RedBox

Central unit for
digital system EasyControl

Version "Basic" item no. 40-02007
Version "Basic-R" item no. 40-02017
Version "V24" item no. 40-02037
Version"Booster" item no. 40-02057
Version"Booster-R" item no. 40-02067

Manual

tams elektronik

Contents

1. Getting started

Checking contents

Please make sure that your package contains:

- RedBox
- power pack (12 V AC / 1,6 A)
- cable to connect a DCC programming track
- versions "Booster" and "Booster-R" only:
    - 3 short-circuit jumpers
    - 2 plug-in parts for terminal strips
- compact disc containing manual, USB-driver (Tams-ID) and demo software

Required auxiliary devices

For operating the digital control you need auxiliary devices (not included in the scope of delivery):

- for versions "Basic", "Basic-R" and "V24": at least one external booster and an appropriate power supply
- for versions "Booster" and "Booster-R": one transformer or power supply unit. Hint: The required output depends on the rail voltage set for the integrated booster. ($\rightarrow$ section 4.6.1. "Connecting voltage supply and rails")
- one input and display device:
    - one EasyControl device with software version from 2.0
      (e.g. LokControl, HandControl, HandControl 2) or
    - a PC with control software or software CV-Navi or
    - an Android smartphone or tablet with app "EasyControl Android" and a Raspberry Pi with WLAN router (e.g. wControl)

Saftey instructions

The RedBox should only be used in concordance with these instructions to control digital model railroad layouts. It is not suitable for use by children under 14. Incorrect use and non-observance of the manul 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 precations 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.
- Use only original spare parts if you have to repair the kit or the ready-built module.

2. What is EasyControl?

EasyControl is a digital control for your model railroad layout, which is assembled from different components. This modular design principle allows you to adjust it to various demands and differently sized model railway layouts.

2.1. Components

It consists of at least

- one digital central unit RedBox (available since 09-2016) or MasterControl (available from 2005 to 2016)
- one external booster (not required with RedBox versions "Booster" and "Booster-R")
- one external control device (not required with MasterControl)

In addition to your central unit RedBox or MasterControl you can use more than 60 additional control devices or adapters in one digital control. The following devices are suitable:

- EasyControl devices (e.g. LokControl, HandControl, HandControl 2)
- digital control devices for bus systems of other manufacturers (e.g. XpressNet)
- PC
- mobile Android terminal devices (e.g. smartphone, tablet)
- DECT-teleohones
- digital central units of other manufacturers for Motorola- and/or DCC-format

→ section 3. Components for digital control system EasyControl

2.2. EasyNet

External control devices or adapters and the central units RedBox or MasterControl communicate via the data bus EasyNet. They can be plugged in or out at any time to the EasyNet, even during operation (plug and play). As a bus line for the EasyNet patch cables with RJ 45 connectors ar used.

One additional control device or adapter can be connected directly to the EasyNet interface of the RedBox or the MasterControl. You need a junction (e.g. wye junction or BusControl), if you want to connect more than one additional device (as far as the device concerned does not have two RJ 45 connectors, like SniffControl or PhoneControl).
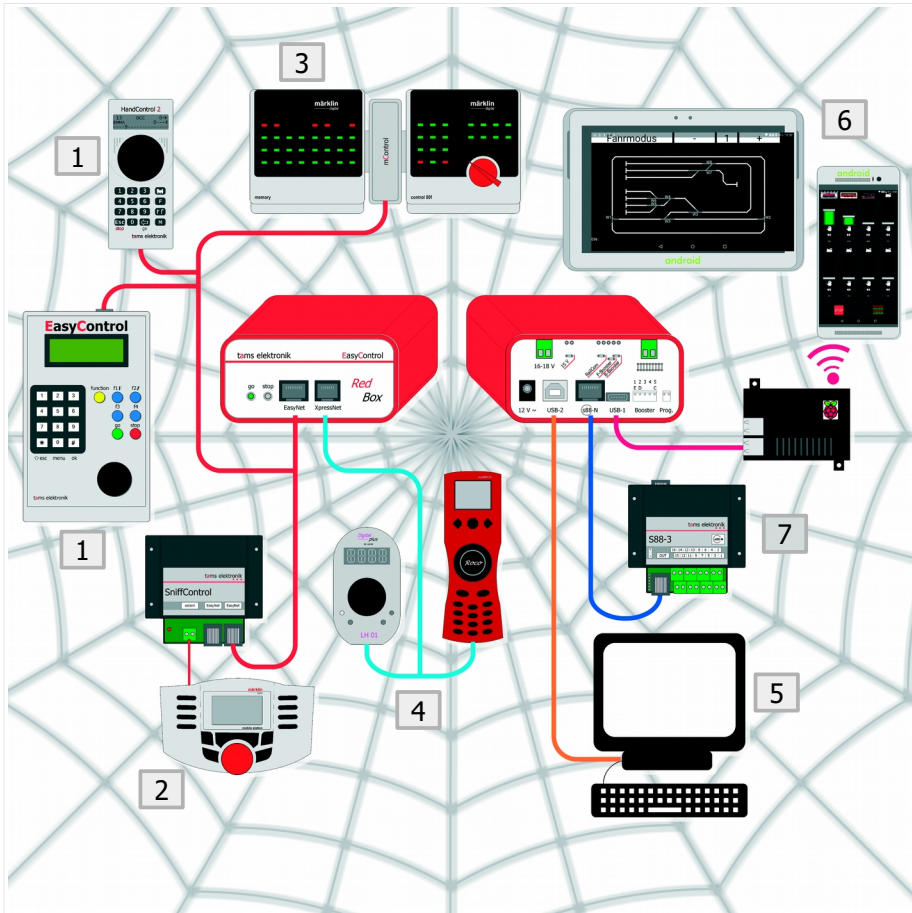
Examples of external control devices and feedback modules to be connected to a RedBox:

1. EasyControl control devices (e.g. LokControl, HandControl 2)
2. Digital central units of other manufacturers for Motorola- and/or DCC-format (e.g. Maerklin Mobile Station): connection via SniffControl
3. Older digital control devices for Maerklin Control Unit: connection via mControl
4. Digital control devices for XpressNet (e.g. Lenz LH01, Roco Multimaus)
5. PC
6. mobile Android terminal devices via Raspberry Pi with WLAN router (e.g. wControl). Hint: The versions "Basic-R" and "Booster-R" have an integrated Raspberry Pi with WLAN router, there is no need for an additional wControl.
7. s88-feedback modules

2.3. Digital formats

EasyControl is a multi protocol control system and capable to control vehicle and accessory decoders of any manufactures compatible with these formats:

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

Moreover you can use the m3-format to control vehicle decoders designed for mfx-format. Feedback data sent in mfx-format cannot be analysed by the digital system EasyControl.

EasyControl allows to operate vehicles with Motorola, DCC or mfx decoders in parallel.

You make the setting for whether operating solenoid accessory decoders in the Motorola or DCC format either

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

→ Section 10. Background information

RailCom

EasyControl supports the feedback standard RailCom. EasyControl devices, mobile terminal devices and the PC allow you to enter commands to read out the CV values of decoders compatible to RailCom. In order to collect and analyse feedback data, you need special RailCom detectors.

→ Section 10. Background information

Decoder addresses , speed levels, switchable functions

Depending on the data format you have the following possibilities for controlling vehicle and accessory decoders:

	Motorola	**DCC**	**m3**
Vehicle decoder addresses	255	10.239	16.384
Amount of speed levels	14 or 27	14, 28 or 128	128
Functions	function (light) f1 bis f4	f0 to f28 or to 32.768	f0 f1 to f15
Accessory decoder addresses	1.020	2.040	––

27 speed levels with the Motorola format

As a standard, the Motorola format supports 14 speed levels. EasyControl additionally offers two methods to extend those speed levels to 27.

