# MasterControl

## Central unit for

## digital control EasyControl

Item no. 40-01007



**Manual**

**Information and tips:**

# www.tams-online.de

**Warranty and service:**

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**The asterisks \*\***

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## **Table of contents**

# 1. What is EasyControl?

EasyControl is a multi protocol control for your model railroad and capable of sending data in the following formats:

- Motorola I („old" Motorola format)
- Motorola II („new" Motorola format)
- DCC (complying to NMRA standards)

It is able to control decoders of any manufacturer compatible with those formats.

Due to its' modular design, EasyControl can be adjusted to various demands and differently sized model railway layouts. All components are connected via the EasyNet.

## 1 MasterControl

The MasterControl is the central unit, which controls every decoder and ensures the communication between all components of the EasyControl. You can only connect one MasterControl to the EasyNet. The MasterControl

- sends control instructions to every kind of decoder on your layout,
- checks for components plugged into the EasyNet,
- polls for data and control instructions from components of the EasyControl,
- sends data to components of the EasyControl,
- and is the central input device for all parameters of the model railroad control. The MasterControl also has it's own database to store all settings.

→ Section 5. Features of your MasterControl

## 2 Power supply

The power is supplied by an AC power pack. One AC power pack can handle the MasterControl and up to four additional control units. To use more, a separate AC power pack can be connected to the BusControl.

## 3 Non-central control devices

Non-central control devices (such as Lok Controls, Hand Controls, Phone Controls) offer the possibility to control your model railroad from different spots and / as well as together with others. They can be plugged in or out at any time to the EasyNet, even during operation. An EasyNet can handle up to 64 non-central control units, adapter or similar.

## 4 SwitchControl

The SwitchControl allows you to integrate an diagrammatic layout pult into the digital control.

## 5 Adapters for other bus systems

The adapters enable you to connect digital devices from other bus systems in the digital system Easy Control. Examples: SniffControl for all DCC- and / or Motorola central units, XNControl for XpressNET-devices.

## 6 BusControl

A BusControl distributor is needed, if you want to connect more than one non-central control unit to the EasyNet. One BusControl is capable of connecting a maximum of 9 control units. Further external devices need additional BusControls.

## 7 DCC programming track

To read the configuration of a locomotive or function decoder or programming those, they have to be put on a programming track. Every common rail can be used for that.

## 8 Driving booster

The driving booster amplifies all control instructions sent by the MasterControl. As the MasterControl does not have it's own booster, at least one external must be connected to it. Additional boosters become necessary, if your overall power demand exceeds the capacity of one booster. Every Märklin**-compatible booster or booster for the DCC system can be used.

The MasterControl sends the following signal through the booster interface:

- An output signal to switch on or off the booster. This signal is used to switch on or off Märklin**-compatible boosters.
- An output signal to control the decoder. This track signal includes all data to control the decoders.

An input signal to receive a short circuit warning. If the booster recognizes a short circuit (too high power consumption), it calls the MasterControl. The MasterControl then switches off the booster and displays a warning.

## 9 Breaking distance booster

Through the output of the breaking distance booster all breaking distances on your layout can be controlled. Every Märklin**-compatible booster or booster for the DCC system can be used as breaking distance booster.

As soon as one of the locomotives enters a breaking distance, the booster receives a stop signal, no matter which speed was set. All other data such as the status of the decoder functions and the driving direction are still sent by the central unit.

## 10 S88 modules

S88 feedback devices or s88-compatible modules recognize the current status of pins connected to their inputs. They submit this information to the next module or the MasterControl using the s88 bus on the principle of bucked-brigade-devices.

One EasyNet supports up to 32 s88 feedback devices or s88-compatible modules. Other manufacturer's modules can be integrated.

## 11 PC

Your MasterControl can be connected to your PC using its USB or it's serial interface. Every software, which supports the Märklin** 6050 or P50X protocol is able to control your MasterControl. A list of control software which can make use of all features of the EasyControl can be found on our website. You are also welcome to call our hotline for further information.
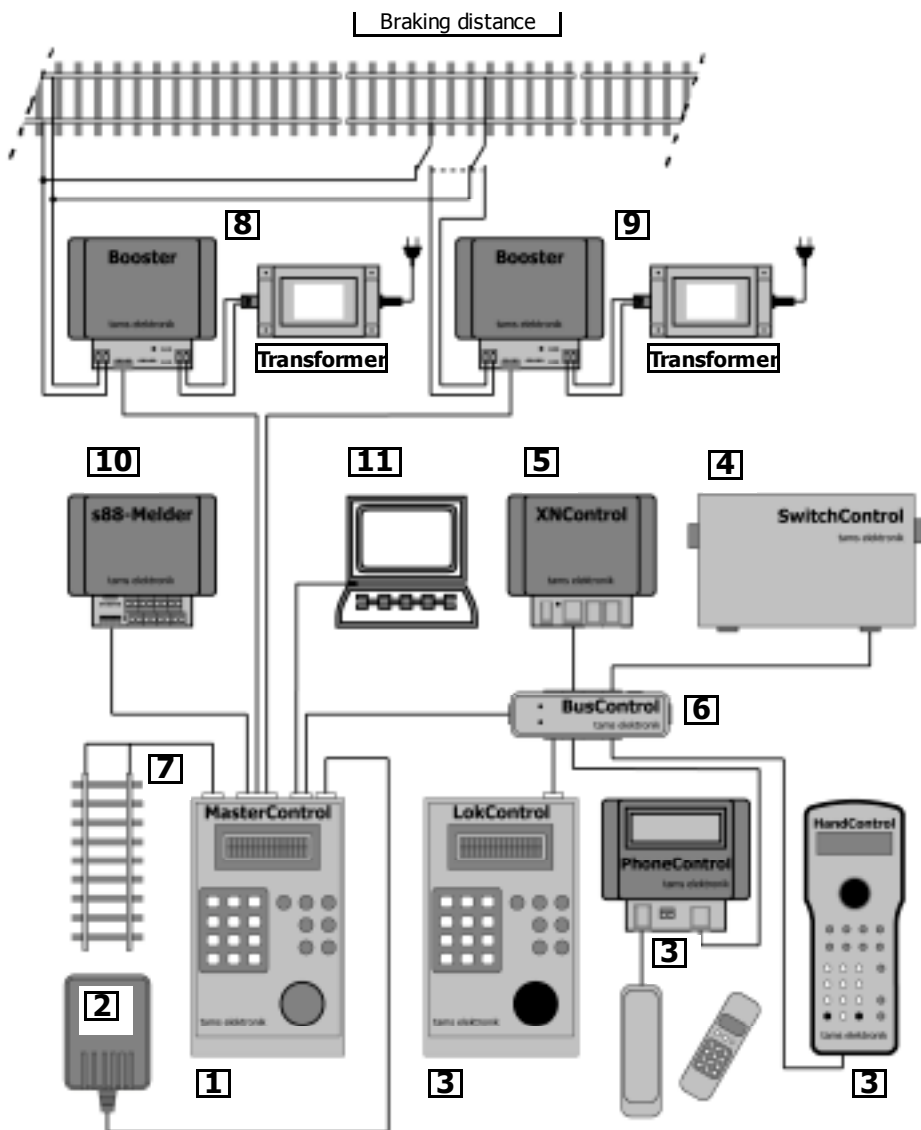
Braking distance

| 1  MasterControl | 5  Adapter for other | 8  Driving booster |
|---|---|---|
| 2  Power supply | bus systems | 9  Breaking distance- |
| 3  Non-central control | 6  BusControl | booster |
| devices | | 10  s88-Module |
| 4  SwitchControl | 7  DCC-programming track | 11  PC |

# 2. Getting started

**Checking contents**

Please make sure that your package contains:
- central unit MasterControl,
- AC power pack,
- cable to connect to a DCC programming track,
- 5-pole crimp connector to connect boosters,
- compact disc containing USB-drivers and demo software,
- this manual.

To use your digital control you need at least one booster. The contents of your package do not include such a device.

**Setting the language**

With factoy settings the displays are shown in German. In order to change the language press the following button while switching on the MasterControl:

1 for German
2 for English
3 for French
4 for Dutch

**Saftey instructions**

EayControl should only be used in concordance with these instructions. It is not suitable for use by children under 14. Incorrect use can be dangerous. In particular there is a risk of electric shock through contact with metal parts under power, especially when an incorrect voltage is used, or when operated in a too humid or wet environment. Therefore the following precautions should be observed:

- Wiring should only be carried out when the control is disconnected.
- Only operate indoors in a dry environment.
- Only use proprietry transformers with the correct voltage.
- Only connect the transformer in an authorised manner to the house power supply.
- Use adequetly thick cable for all wiring. Too thin a cable can overheat.
- If the layout is exposed to condensation, allow at least two hours for drying out.

**First use**

To quickly gain first experiences with your new MasterControl and just operate one locomotive, please follow these steps:

| Nr. | Step | Explanations |
|---|---|---|
| 1 | Overview of the display and controls of the MasterControl | → Section 4 |
| 2 | Connecting booster and power supply | → Section 3 |
| 3 | Switching on AC power | → Section 7.1 |
| 4 | Overview of the parameter settings | → Section 6 |
| 5 | Configuring a booster | → Section 6.4 |
| 6 | Calling locomotive | → Section 6.1 |
| 7 | Setting locomotive parameters | → Section 6.1 |
| 8 | Operating locomotive | → Section 7.2 |

# 3. Connecting power supply and external components
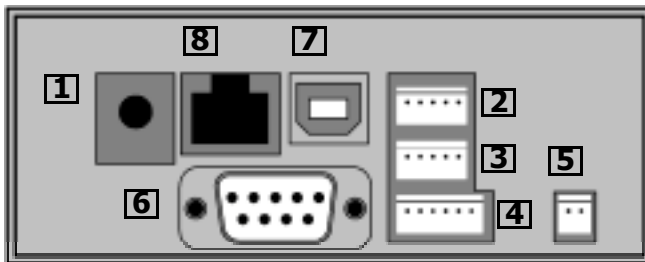


1 Power supply
2 Driving booster
3 Breaking booster
4 s88 module
5 DCC programming track
6 Serial interface
7 USB interface

## **1** Power Supply

Connect the power supply with the "power supply" port and the socket. During self-initialization the MasterControl displays the version number of its software. As soon as the device is ready to operate, the main menu appears.
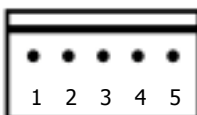
## **2** Driving booster

To use your digital control you need to connect at least one booster to the "Driving booster" port. Every Märklin**-compatible booster or booster for the DCC system can be used. Please read the booster manual!

Please note: Both types of boosters differ regarding short circuit polarity. Yet to be able to use both types of boosters, the short circuit polarity can be set on the MasterControl. As this setting applies to all connected boosters, only one type of booster may be connected to your MasterControl.

