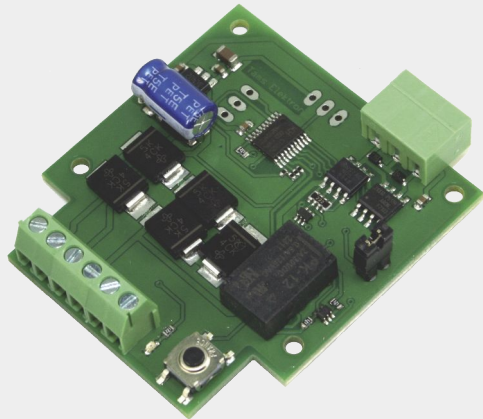


ABC-2

Brake module
for the ABC braking method

Manual



Item numbers 49-03206 | 49-03207

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Printing the manual

The formatting is optimised for double-sided printing. The standard page size is DIN A5. If you prefer a larger display, printing on DIN A4 is recommended.

1. Getting started

The instructions will help you step by step with the safe and proper installation and use of your brake module. Before you start to put the brake module into operation, read this manual completely, especially the safety instructions and the section on possible errors and their elimination. You will then know what you have to pay attention to and thus avoid errors that sometimes can only be rectified with a lot of effort.

Keep the instructions in a safe place so that you can restore functionality later in the event of any malfunctions. If you pass the brake module on to another person, also give the instructions with it.

1.1. Contents of the package

- 1 fully assembled and tested ABC-2 circuit board (item no. 49-03206-01) *or*
1 ABC-2 brake module in housing (item no. 49-03207-01)
- 1 pluggable 3-pin connection terminal, grid dimension 3.5 mm (plugged in on delivery)
- 1 short-circuit plug (jumper) 2-pin, grid dimension 2.54 mm (plugged in on delivery)

1.2. Accessories

Connection cables

The use of stranded wire is recommended for making the connections. Stranded wires consist of several thin individual wires and are therefore more flexible than rigid wires with the same copper cross-section. Recommended cross-sections:

- For connections to the rails: $\geq 0.25 \text{ mm}^2$ (depending on the power consumption of the vehicles in the braking section)
- For the push button (or comparable components or circuits): $\geq 0.05 \text{ mm}^2$
- For the connection of signals/turnouts: $\geq 0.10 \text{ mm}^2$

Push button or comparable components or circuits

The ABC-2 brake module has a switch input to which you can connect push buttons or comparable components or circuits. You can use this to activate and deactivate the braking distance. The following are suitable:

- push buttons, 1x normally open (NO) contact, e.g. item no. 84-5211x or 84-5212x
- contacts in or on the track (e.g. reed contacts, light barriers) or
- external circuits with comparable functionality

1.3. Intended use

The brake module is intended for use in model construction, especially in model railway layouts, according to the specifications in the manual. Any other use is not in accordance with the intended use and will result in the loss of the warranty claim. Intended use also includes reading, understanding and following all parts of the instructions. The brake module is not intended to be used by children under the age of 14.

1.4. Safety instructions

Improper use and non-observance of the instructions can lead to incalculable hazards. Prevent these dangers by carrying out the following measures:

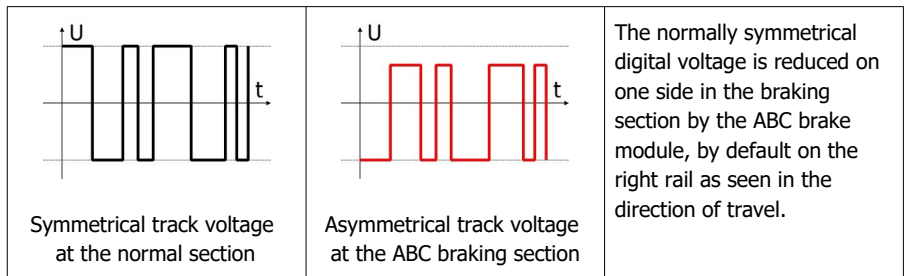
- Only use the brake module in closed, clean and dry rooms. Avoid moisture and splash water in the environment. After condensation has formed, wait two hours for acclimatisation before use.
- Disconnect the brake module from the power supply before carrying out wiring work.
- Supply the brake module only with extra-low voltage as specified in the technical data. Use only tested and approved transformers or power supply units for this purpose..
- Only plug the mains plugs of transformers / power supply units into properly installed and fused earthed sockets.
- When making electrical connections, ensure that the cable cross-section is sufficient.
- Heating of the brake module during operation is normal and harmless.
- Do not expose the brake module to high ambient temperatures or direct sunlight. Observe the information on the maximum operating temperature in the technical data.
- Regularly check the operational safety of the brake module, e.g. for damage to the connection cables.
- If you notice damage or if malfunctions occur, disconnect the connection to the power supply immediately. Send the brake module in for inspection.