Speed level mode 27a: Some decoders (e.g. Maerklin 6090x and Maerklin mfx 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 (e.g. locomotive decoders of Tams Elektronik and ESU). 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

RedBox and MasterControl have connections for a programming track which allows to read out and programm DCC vehicle decoders.

The programming modes to be used and the paremeters to be set depends on the particular decoder (see decoders´s manual). EasyControl supports programming and reading data in the following DCC programming types:

- CV-programming – byte wise and bitwise
- Register and Page programming
- Main track programming (POM)

→ Section 10. Background information

Programming of mfx vehicle decoders

When setting vehicles with mfx decoders onto the programming track, you can

- read out the UID
- and program the address

Programming of Motorola vehicle decoders

It is not possible to program Motorola vehicle decoders on the programming track, as this method is not intended for use with the Motorola format. For that reason you have to program Motorola decoders according to the manufacturer specifications on the main track.

→ Section 10. Background information

3. Components for the digital system EasyControl

3.1. Central unit

As a central unit you can use either a RedBox or a MasterControl (with function "central unit"). The central units RedBox and Master Control

- send control instructions to every kind of decoder on your layout,
- check for components plugged into the EasyNet,
- poll for data and control instructions from components of the EasyControl,
- send data to components of the EasyControl,
- receive feedback data of s88 modules and transfer them to the PC,
- are the interfaces between computer(s) and model railroad layout.

Database for system parameters

RedBox and MasterControl have an integrated database to store all parameters relevent for the digital system:

- booster configuration (short circuit polarity, short circuit sensitivity)
- output of commands for accessory decoders at the booster outputs
- standard data format for vehicle decoders
- switching times for solenoid decoders (minimum/maximum)
- RailCom support
- number of connected s88 modules
- length of signal pause for Motola vehicle decoders

Locomotive database

RedBox and MasterControl have an integrated database to store parameters you apply to a locomotive's address, which are:

- data format
- amount of speed levels
- (locomotive's) name. 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.

Entering and modifying data

In order to display, enter and modify the system parameters or the data of vehicle decoders, you need:

- MasterControl or
- LokControl, HandControl or HandControl 2 (software version 2.0 or higher) or
- PC with software CV-Navi or control software supporting EasyControl or
- Raspberry Pi (or wControl) and Android smartphone or tablet with app "EasyControl Android"

With the central unit RedBox you cannot display, enter or modify system parameters.

3.2. Booster

Each central unit needs at least one booster. With larger layouts you normally need several boosters, connected to separate sections of the layout. The required number of boosters depends on the power requirements of the layout and the amount of current the booster can provide.

Booster outputs

- RedBox: one output for the connection of external boosters (either Maerklin compatible or DCC conform)
- MasterControl: two outputs for the connection of external boosters (either Maerklin compatible or DCC conform). As both interfaces have to be programmed in common, you have to use boosters of the same type for both outputs. It is recommended to use boosters identical in construction.

Integrierted booster

The versions "Booster" and "Booster-R" of the RedBox have an integrated 2.5 A booster (in addition to the booster output). This is sufficient for operating a small layout (up to nominal size H0).

MasterControl and the versions "Basic", "Basic-R" and "V24" of the RedBox do not have integrated boosters. With these central units you have to connect at least one external booster.

3.2.1. Breaking distance booster ("Breaking booster")

Besides the standard booster output, the MasterControl has a second booster output ("breaking booster"), which can be used to control all breaking distances on your layout. Every Maerklin**-compatible booster or booster for the DCC system can be used as breaking booster. As both interfaces have to be programmed in common, you have to use boosters of the same type for both outputs. It is recommended to use boosters identical in construction.

The integrated booster of the RedBox (versions "Booster" and "Boster-R") can be configurated for use as breaking 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.

3.2.2. Seperating driving and switching

As a standard, the commands to control the vehicle decoders are sent continuously via the central unit´s booster output, whereas the commands to control the accessory decoders are sent only when required. For that purpose the transmission of vehicle decoder commands is interrupted shortly, to transfer the accessory decoder commands during the resulting cutout.

In PC controlled (larger) layouts, this kind of data transfer can cause problems, e.g. when vehicle decoders receive stop commands too late and this results in locomotives passing stop signals. Usually two central units are used to solve this problem. They control vehicle and accessory decoders separately (and are controlled by the PC software accordingly).

With MasterControl and RedBox you can switch off the transmission of accessory decoder commands at the booster output. Then, only vehicle decoder commands will be transferred and the delay caused by the transmittsion of accessory decoder commands is excluded.

That way, MasterControl and RedBox (versions "Booster" and "Booster-R") allow to control vehicle and accessory seperately with **one** central unit.

- MasterControl: Controlling the vehicle decoders via the standard booster output (accessory decoder commands switched off) and controlling the accessory decoders via the breaking distance booster output.
- RedBox versions "Booster" and "Booster-R": Controlling the vehicle decoders via the booster output for external boosters (accessory decoder commands switched off) and controlling the accessory decoders via the integrated booster.

There is no need for adapting the control software. You have to register only one central unit for this application.
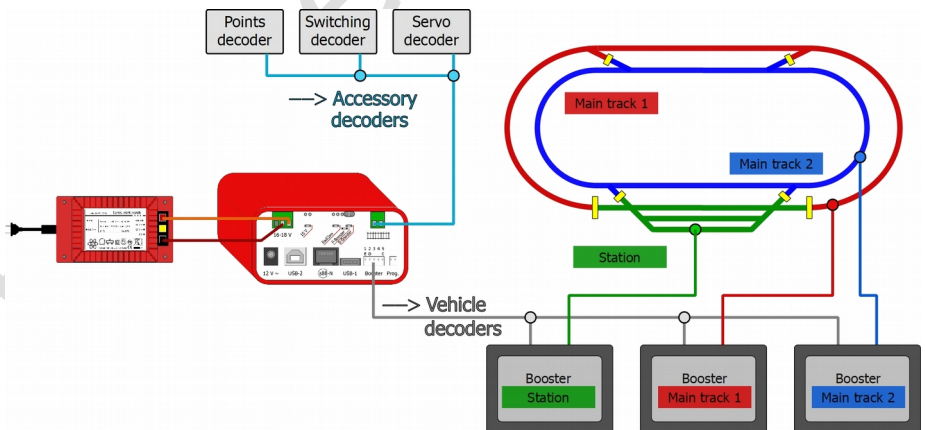
Figure: Seperating driving and switching with one RedBox (versions "Booster" or "Booster-R). The integrated booster controls the accessory decoders, digital commands for the vehicles decoders are sent via the external boosters only.

3.3. Non-central control devices

Non-central control devices (such as external devices for the system EasyControl, XpressNet devices or central units of other manufacturers) 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 more than 60 non-central control units, adapters or similar.

When connecting non-central control devices to the EasyNet, restrictions concerning the controllable digital formats are cancelled. As an example vehicle decoders designed for Motorola or mfx format can be controlled with pure DCC devices. In case the decoder´s amount of speed levels set int the locomotive data base does not correspond to the amount which can be set at the non-central device, the central unit converts the speed levels internally. The number of switchable functions and selectable addresses corresponds to the device´s hardware specification.

You can only use one RedBox or MasterControl (function "control unit") in one digital control. If required, you can use one or several (additional) MasterControls as non-central control devices, when operated by a modified software.

3.4. PC, tablet and smartphone

The versions "Basic", "Booster" and "V24" of RedBox as well as MasterControl have each two interfaces for the (simultaneous) connection of two computers. The versions "Basic-R" and "Booster-R" of the RedBox have one PC-interface each.

