

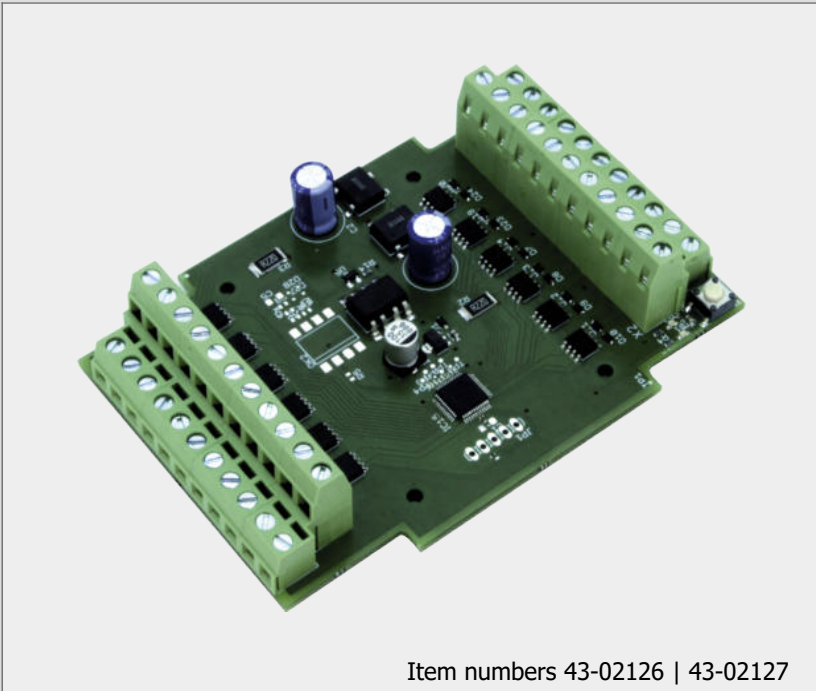
WD-12

12-fold Turnout Decoder

MM

DCC

Manual



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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.

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1. Getting started

The instructions will help you to install and use your turnout decoder safely and correctly, step by step. Before connecting the decoder and putting it into operation, read these instructions thoroughly, especially the safety instructions and the section on possible faults and how to rectify them. You will then know what to look out for and avoid mistakes that can sometimes be very difficult to rectify.

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

1.1. Contents of the package

1 ready-built and tested circuit board WD-12 (item no. 43-02126-01) *or*
1 turnout decoder WD-34.2 in housing (item no. 43-02127-01)

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 all connections: $\geq 0.25 \text{ mm}^2$

Use of turnouts with motor drive

When using turnouts with motor drive you need an adapter

- AMW-1 (item-no. 72-00076) *or*
- AMW-plus (item-no. 72-00176)

Connection of loads with galvanic isolation

To connect a load with its own power supply, you need a bistable relay or a relay board RL-2 (item no. 72-00055-01 or 72-00056).

Push buttons for manual switching of turnouts

If you want to switch turnouts or other consumers manually as an alternative, you will need additional push buttons (1 x NO contact, e.g. item nos. 84-5121x-05 or 84-5211x-10).

1.3. Intended use

The turnout decoder 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 turnout decoder is not intended to be used by children under the age of 14.

1.4. Safety instructions

**Note:**

The turnout decoder contains integrated circuits (ICs). These are sensitive to electrostatic charging. Therefore, do not touch these components until you have "discharged" yourself. For this purpose, e.g. a grip on a radiator is sufficient.

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 turnout decoder 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 decoder from the power supply before carrying out wiring work.
- Supply the decoder only with extra-low voltage as specified in the technical data. Only use tested and approved transformers or power supplies units for this purpose.
- Only plug the mains plugs of transformers/power supplies units into properly installed and fused safety sockets.
- When making electrical connections, ensure that the cable cross-section is sufficient.
- Heating of the decoder during operation is normal and harmless.
- Do not expose the decoder 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 decoder, 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 decoder in for inspection.

2. Operation overview

The WD-12 turnout decoder is mainly used to control accessories that are switched via short switching pulses. Typical applications include all solenoid accessories with or without limit switching, i.e. turnouts and semaphore signals with twin coil drive or decouplers.