→ Section 11: Background information

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**Pin assignment of the booster's interfaces**



1 Short circuit feedback
2 Ground
3 no function
4 Booster „on / off"
5 Data
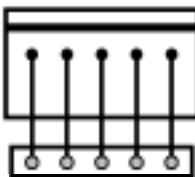
Connector of a Märklin**-compatible booster
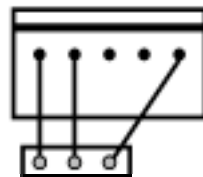
Connector of a DCC-compatible booster

---

## **3** Breaking booster

If you want to control breaking distances using a separate booster, you have to connect it to the "Breaking booster" port. Every Märklin**-compatible booster or booster for the DCC system can be used. The short circuit polarity also applies to the breaking booster, which thus must be of the same type as your driving booster.

An example for controlling breaking distances can be found in the system overview in section 1. Depending on the status of the corresponding points, the breaking distance's power is supplied by either the driving booster or the breaking booster. Such a switch could be a two state relay also controlling a signal.

## 4 s88 modules

Connect the s88 module(s) to the "s88 feedback" port. The plug can only be plugged into the port in one direction. You can connect up to 32 s88 feedback or s88-compatible modules.

Please read the s88 module's manual!

→ Section 11: Background information

## 5 DCC programming track

To read the configuration of a locomotive or function decoder or when programming these, please connect the programming rail to the "DCC programming track" port. The appropriate cable is included.

Put the locomotive on a programming rail. See the decoder's manual for possible configurations.

Please note:

- When integrating the programming track (e.g. as siding) you have to make sure that it's disconnected from the rest of your layout. If not, you would program every DCC decoder on your model railway.
- Only DCC decoders can be programmed using the "DCC programming track" port. Motorola decoders featuring online programming can be programmed on your layout or on an oval track, which is connected to the MasterControl and a driving booster.

→ Section 6.2. Programming DCC decoders

## 6 Serial interface / 7 USB interface

Using these interfaces, you can connect a PC to the MasterControl, to

- update the software,
- control the MasterControl with a PC software. If you want to run more than one control software at the same time, both interfaces can be used.

Please note: Before first using the USB interface, you have to install the included drivers.

## 8 EasyNet

You can connect non-central control devices (such as LokControls) to the EasyNet via the RJ45 interface. Any Ethernet patch cable (used in Computer networks) will work. Please also read the manual of your control device.

To connect multiple non-central control devices you will also need:

- Two or more control devices: one distributor BusControl (not included). One BusControl is capable of connecting a maximum of 9 control units. Further external devices need additional BusControls.
- Five or more control devices: one additional transformer (not included). An additional transformer is capable of supplying 8 additional control devices. To connect more devices, further transformers are needed.

# 4. Display and controls of your MasterControl
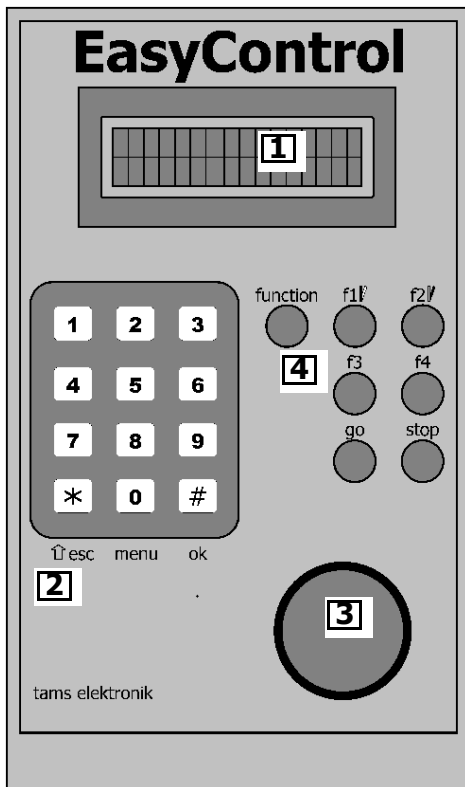


## 1 Display

The digital display features two rows displaying 16 digits each. During operation und while adjusting parameters, all relevant information is shown here. The backlight can be individually set.

## 2 Keypad

The keypad has 10 number keys and the two additional keys $*$ / esc und $\#$ / ok. The key $*$ / esc also functions as shift key (⇧). With $0$ / menu you enter the menu.

## 3 Speed control knob

You can turn the speed control knob continuously in both directions. You will experience slight resistance while turning it. A push-button is also integrated into the speed control knob. By pushing it, an input can be confirmed or during operation mode, the driving direction can be changed.

The MasterControl and LokControl look alike. To distinguish between them, the speed control knob has different colours:

- MasterControl: red
- LokControl: black

## 4 Function keys

| Colour | Label | Function |
|--------|-------|----------|
| Yellow | function | Switch on / off „function / light", alternatively the function f0. After entering a number on the keypad and subsequently pushing function the respective function will be switched on or off. |
| Blue | f1 f2 f3 f4 | Switch on / off functions f1 to f4 alternatively the functions f5 to f8 when pressing shift (⇧) at the same time. Switching points directions: f1 for "straight on", f2 for "branch off". |
| Green | go | Switch on connected boosters. |
| Red | stop | Switch off connected boosters (STOPP-Mode) alternatively emergency halt (HALT-Mode) when pressing shift (⇧) at the same time. |

# 5. Features of your MasterControl

**MasterControl**

You can use your MasterControl to

- enter parameters of the digital control and to
- control operation on your whole model railway layout.

**Locomotive database**

The MasterControl has its own database to store parameters you apply to a locomotive's address, which are:

- data format,
- amount of speed levels and
- (locomotive's) name
→ Section 6.1. Adjusting parameters in the locomotive menu

**Data formats**

The MasterControl is a multi protocol control for your model railroad and capable of sending data in the following formats:

- Motorola I („old" Motorola format)
- Motorola II („new" Motorola format)
- DCC (complying to NMRA standards)
→ Section 11. Background information

**RailCom**

The MasterControl supports the revertive standard RailCom. The MasterControl allows you to enter commands to read out the CV values of decoders compatible to RailCom.
→ Section 11.3. RailCom

**27 speed levels with the Motorola format**

The Motorola format standardly supports 14 speed levels. Your MasterControl additionally offers two methods to extend those speed levels to 27.

Speed level mode 27a: Some decoders support 27 speed levels using the so called interspeed levels. To reach an interspeed level you switch to a higher speed level and immediately switch back. A power failure will cause the loss of this speed information data. Your MasterControl simulates those 27 speed levels and shows them in the display. The MasterControl creates the interspeed levels by regularly switching to a higher speed level for a short time. This ensures that the speed levels are correctly set even after a power failure. Normally, the change between speed levels is not visible.

Speed level mode 27b: Using free bit combinations in the function's double bit helps realizing proper 27 speed levels. The decoder must support this. When controlling locomotive decoders that only support 14 speed levels or the speed level mode 27a with speed level mode 27b, only every second set speed level actually changes speed.

**Programming modes in the DCC format**

The MasterControl supports programming and reading data in the following DCC programming types:

- CV-programming – byte wise and bitwise
- Register programming
- Page programming
- Main track programming
→ Section 11. Background information

**Driving locomotive and function decoders**

Depending on the data format, you have the following possibilities:

|  | Motorola format | DCC format |
|---|---|---|
| Number of locomotive addresses | 255 | 10239 |
| Number of speed levels | 14 or 27 | 14, 28 or 128 |
| Functions | function (light) / f1 to f4 | f0 / f1 to f8 |

Additionally you have following possibilities for all types of data formats:

- Assigning the data format to locomotive addresses separately for each address. This way the EasyControl makes it possible to operate locomotives with Motorola and DCC decoders at the same time.
- Creating double tractions.
- Assigning names to locomotives, additionally to assigning address numbers. For example: A locomotive of type BR 89 is assigned address "89" and the name "EMMA". When applying names to locomotive addresses, you can find a locomotive by looking for it´s name in the database, if you forgot its address number.

**Driving solenoid accessory decoders**

You can operate solenoid accessory decoders (points or switching decoders), which are compatible with the Motorola or the DCC format. You make the setting for whether operating solenoid accessory decoders in the Motorola or DCC format either

- commonly for all connected decoders or
- or seperately for a group of four decoders.

The Motorola format offers 1020 and the DCC format 2040 decoder addresses.

→ Section 7.4. Driving solenoid accessory decoders

**Restoring configuration**

In several situations it can be handy to restore old track configurations. The MasterControl has three possibilities to do this:

- Resetting the system: All active (locomotive, function, points and switching) decoders are switched off, meaning that all functions are switched off and the speed level is reset to "0". This method is used for instance to program a function decoder featuring online programming.

  → Section 7.6. Resetting your system

- Saving and restoring your layout status: The layout status can be saved at any time. Every setting of any active locomotive and function decoders will be saved including the status of functions and switches. When restoring a layout status the speed levels of locomotive decoders are set to "0". Every setting entered after saving a status (such as switching on / off functions, calling a decoder) will be ignored.

  → Section 6.3. Saving and restoring your layout status

- Deleting the configuration: All settings are restored to factory settings and the locomotive database will be deleted.

  → Section 6.4. Subsection Deleting the configuration

# 6. Adjusting parameters of the digital control

All parameters of the digital control are set in the menu.

**Navigating through the menu**

Enter the menu by pressing $\boxed{0}$ / menu. When first entering, it displays the locomotive menu, otherwise the last called menu point.

An arrow in the upper left corner shows the possible actions:

$\updownarrow$ Navigate to another menu point on the same level or go the next higher / lower level

⏎ Enter or change values of existing settings.

To navigate through menu levels or different menu points the keys $\boxed{\#}$ / ok, $\boxed{*}$ / esc and the speed control knob are used.

**Please note**: You can alternatively enter values by

- pressing $\boxed{\#}$ / ok or
- pushing the speed control knob.

