

Please Note:

This document is an unofficial translation.

These notes are not an exact copy but my own v2 interpretation of the ESU Smoke Unit manual. It has NOT been authorised or approved by ESU and used entirely at your own risk.

Read this manual before you begin. If there is anything you do not understand, do NOT proceed with the installation of the smoke unit

Steve Weeks

**Product numbers 54678 & 54679 are NOT plug & play retrofit units. They will only work with both the control pcb supplied and suitably modified sound projects.**

### **3. Important notes - please read this first!**

The smoke generator is intended exclusively for use with electric model railroad layouts using DCC and only operated with the components described in this booklet:

- The smoke generator gets very hot (over 100 ° C) during operation. Avoid touching and select the mounting location so that there can be no direct contact with other components or damage will occur. (See 5.)
- Never overfill the smoke unit. (See 5.1)
- Never turn the smoke generator upside down once filled. Hot steam oil may cause burns.
- All connection work must be carried out only with the operating voltage disconnected.
- Adhere to the presented principles of this manual when connecting the unit.
- Protect from humidity and moisture.
- No cable should ever touch metal parts of the locomotive.
- Make sure that no cables are squeezed or stray when reassembling the Loco.

### **4. General properties**

The two ESU smoke generators provide realistic smoke and steam clouds for your models. An integrated electronic system controls the fan motor as well as the heating of the smoke generator. A sensor maintains the desired temperature, regardless of rail voltage and level to prevent burn-out when the tank is empty.

The smoke generator can be used for both steam and diesel locomotive models

The smoke generators are optimized for use with our LokSound XL V4.0 decoder. The desired amount of smoke can be synchronised exactly to the sound sequence. No settings or programming of the smoke unit pcb must be made once connected to an ESU decoder.

The smoke generator can be connected to other decoders through the SUSI interface. In this mode, fewer options are available. The programming is done in this case through SUSI-CV programming.

#### **Scope of delivery**

So you can find the smoke generator best for your model, two versions are available.

#### **4.1 54678 Gauge "0"**

The "small" smoke generator is intended with its dimensions of 40 x 25 x 29 mm for small gauge 1 and gauge 0 locos. The electronics are attached separately on a harness from the mechanics.

Following parts are included:

- Smoke generator with connected, separate electronic board
- Wiring harness
- PVC hose with a diameter of 7mm

