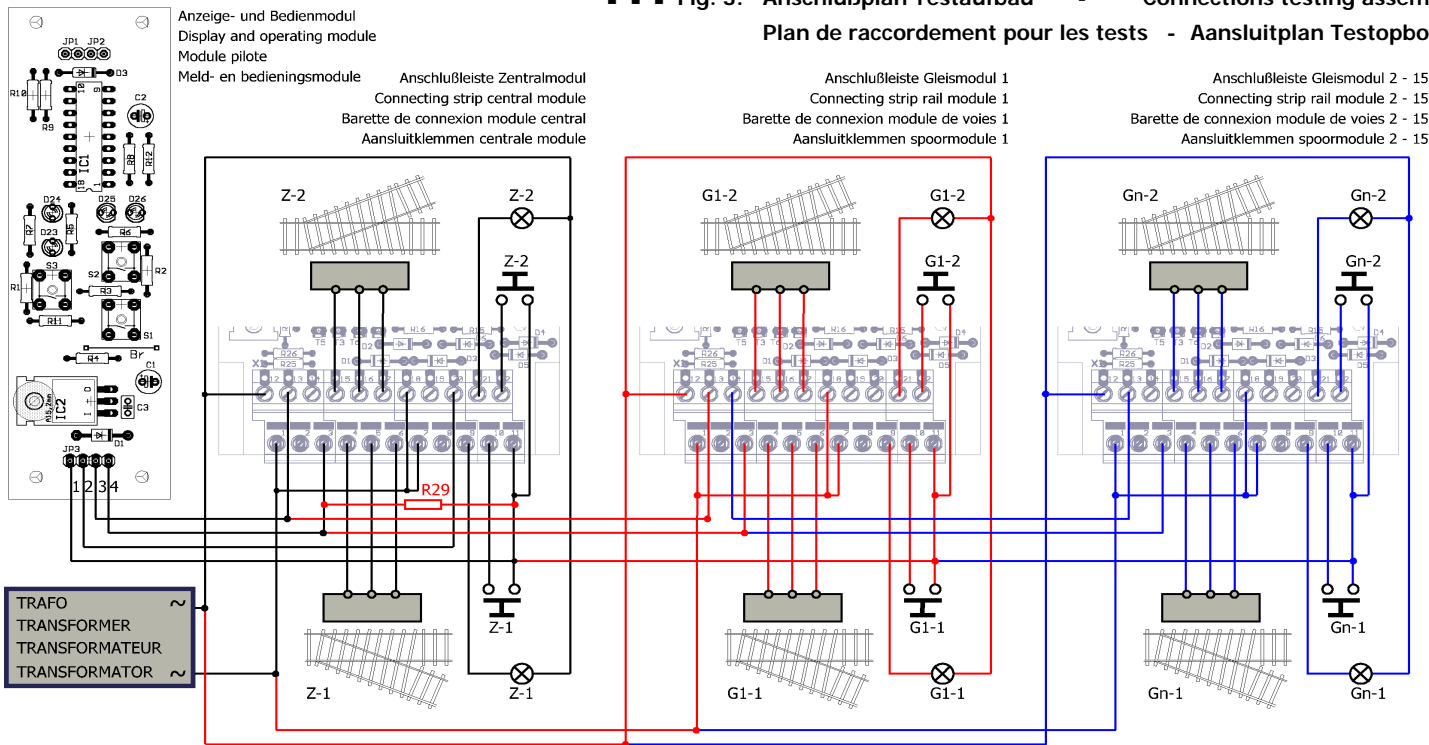
### SBS-AB-1

Schaltplan - Circuit diagram

■ ■ ■ Fig. 2.2



■ ■ ■ Fig. 3: Anschlußplan Testaufbau - Connections testing assembly  
Plan de raccordement pour les tests - Aansluitplan Testopbouw

