

Digital technology



Index

| | |
|---|----------------|
| 1. Introduction | page 2 |
| 2. Installation of decoder, speaker- and electrical couplers | |
| 2.1 Decoder installation | page 3 |
| 2.2 Sound installation | page 4 |
| 2.3 Installation of electrical couplers | page 6 |
| 3. Function output mapping | page 7 |
| 3.1 NEXT18 – decoder | page 7 |
| 3.1.1 NEXT18 – function outputs | page 7 |
| 3.1.2 NEXT18 – function button mapping | page 7 |
| 3.2 ECU (Electronic Control Unit / slave decoder) | page 8 |
| 3.2.1. ECU function outputs | page 8 |
| 3.2.2 ECU function button attribution | page 9 |
| 4. ECU CV – programming | page 10 |
| 4.1 Function mapping (Aspects) | page 11 |
| 4.1.1 Standard function mapping | page 11 |
| 4.1.2 Output Bit mask | page 11 |
| 4.1.4 Default factory configured Aspect overview | page 12 |
| 4.1.5 Example of function mapping settings | page 13 |
| 4.2 Effects for function outputs | |
| 4.2.1 Light intensity | page 13 |
| 4.2.2 Fade effect | page 13 |
| 4.2.3 Delayed ON and OFF outputs switching | page 13 |
| 4.3 Electrical Couplers (AUX12/13) | page 14 |
| 4.4 SPP installation | page 15 |
| 4.5 DC operation | page 15 |
| 4.6 Short circuit protection | page 15 |
| 4.7 Sound / SUSI Switch | page 16 |
| 4.8 CV table | page 17 |

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.

- 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. 66056.

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 HW02SW01 |
|-----------|----------------------|-----------------------|------------------------|

In addition, the index is also stored in CV940.2 (hardware) and CV940.3 (software), as long as the slave address 2 (897=2).

Otherwise, CV980.2&3 for slave address=3 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 | | | 2 | 1-3 | SUSI Slave Adress |
| 900.2 | 940.2 | 980.2 | 1 | | TILLIG Hardware ID |
| 900.3 | 940.3 | 980.3 | 1 | | 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.

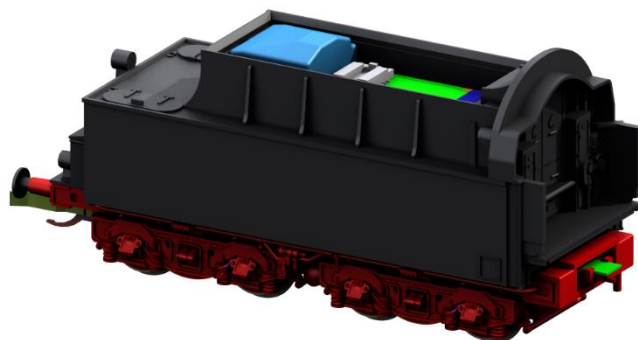
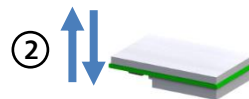
Step 3:

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. 66056** 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 retrofit a speaker, the boiler and run around must be demounted:

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.



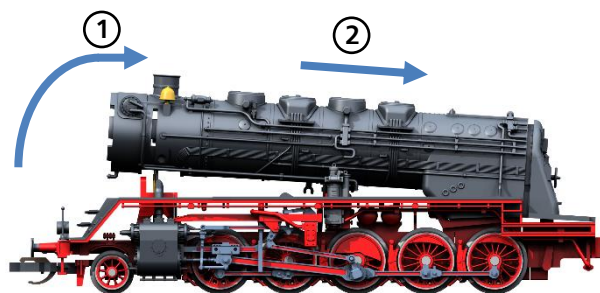
Step 2:

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 **boiler can be dismantled**. To do this, lift it slightly at the front and pull it off to the rear to release the attachment in the area of the firebox.