For better readability the following sections do not mention both methods. Whenever you read "press $\boxed{\#}$ / ok to confirm your input", pressing the speed control knob is also possible.

| Display | Action | Button |
|---|---|---|
| | Call the menu | Press $\boxed{0}$ / menu. |
| $\updownarrow$ | Navigating forward (on the same menu level) | Turn the speed control knob clockwise. |
| $\updownarrow$ | Navigating backwards (on the same menu level) | Turn the speed control knob counter clockwise. |
| $\updownarrow$ | Navigating to the next lower menu level | Press $\boxed{\#}$ / ok or press the speed knob. |
| $\updownarrow$ | Navigating to the next higher menu level | Press $\boxed{*}$ / esc. |
| ⏎ | Moving the cursor to the right (if displayed) | Turn the speed control knob clockwise. (not functional when entering names) |
| ⏎ | Moving the cursor to the left (if displayed) | Turn the speed control knob counter clockwise. |
| ⏎ | Changing the displayed value | Turn the speed control knob or enter a value using the keypad. (Choosing a locomotive in the database by entering its name on the keypad is not possible!) |
| ⏎ | Entering input and exiting menu point | Press $\boxed{\#}$ / ok or press the speed knob. |
| ⏎ | Cancel input | Press $\boxed{*}$ / esc. |

**Menu structure**

| Main menu | Submenu level 1 | Submenu level 2 |
|---|---|---|
| 1. Locomotive menu | 1.1. Choose<br>1.2. Data format<br>1.3. Name<br>1.4. Entry (delete) | |
| 2. DCC programming | 2.1. CV (byte)<br>2.2. CV (bit)<br>2.3. Primary address<br>2.4. Extended address<br>2.5. Register<br>2.6. Page mode<br>2.7. Main track<br>2.8. RailCom-CV | |
| 3. Layout status | 3.1. Save layout status<br>3.2. Restore layout status | |
| 4. Settings | 4.1. Mode 128 speed levels | |
| | 4.2. Mode speed controller | |
| | 4.3. s88 settings | 4.1.1. S-88 module<br>4.1.2. S-88 module test |
| | 4.4. Delete the configuration | |
| | 4.5. Booster configuration | 4.3.1. Short circuit polarity<br>4.3.2. Short circuit sensitivity |
| | 4.6. Interface baud rate | |
| | 4.7. Points | 4.5.1. All points<br>4.5.2. Points format<br>4.5.3. Min. switching time<br>4.5.4. Max. switching time |
| | 4.8. Train format | |
| | 4.9. MM signal pause | |
| | 4.10. RailCom support | |
| 5. Software update | | |
| 6. LCD backlight | | |
| 7. Version and serial number | | |
| 8. Exit | | |

**Factory settings**

| Parameter | Factory settings | Where to change? |
|-----------|------------------|------------------|
| Mode for 128 speed levels | 1:1 | Settings / 128FS Mode |
| Mode for speed controller | AC mode | Settings / Jogdial mode |
| Amount of s88 feedback modules | 0 | Settings / s88 settings / s88 modules |
| Short circuit sensitivity of the booster | 100 ms | Settings / Booster configuration / Short circuit sensitivity |
| Short circuit polarity of the booster ports | positive | Settings / Booster configuration / Short circuit polarity |
| Baud rate of the serial interface | 2400 | Settings / Interface baud rate |
| Data format of points (points format) | Motorola format | Settings / Points / Format |
| Min. switching time for points | 100 ms | Settings / Points / min. switching time |
| Max. switching time for points | 5.0 s | Settings / Points / max. switching time |
| Format for locomotive addresses 1 to 255 | Motorola II format, 14 speed levels | Settings / Locomotive format / Data format |
| Format for locomotive addresses 256 to 10239 | DCC format, 28 speed levels | Locomotive Menu / Data format |
| Signal pause for Motorola-Format | short | Settings / MM signal pause |
| RailCom Support | 3: + Accessory | Settings / RailCom support |
| LCD backlight | 8 | Settings / LCD Backlight |

# 6.1. Adjusting parameters in the locomotive menu

### Calling a locomotive's address

The parameters entered in the locomotive menu always relate to the locomotive currently displayed before entering the menu. To call up a locomotive or function decoder, follow these steps:

- Enter the address number using the keypad and
- Press $\boxed{\#}$ / ok to confirm your input.

An address called for the first time is automatically applied factory settings, which can be found in the above paragraph.

### Locomotive menu

Enter the menu by pressing $\boxed{0}$ / menu and turn the speed control knob until you see the menu point "locomotive menu".
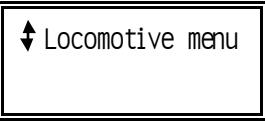
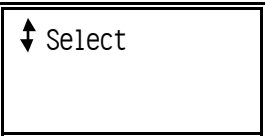| | |
|---|---|
| $\updownarrow$ Locomotive menu | Possible actions:<br>Navigate to submenu level 1 by pressing $\boxed{\#}$ / ok.<br>Navigate to another menu point in the main menu level by turning the speed control knob.<br>Return to normal operation mode by pressing $\boxed{*}$ / esc. |

The submenu enables you to:

- Search for a locomotive's name in the database and select it to operate,
- Individually apply or change parameters for each decoder and save these changes
- Delete names from the database.

### Choosing a locomotive or function decoder from the database

| | |
|---|---|
| $\updownarrow$ Select | Possible actions:<br>Choose a locomotive with $\boxed{\#}$ / ok.<br>Navigate to another menu point by turning the speed control knob.<br>Go back to the main menu level by pressing $\boxed{*}$ / esc. |

$\boxed{\#}$ / ok
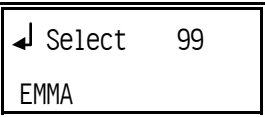
| | |
|---|---|
| $\downarrow$ Select    99<br><br>EMMA | Possible actions:<br>Scroll through your entries in the database by turning the speed control knob.<br>Choose a decoder by pressing $\boxed{\#}$ / ok. You'll be returned to operation mode afterwards.<br>Hint:<br>The submenu "Select" lets you check for entries in the database, which are alphabetically sorted by name. This can help you finding a forgotten address of a decoder. You can directly choose the decoder's name. Your MasterControl then returns to operation mode and chooses the chosen address as active address. |

**Applying a data format to a locomotive's decoder**

```
‡ Data format

  99: MM II   14
```

#  / ok

Possible actions:

Change the data format by pressing # / ok.

Navigate to another menu point by turning the speed control knob.

Go back to the main menu level by pressing * / esc.

```
↵ Data format

  99: MM II   14
```

Possible actions:

Choose the data format by turning the speed control knob.

Enter inputs by pressing # / ok. Changes are saved and you'll be taken back to submenu level 1.

Cancel by pressing * / esc. Changes are not saved and you'll be taken back to submenu level 1.

Hint: In the submenu "Data format" you apply the following data formats and speed levels to the address:

- MM (Motorola) I:  14, 27 a or 27 b speed levels
- MM (Motorola) II:  14, 27 a or 27 b speed levels
- DCC:  14, 28 or 128 speed levels

**Applying a name to a locomotive's address**

```
‡ Name           99

  EMMA
```

or:

```
‡ Name           99


```

#  / ok

Possible actions:

To change / enter a name press # / ok.

Navigate to another menu point by turning the speed control knob.

Go back to the main menu level by pressing * / esc.

```
↵ Name           99

  EMMA
```

Possible actions:

Choose a character by pressing # / ok. The cursor then jumps to the next character.

Enter a number using the keypad. (Pressing # / ok is not required). The cursor then jumps to the next character.

Enter a blank (found in the list of characters before "A") and confirm by pressing # / ok. The cursor then jumps to the next character.

Finish input by entering blanks until the end of the row or (if already displayed) enter existing blanks by pressing # / ok. Changes are saved and you'll be taken back to the submenu level.

Cancel by pressing * / esc. Changes are not saved and you'll be taken back to the submenu level.

Hint: In the submenu „Name" you can apply a name with a maximum of 11 characters. Please note: The name is only saved, if you entered a character, a number or a symbol for each of the 11 digits.

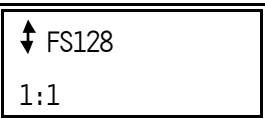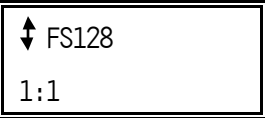**Deleting an entry from the locomotive database**

```
♦ Entry        99

#=Delete
```

If no name appears or
after entering the name,
your control displays:

Possible actions:

To delete a name from the database press $\boxed{\#}$ / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu level by pressing $\boxed{*}$ / esc.

Hint:

Only if a name is applied to the address, the submenu point "Entry" can be chosen.

```
♦ Entry        99

(No Entry)
```

Possible actions:

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu level by pressing $\boxed{*}$ / esc.

**Mode for speed level mode 128**
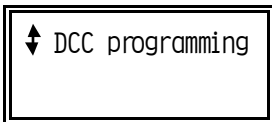
```
♦ FS128

1:1
```

Possible actions:

Change the mode for speed level mode 128 by pressing $\boxed{\#}$ / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu level by pressing $\boxed{*}$ / esc.

```
♦ FS128

1:1
```

Possible actions:

Choose the mode for speed level mode 128 by turning the speed control knob.

Info: In speed level mode 128, turning the speed knob to the next lock alters the speed level by one (mode 1:1). With the mode 1:2 turning the speed knob to the next lock alters the speed level by two. Further more there are two modes available which allow you to alter the speed levels in small steps in the lower speed level area and in bigger steps in the higher speed level area.

| progressive 1 | speed level 0-20: 1:1 | speed level 20-62: 1:2 | speed level 62-126: 1:4 |
|---|---|---|---|
| progressive 2 | speed level 0-10: 1:1 | speed level 10-22: 1:2 | speed level 22-126: 1:4 |

Enter inputs by pressing $\boxed{\#}$ / ok. Changes are saved and you'll be taken back to submenu level 1.

Cancel by pressing $\boxed{*}$ / esc. Changes are not saved and you'll be taken back to submenu level 1.

## 6.2. Programming DCC decoders

To program a locomotive or function decoder, put the locomotive on the DCC programming track (Exception: Main track programming). Enter the menu by pressing ⌑0⌑ / menu and turn the speed control knob until "DCC programming" is displayed.

```
♦ DCC programming
```

Possible actions:

Enter submenu level 1 by pressing ⌑#⌑ / ok.

Navigate to another menu point by turning the speed control knob.

Go back to the operation mode by pressing ⌑*⌑ / esc.

**Programming modes**

The MasterControl supports programming and reading data in the following DCC programming types:

- CV-programming – byte wise
- CV-programming – bitwise
- Register programming
- Page programming

Main track programming is a byte wise CV-programming, where the locomotive can be programmed on the main track. Main track programming is only possible for the last called locomotive's address and for one CV-variable. After changing a variable, your MasterControl automatically returns to operation mode and cancels the programming mode. The set value of the variable is not read from the decoder.

Please note: Each DCC decoder is designed for special modes of programming. To find out, which mode your decoder supports, please read the manual.

→ Section 11. Background information

**Changing the decoder's address**

Changing a decoder's address can easily be achieved by calling the submenu point "Primary address" and "Long address". After entering the address using these menu points, the MasterControl automatically assigns the right values to the CV variables 1 and 29 or 17, 18 and 29.
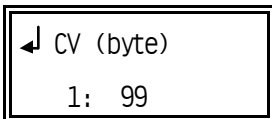
**CV programming (byte wise)**
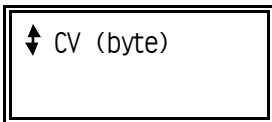
```
♦ CV (byte)
```

⌑#⌑ / ok

Possible actions:

To read or change press ⌑#⌑ / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing ⌑*⌑ / esc.

```
↵ CV (byte)
     1:   99
```

Please note: The CV number is displayed on the left, the CV value on the right.