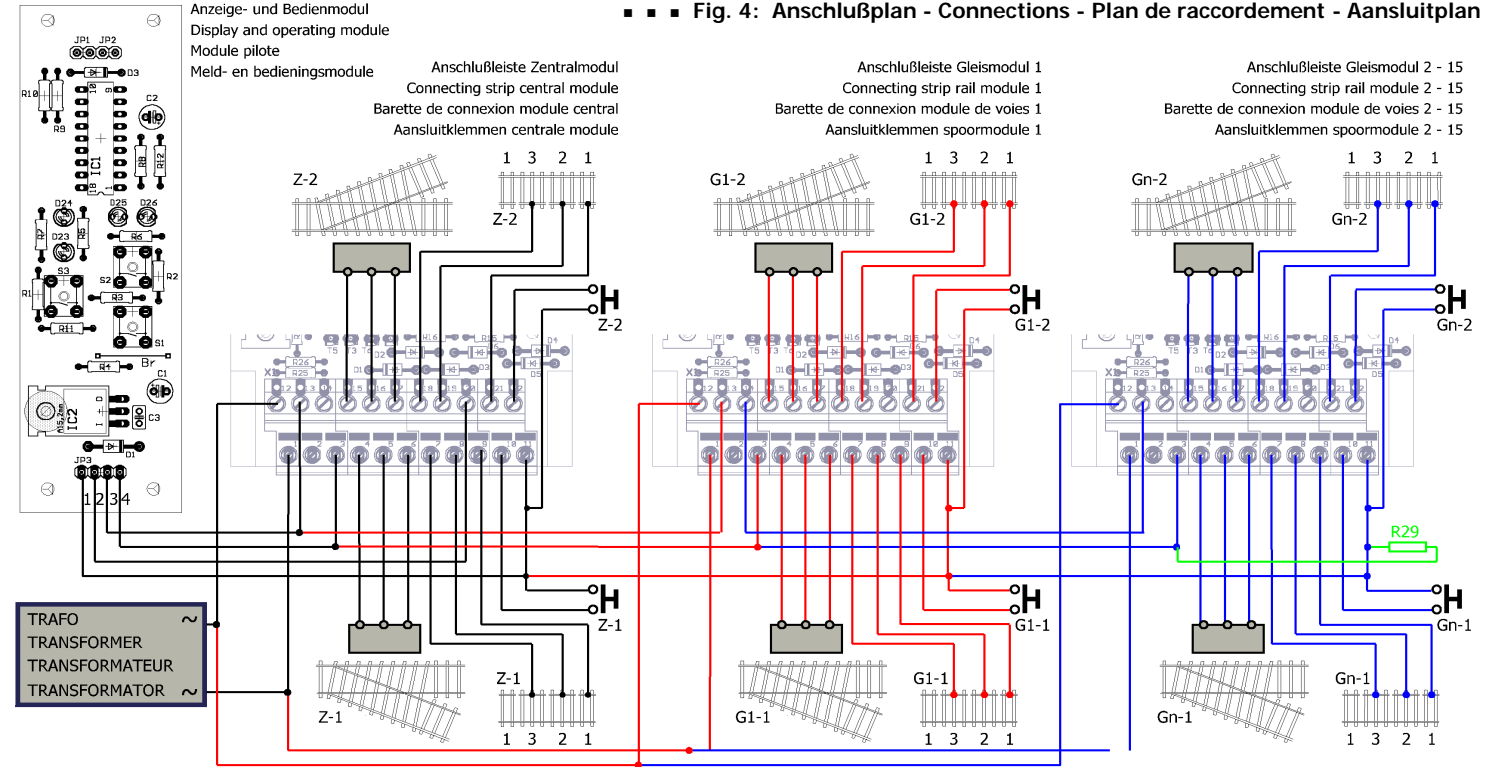


— Anschluß Anzeige- und Bedienmodul an Zentralmodul  
— Connection display and operating module to central module  
— Connexion du module pilote au module central  
— Aansluiting meld- en bedieningsmodule op de centrale module

— Anschluß 1. Gleismodul an Zentralmodul  
— Connection 1st rail module to central module  
— Connexion du premier module de voies au module central  
— Aansluiting 1. spoormodule op de centrale module

