

Digital technology



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1. Introduction

Congratulations for the purchase of a TILLIG quality modell. We are giving you all the information you need to convert your loco to digital and adjust all the features, as you want.

Our modell of loco BR23.0 offer you the following functions:

- Driving direction-dependent front light
- Shunting light downright
- Sound installation ready fo a speaker with capsule or SUSI-Soundmodul
- digital coupler installation ready at the backside



For Plug and Play you can use our **decoder item no. 66039** (train-O-matic). The decoder is completely programmed to use all functions of this modell (*excepting sound*).

If you want to **install sound**, you can use any SUSI bus-capable Next18 sound decoder. The required **loudspeaker**, including wires, is available under **item no. 66055**.

On each page of this manual, you will find the hardware-software index at the bottom left. This shows the development status of the PCBs and the software of the ECU.

To make sure that you have the right variant, you can take a look at the operating instructions enclosed with the product. There you will find the spare parts list. The PCB on which the ECU is installed receives the HW-SW index. If this index does not exist, you can assume that it is HW01SW01.

8a	Leiterplatte Decoder	Circuit board Decoder	396529 HW02SW02
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In addition, the index is also stored in CV980.2 (hardware) and CV980.3 (software), as long as the slave address 3 (897=3).

Otherwise, CV940.2&3 for slave address=2 or CV900.2&3 for slave address=1 are to be used for reading (see table).

CV			Factory Default CV Values	Value-Range	Description
Slave1	Slave2	Slave3			
897			3	1-3	SUSI Slave Adress
900.2	940.2	980.2	2		TILLIG Hardware ID
900.3	940.3	980.3	2		TILLIG Software ID

At the bottom right, you will find the date of the last modification of the manual.

2. Installation of decoder, speaker- and electrical couplers

2.1 Decoder installation

The decoder will be installed at the tender.

Step 1:

The first thing you need to do is remove the coal insert of the tender. This is locked and only needs to be removed.

Step 2:

Now the decoder interface is exposed and you can **remove the redisturb PCB** and **replace it with your Next18 decoder**.

Note: When plugging in the decoder, you should make sure that the PCB is not pushed down too much. It is recommended to hold the PCB in the front area a little against it. This prevents the PCB from grinding on the flywheel of the motor.

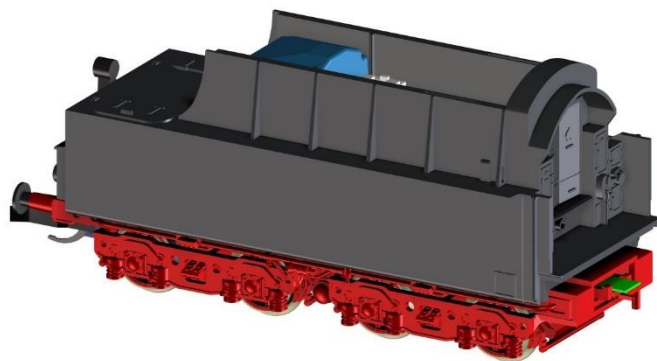
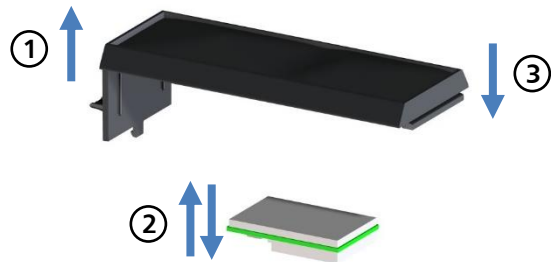
Step 3:

The coal insert can now be snapped back on.

Attention:

The installation space is designed for Next18 standard decoders. The available build space is 16.3x13.5x3.5mm.

When using Next18 sound decoders, it is important to ensure that these dimensions are matching! (e.g. ESU-LokSound5 Nano)



2.2 Speaker installation

There is a **Micro-SUSI interface** on the locomotive's **connecting circuit board**.

This is used to connect our **speaker box** under **item no. 66055** or a SUSI sound module with micro SUSI connector.

In addition, there are two solderpads. A speaker of your choice can be soldered to these.

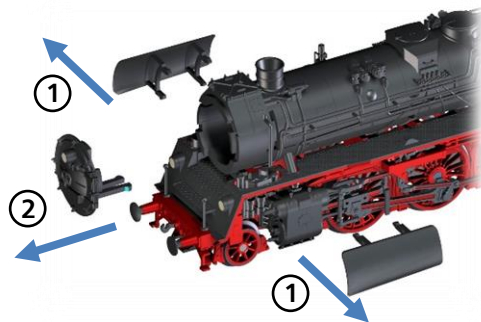
When using third-party products, the maximum installation space of 18.6 x 11.2 x 8.8 mm must be observed.

Whether a loudspeaker or a SUSI module is installed must be defined by programming (see 4.7).

To install a loudspeaker or sound module, the chassis and run around must be demounted from the boiler:

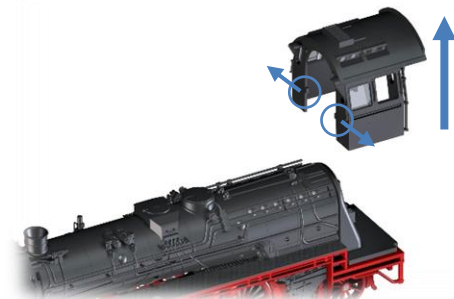
Step 1:

To separate the chassis from the boiler, the first thing to do is to **demount the wind deflectors and the smokebox door**. These are locked into the boiler and only need to be removed.



Step 2:

Now the **driver's cab** has to be demounted. This has snapped over the boiler. To release the detent, it must be spread from the inside and at the same time pulled upwards from the boiler.