You can integrate up to 32 mobile Android terminal devices (tables, smartphones) into the digital system EasyControl for use as wireless control devices. You can establish the WLAN connection with:

- customary single-board computer Raspberry Pi 3 with integrated WLAN or Raspberry Pi 2 and additional WLAN-router
- wControl (item no. 40-09957). wControl consists of a single-board computer Raspberry Pi 3 model B and a micro SD-card preconfigured for use as WLAN interface in the system EasyControl.
- RedBox versions "Basic-R" or "Booster-R" with integrated single-board computer Raspberry Pi 3.
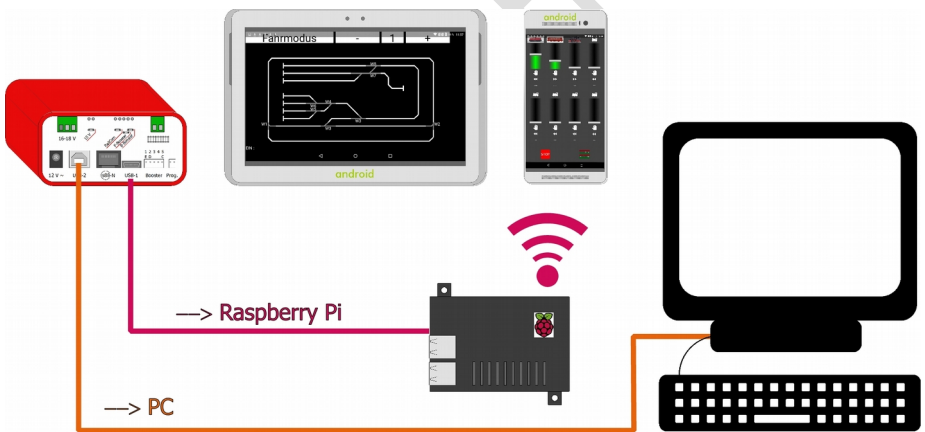
Figure: Integrating PC and mobile terminal devices (here: via an external WLAN interface wControl)
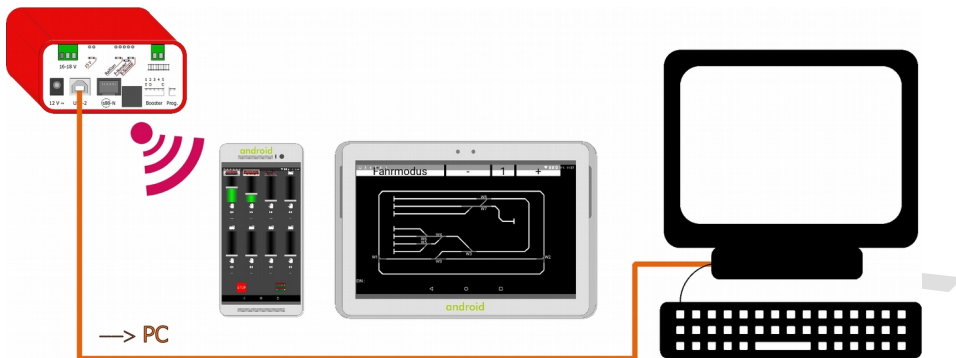
Figure: Integrating PC and mobile terminal devices (here: via the integrated WLAN interface of the RedBox version "Booster-R")

3.4.1. Overview PC- and WLAN interfaces of the central unit versions

	PC interfaces	**WLAN interfaces**
MasterControl	one serial interface (baud rate adjustable) one USB interface with SiLabs identifier	external WLAN interface required
RedBox "Basic" RedBox "Booster"	USB-1 type Mini-B with Tams identifier USB-2 type B with SiLabs identifier	external WLAN interface required
RedBox "Basic-R" RedBox "Booster-R"	USB-2 type B with SiLabs identifier	integrated Raspberry Pi 3 preconfigured for EasyControl
RedBox "V24"	one serial interface (baud rate adjustable) one USB interface with Tams identifier	external WLAN interface required

3.4.2. Control software

Every software, which supports the Märklin** 6050 or P50X protocol is able to control your RedBox or MasterControl.

In order to use a tablet or smartphone as a wireless control device, you have to install an app on your mobile terminal device.

3.5. Adapters for other bus systems

Digital devices of other manufacturers using other bus systems than EasyNet for data transfer can be integrated into the system EasyControl and used for controlling and switching vehicle and accessory decoders. Your RedBox has an integrated XpressNet interface for the connection of up to 16 XpressNet devices.

There are different adapters available for the connection of devices of other manufacturers:

Device to be connected	Adapter
DECT telephones	PhoneControl
XpressNet devices of all manufactureres	XNControl Hint: Your RedBox has integrated XpressNet interface for the connection of up to 16 XpressNet devices.
Motorola and DCC digital control devices of all manufactureres	SniffControl
Older digital control devices for the Maerklin** Control Unit (item no. 6020 and 6021)	mControl Hinwes: mControl replaces Maerklin** Control Unit item no. 6020 or 6021.

3.6. S88 modules

You can connect up to 52 s88 feedback devices or s88-compatible modules with 832 contacts to one RedBox or MasterControl. Modules of all manufacturers can be integrated.

The RedBox has a s88 interface according to standard s88-N (for the connection of a patch cable), the MasterControl a 6-pole interface.
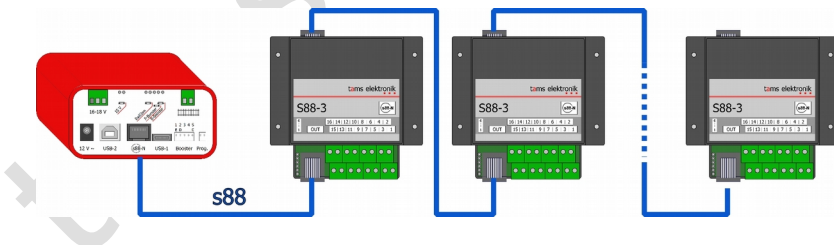
Figure: Connecting s88 modules (max. 52 with 832 contacts)

3.7. DCC programming track

RedBox and MasterControl have a connection for a DCC programming track. Every common rail can be used for that.

For the decoders of vehicles set onto the programming track you can

- in DCC format: read out and program the CVs
- in m3 format (for mfx decoders): program the address and read out the UID

4. Connecting external components and the power supply to the RedBox
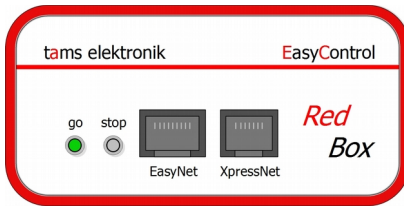
RedBox | Front side
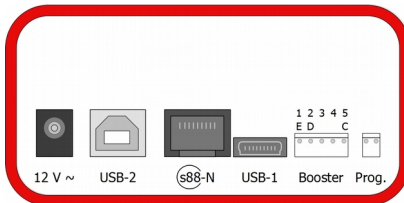
RedBox "Basic" | Rear side
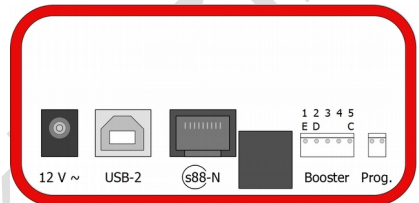
RedBox "Basic-R" | Rear side
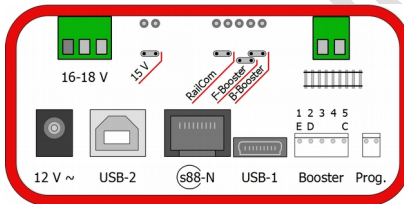
RedBox "Booster" | Rear side
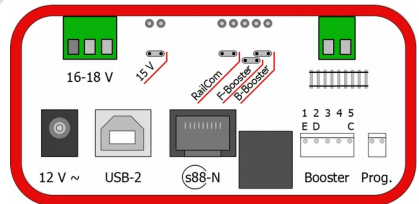
RedBox "Booster-R" | Rear side
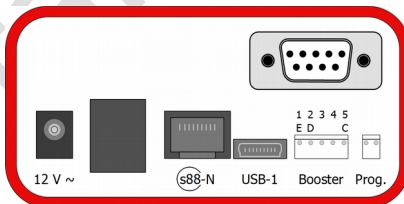
RedBox "V24" | Rear side

4.1. EasyNet interface

You can integrate more than 60 non-central control devices or adapters for devices of other manufacturers into the digital system via the EasyNet interface on the front side of your RedBox. Any (RJ 45) Ethernet patch cable (used in Computer networks) will work. Please also read the manual of your control device or adapter.