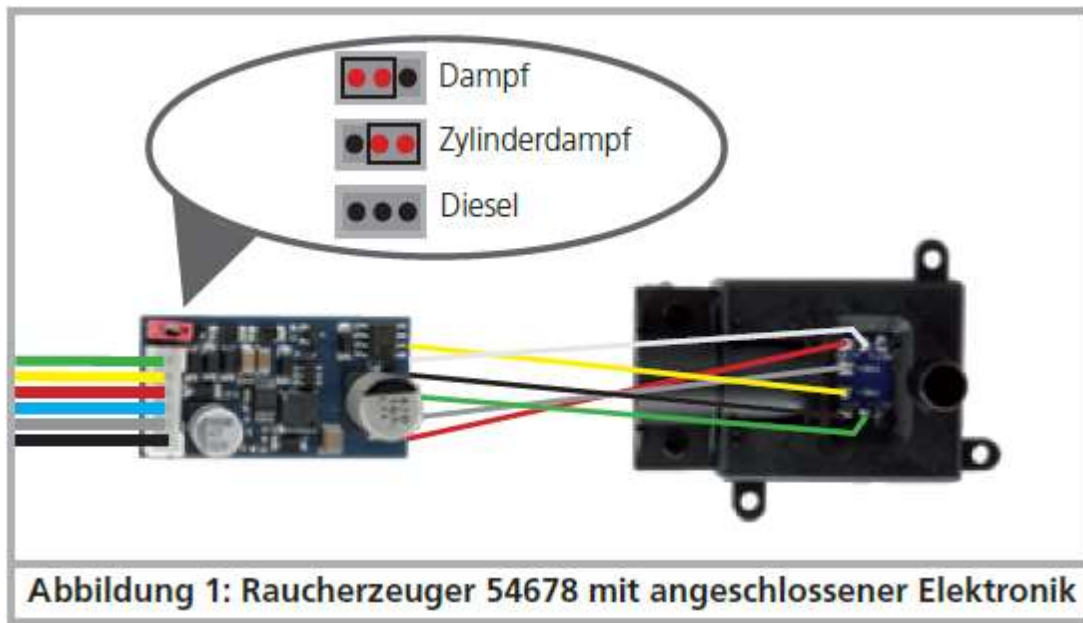
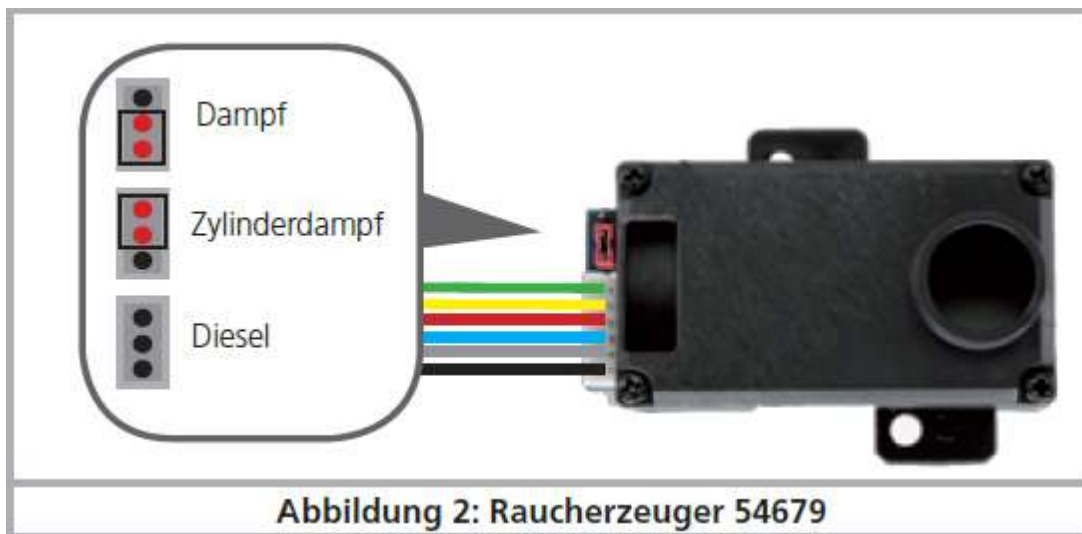


Fig 1 The operating mode can be changed between "Diesel" and "Steam" by means of a jumper.

#### 4.2. 54679 Gauge "1"

The 'Big' smoke generator is compatible with its dimensions of approx. 50 x 28 x 30 mm for many LGB<sup>®</sup> and PIKO<sup>®</sup> locomotives. He may request in connection with LokSound XL v4. 0 decoders be used in the operating mode "Cylinder steam". For this, the following parts are supplied:

- Smoke generator
- wiring harness
- PVC hose with a diameter of 13 mm for chimney / exhaust
- PVC hose with a diameter of 6 mm for cylinder steam
- "Manifold" to redirect the smoke flow to the cylinders
- Suitable screws for "Manifold"



If you want to use the smoke as cylinder steam, you must replace the normal cover with the enclosed elbows. The small hole above serves only to be filled and must be closed during operation at its sole discretion.



"Steam" and "Cylinder steam" can be changed between the operating mode "Diesel", by means of a jumper.

### 5. Installation of the smoke generator

First, install the smoke generator at a suitable point under the chimney and exhaust. The distance between the smoke generator and housing opening should be as low as possible. However a minimum distance of (approx. 1 cm) to plastic enclosures must apply. Pay attention to the exhaust duct and keep as straight as possible so that condensed smoke can drip back into the tank.

To make a tight joint between the housing opening and smoke generator, you can use the provided silicone tube and shorten accordingly.