Possible actions:

Reading a CV: Enter CV number on the keypad (only possible, if the cursor is centred on the CV number field) and confirm input with ⌑#⌑ / ok. The saved value appears in the field on the right.

Changing a CV: Turn the speed control knob (Cursor moves towards the CV value field), enter value with the keypad and confirm by pressing ⌑#⌑ / ok.

Go back to the submenu level 1 by pressing ⌑*⌑ / esc.

## CV programming (bitwise)

```
♦ CV (bit)



# / ok
```

Possible actions:

To read or change press  # / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing  * / esc.

```
↵ CV (bit)

CV:  29 Bit:1=1
```

Possible actions:

Reading a CV bit: Enter CV number and bit number on the keypad (only possible, if the cursor is centred on the corresponding field) and confirm input with  # / ok. The saved value appears in the field on the right.

Changing a CV: Turn the speed control knob (Cursor moves towards the CV bit field), enter value with the keypad and confirm by pressing  # / ok.

Go back to the submenu level 1 by pressing  * / esc.

## Setting primary addresses

```
♦ Primary address



# / ok
```

Possible actions:

To read or change press  # / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing  * / esc.

```
↵ Primary address

 103
```

The MasterControl automatically reads the decoder's address.

Possible actions:

Enter the new address on the keypad and confirm input with  # / ok.

Hint: The CV numbers 1 and 29 are automatically set to "Primary address".

Go back to the submenu level 1 without saving changes by pressing  * / esc.

## Setting extended addresses

```
♦ Extend. address



# / ok
```

Possible actions:

To read or change press  # / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing  * / esc.

```
↵ Extend. address

 10099
```
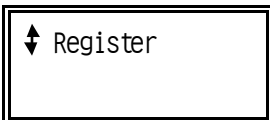
The MasterControl automatically reads the decoder's address.
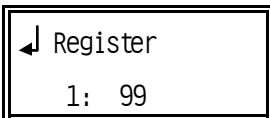
Possible actions:

Enter the new address on the keypad and confirm input with  # / ok. Hint: The CV numbers 17, 18 and 29 are automatically set to "extended addresses".

Go back to the submenu level 1 without saving changes by pressing  * / esc.

### Register programming

```
♦ Register
```

`#` / ok

Possible actions:

To read or change press `#` / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

```
↵ Register
    1:  99
```

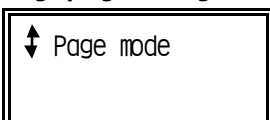Please note: The register number is displayed on the left, the register value on the right.

Possible actions:

Reading a register: Enter the register number on the keypad (only possible, if the cursor is centred on the register number field) and confirm input with `#` / ok. The saved value appears in the field on the right.
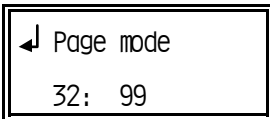
Changing a Register: Turn the speed control knob (Cursor moves towards the register value field), enter value with the keypad and confirm by pressing `#` / ok. Possible values are: 1,2,3, … 8

Go back to the submenu level 1 by pressing `*` / esc.

### Page programming

```
♦ Page mode
```

`#` / ok

Possible actions:

To read or change press `#` / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

```
↵ Page mode
   32:  99
```

Please note: The register number is displayed on the left, the register value on the right.
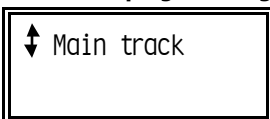
Possible actions:

Reading a register: Enter register number on the keypad (only possible, if the cursor is centred on the register number field) and confirm input with `#` / ok. The saved value appears in the field on the right.
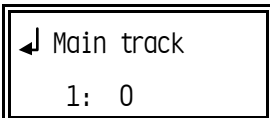
Changing a Register: Turn the speed control knob (Cursor moves towards the register value field), enter value with the keypad and confirm by pressing `#` / ok.

Go back to the submenu level 1 by pressing `*` / esc.

### Main track programming

```
♦ Main track
```

`#` / ok

Possible actions:

To read or change press `#` / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

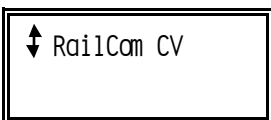Go back to the main menu by pressing `*` / esc.

```
↵ Main track
    1:   0
```

Please note: The CV number is displayed on the left, the CV value on the right.

Please note: The maintrack programming method only allows you to change one variable of the last called decoder address. The set value is not read (Display "0"). After setting a CV variable, the MasterControl returns to operation mode.
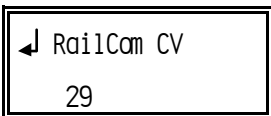
Changing a CV: Enter the CV number on the keypad (only possible, if the cursor is centred on the CV number field), turn the speed control knob (Cursor moves towards the CV value field), enter value with the keypad and confirm by pressing `#` / ok.

Go back to the submenu 1 level without saving changes by pressing `*` / esc.

**Entering RailCom CV-read out commands**

```
  ↕ RailCom CV


```

`#` / ok

```
  ↵ RailCom CV

      29
```

Possible actions:

To enter a RailCom CV-read out command press `#` / ok.

Navigate to another menu point of the submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

Possible actions:

Reading out the CV of a vehicle decoder: Enter the no. of the CV on the keypad and confirm your input with `#` / ok. The display device connected to the rail section that the vehicle decoder is in, shows the value of the CV read out.

Go back to the submenu level 1 by pressing `*` / esc.

## 6.3. Saving and restoring your layout status

Enter the menu by pressing $\boxed{0}$ / menu and if needed, turn the speed control knob to navigate to "Layout status". The following data is saved, when activating "Save layout status":

- List of active locomotives,
- Status of all active locomotive and function decoders,
- Setting of points that have been switched after turning on the MasterControl.

The speed levels of all locomotives are set to „0".

The MasterControl can restore data in two other ways:

→ Section 7.6. Resetting your system
→ Section 6.4. Subsection Deleting the configuration
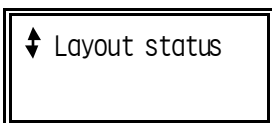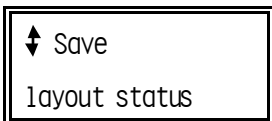
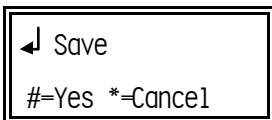| | |
|---|---|
| ⬍ Layout status | Possible actions:<br>To save or restore layout status press $\boxed{\#}$ / ok.<br>Navigate to another menu point of the menu by turning the speed control knob.<br>Go back to the operation mode by pressing $\boxed{*}$ / esc. |
| $\boxed{\#}$ / ok | |
| ⬍ Save<br><br>layout status | Possible actions:<br>To save layout status press $\boxed{\#}$ / ok.<br>To restore layout status turn the speed control knob until "Restore layout status" is displayed. |
| $\boxed{\#}$ / ok | Go back to the main menu by pressing $\boxed{*}$ / esc. |
| ↵ Save<br><br>#=Yes *=Cancel | Possible actions:<br>Save the layout status by pressing $\boxed{\#}$ / ok. You'll be taken back to submenu level 1.<br>Cancel by pressing $\boxed{*}$ / esc. You'll be taken back to submenu level 1 without saving.<br>Hint: Please do not cut power while saving your layout status. If power is cut, repeat saving. |
| ⬍ Restore<br><br>layout status | Possible actions:<br>To restore layout status press $\boxed{\#}$ / ok.<br>To save layout status turn the speed control knob until "Save layout status" is displayed. |
| $\boxed{\#}$ / ok | Go back to the main menu by pressing $\boxed{*}$ / esc. |
| ↵ Restore<br><br>#=Yes *=Cancel | Possible actions:<br>Restore the layout status by pressing $\boxed{\#}$ / ok. You'll be taken back to the operation mode.<br>Cancel by pressing $\boxed{*}$ / esc. You'll be taken back to submenu level 1 without restoring. |
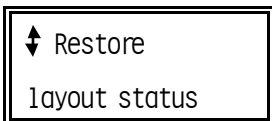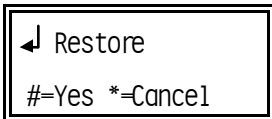
## 6.4. Adjusting parameters of external devices and changing basic settings

Enter the menu by pressing $\boxed{0}$ / menu and if needed, turn the speed control knob to navigate to "Settings". The submenu points help you adjust a number of parameters:

- Mode for speed level 128.
- Mode for speed controller.
- The number of connected s88 devices. You can also check the connected devices here.
- Short circuit polarity and short circuit sensitivity of the connected boosters.
- Baud rate of the serial interface.
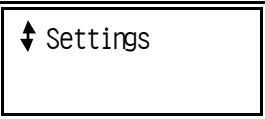- Data format of connected solenoid accessory decoder.
- Standard data format of the locomotive and function decoders. You can also apply an individual data format to each decoder.
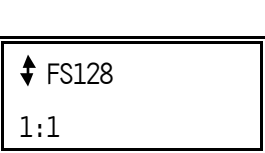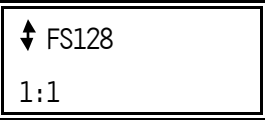- Duration of the signal pause in the Motorola format
- RailCom Support.

Additionally, you can delete the whole configuration using this menu point (master reset).

| | |
|---|---|
| ⬍ Settings<br><br><br><br>$\boxed{\#}$ / ok | Possible actions:<br>To navigate to submenu level 2 press $\boxed{\#}$ / ok.<br>Navigate to another menu point in submenu level 1 by turning the speed control knob.<br>Go back to the main menu by pressing $\boxed{*}$ / esc. |

**Mode for speed level mode 128**

| | |
|---|---|
| ⬍ FS128<br><br>1:1 | Possible actions:<br>Change the mode for speed level mode 128 by pressing $\boxed{\#}$ / ok.<br>Navigate to another menu point of the submenu level 1 by turning the speed control knob.<br>Go back to the main menu level by pressing $\boxed{*}$ / esc. |
| ⬍ FS128<br><br>1:1 | Possible actions:<br>Choose the mode for speed level mode 128 by turning the speed control knob.<br>Info: In speed level mode 128, turning the speed knob to the next lock alters the speed level by one (mode 1:1). With the mode 1:2 turning the speed knob to the next lock alters the speed level by two. Further more there are two modes available which allow you to alter the speed levels in small steps in the lower speed level area and in bigger steps in the higher speed level area. |

| progressive 1 | speed level 0-20:<br>1:1 | speed level 20-62:<br>1:2 | speed level 62-126:<br>1:4 |
|---|---|---|---|
| progressive 2 | speed level 0-10:<br>1:1 | speed level 10-22:<br>1:2 | speed level 22-126:<br>1:4 |

Enter inputs by pressing ⸢#⸥ / ok. Changes are saved and you'll be taken back to submenu level 1.