2. Operation overview

2.1. Functional principle

The ABC (Automatic Break Control) method is based on the fact that

- the ABC brake module reduces either the positive or the negative part of the digital voltage for the braking section and thus generates an asymmetrical track voltage and
- the locomotive decoders detect this asymmetrical track voltage when entering an ABC braking section and thereupon automatically reduce the driving speed with the set braking deceleration or the set braking distance. By setting a constant braking distance, an exact (signal) stop can be realised for all locomotives, regardless of the speed level with which the locomotives enter the braking section.



In principle, the braking section is only effective for one direction of travel at a time. When travelling in the opposite direction, the locomotive does not react to the braking section.

While the locomotive is in the braking section,

- the functions can be switched,
- the CVs of the decoder can be changed by means of main track programming (PoM),
- the direction of travel of the locomotive can be changed and thus the locomotive can be shunted or driven out of the braking section in the opposite direction.

As soon as the braking section is deactivated or the locomotive leaves the braking section, it accelerates to the set speed using the set start-up delay. No short-circuits occur when driving over the separation point between the normal section and the ABC braking section.

In order to be able to use the ABC braking method, the booster must provide an output voltage at the track output that is as symmetrical as possible. When using boosters that do not provide a symmetrical voltage at the output due to their design, the locomotive decoders may not brake reliably when entering the braking section.

2.2. Activating/deactivating the braking section

With switch commands

The braking section on the ABC-2 braking module can be activated and deactivated via a digital switch command in Motorola or DCC format.

Switch command	Braking section	Effect
'Straight ahead'	deactivated	'Free travel': The locomotive travels through the braking section without stopping. If the locomotive has already braked or stopped, it accelerates to the set speed using the set start-up deceleration as soon as the braking section is deactivated.
'Branch'	activated	'Stop': The locomotive reduces its speed with the set braking delay or the set braking distance.

In its delivery state, the ABC-2 module has the accessory decoder address 100. The address can be changed using the programming button on the module.

With switching pulses

The ABC-2 brake module has a switching input to which a push button can be connected to activate and deactivate the braking distance. Alternatively, components or circuits that function according to the principle of a push button can be used. The input of the brake module is connected to ground as soon as the button or circuit is triggered, thereby changing the status of the braking distance.

To activate or deactivate the braking distance, there are other options available as an alternative to sending digital turnout commands, e.g.:

- manually via an external push button
- automatically via contacts in or on the track (e.g. reed contacts, light barriers)
- via external circuits that switch to ground

2.3. Connection of turnouts and/or signals

The ABC-2 module has a special connection for turnouts and/or signals with a maximum total current of 1 A. The turnouts and signals are switched using the digital turnout command, which is sent to the address of the brake module to activate and deactivate the brake section.