#### 5.1 filling of the system

Fill from above through the exhaust outlet. Use only the ESU smoke distillate with ESR type. No. 51990. Using other liquids can cause paint damage, cause a blockage of the system or destruction of the heating unit as a result of residue formation. **Use the smoke function only under supervision in a well-ventilated room. The maximum filling quantities are as follows:**

**2.5 ml for the "small" smoke generator 54678. Run time period of approximately 8 minutes.**

**5.0 ml for the "big" smoke generator 54679. Run time period of approximately 10 to 15 minutes.**

Never exceed the maximum capacity of the system. It is better to fill to little than to much. Remember, even when the tank is dry, the smoke generator itself cannot be damaged ! To prevent the leakage of smoke distillate when filling your system, make sure:

- The model is level.
- You put the distillate in the smoke generator and NOT in the gap between the locomotive body.
- You never turn a filled locomotive on its side or upside down!
- You only fill to the max level allowed.

## 5.2. Connection cable

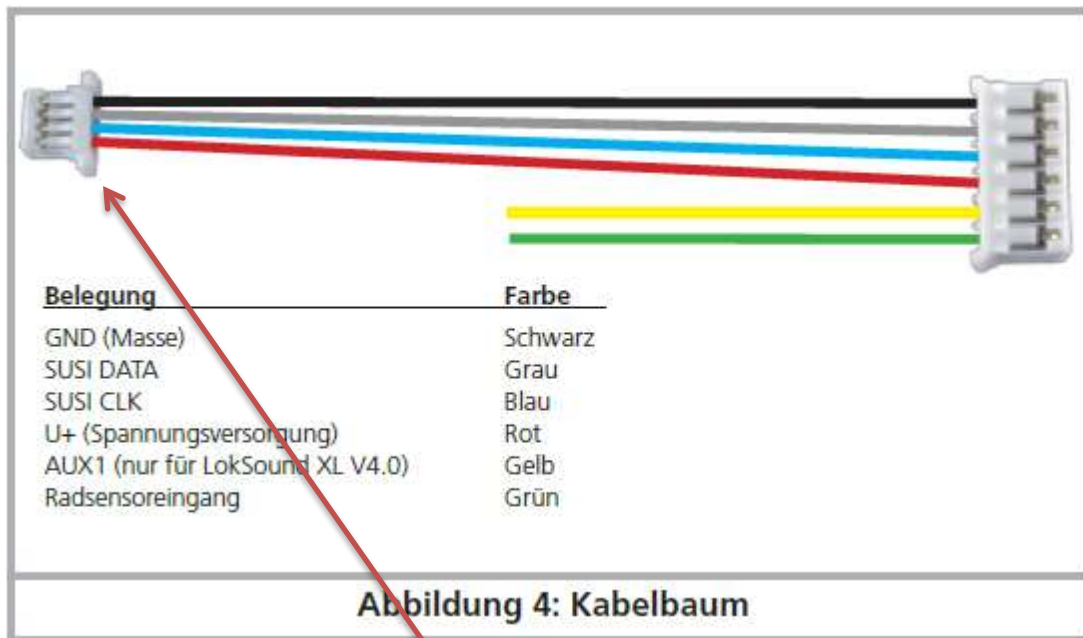


FIG 4 Only the supplied wiring harness is used for connection. It is connected to the 6-pin connector directly on the printed circuit board of the smoke generator. At the other end, you will find the 4-pin connector of the SAR as well as two individual cables.

The green cable, supplies the smoke generator with steam impulses. It can come directly from a HALL sensor or produced (preferred) directly from the decoder. In the operating mode 'Diesel', this cable is not required.