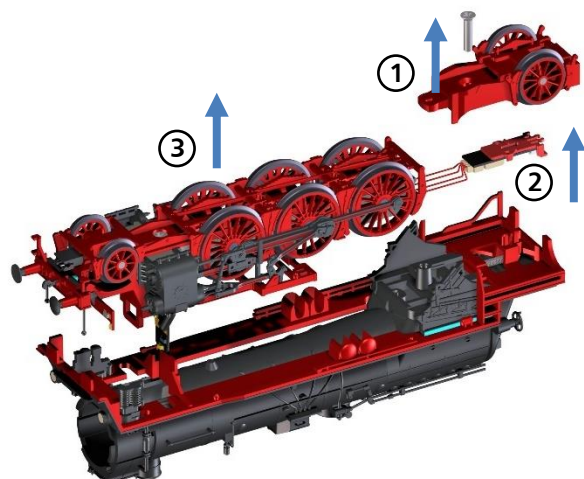


Step 3:

Next, the **rear frame** must be demounted. This is screwed to the ash box.

Note: It is recommended to use a narrow **flat-head** screwdriver for unscrewing.

Then the **connecting circuit board** must be removed from the drawbar and the rest of the chassis dismantled.



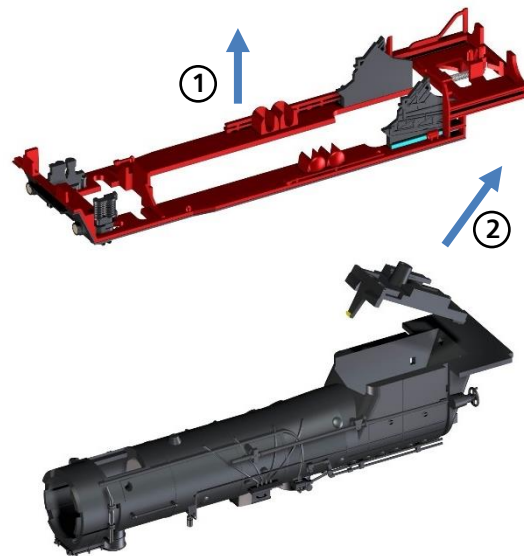
Step 4:

The last demounting step is to remove the ash pan. To do this, the first thing to do is to remove the air tanks from the ash pan.

After that the **run around** can be removed **together with the kinematic and its spring**.

Note: The mainspring is slightly preloaded and can jump away. Please proceed with caution.

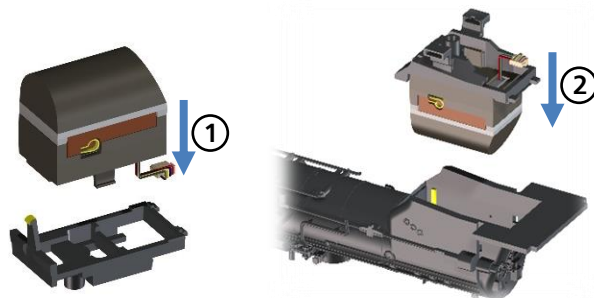
Then loosen the detent of the **ash pan** and pull it **out of the boiler**.



Step 5:

Now the **speaker** can be installed. This is snapped onto the ash box. It is important to ensure that the cable is routed through the rear opening.

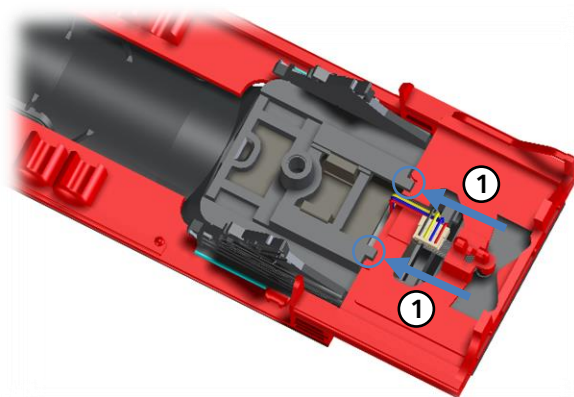
Now the ash box and loudspeaker are locked back into the boiler.



Step 6:

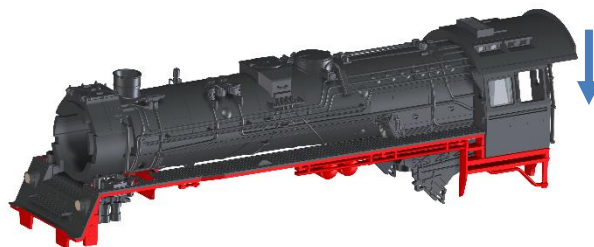
Next, the **run around** can be reassembled. The run around is to be pushed from behind under the retaining lugs of the ash pan. The boiler support snaps into the boiler by itself.

Note: Make sure that the kinematic still swings out completely. Otherwise, it could be wedged between the circulation and the boiler.



Step 7:

To prevent the run around from shifting, the **driver's cab** must now be locked onto the boiler again.

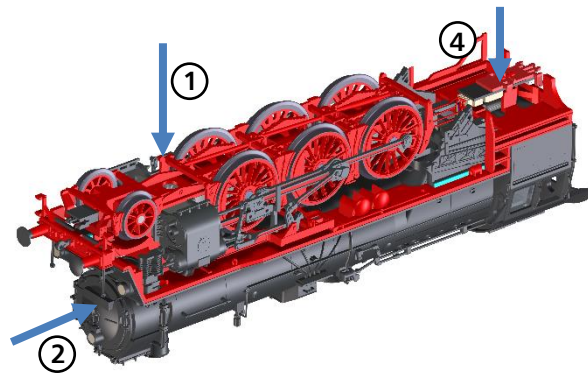
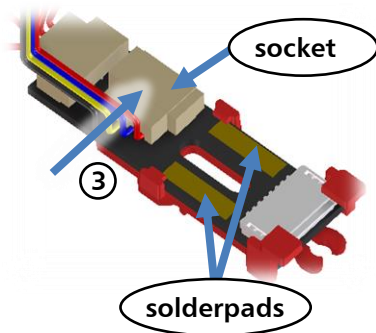


Step 8:

Now the chassis has to be inserted in again and fixed with the smokebox door. Then the **cable of the speaker box** (or SUSI sound module) is **plugged into the socket on the connecting circuit board**.

If a third-party speaker is used, it can be soldered to the solder pads.

Now the **connecting circuit board** can be **snapped back onto the kinematic**.