A short-circuit plug (jumper) on a pin strip on the ABC-2 module is used to set whether a continuous voltage is applied to the output or short voltage pulses are output. The following can therefore be connected to the ABC-2 module:

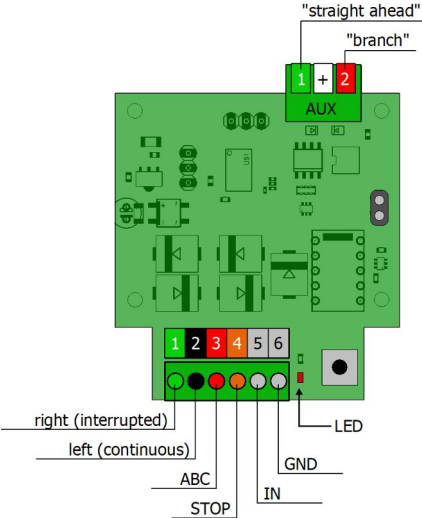
- solenoid accessories (turnouts / semaphore signals with double coil drives) and/or motor driven turnouts with a switching time of max. 500 ms (with or without limit switching) *or*
- 2-aspect light signals and/or motor driven turnouts (with limit switching)

The ABC-2 brake module is not suitable for connecting turnouts with servo drives.

2.4. Optional safety section (emergency stop)

The ABC-2 brake module has a connection for a safety section, which can be set up behind the brake section (as seen in the direction of travel) if required. The safety section is de-energised when the braking section is activated. This ensures that the locomotive stops reliably after braking in the braking section before reaching the normal section.

3. Connections



The brake module is equipped with terminal blocks into which you plug and screw the cables for connection to the rails and the push button (or a comparable circuit).

Connect terminals 1 to 4 of the brake module as shown in the connection example (→ Section 3.1) to the rails of the normal section before the brake section, the right-hand rail in the brake section and the right-hand rail in the safety section (emergency stop).

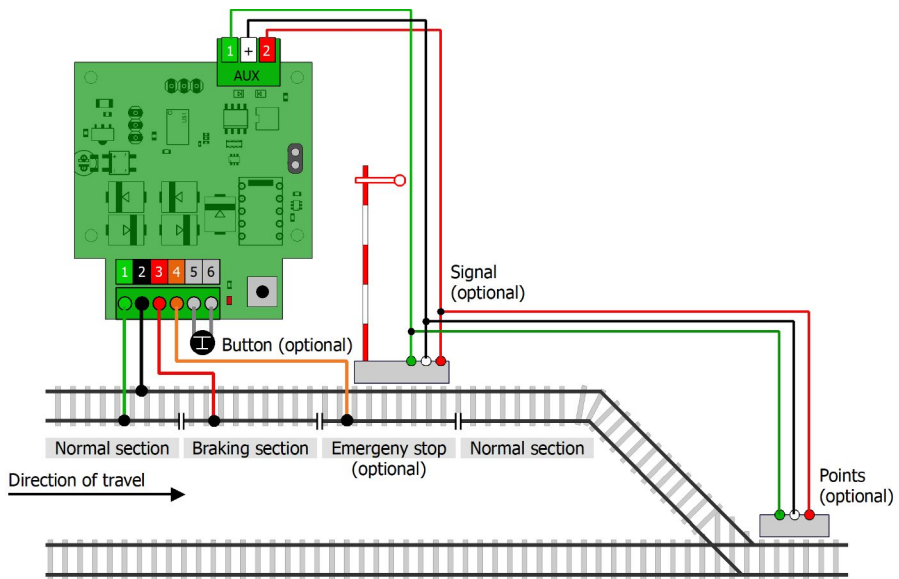
1	'right'	Normal section before the braking section: Right-hand (interrupted) rail as seen in the direction of travel	
2	'left'	Normal section before the braking section: Left-hand (continuous) rail as seen in the direction of travel	
3	ABC	Braking section	
4	STOP	Safety section (emergency stop)	optional
5	IN	Push button (or comparable components or circuits) for (de)activating the braking section → Section 3.3. Connecting an optional push button	optional
6	GND		
AUX		Turnouts and/or signals with a total current of 1 A → Section 3.4. Connecting signals and turnouts	optional



Please note:

The entire current for the train in the braking section must be transmitted via the connection cables to the rails (connections 1...4). Therefore, ensure that the cable cross-section is sufficient and keep the connection cables to the rails as short as possible to avoid a high voltage drop.