Additional connection options

To make use of the 12 output pairs of the WD-12, various other accessories can also be connected:

Consumers with low power consumption that do not require a separate power supply can be connected directly to the outputs of the WD-12. Examples are 1- or 2-term light signals or turnout lanterns with LEDs. For the outputs used accordingly, the value '0' must be set for the on-time in the configuration variables (= infinitely long).

Consumers that are supplied from a separate, galvanically isolated circuit must be switched on and off via a bistable relay. Examples of applications are consumers with higher power consumption (e.g. extensive lighting) or consumers that must be supplied from a separate circuit for functional reasons (e.g. track sections).

Motor-driven turnouts can also be switched with the WD-12, but this requires an additional AMW-1 or AMW-plus adapter for each turnout.

Overview of possible applications

Accessories	Connection to WD-12
Solenoid accessories: Turnouts or semaphore signals with twin coil drive, decouplers	directly
Motor-driven turnouts	via an AMW-1 / AMW plus adapter
Consumers with low power consumption without separate power supply (e.g. light signals and turnout lanterns with LEDs)	directly
Consumers with high power consumption or with separate power supply (e.g. track sections)	via a bistable relay or a relay board RL-2

With one WD-12 turnout decoder, a maximum of the following can be controlled:

- 12 turnouts or semaphore signals with twin coil drive or
- 24 other solenoid accessories or
- 12 turnouts with motor drive or
- 12 to 24 other consumers (depending on the wiring)

It is possible to connect different types of accessories to the total of 12 output pairs.

2.1. Operation

Operation via turnout setting commands

The outputs are switched via turnout setting commands, which are sent by the control unit in DCC or Motorola format to the 12 turnout addresses of the decoder. The 12 turnout addresses are assigned to three 4-address blocks. Each of the three address blocks is assigned its own (accessory decoder) address.

The decoder automatically recognises the data format in which the commands are sent. It is possible to switch the outputs mixed via DCC and Motorola commands, as well as to control one output alternately in DCC and Motorola format

Operation via vehicle decoder commands

In DCC format, the WD-12 turnout decoder can be controlled via locomotive addresses instead of turnout addresses. One 4-block of the decoder is then switched via functions F1 to F4. This makes it possible to use the decoder with DCC digital controls that do not allow turnout addresses to be controlled.

Note: Switching to the use of locomotive addresses is only possible with a DCC control unit. The setting applies to all 12 output pairs of the decoder.

2.2. Programming

Programming with DCC control units

With a DCC control unit, the addresses (separately for each of the three 4-address blocks) and the properties of the turnout decoder can be defined by programming the configuration variables (CVs).

Adjustable properties:

- Control via turnout or locomotive addresses
- On-Time. The setting is made separately for each of the 12 output pairs. The maximum switch-on time that can be set is 25.5 seconds. To switch consumers such as LEDs on and off, the value 0 (= infinite) must be set for the On-Time.

As an alternative to CV programming, the addresses can also be set separately for each of the three 4-address blocks using the programming button on the circuit board.

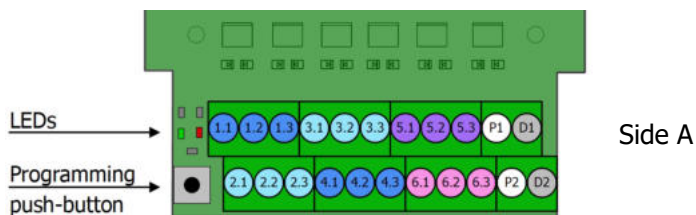
Programming with pure Motorola control units

When using pure Motorola control units, the addresses must be set separately for each of the three 4-address blocks using the programming button. Changing the other decoder properties (on-time, alternative control via locomotive addresses) is not possible with pure Motorola control units.

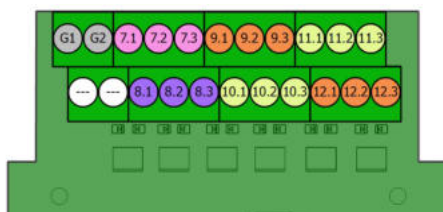
2.3. Short-circuit protection

In case a short-circuit occurs while switching a connected accessory, the decoder stops the switching operation and the LEDs on the PCB start to flash quickly. To resume operation after the short circuit has been rectified, the decoder must be briefly disconnected from the power supply.