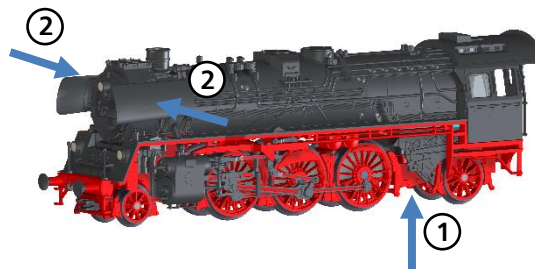


Note: The connecting cables are to be placed in the opening of the ash box in the form of a loop:



Step 9:

Finally, the rear frame is screwed back to the ash pan and the wind deflectors are locked into the boiler.



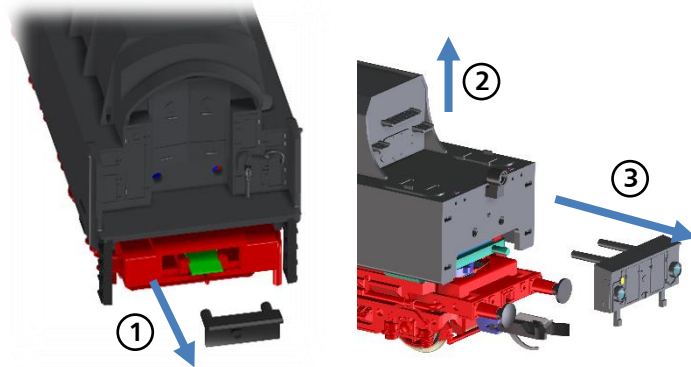
2.3 Installation of electrical couplers

The tender is prepared for the installation of a digital coupling. For installation, the top part must be removed to expose the solder pads.

Step 1:

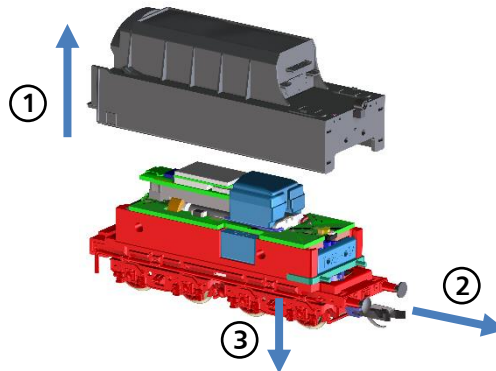
The top part is fixed with the **tread** in the tender end wall and the **toolbox**. These **must be removed**.

To remove the toolbox, **lift the top part about 3mm**, so that the detents of the **toolbox** (if still present) is released. It can then be **pulled off to the rear**.



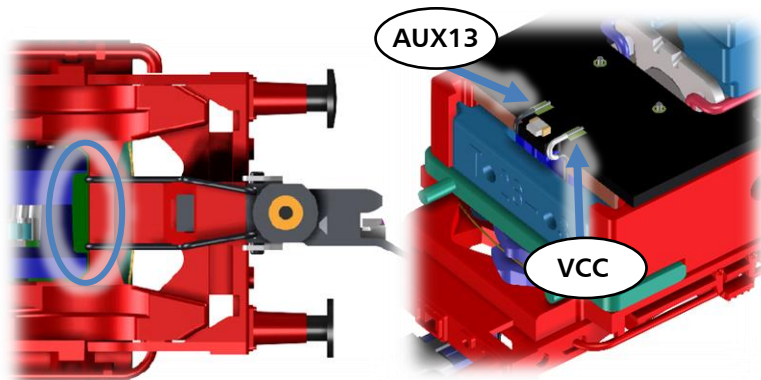
Step 2:

Now the **top part must be pulled upwards** and the **TILLIG coupling must be removed**. It is also convenient to **remove the rear bogie**, which is locked onto the gearbox.



Step 3:

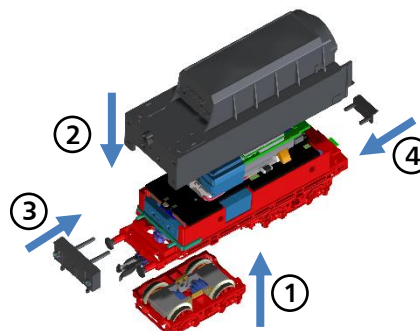
Next, you can **plug in your electrical coupling** and **lay the wires up through the gap between the gearbox and the frame to the circuit board**, where it will be **soldered to the VCC and AUX13** according to the instructions of your coupling.



Step 4:

Finally, everything has to be **reassembled**.

Note: To mount the toolbox, turn the tender upside down so that the weight "T26-34" slides into the correct position.



3. Function output mapping

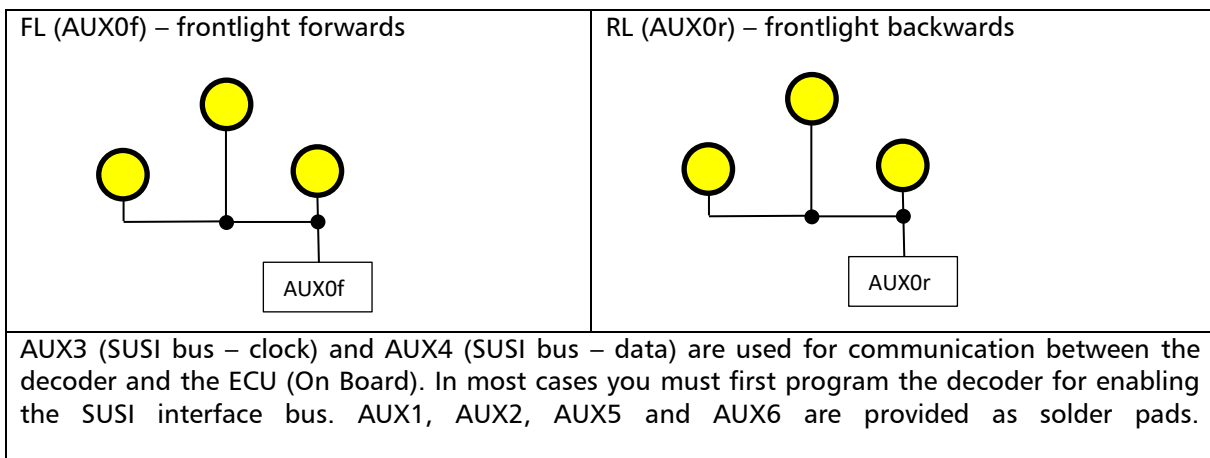
When using a third-party NEXT18 decoder, the function key assignment and the SUSI communication must be programmed by yourself (see 3.1.2). If you use a different NEXT18 decoder of your own choice, you will have to program the function button mapping (assignment) and turn on the SUSI interface bus by yourself.