You can connect one device or adapter directly to the EasyNet interface of your RedBox. You need a distributor (Y-distributor for Ethernet patch cables or BusControl) when using more than one additional device. Exceptions are devices with two EasyNet interfaces, e.g. SniffControl, XNControl.

The power supply of the RedBox is sufficient to supply four additional devices. When connecting more devices, you need a BusControl and an additional AC power pack.

EasyControl devices

Please note, that all EasyControl devices must have the same software version as the RedBox to prevent malfunction of data transfer between the devices.

Other manunfacturer´s digital controls and DECT telephones

Adapters, connected to the EasyNet interface of your RedBox, allow to integrate all Motorola and/or DCC central units made by other manufacturers, and digital devices for other bus systems into the digital system, and to use them as external control devices.

Restrictions of digital central units concerning the usable digital formats are overcome, e.g. you can control vehicle decoders designed for Motorola or mfx format with pure DCC devices. In case the number of speed levels defined for a decoder in the locomotive data base does not correspond to the number of speed levels to be set at the device, the RedBox converts the speed levels internally.

Please note, that with some devices the input options are restricted (e.g. number of switchable functions, length of locomotive addresses, input of accessory decoder commands).

Device to be connected	Adapter
DECT telephone	PhoneControl
XpressNet devices from all manufacturers, e.g. • Roco** Lokmaus 2 and 3, Multimaus (not Lokmaus 1) • handheld controllers by Lenz** • handheld controllers by Massoth**	XNControl Hint: The RedBox has an integrated XpressNet interface for the connection of a maximum of 16 XpressNet devices. Hint: As a power supply for the connected devices you need a DC or AC power pack (e.g. item no. 70-09110).
Motorola and DCC digital central units from all manufacturers	SniffControl
Older digital devices for digital Control Unit by Märklin** (item no. 6020 and 6021), e.g. • Keyboard (item no. 6040) • Memory (item no. 6043) • Control panel Control 80 (item no. 6035) and 80F (item no. 6036) • Infra Control 80 f (item no. 6070)	mControl Hint: The mControl replaces Märklin** Control Unit item no. 6020 or 6021. Hint: As a power supply for the connected devices you need a DC or AC power pack (e.g. item no. 70-09110).
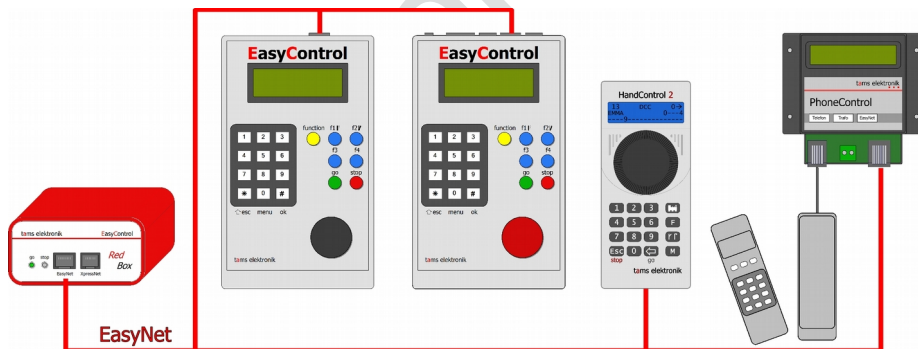
Figure: Connecting EasyControl devices and DECT telephones (from left to right):

• LokControl
• MasterControl (with software "MC-Control")
• HandControl 2
• DECT telephone (via PhoneControl)
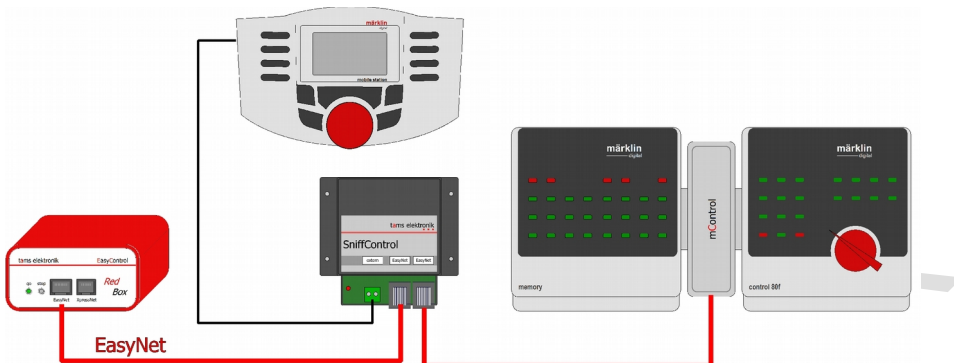
Figure: Connecting other manunfacturer´s digital controls to the EasyNet interface (from left to right):

- Märklin Mobile Station or other Motorola- and/or DCC-central units via SniffControl
- Digital devices for Märklin Control Unit 6020 and 6021 via mControl: The Märklin** Control Unit is replaced by mControl and RedBox..

Hint: SniffControl has two EasyNet interfaces. For that reason there is no need for an extra distributor to connect an additional device.

4.2. XpressNet interface

The XpressNet interface on the front side of the RedBox allows to connect a maximum of 16 XpressNet devices directly to the RedBox(e.g. Roco** Lokmaus 2 and 3, Roco** Multimaus, handheld controllers by   Lenz** and Massoth**) and to use them as external control devices.

Restrictions of the devices concerning the usable digital formats are overcome, e.g. you can control vehicle decoders designed for Motorola or mfx format with pure DCC devices. In case the number of speed levels defined for a decoder in the locomotive data base does not correspond to the number of speed levels to be set at the device, the RedBox converts the speed levels internally.

Please note, that with some devices the input options are restricted (e.g. number of switchable functions, length of locomotive addresses, input of accessory decoder commands).
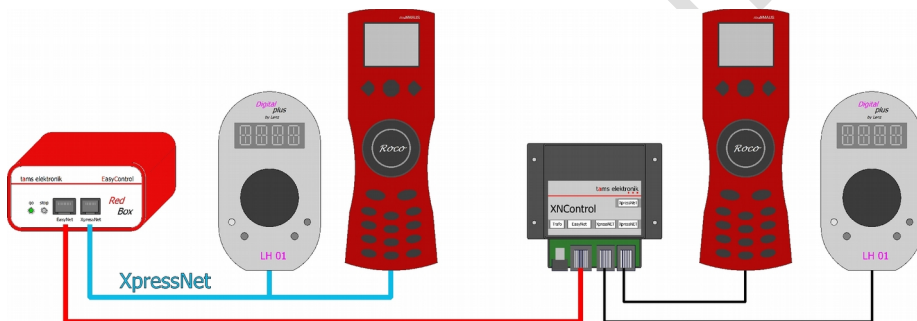
Figure: Connecting XpressNet devices

- Direct connection of a maximum of 16 XpressNet devices via the XpressNet interface.
- As an alternative or an addition, XpressNet devices can be connected via a XNControl connected to the EasyNet interface.