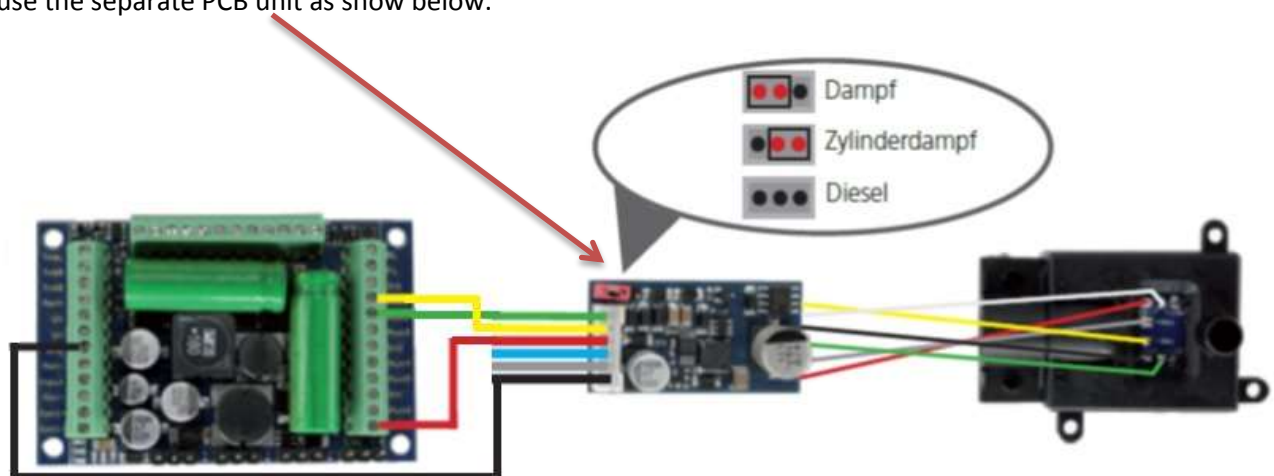
The yellow cable, supplies the smoke generator with commands when it is connected to a LokSound XL V4.0 decoder. If you use a third-party decoder, this cable is not required.

## 5.3. Connection to ESU-decoder

When connecting to an ESU LokSound XL V4.0 decoder the 4-pin connector of the wiring harness is not required. Make the cable connections as follows:

### Connecting 54678 smaller smoke unit to the ESU XL decoder

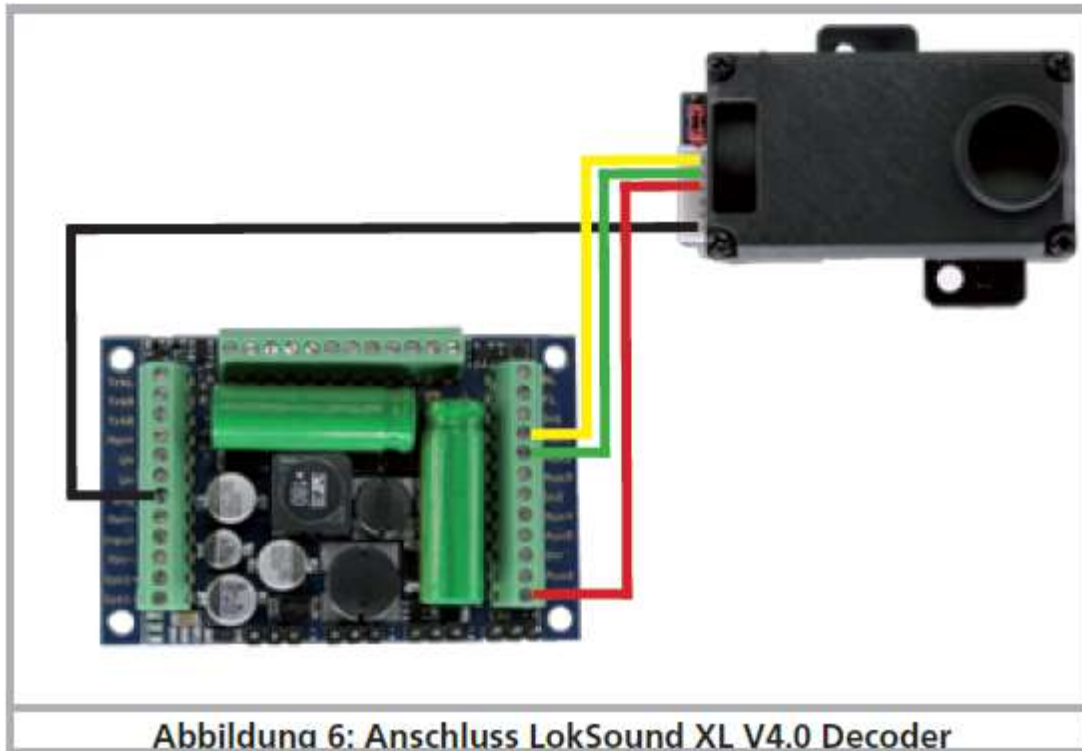
When connecting the smaller smoke unit 54678 to an ESU Loksound XL V4.0 decoder **YOU MUST** retain and use the separate PCB unit as show below.