3.1. Connection assignment WD-12



Turnout decoder WD-12 Side A		
1.1	Solenoid accessory / turnout 1	"diverging" or F1 = "off"
1.2		Return conductor
1.3		"straight" or F1 = "on"
2.1	Solenoid accessory / turnout 2	"diverging" or F2 = "off"
2.2		Return conductor
2.3		"straight" or F2 = "on"
3.3	Solenoid accessory / turnout 3	"diverging" or F3 = "off"
3.4		Return conductor
3.5		"straight" or F3 = "on"
4.1	Solenoid accessory / turnout 4	"diverging" or F4 = "off"
4.2		Return conductor
4.3		"straight" or F4 = "on"
5.1	Solenoid accessory / turnout 5	"diverging" or F5 = "off"
5.2		Return conductor
5.3		"straight" or F5 = "on"
6.1	Solenoid accessory / turnout 6	"diverging" or F6 = "off"
6.2		Return conductor
6.3		"straight" or F6 = "on"
P1	Power supply / transformer (~)	
P2	Power supply / transformer (~)	
D1	Input DCC signal / central unit	
D2	Input DCC signal / central unit	



Side B

Turnout decoder WD-12 Side B		
G1	GND	
G2	GND	
---	not in use	
---	not in use	
7.1	Solenoid accessory / turnout 7	"diverging" or F7 = "off"
7.2		Return conductor
7.3		"straight" or F7 = "on"
8.1	Solenoid accessory / turnout 8	"diverging" or F8 = "off"
8.2		Return conductor
8.3		"straight" or F8 = "on"
9.3	Solenoid accessory / turnout 9	"diverging" or F9 = "off"
9.4		Return conductor
9.5		"straight" or F9 = "on"
10.1	Solenoid accessory / turnout 10	"diverging" or F10 = "off"
10.2		Return conductor
10.3		"straight" or F10 = "on"
11.1	Solenoid accessory / turnout 11	"diverging" or F11 = "off"
11.2		Return conductor
11.3		"straight" or F11 = "on"
12.1	Solenoid accessory / turnout 12	"diverging" or F12 = "off"
12.2		Return conductor
12.3		"straight" or F12 = "on"

3.2. Connection to the power supply

You can supply the decoder and the connected servos and other consumers

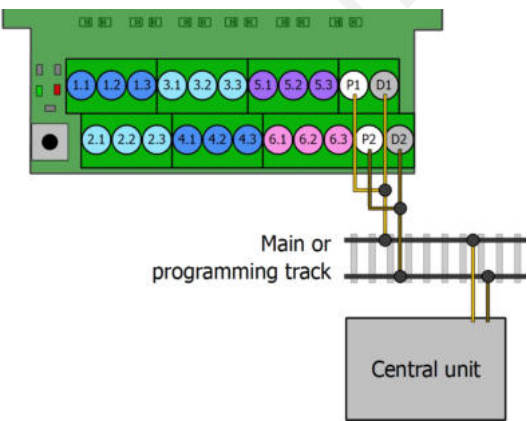
- either with the digital voltage from the booster circuit, i.e. via the integrated booster of the digital central unit or a separate booster,
- or if you want to relieve the digital circuit, via a separate power supply.

P1	Power supply / transformer (~)	 Caution: If a component gets too hot, disconnect the decoder and the power supply from the mains immediately. Possible short circuit! Check the assembly
P2	Power supply / transformer (~)	
D1	Input DCC signal / central unit	
D2	Input DCC signal / central unit	

Power supply via the central unit

 **Caution:**

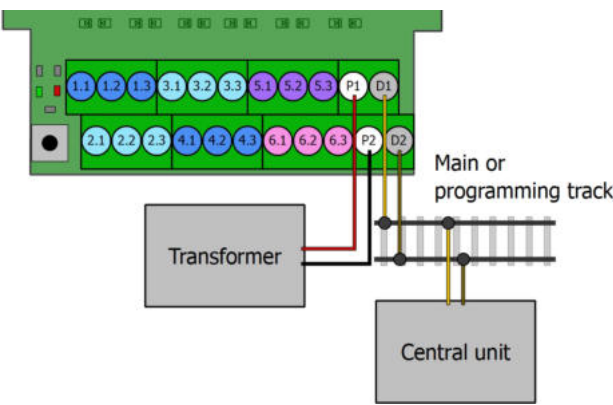
Switch off the control unit before connecting the decoder.