Step 4:

The last dismantling step is to **remove the runaround with kinematic including spring.**

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



Step 5:

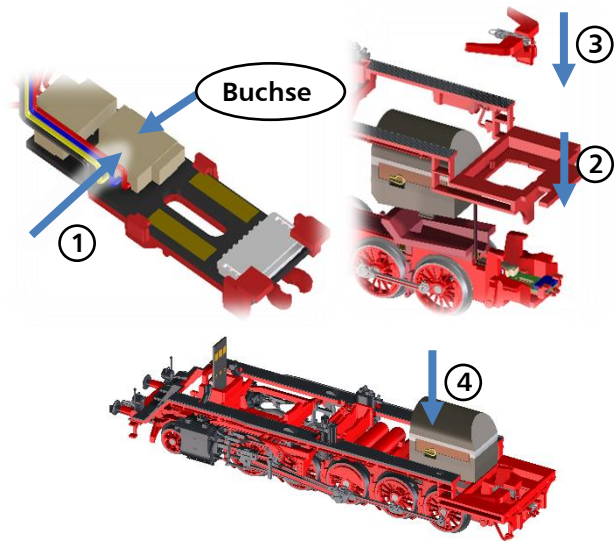
Now the **sound module with speaker can be installed.**

This is to be plugged into the free Micro-SUSI socket on the connecting circuit board.

The **runaround and the kinematic including spring** can then be **reassembled.**

Note: The SUSI cable must be in the area of the firebox before the circulation and must not be pinched.

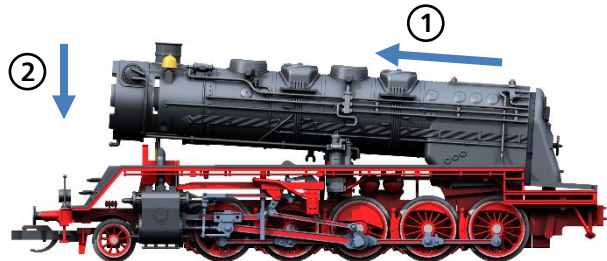
Finally, the **speaker box** is snapped into the **firebox.**



Step 6:

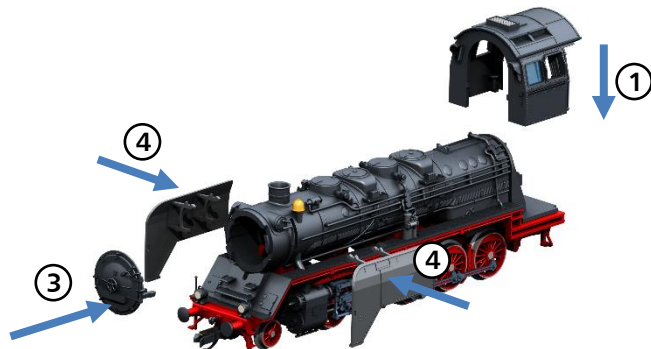
Next, the boiler can be reassembled.

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



Step 7:

Finally the driver's cab, the smokebox door and the wind deflectors are locked back into the boiler.

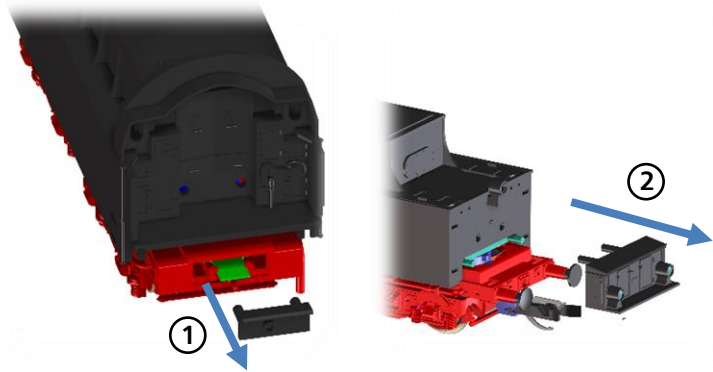


2.3 Installation of electrical couplers

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

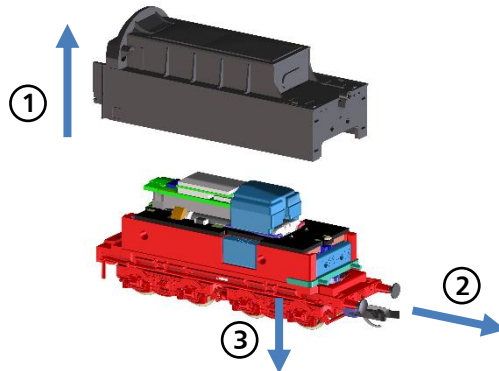
Step 1:

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



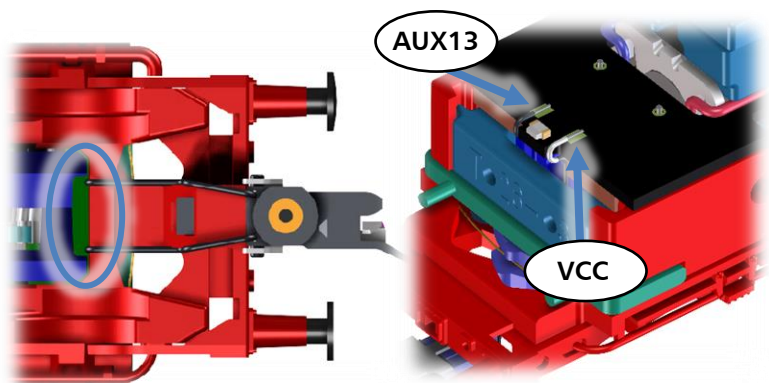
Step 2:

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.



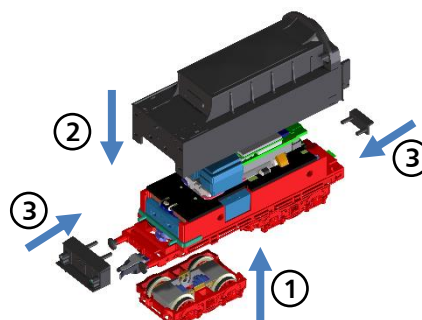
Step 3:

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**.



3. Function output mapping

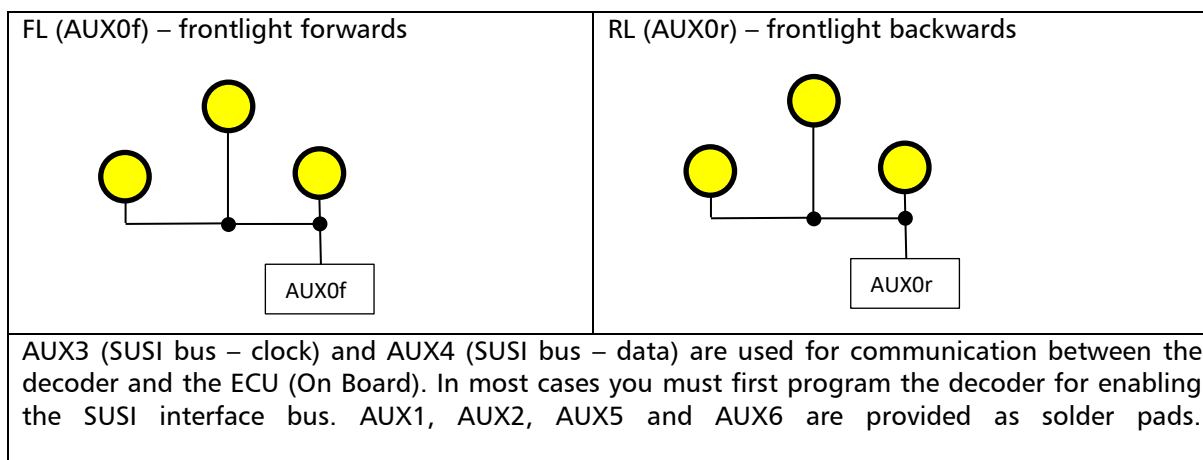
When using a third-party NEXT18 decoder, the function key assignment and the SUSI communication must be programmed by yourself (see 3.1.2). If you use a different NEXT18 decoder of your own choice, you will have to program the function button mapping (assignment) and turn on the SUSI interface bus by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

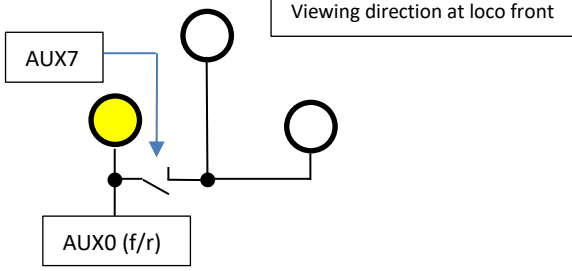
Note: When using third-party decoders, AUX0f+r ON must also be programmed/mapped for the function of the shunting light (front and back side ON) at F2 (bottom right). To do this, follow the operating instructions of your decoder.