3.1. Connection example



The connection example shows the junction of a branch line into a main line. A signal and a switch are connected to the AUX connection of the brake module. The following actions are triggered by a digital switch setting command to the address of the ABC-2:

Switch setting command	Brake section	Effect	Signal	Turnout
'Straight ahead'	deactivated	'Free passage'	'Free passage'	'Branch'
'Branch'	activated	'Stop'	'Stop'	'Straight ahead'

3.2. Setting up the sections

Braking section

When determining the length of the braking section, take into account that the longest train within the section must come to a halt. Cut the right-hand rail at both ends of the braking section, as seen in the direction of travel.

Safety section

If necessary, you can set up a safety section (as seen in the direction of travel) behind the braking section. The safety section is de-energised when the braking section is activated. Cut the right-hand rail at the end of the safety section, as seen in the direction of travel.

3.3. Connecting an optional push button

As an alternative to activating/deactivating the braking section via accessory decoder commands, you can use a push button (1xNO contact) connected to terminals 5 (IN) and 6 (GND). The assignment to the two terminals is not important when using a push button. The input of the brake module is connected to ground as soon as the push button is triggered, thereby changing the status of the brake section.

Instead of a push button, you can use components or circuits that function according to the push button principle.

**Please note:**

When connecting contacts, sensors, external circuits, etc., ensure that they are correctly assigned to the IN and GND terminals. Otherwise, the connections may be damaged (possibly irreparably).

3.4. Connecting signals and turnouts

You can connect turnouts and/or signals with a total current of maximum 1,000 mA (2 s) or 800 mA (continuous) to the AUX connection of the ABC-2 module.

**Please note:**

Exceeding the maximum output current can lead to (possibly irreparable) damage to the output!

The turnouts and signals are switched during operation using the digital accessory decoder command, which is sent to the address of the brake module to activate and deactivate the brake section.

You can use:

- solenoid accessories (turnouts and/or semaphore signals with double coil drives) and/or motor driven turnouts with a switching time of max. 500 ms (with or without limit switching)

or

- 2-aspect light signals and/or motor driven turnouts (with limit switching)

The ABC-2 braking module is not suitable for connecting servo-driven turnouts.

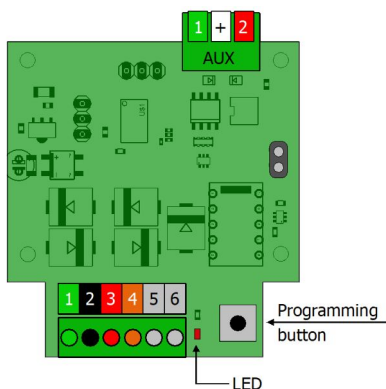
**Please note:**

You must use a short-circuit plug (jumper) on the pin strip on the ABC-2 module to set whether a permanent voltage is to be applied to the output or whether short voltage pulses are to be output. → 4.2.

If the output is not configured correctly, this can lead to malfunctions of the signals/turnouts. Solenoid accessories without limit switching can be irreparably damaged during operation if a voltage is permanently applied to the output.

4. Settings

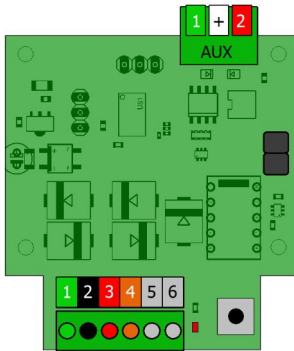
4.1. Setting the address



1. Press the programming button on the circuit board. The LED will flash.
2. Enter the turnout address for the ABC-2 module (e.g. turnout address `10`). Enter a turnout setting command for the selected address.
3. As soon as the LED goes out, the module has accepted the new address.

The setting of configuration variables (CVs) is not necessary with the ABC-2 module.

4.2. Configuring the AUX connection

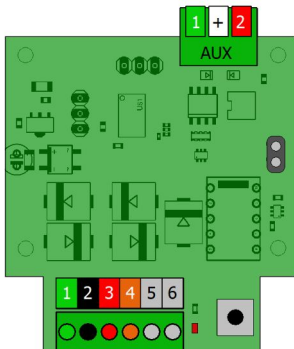


Jumper inserted: Voltage pulses = Delivery state

→ A short voltage pulse is output at the AUX output after a turnout setting command.