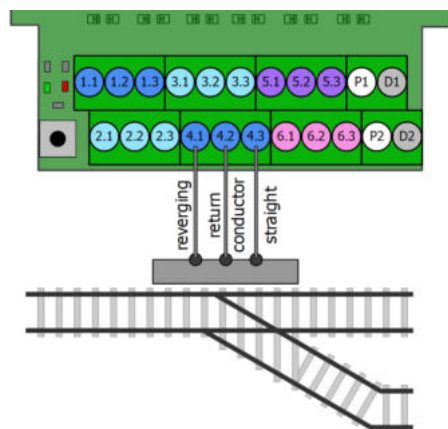
Supply via a separate power supply

 **Caution:**

When connecting several devices to the same voltage supply, generally all connections have to be polarised identically. Otherwise a short circuit will occur, possibly damaging connected devices.

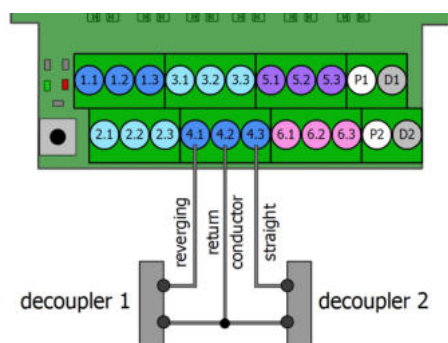


3.3. Connection examples



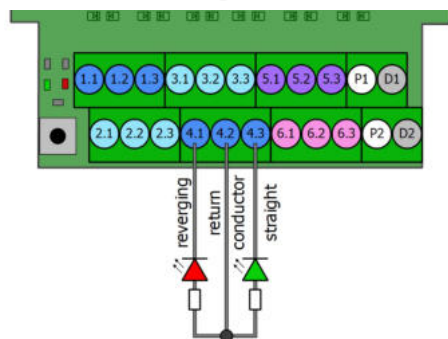
Connection example: Coil driven turnouts

Connection of turnouts
to terminals 4.1 to 4.3 ("turnout 4")