4.3. PC interfaces

Depending on the version, your RedBox has:

- "Basic", "Booster" and "V24": two galvanically isolated PC interfaces, for parallel connection of two computers.
- "Basic-R" and "Booster-R" with integrated WLAN interface: one USB interface

By means of a PC you can

- make software updates for the RedBox
- set parameters for the RedBox (e.g. with software CV-Navi)
- control the layout (with a suitable PC software)

Versions with two USB- interfaces: RedBox "Basic" and "RedBox "Booster"

- USB-1: type Mini-B with Tams identifier
- USB-2: type B with SiLabs identifier

There are no specifications according to the assignment of computer(s) to the two interfaces. Preferably you should connect a computer not operated by Windows or a Raspberry Pi to the interface USB-1.

When using interface USB-1 for a computer operated by Windows, you have to install a driver software from the CD on your computer before the first use. In case it is not possible to install a driver software with Tams identifier for this computer, you should use interface USB-2. Normally, the driver software for this interface will be installed autamatically when used for the first time (from Windows 7).

Versions with one USB-interface: RedBox "Basic-R" and "RedBox "Booster-R"

The versions "Basic-R" and "Booster-R" have one USB interface (USB-2) of type B with SiLabs identifier. Normally, the driver software for this interface will be installed autamatically, when used for the first time (from Windows 7).

Serial interface: RedBox "V24"

The version "V24" of the RedBox has a serial interface and an USB interface with Tams identifier. The serial interface is for use with control software controlling the interfaces COM1 and COM2 only, and or for use with PCs not providing an USB interface.

4.4. WLAN interface

Integrating mobile terminals

You can simultaneously operate a maximum of 32 Android smartphones or tablets in one system EasyControl. If you want to use mobile terminals as wireless control devices with the versions "Basic", "Booster" and "V24" of the RedBox you need an extra WLAN Interface:

- a commercial single-board computer Raspberry Pi 2 **and** an extra WLAN router or
- a commercial single-board computer Raspberry Pi 3 with integrated WLAN router or
- an interface "wControl" (item no. 40-09957) with preconfigured Raspberry Pi 3

You should preferably connect the WLAN interface to the interface USB-1 of the RedBox.

The versions "Basic-R" and "Booster-R" of the RedBox have an integrated WLAN interface.

Required software ("app")

You need the app "EasyControl Android" for the mobile terminal(s) which can be downloaded from the Google Playstore (free trial version, price for the full version: 5,99 € │ status: 12/2016).

4.4.1. Connecting Android devices to the WLAN interface of the RedBox

The Versions "Basic-R" and "Booster-R" have an integrated WLAN interface which has been preconfigured for operation in the EasyNet.

Switching on

Within one minute after switching on the power supply for the RedBox "Basic-R" or "Booster-R" the WLAN is available.

Connecting a mobile terminal with the wControl

Activate on your smartphone or tablet the list with available WLAN networks under "settings".

Connect you mobile terminal to the network "EasyControl_Android" and enter the following password for this network:

   EasyControl

Pay attention to the upper and lowercase letters when entering the password.

Hint: Your smartphone or tablet automatically restores the connection to the latest chosen WLAN when restarted.

Downloading the control software

Download the software from the Google Playstore.

The IP-Adresse of the WLAN (192.168.42.1) is preset in the software EasyControl Android. In case the setting has been overwritten, you have to enter it manually.

4.5. External boosters

To use the version "Basic", "Basic-R" or "V24" you need to connect at least one booster to the booster interface of the RedBox. Every Märklin**-compatible booster or booster for the DCC system can be used. Please observe 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 in the system configuration of the RedBox. As this setting applies to all connected boosters, only one type of booster may be connected to your RedBox. Generally, it is recommended to use identically constructed boosters for supplying the different sections of a circle, in order to avoid problems when crossing the separations between sections.

Pin assignment of the booster interface

Märklin**-compatible booster interface	Booster interface for DCC system
1 2 3 4 5	EDC
1 Short circuit feedback.	E Short circuit feedback.
When the booster detects a short circuit (or in otherwords a too high current consumption), it reports this to the central unit. Thereupon the central unit switches off the booster and displays a short circuit.	When the booster detects a short circuit (or in otherwords a too high current consumption), it reports this to the central unit. Thereupon the central unit switches off the booster and displays a short circuit.
2 Ground	D Ground
3 no function	
4 Booster "on / off"	
= output signal for switching on and off Märklin-compatible boosters	
5 Data	C Data
= output signal (track signal) for controlling vehicle and accesory decoders	= output signal (track signal) for controlling vehicle and accesory decoders

Special features of the RedBox versions "Booster" and "Booster-R"

The integrated booster and the interface for the connection of external boosters are completely separated. When using the integrated booster exclusively for supplying a separate layout part, as braking booster or for controlling accessory decoders, you can use Märklin compatible or DCC boosters as external boosters (exactly as with the version "Basic", "Basic-R" and "V24").

When using external boosters as a supplement for the integrated booster (supplying several booster sections of the same layout), you should use boosters B-3 (item no. 40-19327), as these boosters are identically constructed as the integrated booster. With other booster types, short circuits or interferences with data transfer possibly occur when crossing the separations between booster sections.
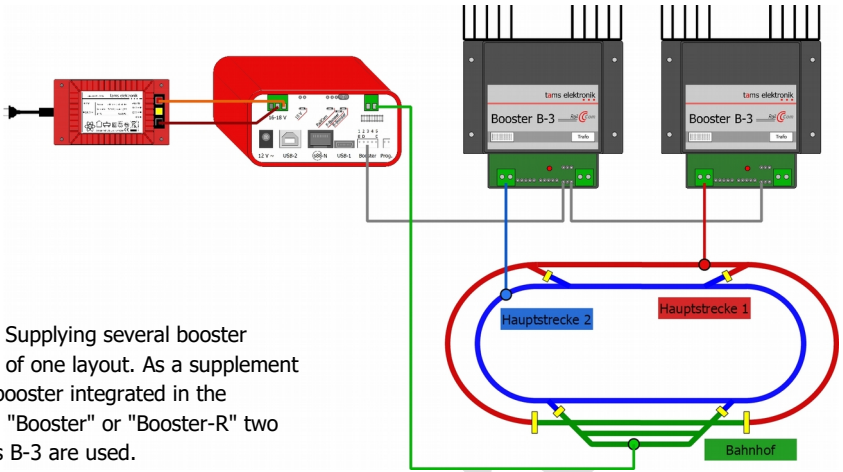
Figure: Supplying several booster sections of one layout. As a supplement for the booster integrated in the versions "Booster" or "Booster-R" two boosters B-3 are used.

4.6. Integrated booster (versions "Booster" and "Booster-R" only)

> ⚠️ **Attention:**
> Be careful to allow the air to flow unhindered through the ventilation slits in the housing of the RedBox, otherwise the integrated booster possibly overheats. **Risk of fire!** Make sure to keep distance to other devices, walls, and similar when connecting your RedBox.

Technical specification of the integrated booster

Supply voltage	Separate transformer or separate switching power supply, output voltage depending on the set track voltage		
	Track voltage set	Output voltage of the transformer	
		AC voltage	DC voltage
	15 V	12 - 15 V	17 - 18 V
	19 V	16 - 18 V	21 − 22 V
Output voltage	15 or 19 volts digital voltage (regulated)		
Power consupmtion	max. 48 watt		
Maximum output current	2,5 A		
Data formats	DCC, Motorola mfx (vehicle decoder commands only)		
Feedback log	RailCom (RailCom cutout can be switched off)		
Output signal	symmetrical		

LED display

A LED on the rear side of the RedBox shows the operating mode of the integrated booster.