3.1 NEXT18S – decoder

This model is using a NEXT18 interface.

The decoder functions are designed by NEM662/RCN118 – NEXT18S.

3.1.1 NEXT18S – function outputs



3.1.2 NEXT18S – function button mapping

The function button mapping listed here correspond to the pre-programmed TILLIG decoder item no. 66039. If you do not want to change the mapping of the ECU, we recommend to using it for third-party decoders as well.

Note: When using third-party decoders, AUX0f+r ON must also be programmed/mapped for the function of the shunting light (front and back side ON) at F2 (bottom right). To do this, follow the operating instructions of your decoder.

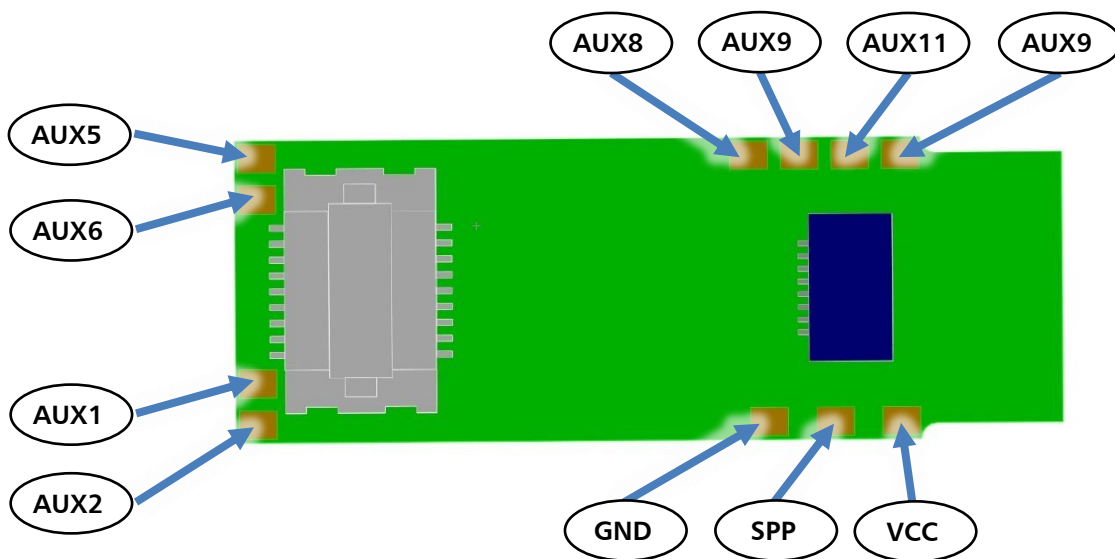
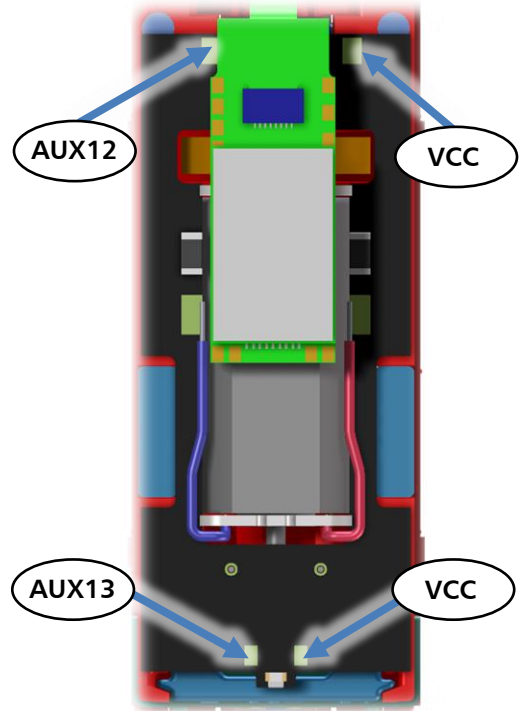
F0 (F2 off)	Front light, driving direction-dependent
F1 (F2 off)	Rear light, driving direction-dependent
F0+F2	Shunting light downright
F3	Shunting gear
F12	Electical decoupling driving direction-dependent (without function output attribution)

3.2 ECU (Electronic Control Unit / slave decoder)

Some functions are controlled by the ECU, which is a function decoder integrated on the locomotive main circuit board. The ECU is communicating with the Next18 decoder on the standard SUSI bus on the AUX3 and AUX4 outputs of the decoder. To enable the SUSI communication, the Next18 decoder should be configured accordingly. All function outputs are amplified to 500mA.

3.2.1 ECU function outputs

<p>AUX7 - light sitch-off 1 (shunting light down right)</p> <p>Viewing direction at loco front</p>
AUX8 - Solder pad
AUX9 - Solder pad
AUX10 - Solder pad
AUX11 - Solder pad
AUX12 - Solder pad for electrical coupling vorn
AUX13 - Solder pad for electrical coupling hinten



3.2.2 ECU function button attribution

F2	light sitch-off 1 shunting light down right
F4	AUX8
F5	AUX9
F6	AUX10
F7	AUX11
F12	Electical coupling (driving direction-dependent)
F13	AUX14 (not available)

4. ECU CV – programming

According to the SUSI standard (RCN-600) the CV-s (Configuration Variables) of the ECU are organized in groups of 40 CVs. The 40 CVs are addressable in one Bank. The Bank contains the group of 40 CVs present 3 times numerated continuously. To each SUSI slave Address, direct access to a group of 40 CVs is possible.

The CV range CV900-CV939 is dedicated to the slave address 1,

CV940 to CV979 for the slave address 2

and CV980 to CV1019 to slave address 3.