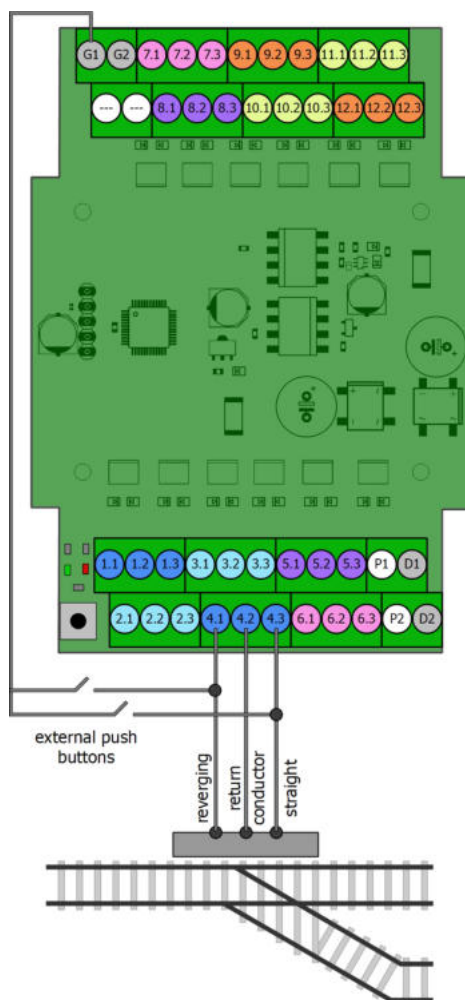
Connection example: Decouplers

Connection of two decouplers
to terminals 4.1 to 4.3



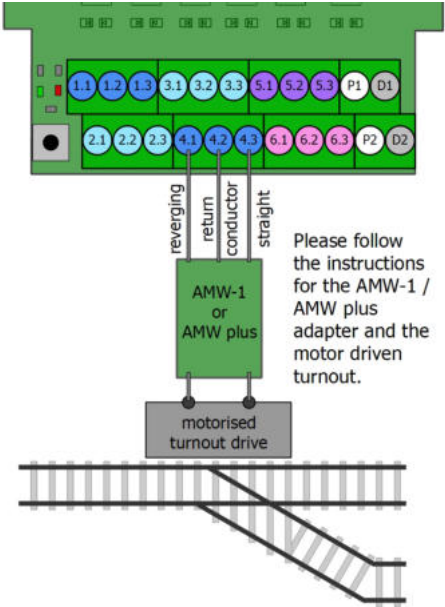
Connection example: 2-term light signal

Connection of two LEDs of a
2-term light signal
to terminals 4.1 to 4.3



**Connection example:
Coil driven turnouts
with manual switching option**

Connection of turnouts
to terminals 4.1 to 4.3 ("turnout 4")



**Connection example:
Motor driven turnout**

Connection of turnouts
to terminals 4.1 to 4.3 ("turnout 4")

4. Settings

You can program the configuration variables (CV) using a DCC digital central unit. See the chapter in the manual of your central unit where the byte wise programming of configuration variables (CVs) is explained.

Note: CV values can only be reported back to the control unit in DCC format if a sufficient current can flow. Therefore, before you start programming the turnout decoder, you should connect an accessory with a current draw of at least 100 mA to pins 1.1 to 1.3 ("Turnout 1"), e.g. a turnout with a twin coil drive.

When using a Motorola central unit you can set the decoder address with the programming push-button. The remaining CV values cannot be changed with pure Motorola control units.

4.1. Setting the addresses

Address blocks of the WD-12

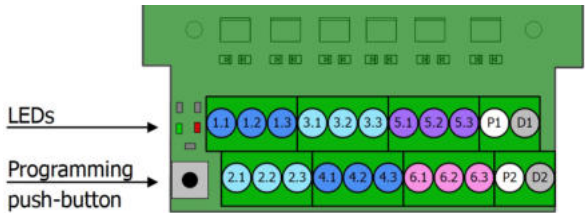
The 12 turnout outputs / output pairs of the WD-12 are assigned to three 4-address blocks. You assign an address to each of the 3 address blocks separately. The addresses are assigned either with the programming button on the circuit board or by CV programming with a DCC control unit. Example of address programming:

Address block	Outputs WD-12	Turnout addresses (examples)	Turnout decoder address / Locomotive decoder address
1	1 ... 4	1 ... 4	1
2	5 ... 8	9 ... 12	3
3	9 ... 12	33 ... 36	9

Setting the address with the push-button

With Motorola central units the address can be set via the programming push-button only. When using DCC central units it is often easier to set the address via the programming push-button than to program it via CV.

Note: Address setting with the programming key is only possible if control via turnout addresses is set for the decoder in CV29.



In order to set the address via the programming push-button perform the following steps:

1. Press the programming button once, twice or three times to select the address block to which you want to assign a turnout address.

Block 1 (turnouts 1...4)	press once		red LED flashes
Block 2 (turnouts 5...8)	press twice		green LED flashes
Block 3 (turnouts 9...12)	press three times	 	red and green LEDs flash

2. Set one of the addresses from the quadruple address block you want to use for switching the connected accessories at the control unit (e.g. address "10" from the quadruple address block 9 – 12). Perform a switching command for the chosen address.
3. As soon as the LED(s) go(es) out, the decoder has taken over the new address.

Setting the decoder address via CVs

Instead of setting the address using the programming button, you can alternatively set it by programming the CVs with a DCC control unit. The accessory decoder addresses, via which the switching commands are sent, result as follows:

decoder address x 4 = highest address of the quadruple accessory decoder address block

Note: For the control of the decoder in Motorola format "255" is the highest decoder address (= turnout address 1020).

Note: With some control units the numbering of the turnout addresses does not start with "1" but with "0". The addresses assigned to an address block are shifted accordingly.