4.6.1. Connecting voltage supply and rails

There are plug-in type terminals for connecting voltage supply and rails on the rear sides of the versions "Booster" and "Booster-R". Insert the connecting cables into the plug-in parts (included in delivery), tighten the screws and insert them into the socket parts on the rear side of your RedBox.

- Voltage supply (transformer or power supply unit): 3 pole, connection "16-18 V"
- Rails: 2 pole, connection "rails"

3 pole:
Voltage supply for
integrated booster

2 pole:
Rails
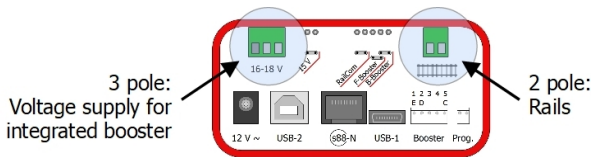
> ⚠ **Attention:**
> Do not interchange the connections for voltage supply and rails. In this case, your RedBox probably will be damaged when put into operation!

Recommended cable cross sections

- Voltage supply: minimum 0.75 mm²
- Rail connection: minimum 1.5 mm²

Voltage supply for the integrated booster

For the integrated booster a separate voltage supply is required:

- a.c. transformer with an output voltage of
            12 - 15 V (with 15 V track voltage) or
            16 - 18 V (with 19 V track voltage)
- power supply unit with a set voltage of
            17 - 18 V (with 15 V track voltage) oder
            21 - 22 V (with 19 V track voltage)

> ⚠ **Attention:**
> The output voltage of transformer or power supply unit should not exceed the specified values as the booster has to dissipate the surplus voltage as heat. The integrated booster possibly overheats. **Risk of fire!**

Connection to the rails

You should connect the two rail connections of the integrated booster to the two rails (with 2 rail systems) or one rail and the middle conductor (with 3 rail systems). The booster current should be fed into the rails every 2 to 3 m, as the resistances at the track pieces´ transistions are quite high. In case the distances are too long, problems with reporting short circuits or the vehicles´power supply possibly occur.

4.6.2. Configurating the integrated booster

On the rear side of your RedBox there are several pin headers, you can bypass with jumpers or not to make settings:

- 15 V: setting the track voltage
- RailCom: RailCom cutout on or off
- F-Booster and B-Booster: Using the integrated booster as standard booster ("driving booster") or as breaking booster

Setting the track voltage

	Jumper set: 15 V (regulated) **Jumper not set:** 19 V (regulated)

RailCom® cutout on / off

	Jumper set: RailCom cutout switched on **Jumper not set:** RailCom cutout switched off Recommendation: If not using RailCom as feedback system, you should switch off the RailCom cutout (jumper not set).

Choosing standard or breaking booster
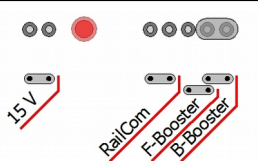
You have to insert the jumper either ro F-Booster or B-Booster. When the jumper is not set, the booster has no function, as a display the LED flashes.

	Jumper set to F-Booster: Use of the integrated booster as "standard booster" (driving booster). At the booster output "normal" digital commands are available to control vehicle and accessory decoders.
	Jumper set to B-Booster: Use of the integrated booster as "breaking booster". At the booster output digital commands are available to control vehicle and accessory decoders. For the vehicle decoders is sent speed level "0" – regardless of the actually set value.

4.6.3. Driving and switching separately with one RedBox

You can configure the integrated booster (for use as driving or breaking booster) that way, sending digital commands to control accessory decoders will be suppressed. In doing so, you prevent the transfer of vehicle commands being interrupted by sending commands for accessory decoders. You need a PC (with program CV-Navi or control software) to set your RedBox to this use.

Please note: The settings made for use as "standard booster" (driving booster) apply to all external boosters as well. Basically, 4 different settings are possible. For most uses the following setting makes sense:

	Jumper set to B-Booster **+ no accessory commands to driving booster** This is the standard setting when sending commands for vehicle and accessory decoders separately. The integrated booster controls and supplies the accessory decoders, external boosters are used to control and supply the vehicle decoders. With this setting, it is possible to use the integrated booster as a breaking booster as well.
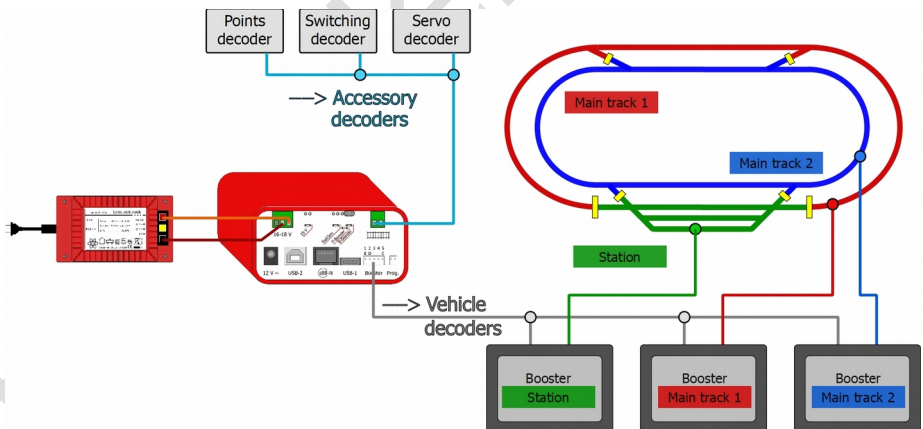
Example of use: The integrated booster controls and supplies the accessory decoders. At the interface for external boosters the accessory decoder commands are suppressed. The external boosters tranfer driving commands for vehicle decoders only.

4.7. S88 feedback modules

You can connect a maximum of 52 s88 feedback modules or s88 compatible modules (with a maximum of 832 contacts). It is possible to connect feedback modules with connections according to the standard s88-N directly by using patch cables with RJ 45 connectors. In order to connect previous modules with 6 pole pin connectors to your RedBox, you need an adapter s88-A-SR or s88-A-BR. Please observe the manual for your s88 module!

→ Section 11: Background information

> ⚠ **Attention:**
> There are s88 feedback modules with RJ 45 connectors available which do not comply with the standard s88-N. You should not connect these modules to your RedBox. When put into operation, the RedBox and/or connected modules possibly are damaged.
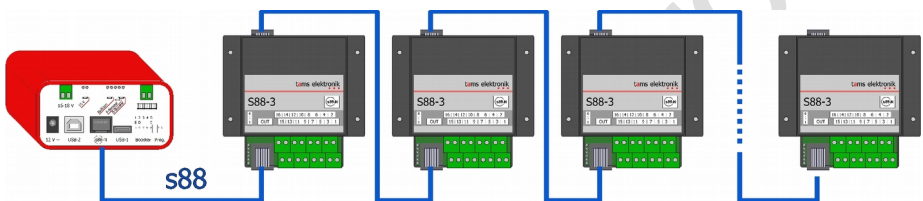
Figure: Connection s88 modulen (max. 52 with 832 contacts)

4.8. Programming track

You can use the programming track

- to read out and program vehicles decoders for the DCC format
- to program the addresses of vehicles decoders for the mfx format and to read out their UID

Please have a look into the decoder´s manual to find out which programming modes can be used and which parameters can be set.

Please not: It is not possible to program pure Motorola vehicle decoders on the programming track, as this format does not provide this programming mode. Motorola decoders have to be programmed on the main track according to the manufacturer´s specifications.