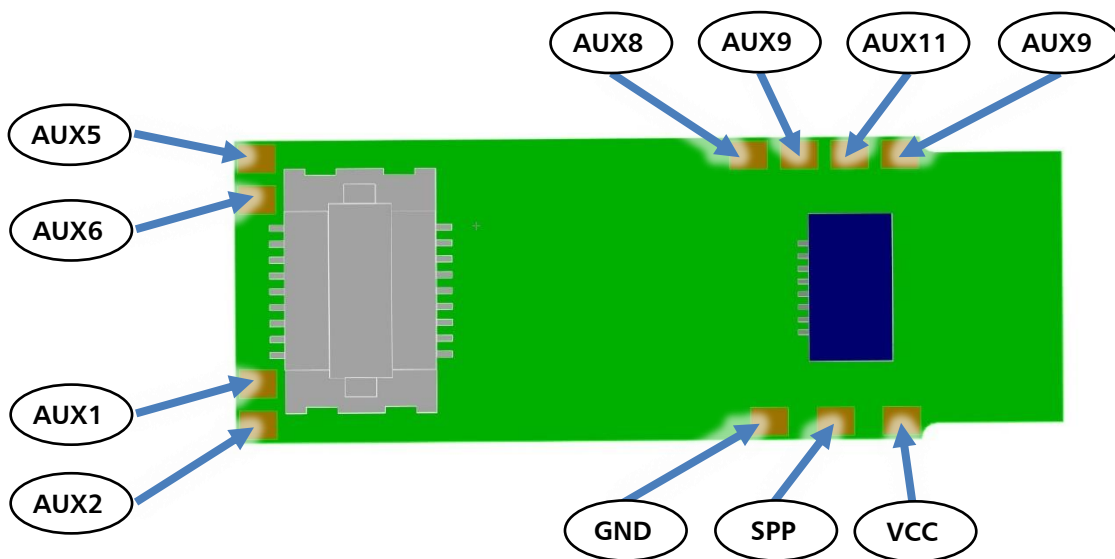
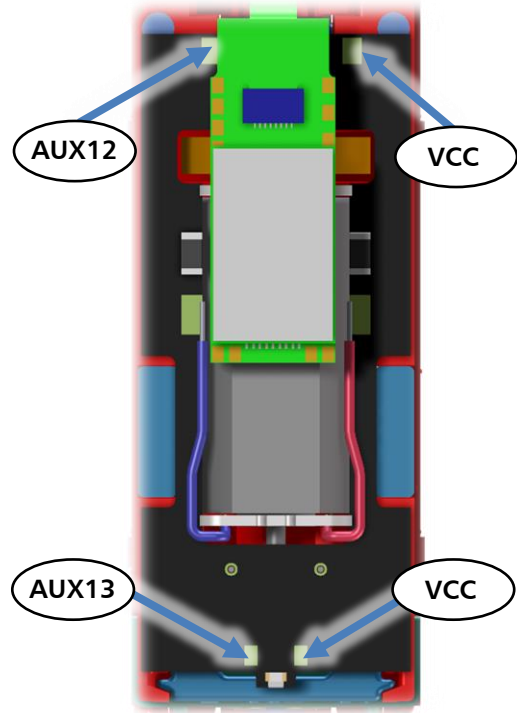
| | |
|----------------|--|
| F0 (F2 off) | Front light, driving direction-dependent |
| F1 (F2 off) | Rear light, driving direction-dependent |
| F0+F2 | Shunting light downright |
| F3 | Shunting gear |
| F12 | Electical decoupling driving direction-dependented (without function output attribution)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

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>  |
| AUX8 - Solder pad |
| AUX9 - Solder pad |
| AUX10 - Solder pad |
| AUX11 - Solder pad |
| AUX12 - Solder pad for electrical coupling front |
| AUX13 - Solder pad for electrical coupling back |



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 2 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 2.