**Connection shown with item 54678 (Note: Blue & Grey wires not required. Isolate with heat shrink)**

## Connecting 54679 larger smoke unit to the ESU XL decoder

When connecting the large smoke unit 54679 to an ESU Loksound XL V4.0 decoder the 4 pin connector of the wiring harness is not required. Make the cable connections directly to the chip as shown in Fig 6.



### Connection shown in Fig. 6. With item 54679

The smoke generator yellow cable receives its commands. This must be connected to the AUX1 output of the decoder. Only the AUX1 output is able to provide the data after it is configured. (see section 6.1).

Connect the Green wire to any AUX port (aux 2 to 10). This output is configured as "Steam shock triggers" and ensures a steam synchronously to the sound. (AUX2 is used in the example.)

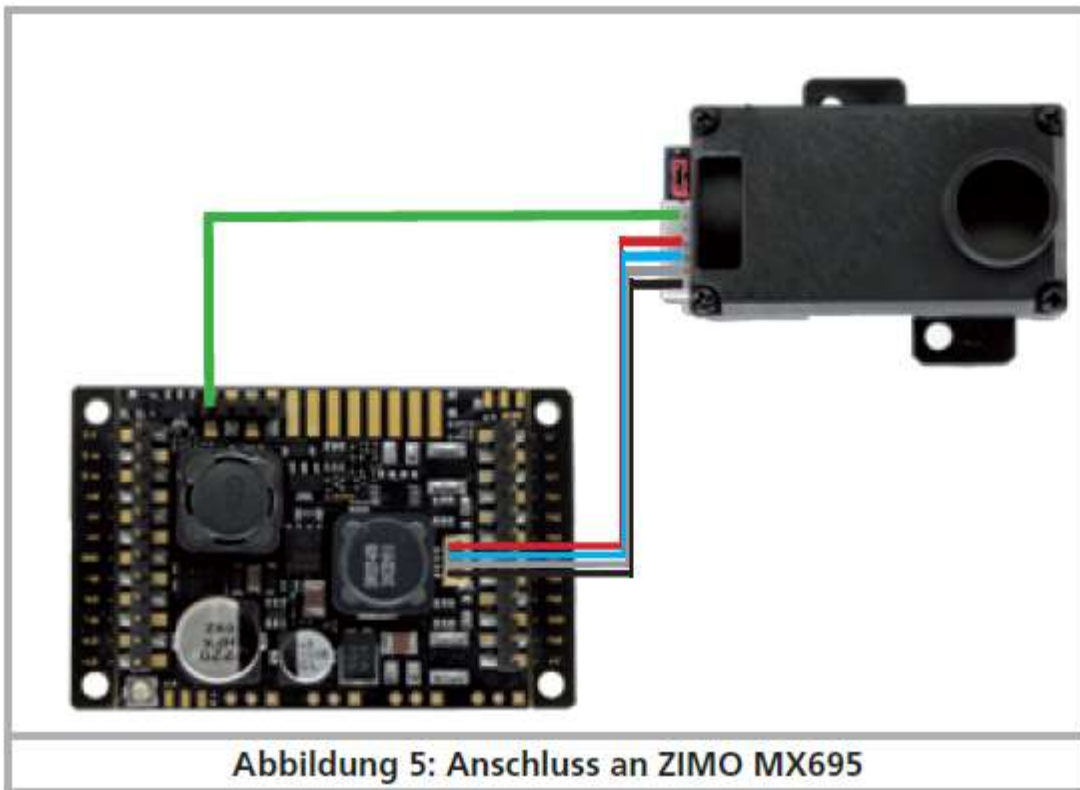
The LokSound decoder must be programmed as described in section 6.1.

### 5.4. Connection to other decoder (SUSI)

Of course the ESU smoke generator can be used with decoders of other manufacturers. This is exemplarily shown for one common type.

#### 5.4.1. ZIMO MX695 / MX696

The SUSI plug of the module is as usual directly connected to the decoder. For the steam shock triggers, ZIMO has provided a special connection.