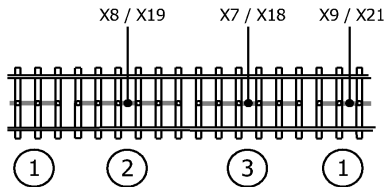
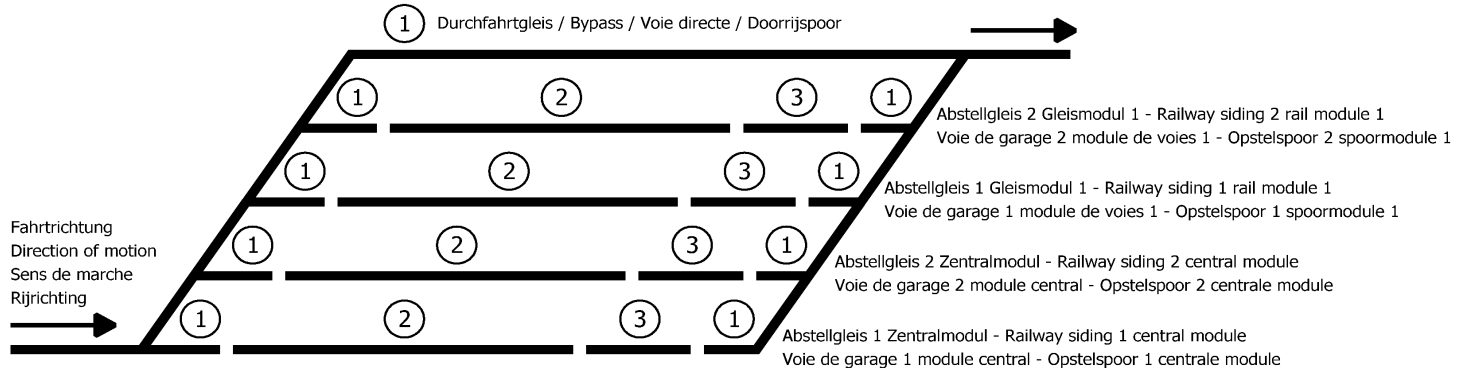
— Anschluß Gleismodule 2 - 15 an vorheriges Gleismodul  
— Connection rail modules 2 to 15 to the previous rail modules  
— Connexion des modules de voies 2-15 au module de voies qui le précède  
— Aansluiting spoormodule 2 - 15 op de voorlaatste spoormodule

■ ■ Fig. 4: Anschlußplan - Connections - Plan de raccordement - Aansluitplan

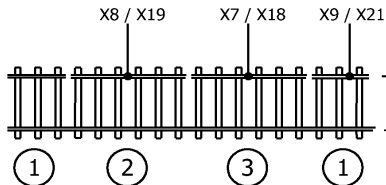


<ul style="list-style-type: none"> <li>— Anschluß Anzeige- und Bedienmodul an Zentralmodul</li> <li>— Connection display and operating module to central module</li> <li>— Connexion du module pilote au module central</li> <li>— Aansluiting meld- en bedieningsmodule op de centrale module</li> </ul>	<ul style="list-style-type: none"> <li>— Anschluß 1. Gleismodul an Zentralmodul</li> <li>— Connection 1st rail module to central module</li> <li>— Connexion du premier module de voies au module central</li> <li>— Aansluiting 1. spoormodule op de centrale module</li> </ul>	<ul style="list-style-type: none"> <li>— Anschluß Gleismodule 2 - 15 an vorheriges Gleismodul</li> <li>— Connection rail modules 2 to 15 to the previous rail modules</li> <li>— Connexion des modules de voies 2-15 au module de voies qui le précède</li> <li>— Aansluiting spoormodule 2 - 15 op de voorlaatste spoormodule</li> </ul>	<ul style="list-style-type: none"> <li>— Anschluß letztes Gleismodul</li> <li>— Connection of the last rail module</li> <li>— Connexion du dernier module</li> <li>— Aansluiting van de laatste module</li> </ul>
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■ ■ ■ Fig. 5: Anschluß der Gleisabschnitte - Connection of the track sections  
Connexion des sections de voie - Aansluiten van de railstukken



Anschluß an Gleise mit Mittelkontakt  
Connection to three rail system  
Raccordement à la voie avec conducteur central  
Aansluiten op rails met middengeleider



Anschluß an Gleise ohne Mittelkontakt  
Connection to two rail system  
Raccordement à la voie sans conducteur central  
Aansluiten op rails zonder middengeleider

- ① Abschnitt 1:  
Einfahr- und Ausfahrtgleis mit Weichen / Durchfahrtgleis  
Section 1:  
Entrance and departure tracks with points / Bypass  
Section 1:  
Voies d'entrée et de sortie avec aiguillages / Voie directe  
Railstuk 1:  
Intij- en uitrijspoor met wissels / Doorrijspoor
- ② Abschnitt 2: Abstellgleis Teil A  
Section 2: Railway siding part A  
Section 2: Voie de garage partie A  
Railstuk 2: Opstelspoor deel A
- ③ Abschnitt 3: Abstellgleis Teil B  
Section 3: Railway siding part B  
Section 3: Voie de garage partie B  
Railstuk 3: Opstelspoor deel B

Aktuelle Informationen und Tipps:  
Information and tips:

<http://www.tams-online.de>

Garantie und Service:  
Warranty and service:

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