Cancel by pressing ⸢*⸥ / esc. Changes are not saved and you'll be taken back to submenu level 1.

**Mode for speed controller**

```
♦ Jogdial mode

AC Modus
```
⸢#⸥ / ok

Possible actions:

To change the mode for speed controller press ⸢#⸥ / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing ⸢*⸥ / esc.

```
↵ Jogdial mode
  AC Modus
```
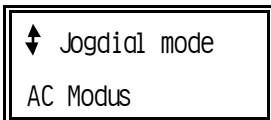⸢#⸥ / ok

Possible actions:

Choose the mode for speed controller by turning the speed control knob.
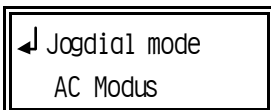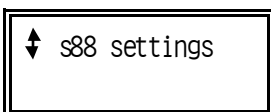
Enter inputs by pressing ⸢#⸥ / ok. Changes are saved and you'll be taken back to submenu level 1.

Cancel by pressing ⸢*⸥ / esc. Changes are not saved and you'll be taken back to submenu level 1.

Info: In order to release a change of the driving direction in AC speed controller mode you have to press the speed control knob. After reaching the speed level 0 turning the speed control knob further counterclockwise shows no effect.

In DC speed controller mode both turning the speed control knob clockwise and counterclockwise effect an increase of the speed level. When turning the speed control knob clockwise the locomotive runs in forward direction, when turning it counterclockwise, in backward direction. It is also possible to change the driving direction by pressing the speed control knob.

**Entering settings for s88 modules**
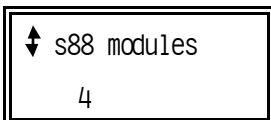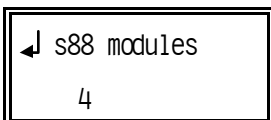
```
♦ s88 settings
```
⸢#⸥ / ok

Possible actions:

To navigate to submenu level 2 press ⸢#⸥ / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing ⸢*⸥ / esc.

```
♦ s88 modules
       4
```
⸢#⸥ / ok

Possible actions:

To enter the amount of s88 module press ⸢#⸥ / ok.

Navigate to another menu point of submenu level 2 by turning the speed control knob.

Go back to the main menu by pressing ⸢*⸥ / esc.

```
↵ s88 modules
       4
```

Possible actions:

Enter the amount of s88 modules. Possible values: 0 to 32.

Confirm input by pressing ⸢#⸥ / ok. You'll be taken back to submenu level 1 and changes are saved.

Cancel with ⸢*⸥ / esc. You'll be taken back to submenu level 1 without saving changes.

**Testing s88 modules**

```
♦ s88 module test
```

`#` / ok

```
↵ s88 module test
Nr:  1■■■■□□□□□
```

Possible actions:

To test the connected s88 modules press `#` / ok.

Navigate to another menu point of submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

Possible Actions:

Go back to submenu level 1 by pressing `*` / esc. or `#` / ok.

To test an s88 module, enter its number and press `#` / ok. A check of the inputs starts, when pressing `0` /menu.

The master control checks the input's status one after the other. The statuses of inputs 1 to 8 are displayed in the upper row, those of inputs 9 to 16 in the lower row:

□ = idle,  ■ occupied.

The MasterControl repeats the check continuously. Inputs checked as occupied will still be displayed as occupied if their status changed while checking. This helps you to find very short (and eventually falsely reported) statuses. To refresh the displayed check results press `0` /menu.

Differences between the displayed status and the current status of an s88 module point to errors concerning your s88 bus, your s88 module or parts of your model railway layout, connected to the s88 module.

**Deleting the configuration (master reset)**

```
♦ Delete
   configuration
```

`#` / ok

```
↵ Configuration
#=Del. *=Cancel
```
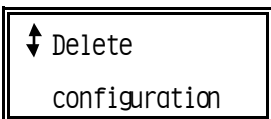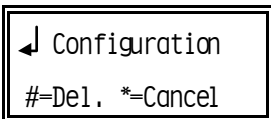
Possible actions:

To delete the configuration press `#` / ok.

Navigate to another menu point of submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

Possible actions:

Delete the configuration by pressing `#` / ok. This process takes a while, the MasterControl is reset to factory settings and the track power is switched off.

Cancel with `*` / esc. You'll be taken back to the main menu without deleting the settings.

Using this menu point, you reset every setting to factory settings and the locomotive database is deleted. A saved layout status remains in the memory and can be restored afterwards.

⚠ Please note:

You cannot stop the reset process. Don't cut power while doing this as this can permanently damage the MasterControl's database!

**Configuring the booster**

```
┌─────────────────────┐
│ ⬍ Booster           │
│                     │
│    configuration    │
└─────────────────────┘
```
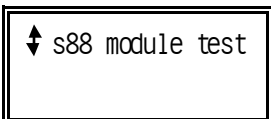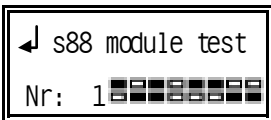
Possible actions:

To navigate to submenu level 2 press $\boxed{\#}$ / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing $\boxed{*}$ / esc.

$\boxed{\#}$ / ok

```
┌─────────────────────┐
│ ⬍ Short c. pol.     │
│                     │
│  positive  (MM)     │
└─────────────────────┘
```

Possible actions:

To change the short circuit polarity press $\boxed{\#}$ / ok.

Navigate to another menu point of submenu level 2 by turning the speed control knob.

$\boxed{\#}$ / ok

Go back to the main menu by pressing $\boxed{*}$ / esc.

```
┌─────────────────────┐
│ ↵ Short c. pol.     │
│                     │
│  positive   (MM)    │
└─────────────────────┘
```

Possible actions:

Adjust the short circuit polarity by turning the speed control knob.

Confirm your input by pressing $\boxed{\#}$ / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with $\boxed{*}$ / esc. You'll then be taken back to submenu level 1 without saving changes.

Hint:

The use Märklin\*\*-compatible boosters requires setting the short circuit polarity to „positive" and for DDC-compatible boosters to "negative".

```
┌─────────────────────┐
│ ⬍ Short c. sens.    │
│                     │
│  100 ms             │
└─────────────────────┘
```

Possible actions:

Adjust the short circuit polarity by turning the speed control knob.

Navigate to another menu point of submenu level 2 by turning the speed control knob.

$\boxed{\#}$ / ok

Go back to the main menu by pressing $\boxed{*}$ / esc.

```
┌─────────────────────┐
│ ↵ Short c. sens.    │
│                     │
│  100 ms             │
└─────────────────────┘
```

Possible actions:

Adjust the short circuit polarity by turning the speed control knob. Possible values: OFF, 5, 10, 15, ... 1000 ms.

Confirm your input by pressing $\boxed{\#}$ / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with $\boxed{*}$ / esc. You'll then be taken back to submenu level 1 without saving changes.

Hint:

The lower the set value, the faster the short circuit detection reacts and booster outputs are switched off. Please note: A high value can cause "welding" in case of a short circuit (especially in combination with a powerful booster).

**Setting interface baud rate**

```
♦ Interface baud

2400 Baud
```
`#` / ok

Possible actions:

To set the interface baud rate press `#` / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

```
↵ Interface baud

2400 Baud
```

Possible actions:

Adjust the interface baud rate by turning the speed control knob.
Possible values: 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600.
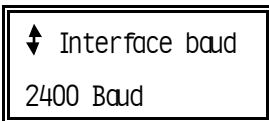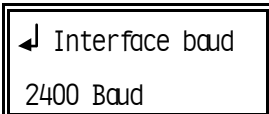
Confirm your input by pressing `#` / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with `*` / esc. You'll then be taken back to submenu level 1 without saving changes.

Hints:

When using the serial interface, this value has to be set according to your PC interface configuration.

The USB interface is 57600 and can't be changed.

**Making settings for solenoid accessory decoders**

```
♦ Points config.
```
`#` / ok
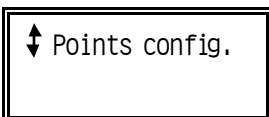
Possible actions:

To set the points format press `#` / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

**Setting standard data format for all solenoid accessory decoders**

```
♦ All points

Motorola
```
`#` / ok
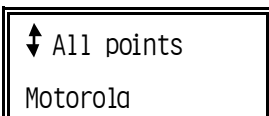
Possible actions:

To set the points format for all solenoid accessory decoders press `#` / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

```
↵ All points

Motorola
```
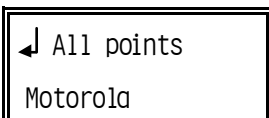
Possible actions:

Adjust the points format for all solenoid accessory decoders by turning the speed control knob.

Confirm your input by pressing `#` / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with `*` / esc. You'll then be taken back to submenu level 1 without saving changes.

Hint:

This setting applies to all connected solenoid accessory decoders.

**Setting standard data format for single solenoid accessory decoders**

```
⬍ Points format

1-   4: MM
```

`#` / ok

It is possible to set the points format for each group of four single points (adresses 1-4, 5-8, etc.) seperately.

Possible actions:

Choose a points group by entering a decoders´s adress from the group of four points and `#` / ok. To set the points format for this group press `#` / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

```
↲ Points format

1-   4: MM
```

Possible actions:

Adjust the points format for the chosen group of four points by turning the speed control knob.

Confirm your input by pressing `#` / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with `*` / esc. You'll then be taken back to submenu level 1 without saving changes.

**Setting switching time of solenoid accessory decoders**

```
♦ min. switch.time
100 ms
```
`#` / ok

Possible actions:
To set a minimum switching time press `#` / ok.
Navigate to another menu point in submenu level 2 by turning the speed control knob.
Go back to submenu level 1 by pressing `*` / esc.

```
↵ min. switch.time
100 ms
```

Possible actions:
Adjust the minimum switching time by turning the speed control knob. Possible values: 0, 50, 100, 150 … 1000 ms.

Confirm your input by pressing `#` / ok. You'll then be taken back to submenu level 2 and changes are saved.

Cancel with `*` / esc. You'll then be taken back to submenu level 2 without saving changes.
Hints:
When setting a certain minimum switching time, you can switch points by quickly tapping the function key, although the points need a longer switching time.

```
♦ max. switch.time
5,0 s
```
`#` / ok

Possible actions:
To set a maximum switching time press `#` / ok.
Navigate to another menu point in submenu level 2 by turning the speed control knob.
Go back to submenu level 1 by pressing `*` / esc.

```
↵ max. switch.time
5,0 s
```

Possible actions:
Adjust the maximum switching time by turning the speed control knob. Possible values: 0.1, 0.2, 0.3, 0.4 … 25.5 s.

Confirm your input by pressing `#` / ok. You'll then be taken back to submenu level 2 and changes are saved.