The ECU is locked by delivery via the programming lock in CV942.3 and 943.3. 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 942 and 943 can be written. Only then, you can will be able to change the other CV's.

(step1: CV1021=3; step2: CV942=0; step3: CV943=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: CV942=0; step3: CV943=1)

To RESET the ECU to factory settings, write in the CV940.0=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 (CV955.0) to Aspect 8 (CV962.0) with their value. If no function key is to be assigned, a value from 29 till 63 must be written.

CV964.0-979.0 (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 CV964.0=4
- AUX7-14 for Driving direction BWD „AUX9“ defined in CV965.0=4
- Function button „F5“ defined in CV955.0=5

Aspect2: F6 controls AUX10.

- AUX7-14 for Driving direction FWD „AUX10“ defined in CV966.0=8
- AUX7-14 for Driving direction BWD „AUX10“ defined in CV967.0=8
- Function button „F6“ defined in CV956.0=6

Aspect3: F13 controls AUX14.

- AUX7-14 for Driving direction FWD „AUX14“ defined in CV968.0=128
- AUX7-14 for Driving direction BWD „AUX14“ defined in CV969.0=128
- Function button „F13“ defined in CV957.0=13

Aspect4: F7 controls AUX11.

- AUX7-14 for Driving direction FWD „AUX11“ defined in CV970.0=16
- AUX7-14 for Driving direction BWD „AUX11“ defined in CV971.0=16
- Function button „F7“ defined in CV958.0=7

Aspect5: F4 controls AUX8 (high beam).

- AUX7-14 for Driving direction FWD „AUX8“ defined in CV972.0=2
- AUX7-14 for Driving direction BWD „AUX8“ defined in CV973.0=2
- Function button „F4“ defined in CV959.0=4

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

- AUX7-14 for Driving direction FWD „AUX7“ defined in CV974.0=1
- AUX7-14 for Driving direction BWD „AUX7“ defined in CV975.0=1
- Function button „F2“ defined in CV960.0=2

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

- AUX7-14 for Driving direction FWD „AUX13“ defined in CV976.0=64
- AUX7-14 for Driving direction BWD „AUX12“ defined in CV977.0=32
- Function button „F12“ defined in CV961.0=12

Aspect8: Freely available

- AUX7-14 for Driving direction FWD „non“ defined in CV978.0=0
- AUX7-14 for Driving direction BWD „non“ defined in CV979.0=0
- Function button „non“ defined in CV962.0=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 CV962.0 the value 9 - this means that the Function F9 will control the Aspect8.
- For the forward direction - set Bit2 (AUX9) and Bit4 (AUX11) in CV978.0. Decimal value will be 20.
- For the reverse direction - set Bit3 (AUX10) and Bit7 (AUX14) in CV979.0. 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 CV945.0 – CV950.0 (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 CV954.0. 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 CV943.0 (Fade in) and CV944.0 (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 CV943.2 and 944.2 are using the same bitmask structure as in the table above. These two CVs are used for the delayed turn ON (CV943.2) and delayed turn OFF (CV944.2) 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 CV943.1 (turn ON delay) and CV944.1 (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 CV975.2, and the PWM signal value (intensity) is set in CV950.0 – front coupler or CV951.0 – rear coupler. These settings provide a proper switching-on operation for the electrical coupler.

In CV976.2 the **hold-on time** is set with a PWM value of CV950.2 – front coupler and CV951.2 - rear coupler. The frequency of the PWM signal is approximately 20 kHz, ensuring a proper operation.

One time unit in CV975.2 and CV976.2 is equivalent to 40 milliseconds. So a value of 5 in CV975.2 has the meaning of $5 * 40 = 200\text{ms}$, and the value of 75 in CV976.2 equates to $75 * 40 = 3\text{ seconds}$. After the defined time in CV976.2 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 CV942.0 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 CV977.2. One unit of CV977.2 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 CV979.2 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: $CV979.2 = 126 \cdot I[A]$. 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 CV978.2, which will be set to the value 1 (in normal condition, without errors, the value of the CV978.2 is 0). Reading the value of CV978.2 will inform us if there was a short circuit condition. The value of CV978.2 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.