CV	No.	Input value (Default)	Remarks and tips
Decoder address "Basic value"	17 → block 1	0, 1, 2, 3, ... 7 (0)	The "base value" of the decoder address results from multiplying the input value by 64.
	40 → block 2		
	42 → block 3		
Decoder address "Additional value"	18 → block 1	1, 2, 3, ... 63 (1)	The decoder address results from the addition of the "additional value" to the "basic value".
	41 → block 2		
	43 → block 3		

Value in CV17, 40, 42	0	1	2	3	4	5	6	7
→ Basic value	0	64	128	192	256	320	384	448

Value in CV18, 41, 43	1...63	0...63	0...63	0...63	0...63	0...63	0...63	0...62
→ Address	1	64	128	192	256	320	384	448
	...	...	...	...	...	...	...	...
	63	127	191	255	319	383	447	510

4.2. Basic settings

CV	No.	Input value (Default)	Remarks and tips
Version	7	---	Read only!
Manufacturer	8	(62)	Read only!
Reset	8	0 ... 255	Any input value restores the settings in state of delivery.
Configuration data	29	0, 128 (128)	Operation via turnout addresses 0 locomotive addresses 128

4.3. Setting the on-time

CV	No.	Input value (Default)	Remarks and tips
Turnout 1	44	0, 1, 2 ... 255 (3)	Setting options: 1 Minimum on-time for switching solenoid devices 255 Maximum on-time for switching solenoid devices (= 25.500 seconds) 0 Infinite on-time This setting is used for outputs to which loads are connected that are switched on and off with turnout setting commands (e.g. LEDs).
Turnout 2	45	0, 1, 2 ... 255 (3)	
Turnout 3	46	0, 1, 2 ... 255 (3)	
Turnout 4	47	0, 1, 2 ... 255 (3)	
Turnout 5	48	0, 1, 2 ... 255 (3)	
Turnout 6	49	0, 1, 2 ... 255 (3)	
Turnout 7	50	0, 1, 2 ... 255 (3)	
Turnout 8	51	0, 1, 2 ... 255 (3)	
Turnout 9	52	0, 1, 2 ... 255 (3)	
Turnout 10	53	0, 1, 2 ... 255 (3)	
Turnout 11	54	0, 1, 2 ... 255 (3)	
Turnout 12	55	0, 1, 2 ... 255 (3)	

5. Checklist for troubleshooting and error correction



Warning:

If you notice a strong heat development, immediately disconnect the connection to the supply voltage. **Fire hazard!**

Possible causes:

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

No reaction of the decoder

Possible causes:

- The connection of the decoder to the central unit and / or the power supply is interrupted. → Check the connections.
- The connection of the decoder to the accessory or the turnout is interrupted. → Check the connections.
- The central unit is not operating. → Check if the central unit is ready for operation.
- The connected accessory or the connected turnout is defective. → Check the accessory or the turnouts.

No reaction of the decoder after programming

Possible cause:

When programming the decoder address via CV you set the decoder address. To switch the decoder accessory decoder addresses are used. → Input the accessory decoder address to switch. Advice: The decoder address multiplied with 4 tallies to the highest address from the quadruple accessory decoder address block.

Example: decoder address = 10 → corresponding accessory decoder addresses: 37 to 40

'Error' message from the control unit when reading out the CV values

Possible cause:

There is insufficient current. → Connect an accessory with a current draw of at least 100 mA to terminals 1.1 to 1.3 ('Turnout 1'), e.g. a turnout with a twin coil drive.

Flashing of the LEDs on the PCB

Possible cause:

Short circuit at one of the turnouts / connected accessories. → Eliminate the short circuit. To resume operation, you must briefly disconnect the decoder from the power supply.

5.1. Technical Hotline

If you have any questions about the use of the decoder, 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 decoder 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

Data formats	Motorola DCC (according to NMRA and RCN standard)
Adress range Hint: The adress range to be used also depends from the control unit.	MM: 1020 turnout addresses DCC: 2040 turnout addresses or 510 vehicle decoder addresses (locomotive addresses)
Feedback format	---

Outputs

Number of outputs	24 (12 output pairs)
-------------------	----------------------

Electrical properties

Power supply	Digital voltage of the booster circuit (12 – 24 volts) or 12 – 18 V a.c. voltage or 12 – 24 V d.c. voltage
Current consumption (without connected devices) approx.	60 mA
Maximum current per output	up to 2 seconds: 1,500 mA persistent: 800 mA

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.
Overload protection	Automatic interruption of the switching process in the event of a short circuit on a connected consumer

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: 74 x 105 mm

Ready device including housing: 100 x 107 x 35 mm

Weight (approx.)

Assembled board (ready-made module): 80 g

Ready device including housing: 130 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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