Cancel with `*` / esc. You'll then be taken back to submenu level 2 without saving changes.
Hints:
By setting a maximum switching time, you can prevent damages at the points caused by too long switching times.

### Setting standard data format for locomotive and function decoders
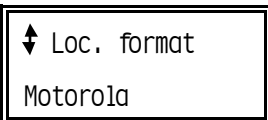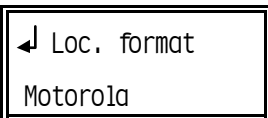
```
♦ Loc. format

Motorola
```

$\boxed{\#}$ / ok

Possible actions:

To set the data format for decoders press $\boxed{\#}$ / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing $\boxed{*}$ / esc.

```
↵ Loc. format

Motorola
```

Possible actions:

Adjust the standard data format by turning the speed control knob.

Confirm your input by pressing $\boxed{\#}$ / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with $\boxed{*}$ / esc. You'll then be taken back to submenu level 1 without saving changes.

Hints:

This setting will be set standard setting for all decoders with address numbers up to 255. Locomotive and function decoders with addresses from 256 are set to DCC-Format with 28 speed levels – independent of the settings in this menu point. The standard settings for Motorola is 14 speed levels and for DCC 28 speed levels.

Using the locomotive menu, you can set a different data format and / or another amount speed levels.

### Setting duration of the signal pause in the Motorola format

```
♦ MM sig. pause

Short (1.5 ms)
```

$\boxed{\#}$ / ok
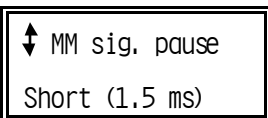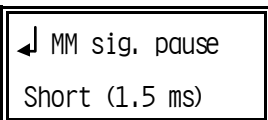
Possible actions:

To set the duration of the signal pause press $\boxed{\#}$ / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing $\boxed{*}$ / esc.

```
↵ MM sig. pause

Short (1.5 ms)
```

Possible actions:

Adjust duration of the signal pause by turning the speed control knob. Possible values: short (1.5 ms) or long (4.025 ms).

Confirm your input by pressing $\boxed{\#}$ / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with $\boxed{*}$ / esc. You'll then be taken back to submenu level 1 without saving changes.

Hints:

These settings only apply to locomotive or function decoders in the Motorola format. It's recommended to set the signal pause to 1.5 ms. Only if problems with Motorola I decoders occur in operation mode, should you change the setting to 4.025 ms.

**RailCom Support**

```
♦ RailCom Support

1: Tailbits
```

`#` / ok

```
↵ RailCom Support

1: Tailbits
```

Possible actions:

To set the RailCom support press `#` / ok.

Navigate to another menu point in submenu level 1 by turning the speed control knob.

Go back to the main menu by pressing `*` / esc.

Possible actions:

Adjust the RailCom support by turning the speed control knob.

Possible adjustments:

0: off. The Railcom support is switched off.

1: Tailbits. There will be left space for the RailCom cutout during data transfer.

2: + IdNotify. The central unit sends regularly it´s identification. (In addition to Tailbits).

3: + Accessory. The central unit sends regularly a point command, to allow the points decoders sending feedback signal. (In addition to Tailbits and IdNotify)

Confirm your input by pressing `#` / ok. You'll then be taken back to submenu level 1 and changes are saved.

Cancel with `*` / esc. You'll then be taken back to submenu level 1 without saving changes.

## 6.5. Updating the software of external devices

| |
|---|
| ↕ Software update |

Hint: This only executes an update for external devices! Detailed instructions about the software update can be found in the manual of your external device.

→ Section 8. Software update

Possible actions:

To update the software press  #  / ok.

Navigate to another menu point in the main menu by turning the speed control knob.

Go back to the operation mode by pressing  *  / esc.

## 6.6. Adjusting display backlight

| |
|---|
| ↕ LCD backlight<br><br>12 |

Possible actions:

To adjust the display backlight press  #  / ok.

Navigate to another menu point in the main menu by turning the speed control knob.

 #  / ok      Go back to the operation mode by pressing  *  / esc.

| |
|---|
| ↕ LCD backlight<br><br>8 |

Possible actions:

Adjust the LCD backlight by turning the speed control knob.

Possible values: 0 to 16.

Confirm input by pressing  #  / ok. You'll then be taken back to the main menu.

Cancel with  *  / esc. You'll then be taken back to the main menu without saving changes.

Hint: The intensity of the LCD backlight is adjusted according to the entered value. It is only set, if you confirm your input by pressing  #  / ok.

## 6.7. Checking version and serial number

| |
|---|
| ↕ MasterControl<br><br>Softw.V1.4.0 |

The version number is automatically displayed when entering the menu point.

Possible actions:

Display the serial number by pressing  #  / ok.

Navigate to another menu point in the main menu by turning the speed control knob.

Go back to the operation mode by pressing  *  / esc.

## 6.8. Exit

| |
|---|
| ↕ Exit |

Possible actions:

Go back to the operation mode by pressing  #  / ok or  *  / esc.

Navigate to another menu point in the main menu by turning the speed control knob.

# 7. Operation

## 7.1. Switching track power on / off

```
┌─────────────────────┐
│  99    Stop    0  ▉ │
│                     │
│                . . . . │
└─────────────────────┘
```

After switching on your MasterControl the connected booster(s) have no power, meaning that your track also has no power. Before switching on the power, it's possible to check and reduce the current speed levels of active locomotives and to restore a saved configuration.

```
┌────┐
│ go │
└────┘
```

The decoder address last used will be displayed when switching on the MasterControl.

```
┌─────────────────────┐
│  99    MMII    0  ▉ │
│                     │
│                . . . . │
└─────────────────────┘
```

Press ⎡go⎤ to switch on the boosters. The data format of the locomotive last used will be displayed.

**STOP**

You can switch off all boosters by pressing ⎡stop⎤. If for instance two trains are about to crash, you can stop the operation of your model railroad. Please note: The current speed levels and function statuses are not discarded! As soon as you start operation again by pressing ⎡go⎤ all active locomotives start moving as before.

Attention! Some locomotive decoders have additional power buffers, which can support a locomotive when power is cut. Before operating such a decoder, please check how much energy is stored and which of the locomotives is able to move without power, otherwise cutting power to the booster(s) might not prevent a crash.

**HALT**

By simultaneously pressing shift (⇧) and the ⎡stop⎤ key, you can also stop operation. In contrast to "STOP", "HALT" also deletes the currently set speed levels. The statuses of functions remain saved, the track voltage is not switched off.

**HALT for one locomotive**

By simultaneously pressing shift (⇧) and the speed control knob, you can stop the last called locomotive immediately, whose data is shown in the display. The locomotive´s speed level will be set to „0" internally. The statuses of functions and the set speed level remain saved. The track voltage is not switched off, consequently other locomotives on the layout drive on.

The set speedlevel and the directional arrow flashing in the display show the halt. You can alter the speed level and the functions during the halt. In order to release the halt press shift (⇧) and the speed control knob again.

## 7.2. Driving locomotive and function decoders

### Active locomotive and function decoders

As soon as you call up a locomotive or function decoder, its' address will internally be saved as "active". The last called address will be displayed. The internal memory can store up to 64 active locomotives. If you call up a 65th decoder, the MasterControl will delete the locomotive that has hasn't been used for the longest period from the active locomotives memory.

As soon as call up an address on your MasterControl, the system automatically grabs the corresponding parameters saved in the locomotive database. If you call up an address for the first time, it will be assigned standard parameters.
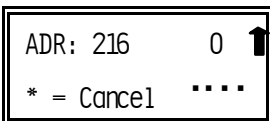
→ Section 6.1. Adjusting parameters in the locomotive menu

### The Display

The display shows the last called decoder address, the locomotive's name (if set), the corresponding data format, the set speed level, the driving direction and the switched-on functions. The display shows as well, if an active locomotive is accessable or not for other control units.

Please note: In the Motorola I format no information about driving directions is sent and thus no such information is displayed.

### Enter address

```
ADR: 216      0  ↑

* = Cancel   · · · ·
```
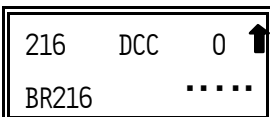
Please enter the locomotive or function decoder's address using the keypad. When entering the first digit, the display is automatically set to address input.

Hint: The address can have 1 to 5 digits. The input of zeros to fill up 5 digits is not necessary, but will take you to the main menu.

Please enter your input by pressing  #  / ok.

 #  / ok

To Cancel your input, press  *  / esc.

```
216     DCC   0  ↑

BR216        · · · · ·
```

After calling up a locomotive, the address, the locomotive's name (if set) and the corresponding data format are displayed. If the address is already saved in the locomotive database, the stored information is used. If it is not saved there, it will be assigned standard settings.

### Alternately controlling two locomotive adresses

By holding down shift (⇧) while pressing  0  / the display menu shows the locomotive address before the active address. This function allows to switch easily and quickly between two addresses you intend to control in parallel.

### Calling up a locomotive from the locomotive database

Instead of entering a decoder's address, you can call up a locomotive from the locomotive database. This might be handy if you forgot the locomotive's address but know its name. Enter the menu by pressing  0  / menu. For further steps read section 6.1.

### Adjusting a locomotive´s speed

| 216 | DCC | 15 ⬆ |
|-----|-----|------|
| BR216 | | • • • • • |
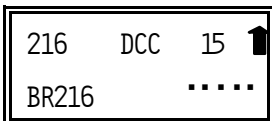
Adjust the speed by turning the speed control knob. The highest possible speed level depends on the data format and the amount of speed levels assigned to the decoder.

### Directly entering a locomotive´s speed

| 216 | DCC | 18 ⬆ |
|-----|-----|------|
| BR216 | | • • • • • |

Instead of setting a locomotive´s speed by turning the speed knob you can enter the speed level using the keypad. Press ⎡go⎤ to confirm the input.

### Setting the driving direction

| 216 | DCC | 0 ⬇ |
|-----|-----|------|
| BR216 | | • • • • • |

By pressing down the speed control knob, you change the current driving direction. The current value will be displayed as an arrow (not if Motorola I decoders are used). When changing the driving direction, the current speed level is set to "0", which causes some decoders to execute an emergency stop.

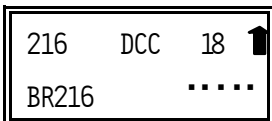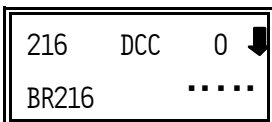With the DC mode set for the speed controller, the driving direction is set by the rotating direction of the speed control knob:

clockwise: driving direction „forwards",

counterclockwise: driving direction „backwards".