The ECU is using the slave address 3 by default, so in the factory configuration all of the configurations CVs are used in the range CV979-CV1019.

If you want to change the slave address, program the desired address into the CV897. If you change the slave address, the CV ranges will change by the value 40 per address jump (see above).

But since more than 40 CV's are needed, multiple Banks are available. In order to better represent the Banks after the CVs, a dot is used, as described in the RCN600. (e.g. 983.2 = CV983, Bank 2). The Banks can be selected between 0 and 254. Currently, Bank0, Bank1, Bank2, Bank3 and Bank254 are used for the ECU. The CV Bank Index is selected in CV1021 (which is accessible all the time). Before executing any CV operation, please check the Index of the CV Bank. The default value of CV1021 is 0 (Bank0).

Example1: CV900.0 means that CV900 is located in Bank0 for the SUSI slave address 1. The corresponding CV is CV940.0 for the SUSI slave address 2 or CV980.0 for the SUSI slave address 3.

Example2: CV904.2 means that CV904 is located in Bank2 for the SUSI slave address 1. The corresponding CV is CV944.2 for the SUSI slave address 2 or CV984.2 for the SUSI slave address 3.

Please note: All the following CVs are described for slave address 3.

The ECU is locked by delivery via the programming lock in CV982.3 and 983.3. In order to be able to program it, the ECU must be unlocked by writing both CV's to the same value, e.g. 0. To do this, the first thing to do is to write bank 3 in CV1021. After that, CV 982 and 983 can be written. Only then, you can will be able to change the other CV's.

(step1: CV1021=3; step2: CV982=0; step3: CV983=0)

We strongly recommend reactivating the programming lock after completing the programming, otherwise the ECU will be overwritten with a software update of your decoder and may no longer work!

(step1: CV1021=3; step2: CV982=0; step3: CV983=1)

To RESET the ECU to factory settings, write in the CV980.0=0.

We recommend that you change the CV values only if you are sure of their function and the impact of your action. Incorrect CV settings can negatively affect the performance of the ECU or cause incorrect responses to the commands transmitted from the command station.

4.1 Function mapping (Aspects)

The F0-F28 function buttons mapping to the outputs AUX7-14 is made in a double level scheme. The group of outputs is controlled in the same time by a function is called Aspect. The ECU has a total 8 configurable Aspects.

4.1.1 standard function mapping

The standard function mapping is used by default. For this one function button is defined for one Aspect. The function buttons F0-F28 (value 0-28) can be selected. These are assigned to Aspect 1 (CV995.0) to Aspect 8 (CV1002.0) with their value. If no function key is to be assigned, a value from 29 till 63 must be written.

CV1004.0-1019.0 (Aspect 1-8) describes which function outputs from AUX7 to AUX14. The even CV-numbers are for the forward direction and the odd numbers for reverse direction. These CVs are described after the following Bit mask.

4.1.2 Output Bit mask

Each bit position corresponds to one output as it can be seen in the table below:

Bit	Bit7 (= 128)	Bit6 (= 64)	Bit5 (= 32)	Bit4 (= 16)	Bit3 (= 8)	Bit2 (= 4)	Bit1 (= 2)	Bit0 (= 1)
AUX7-14	AUX14	AUX13	AUX12	AUX11	AUX10	AUX9	AUX8	AUX7

4.1.3 Extended function mapping

The extended function mapping is being planned and is not yet available in this software version.

4.1.4 Default factory configured Aspect overview

Aspect1: F5 controls AUX9.

- AUX7-14 for Driving direction FWD „AUX9“ defined in CV1004.0=4
- AUX7-14 for Driving direction BWD „AUX9“ defined in CV1005.0=4
- Function button „F5“ defined in CV995.0=5

Aspect2: F6 controls AUX10.

- AUX7-14 for Driving direction FWD „AUX10“ defined in CV1006.0=8
- AUX7-14 for Driving direction BWD „AUX10“ defined in CV1007.0=8
- Function button „F6“ defined in CV996.0=6

Aspect3: F13 controls AUX14.

- AUX7-14 for Driving direction FWD „AUX14“ defined in CV1008.0=128
- AUX7-14 for Driving direction BWD „AUX14“ defined in CV1009.0=128
- Function button „F13“ defined in CV997.0=13

Aspect4: F7 controls AUX11.

- AUX7-14 for Driving direction FWD „AUX11“ defined in CV1010.0=16
- AUX7-14 for Driving direction BWD „AUX11“ defined in CV1011.0=16
- Function button „F7“ defined in CV998.0=7

Aspect5: F4 controls AUX8 (high beam).

- AUX7-14 for Driving direction FWD „AUX8“ defined in CV1012.0=2
- AUX7-14 for Driving direction BWD „AUX8“ defined in CV1013.0=2
- Function button „F4“ defined in CV999.0=4

Aspect6: F2 controls AUX7 (Light switch-off 1)

- AUX7-14 for Driving direction FWD „AUX7“ defined in CV1014.0=1
- AUX7-14 for Driving direction BWD „AUX7“ defined in CV1015.0=1
- Function button „F2“ defined in CV1000.0=2

Aspect7: F12 controls AUX12 und AUX13 (Electrical couplings) driving directions depended.

- AUX7-14 for Driving direction FWD „AUX13“ defined in CV1016.0=64
- AUX7-14 for Driving direction BWD „AUX12“ defined in CV1017.0=32
- Function button „F12“ defined in CV1001.0=12

Aspect8: Freely available

- AUX7-14 for Driving direction FWD „non“ defined in CV1018.0=0
- AUX7-14 for Driving direction BWD „non“ defined in CV1019.0=0
- Function button „non“ defined in CV1002.0=63

4.1.5 Example of function mapping settings

To configure Function F9 to turn on AUX9 together with AUX11 in forward direction, and AUX10 together with AUX14 in reverse direction using Aspect8 (available for user configuration) the following is to be done:

- Write in CV1002.0 the value 9 - this means that the Function F9 will control the Aspect8.
- For the forward direction - set Bit2 (AUX9) and Bit4 (AUX11) in CV1018.0. Decimal value will be 20.
- For the reverse direction - set Bit3 (AUX10) and Bit7 (AUX14) in CV1019.0. Decimal value will be 136.