For this output to work, you must correctly set the CVs. In particular, the output of a function (here: FA2) are defined as "Heat level".

Sample programming for steam generator on FA2:

	Dampf	Diesel
CV 128	72	80

You can change various properties of the smoke generator by SUSI-CVs after the programming of the decoder. Section 6.2 gives information.

## 6. Programming of the smoke generator

The smoke has several settings with which you can adjusted the function model. Depending on what decoder you are using different settings must be made.

### 6.1. for ESU LokSound XL decoder

You can configure the smoke generator extensively for your purposes. To do this, an ESU LokProgrammer 53451 is required. This allows you to make changes within the sound sequence. You must first load the desired sound project in the LokProgrammer and then change settings. Sound and smoke control work so closely together, otherwise no results will be possible. This is displayed as an example in the file 56529 (BR 50) with all the required settings.

If other sound projects are used you must perform ALL changes as necessary, even the settings.

### 6.1.1. Basic settings

Initially the AUX1 output must be set so, that it provides the data for the smoke generator instead of a normal function output.

Select output "Aux 1 [1]" in the "Function outputs" tab and select mode "External controlled Smoke Unit"  
Then, click the last entry.

The screenshot displays the 'Change decoder settings' window. On the left is a navigation sidebar with icons for 'Drivers' cab', 'Read / Write CVs', 'Decoder', 'Information', and 'Sound'. The main area is divided into two columns. The left column contains icons for 'Address', 'Analog settings', 'Compatibility', 'DCC Settings', 'Driving characteristics', 'Function mapping', 'Function outputs' (highlighted in blue), 'Function settings', and 'Identification'. The right column, titled 'Physical output configuration', shows the following settings:

- Output:** AUX1 [1] (dropdown menu)
- Name:** (empty text field)
- Power on delay: [CV276.3:0 (CV32=0)]**: 0 s (slider and numeric input)
- Power off delay: [CV276.7:4 (CV32=0)]**: 0 s (slider and numeric input)
- Enable function timeout [CV277 (CV32=0)]**
- Time until automatic power off: [CV277 (CV32=0)]**: 0.41 s (slider and numeric input)
- Output mode (effect):** External controlled smoke unit (dropdown menu)
- Radio button options for output mode:
  - KM1 BR 41 / BR 44
  - KM1 (other)
  - KISS
  - ESU Smoke Unit (Gauge 0, G)

Fig 8



Then, the output with the green cable (This example is AUX2) must be configured, so that a steam shock trigger is sent.