Use this setting for:

- solenoid accessories, e.g. turnouts and/or semaphore signals with double coil drives and/or
- motor driven turnouts with a switching time of max. 500 ms (with or without limit switching)



Jumper not plugged in: Permanent voltage

→ A permanent voltage is applied to the AUX output.

Use this setting for:

- 2-term light signals and/or
- motor driven turnouts (with limit switching)

5. Checklist for troubleshooting and error correction



Warning:

If you notice a strong heat development, immediately switch off the power supply for the layout. **Fire hazard!**

Possible causes:

- One or more connections are faulty. → Check the connections.
- The module is defective. → Send the module in for inspection.

No reaction of the locomotive when entering the braking section

Possible causes:

- The separation points for the braking section are on the left rail instead of the right rail (seen in direction of travel) or are not continuous. → Check the separation points.
- The CV-settings of the locomotive decoder are not correct. → Check the CV-settings if the ABC-braking method is active and if the ABC-detection is inverted.
- The output voltage of the booster is not symmetrical. → If possible, change the ABC sensitivity of the decoder in the CV settings. Boosters that do not produce a symmetrical output voltage due to their design may not be suitable for the use of the ABC braking method.

No response from ABC-2 to switch setting commands

Possible cause:

- The ABC-2 brake module has been assigned a different address than expected. → Reprogram the address (→ Section 4.1).

No response from ABC-2 to switching pulses at the input (terminals 5 and 6)

Possible causes:

- The push button used does not have the correct switching function. → Ensure that you are using a 1xNO push button that closes the (normally open) circuit when actuated.
- Push buttons, comparable components or circuits are defective. → Check the functionality of the switching input by connecting a new 1xNO push button for testing purposes.
- Components or external circuits are connected incorrectly to the IN and GND terminals. → Check the connections. It cannot be ruled out that the IN and GND connections and/or connected components or external circuits have been damaged by incorrect connection.

Problems with connected signals or switches

Connected signals or switches are not being switched. Possible cause:

- The current consumption of the connected signals or turnouts is more than 1,000 mA (2 s) or 800 mA (continuous). → Check the current consumption. It cannot be ruled out that the AUX output has been damaged by the overload.

The LEDs/lights of light signals go out after a short time, even though no turnout command has been sent. Possible cause:

- The configuration for the output is incorrect. → Set a continuous voltage for the use of light signals; the jumper must not be plugged in. (→ 4.2.)

Turnouts/signals with double coil drives become hot. Possible cause:

- The configuration for the output is incorrect. → Set voltage pulses for the use of solenoid accessories; the jumper must be plugged in. (→ 4.2.)

5.1. Technical Hotline

If you have any questions about the use of the module, our technical hotline will help you (telephone number and e-mail address on the last page).

5.2. Repairs

You can send us a defective module for inspection / repair (address on the last page). Please do not send us your return freight collect. In the event of a warranty or guarantee claim, we will reimburse you for the regular shipping costs.

Please enclose the following with your shipment

- proof of purchase as evidence of any warranty or guarantee claim
- a brief description of the defect
- the address to which we should return the product(s)
- your email address and/or a telephone number where we can reach you in case of queries.

Costs

The inspection of returned products is free of charge for you. In the event of a warranty or guarantee claim, the repair and return are also free of charge for you.

If there is no warranty or guarantee case, we will charge you the costs of the repair and the costs of the return. We charge a maximum of 50% of the new price for the repair according to our valid price list.

Carrying out the repair(s)

By sending in the product(s), you give us the order to inspect and repair it. We reserve the right to refuse the repair if it is technically impossible or uneconomical. In the event of a warranty or guarantee claim, you will then receive a replacement free of charge.

Cost estimates

Repairs for which we charge less than € 25.00 per item plus shipping costs will be carried out without further consultation with you. If the repair costs are higher, we will contact you and carry out the repair only after you have confirmed the repair order.