4.2 Effects for function outputs

4.2.1 Light intensity

The PWM values of the outputs (light intensity) can be set in CV985.0 – CV990.0 (AUX7-AUX14) (see 4.7 CV table). If the outputs are used internally by the electronics of the ECU, so are used as light switch-off (e.g. shunting light), the outputs are not using the PWM values. Changing these PWM CV values has no effect on these.

4.2.2 Fade effect

The Fade effect setting can be activated in CV994.0. This CV is using the output bit mask (4.1.1.) By default the Fade effect is disabled for AUX7 since it is an internal output. For programming the time values (8ms steps) please use CV983.0 (Fade in) and CV984.0 (Fade out).

4.2.3 Delayed ON and OFF outputs switching

The delayed switching (ON and OFF) can be controlled individually for each output of the ECU. The delay values (ON and OFF) will be valid globally for all outputs. The CV983.2 and 984.2 are using the same bitmask structure as in the table above. These two CVs are used for the delayed turn ON (CV983.2) and delayed turn OFF (CV984.2) of the specific AUX. The delay is active for an AUX output only if the corresponding bit is set (value 1) in the bitmask. By default the corresponding bit to the turn OFF delay of AUX7 is set. This setting is required to synchronize the ECU with the front and rear lights (FL/RL) with of the locomotive DCC decoder. The delay time is set in CV983.1 (turn ON delay) and CV984.1 (turn OFF delay). One unit corresponds to 8 milliseconds. The factory default value 50 equates to $50 \cdot 8 = 400$ milliseconds.

The outputs AUX12 and AUX13 cannot be used with the delay function if they are configured for electrical coupler operation.

4.3 Electrical Couplers (AUX12/13)

4.3.1 Programming

The special outputs dedicated for the usage of electrical couplers (AUX12/AUX13) are accessible to the user as solder pads (AUX12 in the front, AUX13 in the rear). The operation of these outputs requires special settings. The electrical coupler requires **higher power** for a shorter period when they are switched on, and a **lower power** for the hold time (if they are kept on). The power applied to the electrical couplers will depend on the duty cycle of the PWM signal applied.

The **switching on time** is set in CV1015.2, and the PWM signal value (intensity) is set in CV990.0 – front coupler or CV991.0 – rear coupler. These settings provide a proper switching-on operation for the electrical coupler.

In CV1016.2 the **hold-on time** is set with a PWM value of CV990.2 – front coupler and CV991.2 - rear coupler. The frequency of the PWM signal is approximately 20 kHz, ensuring a proper operation.

One time unit in CV1015.2 and CV1016.2 is equivalent to 40 milliseconds. So a value of 5 in CV1015.2 has the meaning of $5 * 40 = 200\text{ms}$, and the value of 75 in CV1016.2 equates to $75 * 40 = 3\text{ seconds}$. After the defined time in CV1016.2 elapses, the electrical coupler will be automatically switched off (even if the function which controls it is not released). A new coupler sequence will be initiated only after the controlling function is released and switched on again.

The ECU is controlling only the electrical coupler operation. For the control of the engine/locomotive movement in reverse/forward direction known as the specific "tango/waltzer" during the uncoupling, the locomotive decoder must be configured properly. To keep the electrical coupler engagement synchronized with the reverse/forward movement of the locomotive, both operations (the uncoupling controlled by the ECU and the movement of the locomotive controlled by the DCC decoder) must be mapped to the same function.

The front and rear electrical coupler outputs can be also used as standard outputs with PWM signal, with or without fade effect. The selection is made in CV982.0 Bit5 for AUX12 (front coupler) respectively Bit6 for AUX13 (rear coupler). For zero value of the Bit5 (Bit6) the outputs will behave as standard outputs. If the bits are set (1), the output will be configured for electrical coupler operation. The two outputs can be configured independently. One of them can be configured as electrical coupler while the other can be configured as standard output.

4.4 SPP installation

Sadly it was not successful to integrate an SPP at this loco. But if you find a place to assemble one, you'll find the needed solder pads (VCC, GND and SPP) at the decoder pcb. The operating is using the ECU like at the integrated SPP.

The power pack (SPP) is enabled only in digital DCC operation. It will operate only while is receiving valid SUSI packets from the Next18 decoder. During the CV operations the SPP will be disabled if the Next18 decoder is transmitting the All Off command over the SUSI interface.

The SPP switching off time after the track contacts are lost can be set in CV1017.2. One unit of CV1017.2 is equivalent to 16 milliseconds. The default value of 62 is approximately equal to 1 second ($62 \cdot 16 = 992$ milliseconds). The highest value is approximately 4 seconds.

4.5 DC operation

In analog DC mode the ECU is not working. When an analog DC Dummy board is used instead a DCC decoder, only the standard light functions will operate (front and rear white/red), all other configurations will be disabled. If a Next18 DCC decoder is used with the ECU in analog DC mode, the active functions will depend on the DCC decoder configuration.

4.6 Short circuit protection

The outputs AUX8 - AUX13 are user accesible as solder pads. They are short circuit protected power outputs. The short circuit current value is set in CV1019.2 with a factory default value of 63, which equivalets to a current limit of 500 mA (total current on the outputs). The current value calculation can be made with the following formula: $CV1019.2 = 126 \cdot I[A]$. Increasing this value above the factory default value is recommended only if the external consumer(s) requires a higher startup current. We strongly recommend to not alter the factory default value.

If the short circuit protection is triggered, this will be signaled in CV1018.2, which will be set to the value 1 (in normal condition, without errors, the value of the CV1018.2 is 0). Reading the value of CV1018.2 will inform us if there was a short circuit condition. The value of CV1018.2 will not be cleared automatically to 0, it must be done manually

The outputs AUX9 and AUX10 are used internally for the cabin front and rear lights. These outputs do not have short circuit protection.

AUX7 is used for the logic of the shunting lite, so it has no short circuit protection.