In order to make settings for the decoder on the programming track you need:

- a piece of rails, which you connect to the programming track connection "Prog" of your RedBox by means of the included connecting cable
- an EasyControl device with software status 2.0 or higher (e.g.. LokControl, HandControl, HandControl 2) or
- a PC with software CV-Navi or a control software supporting the programming of decoders or
- a mobile Android device (smartphone, tablet) with app "EasyControl Android", connected viy a Raspberry Pi to the RedBox

> **⚠ Attention:**
> When integrating the programming track into your layout (e.g. as siding) you have to make sure that both rails are disconnected from the rest of your layout.
> **If not, the connection for the programming track possibliy will be damaged!**
> Moreover, you would program every DCC decoder on your model railway.

4.9. Power supply for control devices

The power for your RedBox is supplied by an AC power pack (included in the scope of supply). One AC power pack can handle the central unit and up to four additional control units. To use more, a separate AC power pack can be connected to the BusControl.

Connect the power pack to the connection "12 V ~" on the rear side of the RedBox and the power socket. As soon as the RedBox is ready for operation, the red LED on the front side lights up.

Hint: The power pack supply the RedBox and up to four additional control units only, but not the booster integrated in the versions "Booster" or "Booster-R". For supplying the integrated booster (and rails) you need a transformer or a power supply unit.

→ Section 4.5.: Integrated booster

5. Adjusting parameters of the digital control

You can combine EasyControl with different types of devices. In the system parameters, you have to define which types of devices (booster, decoders, etc.) you use, to ensure error-free control of the devices.

Your RedBox does not allow to display, enter or edit the system parameters. For that purpose you can use:

- EasyControl devices (e.g. MasterControl, LokControl, HandControl, HandControl 2): The devices must have a software version from 2.0. The manuals from version 07/2018 which are available for free download on our homepage, give further information how to proceed.
- PC (with software CV-Navi or control software with EasyControl support)
- mobile Android smartphone or tablet with app "EasyControl Android" and Raspberry Pi

Setting duration of the signal pause in the Motorola format

These settings only apply to vehicle 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.

Default value	Possible settings
short	short (= 1.5 ms) long (= 4.025 ms)

Configuring the boosters

The settings of both the booster type (Motorola or DCC) and the short circuit polarity apply to all connected (external) boosters.

Default value	Possible settings
DCC booster	DCC (conform) booster: short circuit polarity = "negative" MM-(kompatible) booster: short circuit polarity = "positive"
Short circuit polarity = 100 ms	Value range: AUS, 5, 10, 15, ... 1000 ms 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 standard data format for vehicle decoders

This setting will be set as standard for the programming of all locomotive and function decoders.

Default value	Possible settings
DCC format, 28 speed levels	DCC format, 28 speed levels Motorola format, 14 speed levels

You have to alter the settings in the locomotive data base if you want to control specific vehicle decoders with a different format or number of speed levels. Make changes in the data base

- with an EasyControl device: using the locomotive menu
- with a PC: using the program "CV-Navi" or a control software
- with a smartphone or tablet and a Raspberry Pi: using the app "EasyControl Android"

RailCom support

Default value	Possible settings
++ Accessory	off (0): The Railcom support is switched off.
	Tailbits (1): There will be left space for the RailCom cutout during data transfer.
	+ IdNotify (2):The central unit sends regularly it´s identification (in addition to Tailbits).
	++ Accessory (3): The central unit sends regularly a point command, to allow the points decoders sending feedback signal (in addition to Tailbits and IdNotify).

Booster options (for versions "Booster" and "Booster-R" only)

It is possible to suppress the output of accessory decoder commands individually for driving and breaking booster, for none of them, or for both boosters. When using the integrated booster to control accessory decoders ("switching") and the external booster(s) to control vehicle decoders ("driving"), you have to

- put the jumper on "B-Booster"
- adjust the booster option to "no accessory commands for driving booster"

Default value	Possible settings
---	---
	no accessory commands for driving booster
	no accessory commands for breaking booster
	no accessory commands for driving and breaking booster
	Hint: Normally, "no accessory commands for driving booster" is the only appropriate setting.

Setting the number of s88 modules

Default value	Possible settings
0	Value range: 0, 1, 2, 3....52

Setting switching time of solenoid accessory decoders

The setting applies to all solenoid accessory decoders.

Default value	Possible settings
minimum switching time: 100 ms	Value range: 0, 50, 100, 150 ... 1000 ms Hint: 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.
maximum switching time: 5.0 s	Value range: 0.1 , 0.2 , 0.3, 0.4 ... 25.5 s Hint: By setting a certain maximum switching time, you can prevent damages at the points caused by too long switching times.

Setting interface baud rate (version "V24" only)

Default value	Possible settings
57600 Baud	Value range: 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600 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.

6. Operation

6.1. Switching on / off

Switching on your RedBox

After switching on the power supply for your RedBox, the connected booster(s) first have no power, meaning that your track also has no power. The red LED in the "stop"-button is illuminated.

Push the button "go" to switch on the boster(s). The green LED in the "go"-button is illuminated.

Switching off your RedBox

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.

6.2. Plug and play

You can establish or interrupt connections of external devices or adapters to the EasyNet at any time – even during ongoing operation (plug and play).

6.3. LED displays on the front side

The two buttons "go" and "stop" have an integrated red or rather red LED. The LEDs show the operating mode of your RedBox.

red	off	The RedBox has not been connected to the power supply.
green	off	
red	permanently on	The RedBox has been swithed **on**.
green	off	All boosters are switched **off**.
red	off	The RedBox has been swithed **on**. .
green	permanently on	All boosters have been swithed **on**
red	fast flashing	A booster has reported a short circuit. As a consequent, the RedBox has switched off the track power.
green	off	After having eliminated the short circuit, you have to push "go" in order to restart operation.
red	slow flashing	The update mode has been started for the RedBox.
green	off	In order to return to standard operation, you have to switch off the RedBox (shortly interrupt the power supply). Hint: Do not finish the update mode, after the software transfer has been started.
red	alternating flashing	The update mode has been started for the external devices.
green		In order to return to standard operation, you have to switch off the RedBox (shortly interrupt the power supply).

6.4. LED displays on the rear side (versions "Booster" and "Booster-R" only)

The LED on the rear side shows operating modes or issues encountered for the integrated booster.

off	RedBox and boosters are switched **off**.
permanently on	RedBox and boosters are switched **on**.
slow flashing (approx. once per second)	The booster does not receive signals from the central unit. Please check, ■ if the central unit has been set to "stop". ■ if the jumper has been set to B-Booster or F-Booster. If not, insert the jumper.
fast flashing	A short circuit has occured at the track output, whereupon the RedBox has switched off the track voltage. After having eliminated the short circuit, you have to push "go" in order to restart operation.

7. Update

Your RedBox and other EasyControl devices are state-of-the-art products, which are constantly improved and adapted to occurring changes. To benefit from this development, you can update the devcies to the newest software version.

> **Please note:** All EasyControl devices used in one digital control system must have the same software version! Otherwise malfunction of data transfer between the devices might occur.

You can download the most recent version of the software (firmware) for free from our homepage (area "Download"). In order to perform the update, you need

- a PC running Microsoft Windows or Linux and internet access
- an USB cable (or when using the version "V24" a serial cable)
- Software "CV-Navi", which you can download from our hoemage for free

If you cannot or do not want to perform the update yourself, you can send us your RedBox to update it. In case you use further EasyControl devices together with your RedBox, you have to send them in for update as well. The update is free of charge, we only charge the return expenses according to our valid price list.

Software-Update for your RedBox

First, download the firmware (i.e. the software running the RedBox) from our homepage on your PC. You find the firmware under:

www.tams-online.de/download/firmware

Then, switch off the RedBox. Simultaneously pressing "stop" and "go" switch the power back on, while holding both keys. The red LED on the front side of the RedBox flashes and the green LED is off.