6. Technical data

Digital protocols

Digital formats	Motorola DCC (in accordance with NMRA and RCN standards)
Address range Note: The usable address range also depends on the control centre	MM: 1020 accessory decoder addresses DCC: 2040 accessory decoder addresses

Inputs and outputs

Switch input	1 input for connecting a push button or comparable components or external circuits
Output	1 output for connecting signals and/or turnouts

Electrical characteristics

Supply voltage	Digital voltage from the booster circuit (12 - 24 volts)
Current consumption	max. 80 mA (without connected loads)
Maximum current at the rail connections	3 A duration 6 A peak (maximum 10 seconds)
Maximum current at the output (AUX)	1,000 mA (2 s) 800 mA (continuous)

Protection

Protection class	Ready-made module (without housing): IP 00 Meaning: No protection against foreign bodies, contact and water. Ready device (in housing): IP 20 Meaning: Protected against solid foreign bodies with diameter ≥ 12.5 mm and access with a finger. No protection against water.
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Environment

For use in closed rooms

Ambient temperature during operation

0 ~ + 30 °C

Permissible relative humidity during operation

10 ~ 85% (non-condensing)

Ambient temperature during storage

- 10 ~ + 40 °C

Permissible relative humidity during storage

10 ~ 85% (non-condensing)

Other features

Dimensions (approx.)

Circuit board: 48 x 52 mm

Ready device including housing: 70 x 60 x 25 mm

Weight (approx.)

Assembled board (ready-made module): 18,5 g

Ready device including housing: 35,5 g

7. Warranty, EU conformity & WEEE

7.1. Guarantee bond

For this product we issue voluntarily a guarantee of 2 years from the date of purchase by the first customer, but in maximum 3 years after the end of series production. The first customer is the consumer first purchasing the product from us, a dealer or another natural or juristic person reselling or mounting the product on the basis of self-employment. The guarantee exists supplementary to the legal warranty of merchantability due to the consumer by the seller.

The warranty includes the free correction of faults which can be proved to be due to material failure or factory flaw. With kits we guarantee the completeness and quality of the components as well as the function of the parts according to the parameters in not mounted state. We guarantee the adherence to the technical specifications when the kit has been assembled and the ready-built circuit connected according to the manual and when start and mode of operation follow the instructions.

We retain the right to repair, make improvements, to deliver spares or to return the purchase price. Other claims are excluded. Claims for secondary damages or product liability consist only according to legal requirements.

Condition for this guarantee to be valid, is the adherence to the manual. In addition, the guarantee claim is excluded in the following cases:

- if arbitrary changes in the circuit are made,
- if repair attempts have failed with a ready-made module or device,
- if damaged by other persons,
- if damaged by faulty operation or by careless use or abuse.

7.2. EU Declaration of Conformity



This product fulfils the requirements of the following EU directives and therefore bears the CE marking.

2001/95/EU Product Safety Directive

2015/863/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

2014/30/EU on electromagnetic compatibility (EMC Directive). Underlying standards:

DIN-EN 55014-1 and 55014-2: Electromagnetic compatibility - Requirements for household appliances, electric tools and similar electrical appliances. Part 1: Emitted interference, Part 2: Immunity to interference

To maintain electromagnetic compatibility during operation, observe the following measures:
Only connect the supply transformer to a professionally installed and fused earthed socket.
Do not make any changes to the original components and follow the instructions, connection and assembly diagrams in this manual exactly.
Only use original spare parts for repair work.

7.3. Declarations on the WEEE Directive

This product is subject to the requirements of the EU Directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE), i.e. the manufacturer, distributor or seller of the product must contribute to the proper disposal and treatment of waste equipment in accordance with EU and national law. This obligation includes

- registration with the registering authorities ("registers") in the country where WEEE is distributed or sold
- the regular reporting of the amount of EEE sold
- the organisation or financing of collection, treatment, recycling and recovery of the products
- for distributors, the establishment of a take-back service where customers can return WEEE free of charge
- for producers, compliance with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive.



The "crossed-out wheeled bin" symbol means that you are legally obliged to recycle the marked equipment at the end of its life. The appliances must not be disposed of with (unsorted) household waste or packaging waste. Dispose of the appliances at special collection and return points, e.g. at recycling centres or at dealers who offer a corresponding take-back service.

Further Information and Tips:
<http://www.tams-online.de>

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