### Switching functions f0 / light and f1 to f4

| 216 | DCC | 15 ⬆ |
|-----|-----|------|
| BR216 | ⬚ | F • F •  1 3 |
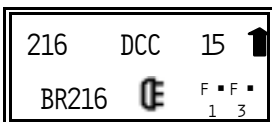
Press one of the buttons ⎡function⎤, ⎡f1⎤, ⎡f2⎤, ⎡f3⎤ or ⎡f4⎤. If a function is switched on, it is displayed.

To switch functions when driving in double traction, please see section 7.3.

### Switching functions f5 to f8

| 216 | DCC | 15 ⬆ |
|-----|-----|------|
| BR216 | | ⇧F • • •  5 |
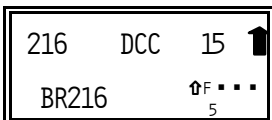
DCC decoders only support the functions f5 to f8. To switch the functions hold down shift (⇧) while pressing ⎡f1⎤ for function f5, ⎡f2⎤ for function f6, and so on.

To display the statuses of the functions f5 to f8 press the shift key. The display then shows the shift symbol (⇧) and the active functions are shown.

**Switching functions f1 to f12**

For the last called locomotive, whose data are shown in the display you can switch a function by entering the function´s number via the keyboard and switching it on and off with the button function afterwards. This method allows you to switch the functions f1 to f12.

**Displaying functions switched on**

When pressing shift (⇧) for the last called locomotive, whose data is shown in the display, all functions switched on are shown in the display (except for function / f0). As the number of functions in Motorola format is limited to 4, this functions is inactive for locomotives with Motorola decoder.

## 7.3. Double tractions

**Creating double tractions**

Move the locomotives behind each other and set the same driving direction for both of them.

Please note: A double traction is only possible, if both decoders have the same amount of speed levels. A double traction with decoders of different formats is possible, if both decoders are running with 14 speed levels or the Motorola decoder is running at 27 and the DCC decoder at 28 speed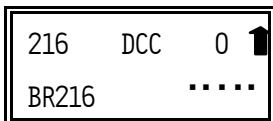 levels. If you try to create double tractions of decoders with a different amount of speed levels, your MasterControl displays an error message.

```
216    DCC    0 🔼

BR216       • • • • •
```

Enter the address of the first locomotive and confirm by pressing [#] / ok.

Hint:

It is easier switching the functions of the locomotive first set after installing double traction.

Just press [#] / ok again.

```
#-ADR: 3      0 🔼

* = Cancel   • • • •
```
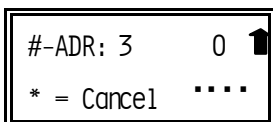
Then enter the address of the second locomotive and confirm by pressing [#] / ok.

To cancel an input, press [*] / esc.

```
216  🔒 DCC   0🔼

3    • • • •  • • • •
```

Both addresses will be displayed on top and on the bottom of the display. Both locomotives now respond simultaneously to driving commands or a direction change.

The lock sign (🔒) displays that the double traction cannot be taken over by another control unit.

**Switching the functions of double tractions**

```
216  🔒 DCC   0🔼

3    • F • •🔲 F • • •
        2        1
```
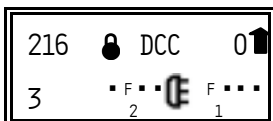
You can switch the functions f0 and function f1 to f4 of both locomotives in the double traction separately. Switching functions f5 to f8 is not possible.

You switch the functions of the locomotive displayed in the upper row of the display (the first locomotive) by pressing [function], [f1], [f2], [f3] or [f4]. To switch the functions of the locomotive displayed in the lower row of the first display (the first locomotive) by additionally holding the shift key.

The active functions of the first locomotive are displayed in the right lower row and for the second locomotive in the middle lower row. In our example locomotive number 216 has the active functions f0 and f1, locomotive 3 the active function f2.

**Cancelling a double traction**

```
┌─────────────────────┐
│                     │
│  3    DCC    0    ⬆ │
│                     │
│           ▪ F ▪ ▪   │
│              2      │
└─────────────────────┘
```
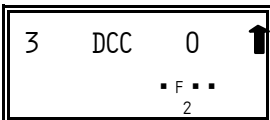
To cancel a double traction, enter the address of the locomotive you want to drive first. Confirm your input by pressing ⬜ # / ok.

# 7.4. Driving solenoid accessory decoders

To switch points or switching decoders, follow these steps:

- **Only** enter the decoder's address. Please note: Do **not** press ⬜ # / ok after the input. The MasterControl will otherwise call up a locomotive's address.
- Press the ⬜ f1 key for the points direction "straight on" or the switching decoder output "on" alternatively press the ⬜ f2 key for „branching" or the switching decoder output "off".

**Switching time**

The signal to switch points or a switching decoder is sent as long as you press the functions key. Nonetheless, the minimum and maximum switching time is limited as set in the menu point "Points configuration".

→ Section 6.4. Subsection Setting switching time of solenoid accessory decoders

Please note: To switch some types of components, that are driven by points or a switching decoder (such as decouplers) a short impulse is not enough. To avoid problems, please press the function button as long as needed or adjust the minimum switching time.

**Data format of solenoid accessory decoders**

The data format applies to all solenoid accessory and switching decoders.

→ Section 6.4. Subsection Setting standard data format for solenoid accessory decoders

## 7.5. Operation with MasterControl and non-central control devices

As soon as a non-central control device is plugged in, it automatically connects to the MasterControl. If an address is called up on a controlling device, the MasterControl checks, if it is locked from external access. If this is not the case, the MasterControl gives control to the controlling device and transfers the current status such as data format, speed level, driving direction, status of the functions and the locomotive's name. Then you can control the locomotive from the non-central control device. The driving information is transferred to the MasterControl, which then communicates with the decoder.

### Locking an address

As soon as you enter a decoder address, you can take over control from another device. To deny that enter the address again and confirm your input by pressing $\boxed{\#}$ / ok. The locomotive is then locked and the lock sign ( 🔒 ) is displayed. Entering the address again or entering another turns the lock off.

### Specialities of a double traction

A double traction stays under control of the control device it was established on. The double traction can't be taken over by another device. Only if you enter another address on the non-central control device, is it possible to take over a double traction.

## 7.6. Resetting your system

By simultaneously pressing the "Stop" and "Go" keys, you reset your system. Press these keys until the MasterControl displays "Reset". When releasing the keys, the reset is done:

- All functions of locomotive and function decoders are switched off.
- All locomotive's speed levels are set to "0".
- All double tractions are cancelled.
- On all connected devices, the last called address is set.
- The booster(s) is / are switched off.

Please don't confuse this reset with the deleting of a configuration (general reset) or restoring the model railway status.

→ Section 6.3. Saving and restoring your model railway status
→ Section 6.4. Subsection Deleting configuration

# 8. Software update

Your MasterControl is a state-of-the-art product, which is constantly improved and adapted to occurring changes. To benefit from this development, you can update the MasterControl to the newest software version.

First, switch off the MasterControl. Simultaneously pressing ⌑stop⌑ and ⌑go⌑ switch the power back on, while holding both keys. It will then display „Boot Loader", the version number (= update application) as well as the hardware version, e.g. „HW = 12".

Now please connect the MasterControl to your PC and execute the update application.

Please note: Always connect the MasterControl to your PC before executing the update application. Otherwise your PC might have difficulties detecting the interface.

Follow the instructions of the update application.

### Update-Service

Our update service gives you the ability to keep the MasterControl up-to-date. You can update the software, if you have a PC running Microsoft Windows or Linux as well as a serial or a USB cable. The most recent version of the software can be found on our website. Alternatively, you can order a CD or send us your MasterControl to update it. Request further information at our hotline or on our website.

If you send the included form back to us, we keep you informed about updates and news concerning your EasyControl.

# 9. Check list for troubleshooting

## 9.1. Errors occurring while starting up

- After switching on track power, the locomotive responds to switching on / off its functions, but not to turning the speed control knob.
  Possible reason: The driving booster is connected to the breaking booster port, which sends a „0" as speed level. → Please connect the booster to the driving booster port.
- When switching on the booster by pressing ⌐go⌐ , your MasterControl switches off and reports a short circuit.
  Possible reason: The short circuit polarity settings of the booster(s) are wrong. → Change the short circuit polarity settings.

## 9.2. Errors occurring while setting parameters

- The entered parameters are not saved.
  Possible reason: You quit the menu point without confirming your input by pressing ⌐#⌐ / ok.
  → Repeat the steps and confirm your input by pressing ⌐#⌐ / ok .
- An entered name is not saved.
  Possible reason: You entered less than 11 characters. → Repeat your input and if necessary, enter additional blanks.
- When switching on the MasterControl, it blocks when displaying its' version number.
  Possible reason: The locomotive database contains corrupted data, for instance as a result of cutting power while resetting. → Hold ⌐0⌐ / menu pressed while switching on the MasterControl, which will then switch to "Delete configuration". Execute this menu point.
- When programming a DCC decoder the MasterControl displays an error.
  Possible reason: You've choosen a programming method not supported by the decoder. → See the manual of the decoder for supported programming methods.
- When reading an extended address from the decoder the MasterControl displays an error.
  Possible reason: Your decoder does not support extended addresses.
- While testing an s88 module, its inputs are displayed as occupied, although most of them / all of them are idle.
  Possible reason: The connector is plugged into the port the wrong way. → Check the connection.
- You cannot test all s88 modules, although their connection is ok.
  Possible reason: The setting for the amount of s88 modules is wrong. → Change the setting for the amount of s88 modules.

## 9.3. Errors occurring while operating

- A locomotive does not respond to driving or function commands, although you entered the right address.
  Possible reason: The decoder is assigned a wrong format. → Change the data format.
- A locomotive with DCC decoder immediately drives fast, although in speed level 1.
  Possible reason: The decoder only supports 14 or 28 speed levels, but is assigned 128 ones.
  → Change the amount of speed levels.
- You can't switch on / off lights on a locomotive with DCC decoder and / or when accelerating, the lights flicker.
  Possible reason: The speed level settings of both decoder and MasterControl do not match. → Change the speed level settings of the decoder or MasterControl.
- When accelerating a locomotive with a Motorola decoder, only every second speed level increases the locomotive's speed.
  Possible reason: The locomotive decoder was assigned speed level „27 a" or „27 b, but the locomotive decoder only supports 14 speed levels. → Change the amount of speed levels.
- In operation mode, locomotives with Motorola I decoders are causing problems: They do not respond to driving or function commands or have an odd driving behaviour.
  Possible reason: The duration of the signal pause is set inaccurately. → Change the duration of the signal pause.
- The two locomotives in double traction move in opposite directions.
  Possible reason: Before establishing a double traction, you did not set the driving direction for both locomotives.  → Repeat the creation of the double traction.
- The points cannot be switched.
  Possible reason: The point format is wrong. → Change the points format.
- The MasterControl does not respond to software commands of a connected PC.
  Possible reason: The baud rate is wrong. → Change the baud rate.
  Possible reason: The connection between MasterControl and PC is bad. → Check your cable. Also check, if the right COM port is set in the software.