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.

8. Check list for troubleshooting

8.1. Errors occurring while starting up

- After switching on track power, the locomotive responds to switching on / off its functions, but not to turning a control device´s speed control knob.
  Possible reason: The integrated booster (versions "Booster" and "Booster-R") has been configurated as breaking booster and always sends a "0" as speed level. → Alter the integrated booster´s configuration by putting the jumper on "F-Booster".

- When switching on the booster by pressing "go", your RedBox switches off immediately, the red LED in the "stop"-button flashes quickly.
  Possible reason: The short circuit polarity settings of the booster(s) are wrong. → Change the short circuit polarity settings.

- Versions "Booster" and "Booster-R": After switching on the RedBox and pushing the "go"-button the green LED in the "go-button" and the red LED of the integrated booster on the rear side are illuminated. Nevertheless, the locomotives do not respond to turning a control device´s speed control knob.
  Possible reason: The power supply for the booster (transformer, switching power-supply) have not been connected properly or not been switched on. → Check the booster´s power supply.

8.2. Errors occurring while setting parameters

- When programming a DCC decoder an error is displayed.
  Possible reason: You've choosen a programming method not supported by the decoder. → See the manual of the decoder for supported programming methods.

- 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.

8.3. 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 and in the locomotive data base do not match. → Change the speed level settings of the decoder or in the data base.

- 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 the locomotive data base.

- 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 RedBox does not respond to software commands of a connected PC.

  The connection between MasterControl and PC is bad. → Check your cable. Also check, if the right COM port is set in the software.

  Possible reason (version "V24" only): The baud rate has been set faultily. → Alter the baud rate.

8.4. Errors occurring during software update

- After the software update, the RedBox won't start.

  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.

Hotline

If problems with your device occur, our hotline is pleased to help you (mail address on the last page).

Repairs

You can send in a defective device for repair (address on the last page). In case of guarantee the repair is free of charge for you. With damages not covered by guarantee, the maximum fee for the repair is 50 % of the current sales price according to our valid price list. We reserve the right to reject the repairing of a module when the repair is impossible for technical or economic reasons.

Please do **not** send in devices for repair charged to us. In case of warranty we will reimburse the forwarding expenses up to the flat rate we charge according to our valid price list for the delivery of the product. With repairs not covered by guarantee you have to bear the expenses for sending back and forth.

9. Technical Specifications

9.1. RedBox

Data formats	Motorola-I and –II DCC (corresponding to NMRA-and RCN-standard) m3 (for driving mfx decoders)
Power supply	12 volts AC
Power consumption (without consumer)	approx. 200 mA
Interfaces for the connection of external control devices	EasyNet (RJ 45) XpressNet (RJ 12)
PC interfaces (galvanically isolated)	Versions "Basic", "Basic-R", "Booster", "Booster-R": USB-1 type Mini-B with Tams identifier USB-2 type B with SiLabs identifier
	Version "V24": one serial interface (baud rate adjustable) one USB interface with Tams identifier
Other interfaces	Booster (optionally compatible with Märklin or DCC conform) DCC programming track s88 feedback module (corresponding to standard s88-N) Power supply
Maximum amount of s88 modules	52 s88 or s88 compatible modules (832 contacts)
Vehicle decoder addresses	Motorola: 255 (1 – 255) DCC: 10239 (1 – 10239) m3: 16384
Speed levels	Motorola: 14 or 27 (a or b) DCC: 14, 28 or 128 m3: 128
Functions	Motorola: function, f1 to f4 DCC: f0 to f28 resp. f32768 m3: f0, f1 to f15
Accessory decoder addresses	Motorola: 1020 (1 – 1020) DCC: 2040 (1 – 2040) m3: ---

Protection	IP 00	
Ambient temperature while operating	0 - + 60 °C	
Ambient temperature in storage	- 10 to + 80 °C	
Comparative humidity allowed	max. 85 %	
Dimensions (approx.)	95 x 135 x 45 mm	
Weight (approx.)	Version "Basic"	160 g
	Version "Basic-R"	172 g
	Version "Booster"	215 g
	Version "Booster-R"	217 g
	Version "V24"	170 g

9.2. Integrated Booster (Versions "Booster" and "Booster-R")

Supply voltage	16 - 18 volts AC voltage or 17 – 22 volts DC voltage
Output voltage	15 or 19 volts digital voltage (regulated)
Power consumption	max. 48 watt
Maximum output current	2,5 A
Data formats	DCC, Motorola mfx (vehicle decoder commands only)
Feedback log	RailCom (RailCom cutout can be switched off)
Output signal	symmetrical

10. Background information

10.1. 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 15th 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.

10.2. DCC-Format

The DCC format was developed by LENZ** and later declared as standard by the NMRA (National Model Railroad Association). Meanwhile the RailCommunity (Association of Manufacturers of Model Railcroad Products) maintains and advances this standard.

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 central 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 28 (or 32768) 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 central 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 10.2. you can find the most commonly used CV variables and their possible values.

Page programming and register programming

Before CV programming, 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.

CV#	CV name	Value (Default value)	Explanations
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.

10.3. m3

We have developped this protocol for our digital system EasyControl in order to drive mfx vehicle decoders. It is possible to program vehicles with mfx decoders on a programming track connected to the RedBox or the MasterControl. m3 does not allow to read feedback messages sent via mfx.

10.4. s88

In PC controlled layouts remote indication via the s88 bus is very common. Many digital central units have a (usually 6 pole) connection for a s88 cable. Remote indication via the s88 bus is customary in a.c. as well as in d.c. layouts – independent of the digital format in use.

Most feedback modules allow to connect up to 16 inputs, whose state (open or connected to earth) is reported to the receiver (interface or central unit). Several feedback modules can be connected in series, the maximum number depends on the receiver (e.g. 52 with MasterControl or RedBox).

s88-N

The standard s88-N regulates the assignment of commercial Ethernet patch-cables for use in s88 feedback systems. Unlike the 6-conductor connecting cables frequently used in the past, the patch-cables used in computer networks are screened against outside electric signals. Thus using patch-cables reduces the liability to interference considerably, even with long lines. All modules corresponding to this standard are compatible to each other.

10.5. 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.

10.6. Boosters

Boosters amplify the digital signals send from the central 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 / > 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.

11. The asterisks **

This manual mentions the following companies:

ESU electronic solutions ulm GmbH & Co. KG
Edisonallee 29
DE-89231 Neu-Ulm

LENZ** Elektronik GmbH
Vogelsang 14
DE-35398 Gießen

MASSOTH** Elektronik GmbH
Frankensteiner Str. 28
DE-64342 Seeheim

Gebr. MÄRKLIN** & Cie. GmbH
Stuttgarter Straße 55-57
DE-73033 Göppingen

ROCO**
Modelleisenbahn München GmbH
Kronstadter Str. 4
DE-81677 München

12. Guarantee bond

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

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

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

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

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

13. EU declaration of conformity

C E   This product conforms with the EC-directives mentioned below and is therefore CE certified.

2004/108/EG on electromagnetic. Underlying standards: EN 55014-1 and EN 61000-6-3.

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

- Connect the transformer only to an approved mains socket installed by an authorised electrician.
- Make no changes to the original parts and accurately follow the instructions, connection diagrams and PCB layout included with this manual.
- Use only original spare parts for repairs.

2011/65/EG on the restriction of the use of certain hazardous substances in electrical and electronic equipment (ROHS). Underlying standard: EN 50581.

14. Declarations conforming to the WEEE directive

This product conforms with the EC-directive 2012/19/EG on waste electrical and electronic equipment (WEEE).

Don´t dispose of this product in the house refuse, bring it to the next recycling bay.

Information and tips:

http://www.tams-online.de

Warranty and service:

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