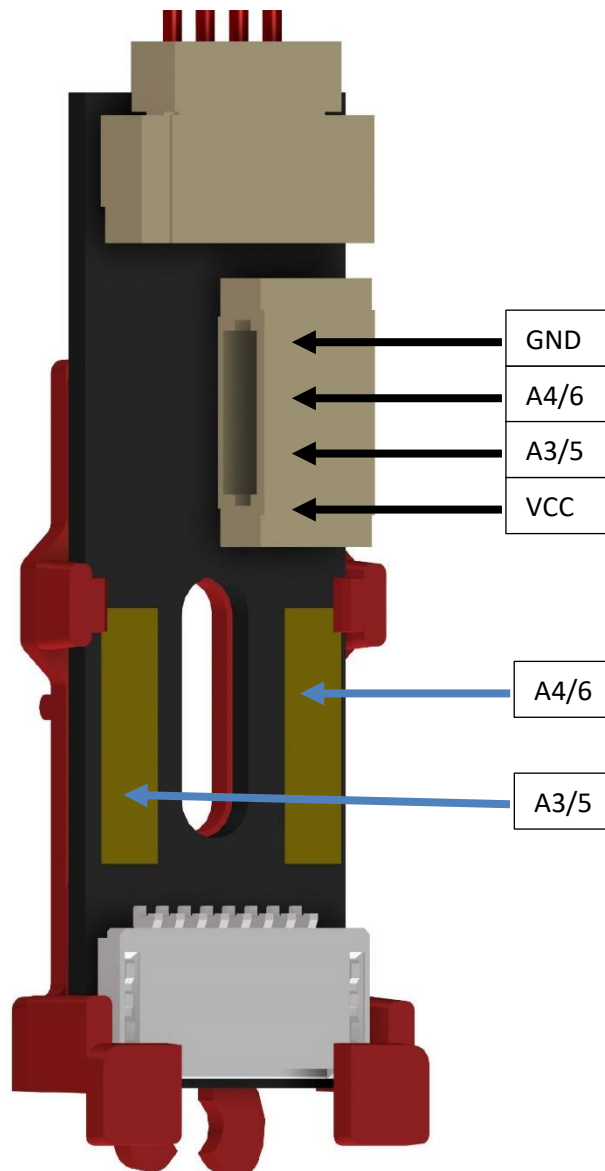
4.7 Sound / SUSI Switch

To be able to use the Micro-SUSI interface, in the locomotive, to connect a speaker, an internal switch has been adapted, with which you can determine what you want to connect via CV programming. The ECU is factory-programmed to install a loudspeaker.

CV982.1 = 0 for AUX5 / AUX6 (speaker connection)

CV982.1 = 1 for AUX3 / AUX4 (SUSI Clock and SUSI Data)

If a loudspeaker is incorrectly connected even though the Micro-SUSI interface has been programmed to use SUSI, this will interfere with the data transmission of the SUSI protocol and the ECU may not work properly. Therefore, a security layer is programmed that causes the CV982.1 to be automatically written to 0 as soon as the SUSI protocol fails for more than 10 seconds.



4.8 CV table

In the table on the following pages are listed all the CV's of the ECU. The CV's are divided into 3 columns, one for each slave address (see also: Introduction Chapter 4). The CV's relevant to you are marked in bold.

CV			Factory Default CV-values	CV Valuee-Bereich	Description
Slave1	Slave2	Slave3			
	897		3	0-3	SUSI Slave Adresse
	898		0	/	reserved
	899		0	/	reserved
900.0	940.0	980.0	78	0-255	Manufacturer ID/RESET 78=train-O-matic, any written value will reset the decor to the factory default CV values
900.1	940.1	980.1	2	/	tOm Hardware ID
900.2	940.2	980.2	2	/	TILLIG Hardware Version
900.3	940.3	980.3	2	/	TILLIG Software Version
900.254	940.254	980.254	0	/	Alternative Manufacturer ID
901.0	941.0	981.0	3	/	Firmware Version
901.1	941.1	981.1	6	/	Firmware Sub Version
901.2	941.2	981.2	0	/	Firmware build number MSB
901.3	941.3	981.3	149	/	Firmware build number LSB
901.254	941.254	981.254	10	/	SUSI Version 1.0
902.0	942.0	982.0	104 = 8 +32 +64	0-255	- Configuration Data:
				Bit 0	0 (0) Normal driving direction
				= 1 (1)	Inverted direction
				Bit 1	0 (0) SUSI-direction used
				= 1 (2)	FL/RL-direction used
				Bit 3	0 (0) Aspect priority level used (1-8)
				= 1 (8)	Aspect priority level not used
				Bit 5	0 (0) AUX12 Standard PWM output
				= 1 (32)	AUX12 Output for electrical coupling
				Bit 6	0 (0) AUX13 Standard PWM output
				= 1 (64)	AUX13 Output for electrical coupling
902.1	942.1	982.1	0	0-1	Sound / SUSI Switch
902.2	942.2	982.2	/	/	reserved
902.3	942.3	982.3	0	0-255	Lock Value
903.0	943.0	983.0	50	1-127	Time for Fade In Effect in 8ms Steps
903.1	943.1	983.1	50	0-255	Time of Turn On Delay in 8ms Steps
903.2	943.2	983.2	0	0-255	Outputs Turn On Delay (AUX7-14) bit0 – AUX7... bit7 – AUX14 (see 4.1.1) Bit Value = 0, instant Turn On Bit Value = 1, Turn On Delay is used
903.3	943.3	983.3	1	0-255	Lock ID