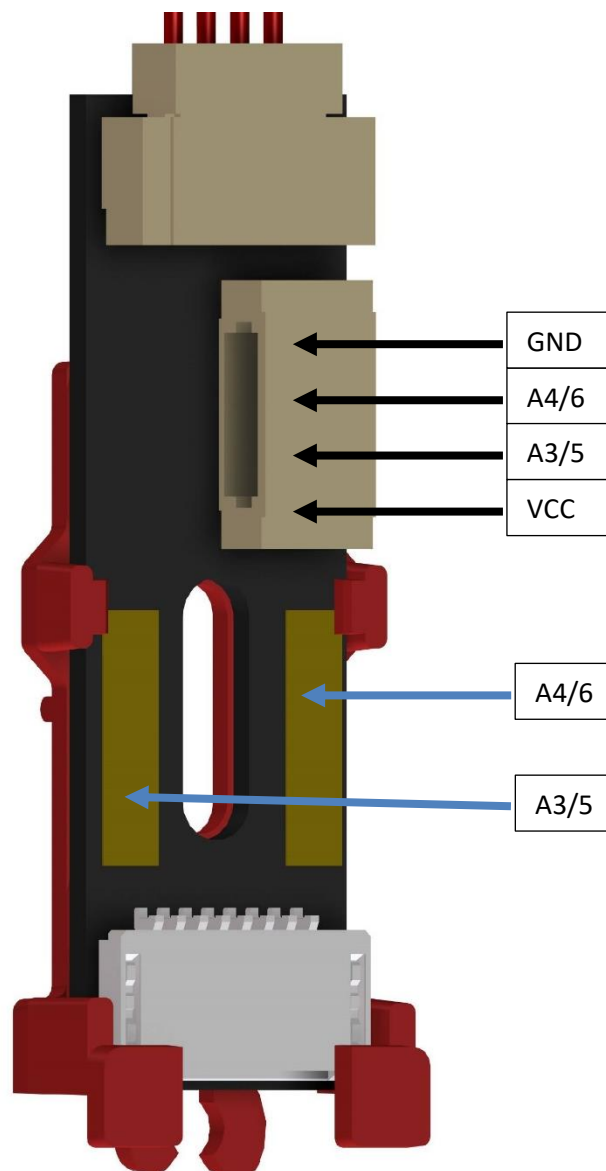
4.7 Sound / SUSI Switch

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.

CV942.1 = 0 for AUX5 / AUX6 (speaker connection)

CV942.1 = 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 CV942.1 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 | | 2 | 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 | 1 | / | 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 | 147 | / | 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: <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Bit 0</td> <td>0</td> <td>(0)</td> <td>Normal driving direction</td> </tr> <tr> <td>=</td> <td>1</td> <td>(1)</td> <td>Inverted direction</td> </tr> <tr> <td>Bit 1</td> <td>0</td> <td>(0)</td> <td>SUSI-direction used</td> </tr> <tr> <td>=</td> <td>1</td> <td>(2)</td> <td>FL/RL-direction used</td> </tr> <tr> <td>Bit 3</td> <td>0</td> <td>(0)</td> <td>Aspect priority level used (1-8)</td> </tr> <tr> <td>=</td> <td>1</td> <td>(8)</td> <td>Aspect priority level not used</td> </tr> <tr> <td>Bit 5</td> <td>0</td> <td>(0)</td> <td>AUX12 Standard PWM output</td> </tr> <tr> <td>=</td> <td>1</td> <td>(32)</td> <td>AUX12 Output for electrical coupling</td> </tr> <tr> <td>Bit 6</td> <td>0</td> <td>(0)</td> <td>AUX13 Standard PWM output</td> </tr> <tr> <td>=</td> <td>1</td> <td>(64)</td> <td>AUX13 Output for electrical coupling</td> </tr> </table> | 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 |
| 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 fornt 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 |