## 9.4. Errors occurring during software update

- After the software update, the MasterControl won't start and / or displays "incompatible software".
  Possible reason: You updated using the wrong software file, for instance an update for the LokControl. → Update again.
- While updating, the progress bar jumps back (often).
  This is not an error. The update application checks continuously, if the data transferred is correct. If this is not the case, it repeats the transfer.

# 10. Technical Specifications EMV, CE and warranty

## 10.1. Technical Specifications

| | |
|---|---|
| Data formats: | Motorola-I and –II |
| | DCC (NMRA standard) |
| Power supply: | 12-18 Volt AC |
| Power consumption (without consumer): | approx. 220 mA |
| Interfaces: | Power supply |
| | DCC programming track |
| | Driving booster and breaking booster |
| | s88 feedback module |
| | RS232 (PC) |
| | USB (PC) |
| | EasyNet (e.g. for LokControl) |
| Maximum amount of s88 modules: | 32 s88 or s88 compatible modules |
| Maximum amount of locomotive addresses: | 255 in the Motorola format $(1 - 255)$ |
| | 10239 in the DCC format $(1 - 10239)$ |
| Maximum amount of points addresses: | 1020 in the Motorola format $(1 - 1020)$ |
| | 2040 in the DCC format $(1 - 2040)$ |
| Protection: | IP 00 |
| Ambient temperature while operating: | 0 to + 60 °C |
| Ambient temperature while not operating: | -10 to + 80 °C |
| Maximum humidity: | max. 85 % |
| Dimensions: | approx. 180 x 105 x 55 mm |

## 10.2. EMV, CE and warranty

**EMV advice**

This product conforms to the EURONORM EN 55014 & EN 50082-1, and the guidelines 89/336/EWG (EMVG vom 09.11.1992) for electromagnetic interference have been adhered to, and it therefore meets all legal requirements for the CE marking.

In order to maintain this conformity please adhere to the following recommendations

- Only use proprietry transformers with the correct voltage.
- Only connect the transformer in an authorised manner to the house power supply.
- Do not tamper with the original equipment and in the case or repair always use original spare parts.
- Carefully follow the instructions in this manual.

**Declaration of Conformity**

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

**Guarantee Conditions**

This product carries a two year garantee covering material defect and fabrication errors. We also guarantee the adherence to the product specifications, as long as the operation of this product has been conducted according to the instructions in this manual. Claims will be satisfied either through repair or replacement, failing this a reimbursement of the purchase price will be considered.

Claims that exceed the requirements of German law are not covered, in particular for damage or injury that may be brought in connection with the use of this product. Further more the following cases invalidate this guarantee:

- damage through incorrect or careless use,
- when the product has been modified or tampered with,
- when the product has been overloaded or connected to a incorrect power supply,
- damages caused by external influences i.e. a third party or an accident

# 11. Background information

## 11.1. Motorola-Format

Märklin originally introduced the Motorola format**, using Chips from Motorola, hence the name. First, only 80 addresses could be used, later this was extended to 255.

### Data transfer in the Motorola format

Data is transferred in so called packets, which are sent with pauses in between. This kind of data transfer results in DC power on the track. Hence, locomotives without decoder start moving as soon as they are put on the track.

The previously developed Motorola I format relies on sending packets on two different frequencies: One data packet contains the address information, the 14 speed level data, and the status of one function and is continuously sent. A theoretically possible $15^{th}$ speed level is used to switch driving directions. The information about the state of additional functions is sent in the second packet. This is only sent, if the status changes.

The later developed Motorola II format relies on sending one packet continuously: This packet contains the address and the speed levels as well as additional information about the status of the four functions and the absolute driving direction. The Motorola II format allows only 14 speed levels as well. In the meantime, decoders have become available, which support 27 speed levels by adding additional "half levels" in between the existing speed levels.

### Compatibility of both Motorola formats

Regardless which of the two Motorola format the decoder receives, it can change the speed level, the driving direction and the function "light" correctly. To be able to use the four additional functions, it must be controlled using the appropriate format.

### Driving solenoid accessory decoders for the Motorola format

The information to switch solenoid accessory decoders (points und switching decoders) is sent in the same second data packet in the Motorola I format as the information of the four additional functions. In the Motorola II format, this second packet only contains information to drive solenoid accessory decoders. This data packet is only sent, when the status of solenoid accessory decoders changes.

With 80 addresses this adds up to 80 x 4 = 320, with 255 to 255 x 4 = 1020 addresses.

When calling address from a control unit, it must distinguish between locomotive and solenoid accessory decoders, in order to control both. It depends on the control unit how this is done.

## 11.2. DCC-Format

The DCC format was developed by LENZ** and later declared as standard by the NMRA (National Model Railroad Association).

### Data transfer in the DCC format

In the DCC format, data is transferred continuously and thus there is no DC power on the track. Hence, different to Motorola formats, locomotives without decoders do not automatically start moving when put on the track. It is possible to control one decoderless locomotive from the control unit in DCC layouts, because the analog driving signals are laid over the digital signals. Nonetheless, this feature is not recommended, as it tends to damage the engine electrics. This is the reason why it is not supported in EasyControl.

### Possibilities of the DCC format

The DCC format features up to 10239 addresses, up to 13 (in near future 127) functions and up to 128 speed levels as well as an absolute driving direction. How may addresses, functions and speed levels can actually be used depends on component limits such as the limits of decoders or the control unit.

### CV programming

Today's CV programming allows you to set a decoders properties by setting the so-called configuration variables (CV variables). The meaning of each variable is clearly defined by the NMRA. Each variable has 8 bits and can contain the values of 0 to 255. To be able to use extended addresses, one address uses two CV variables. The values can be transferred bitwise or bytewise. Bitwise transfer only makes sense if each bit has its' own property (e.g. CV# 29). In the table in ssection 11.2. you can find the most commonly used CV variables and their possible values.

### Page programming and register programming

Before CV programming, there was register programming and page programming.

The possibilities to set the decoder properties are limited when page programming is used. There are only 8 registers to program (primary address, Vstart, acceleration rate, deceleration rate, configuration data, manufacturer version No., manufacturer ID). The possible values of the register variables are analog to those of the CV variables.

Page programming offers the same possibilities as CV programming. The properties of the decoder are set in register variables. 4 registers make one page. The pages are adjacent (register 1 to 4 on Page 0, register 5 to 8 on page 1, and so on) so a register can be accessed directly while programming.

**Configuration variables for the DCC format (exert)**

| CV# | CV name | Value (Default value) | Explanations |
|---|---|---|---|
| 1 | Primary address | 0 ... 127 (3) | The primary address contains a value between 1 and 127. Is the CV# 1 equal to 0, the decoder switches to analog mode. |
| 2 | Vstart | 0 ... 255 (-) | Defines the current powering the engine at minimum speed. |
| 3 | Acceleration rate | 0 ... 255 (-) | Defines the duration of the pause while switching up to the next higher speed level. |
| 4 | Deceleration rate | 0 ... 255 (-) | Defines the duration of the pause while switching down to the next lower speed level. |
| 5 | Vhigh | 0 ... 255 (0) | Defines the current powering the engine at maximum speed. |
| 6 | Vmid | 1 ... 255 (1) | Defines the current powering the engine at moderate speed. |
| 7 | Manufacturer version No. | 1 ... 255 | This is the version number of the decoder's internal software. |
| 8 | Manufacturer ID | e.g. 62 | In this case: Tams Elektronik GmbH |
| 9 | Total PWM period | 0 ... 255 (0) | The current powering the electric motors is facilitated by switching on / off the power. The interval between those power peeks is called PMW period. By altering the PMW period, the individual running characteristics of an electric motor are changed. |
| 17 + 18 | Extended address | 1 ... 10239 (-) | Defines the address between 1 and 10239, if the decoder is set to extended addresses. |
| 19 | Consist address | 0 ... 127 (-) | Defines the alternate (second) address of the decoder. |
| 29 | Configuration data #1 | 0 ... 255 (-) | Defines main properties of the decoder: Driving direction, amount of speed steps, switching to analog operation, additional feedback while in programming mode, choice of the speed table, primary addresses or extended addresses. |
| 33 – 46 | Output Loc. FL(f), FL(r), F1-F12 | 0 ... 255 (-) | Contains a matrix indication of which function inputs control which Digital Decoder outputs. |
| 49 – 64 | Manufacturer Unique | 0 ... 255 (-) | Reserved for manufacturer unique CV's. |
| 67 – 94 | Speed Table (only in 28 speed steps mode) | 0 ... 255 (-) | A speed table consisting of 28 values for forward speeds forming a smooth power curve, whereas each speed step is assigned a specific engine power value. A value of "0" is defined as no power, a value of "255" as maximum power. |

## 11.3. RailCom

RailCom is an extension of the DCC protocol and defines all details of importance for reporting back data in DCC controlled digital layouts. The basic idea is that RailCom compatible decoders are not only used as recipients of digital commands but also report back data via the rails to the RailCom detectors.

In order to make room for reporting back data, special RailCom boosters cut short gaps into the continuous DCC data stream from the central unit to the decoders. These RailCom cutouts are used to send data from the decoders to the detectors.

Using RailCom allows you e.g. to send commands to read out CVs from the central unit to the decoders and to display the CVs´ values at the RailCom detectors.

## 11.4. Booster

Boosters amplify the digital signals send from the control unit and supply a connected track with power. You have to connect at least one external booster to the MasterControl, as there is no booster integrated. The actual number of boosters needed depends on the power consumption of your model railway.

**Measuring the power consumption**

- a locomotive:  Gauge N: 600 mA  / Gauge H0: 800 mA / $\geq$ Gauge 0: 1 A
- a wagon light: 50 - 200 mA
- another consumer (such as a sound module): 100 - 300 mA
- reserve for points: 10% of the calculated sum of power consumption

**Booster types**

Märklin**-compatible and DCC-compatible boosters are switched on / off in different ways. Märklin**-compatible boosters are switched on using their own signal switched with an extra pin on the booster port. DCC boosters are switched on as soon as a data signal is recognized. The booster ports of the MasterControl can be configured to work with both types.

Balanced boosters keep the power in a specific track section constant. Contrary to that, sections with non-balanced boosters might suffer from increasing and decreasing power, causing changes in locomotive speeds and the lightings´brightness.

**Hint 1**

Split your model railway layout in several track sections. Each section should run a maximum of 3 to 5 locomotives. Make sure that section borders are not crossed that often.

**Hint 2**

Only use boosters of one type and made by one manufacturer to avoid problems when crossing the interruption between two track sections such as:

- Problems with data transfer to the decoders.
- Current leakage that make locomotives move by themselves.
- Short circuits when crossing sections.