904.0	944.0	984.0	50	1-127	Time for Fade Out Effect in 8ms Steps
904.1	944.1	984.1	50	0-255	Time of Turn Off Delay in 8ms Steps
904.2	944.2	984.2	1	0-255	Outputs Turn Off Delay (AUX7-14) bit0 – AUX7... bit7 – AUX14 (see 4.1.1) Bit Value = 0, instant Turn Off Bit Value = 1, Turn Off Delay is used
905.0	945.0	985.0	255	/	AUX7 max. PWM Value (keep it at Value 255)
905.1	945.1	985.1	/	/	reserved
905.2	945.2	985.2	/	/	reserved
906.0	946.0	986.0	255	0-255	AUX8 max. PWM Value (Light intensity)
906.2	946.2	986.2	/	/	reserved
907.0	947.0	987.0	255	0-255	max. PWM Value AUX9 (Light intensity)
908.0	948.0	988.0	255	0-255	max. PWM Value AUX10 (Light intensity)
909.0	949.0	989.0	255	0-255	max. PWM Value AUX11 (Light intensity)
910.0	950.0	990.0	255	0-255	max. PWM Value AUX12 (Light intensity) or High-PWM Value front electrical coupling
910.2	950.2	990.2	100	0-255	Low-PWM Value front electrical coupling
911.0	951.0	991.0	255	0-255	max. PWM Value AUX13 (Light intensity) or High-PWM Value back electrical coupling
911.2	951.2	991.2	100	0-255	Low-PWM Value back electrical coupling
912.0	952.0	992.0	255	0-255	max. PWM Value AUX14 (Light intensity)
913.0	953.0	993.0	/	/	reserved
914.0	954.0	994.0	255	0-255	Outputs Fade Effect (AUX7-14) bit0 – AUX7... bit7 – AUX14 (see 4.1.1) Bit Value = 0, instant Turn On and Off Bit Value = 1, using Fade Effect
915.0	955.0	995.0	5	0-63	Function button which is mapped at Aspect 1
915.1	955.1	995.1	/	/	reserved
915.2	955.2	995.2	/	/	reserved
916.0	956.0	996.0	6	0-63	Function button which is mapped at Aspect 2
916.1	956.1	996.1	/	/	reserved
916.2	956.2	996.2	/	/	reserved
917.0	957.0	997.0	13	0-63	Function button which is mapped at Aspect 3
917.1	957.1	997.1	/	/	reserved
917.2	957.2	997.2	/	/	reserved
918.0	958.0	998.0	7	0-63	Function button which Aspect 4
918.1	958.1	998.1	/	/	reserved
918.2	958.2	998.2	/	/	reserved
919.0	959.0	999.0	4	0-63	Function button which is mapped at Aspect 5
919.1	959.1	999.1	/	/	reserved
919.2	959.2	999.2	/	/	reserved
920.0	960.0	1000.0	2	0-63	Function button which Aspect 6
920.1	960.1	1000.1	/	/	reserved
920.2	960.2	1000.2	/	/	reserved

921.0	961.0	1001.0	12	0-63	Function button which is mapped at Aspect 7
921.1	961.1	1001.1	/	/	reserved
921.2	961.2	1001.2	/	/	reserved
922.0	962.0	1002.0	63	0-63	Function button which is mapped at Aspect 8
922.1	962.1	1002.1	/	/	reserved
922.2	962.2	1002.2	/	/	reserved
923.0	963.0	1003.0	/	/	reserved
924.0	964.0	1004.0	4	0-255	Output Aspect 1 (AUX7-14), forward (see 4.1.1)
924.1	964.1	1004.1	/	/	reserved
925.0	965.0	1005.0	4	0-255	Output Aspect 1 (AUX7-14), backward (see 4.1.1)
925.1	965.1	1005.1	/	/	reserved
926.0	966.0	1006.0	8	0-255	Output Aspect 2 (AUX7-14), forward (see 4.1.1)
926.1	966.1	1006.1	/	/	reserved
927.0	967.0	1007.0	8	0-255	Output Aspect 2 (AUX7-14), backward (see 4.1.1)
927.1	967.1	1007.1	/	/	reserved
928.0	968.0	1008.0	128	0-255	Output Aspect 3 (AUX7-14), forward (see 4.1.1)
928.1	968.1	1008.1	/	/	reserved
929.0	969.0	1009.0	128	0-255	Output Aspect 3 (AUX7-14), backward (see 4.1.1)
929.1	969.1	1009.1	/	/	reserved
930.0	970.0	1010.0	16	0-255	Output Aspect 4 (AUX7-14), forward (see 4.1.1)
930.1	970.1	1010.1	/	/	reserved
931.0	971.0	1011.0	16	0-255	Output Aspect 4 (AUX7-14), backward (see 4.1.1)
931.1	971.1	1011.1	/	/	reserved
932.0	972.0	1012.0	2	0-255	Output Aspect 5 (AUX7-14), forward (see 4.1.1)
932.1	972.1	1012.1	/	/	reserved
933.0	973.0	1013.0	2	0-255	Output Aspect 5 (AUX7-14), backward (see 4.1.1)
933.1	973.1	1013.1	/	/	reserved
934.0	974.0	1014.0	1	0-255	Output Aspect 6 (AUX7-14), forward (see 4.1.1)
934.1	974.1	1014.1	/	/	reserved
935.0	975.0	1015.0	1	0-255	Output Aspect 6 (AUX7-14), backward (see 4.1.1)
935.1	975.1	1015.1	/	/	reserved
935.2	975.2	1015.2	5	0-255	Time for high PWM of electrical coupling in 40ms Steps
936.0	976.0	1016.0	64	0-255	Output Aspect 7 (AUX7-14), forward (see 4.1.1)
936.1	976.1	1016.1	/	/	reserved
936.2	976.2	1016.2	75	0-255	Time for low PWM of electrical coupling in 40ms Steps

937.0	977.0	1017.0	32	0-255	Output Aspect 7 (AUX7-14), backward (see 4.1.1)
937.1	977.1	1017.1	/	/	reserved
937.2	977.2	1017.2	62	0-255	Buffering time SPP turn off delay, after losing track power
938.0	978.0	1018.0	0	0-255	Output Aspect 8 (AUX7-14), forward (see 4.1.1)
938.1	978.1	1018.1	/	/	reserved
938.2	978.2	1018.2	0-1	0	Output short circuit flag
939.0	979.0	1019.0	0	0-255	Output Aspect 8 (AUX7-14), backward (see 4.1.1)
939.1	979.1	1019.1	/	/	reserved
939.2	979.2	1019.2	63	0-255	Outputs short circuit protection level
	1020		/	/	SUSI Status Byte
	1021		0	0-254	CV memory-Bank selector
	1022		/	/	reserved
	1023		/	/	reserved
	1024		/	/	reserved