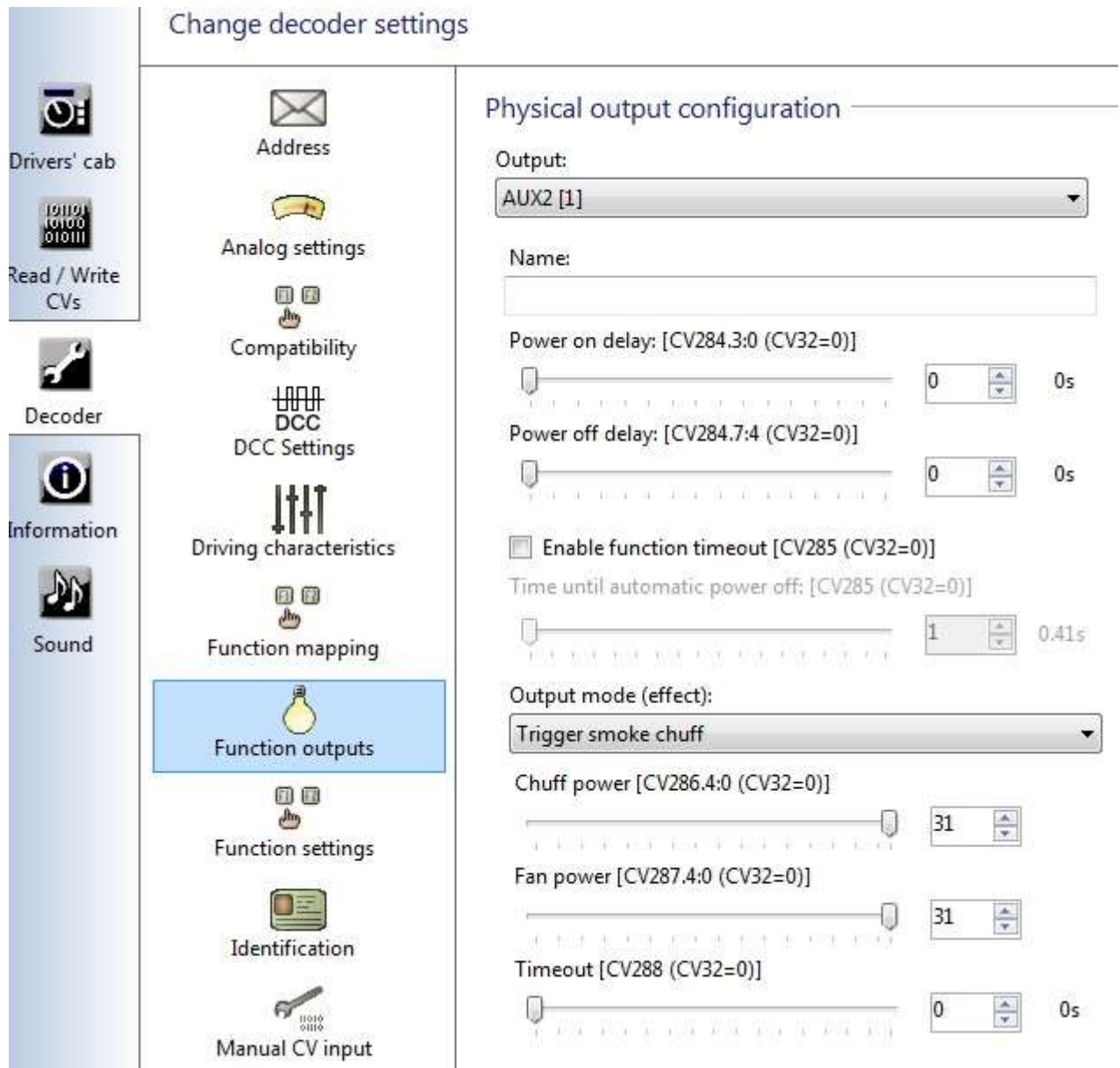


Fig 9

Choose the mode "Trigger smoke chuff" and make the "strength of chuff " and the "strength of the Fan" a value of 31, the "timeout", however, to 0.

Now, you must define the function key with which the smoke generator is to be inserted. This is done in the register "Function mapping". The logical function "ESU smoke unit" must be selected in the mapping line of the desired function button. In our example this is the case with the F4 key.

### 6.1.2 Flow of sound settings

The most important and most comprehensive settings are to make "Sound" in the tab strip. Adjust the desired heating temperature and fan speeds in the sound. This is only for a few factory projects.

Select first from the list of available sounds slot 1

You will find the interesting settings properties in the section "ESU smoke generator".

**Fan:** Here you can set the speed of the fan motor. The greater the faster the fan and the more smoke turns the values will be ejected. A value of 255 means "Full throttle". You must determine the model depending on what values are appropriate. High fan speeds require also usually a higher temperature, so the desired amount of smoke is also produced.

**Temp:** Here you can set the temperature in degrees Celsius. Higher values produce more smoke, but lead to high thermal loads of the smoke generator. The maximum temperature of the smoke generator is also internally limited and dependent on the mechanics. Therefore the potential value of 255 ° C will not be reached.

**Filter:** Here you can set how fast the fan motor to respond to changes to the desired speed. A value of 0 ensures a direct adaptation, while higher values make for a smooth transition. This can have a sometimes more realistic smoke effect.

**Steam:** This checkbox must be used everywhere where hits are played. Only when ticked, will the LokSound decoder instruct the smoke generator, to produce a chuff, otherwise, a continuous stream is emitted (diesel mode).

Now, you have to enter sensible values for each individual State. We recommend the following procedure:

STOP condition: Low values should be entered here, E.g.

Lüfter	59
Temperatur	165
Filter	0
Dampfstoß	Nicht gesetzt

States SD ("stop to drive"), DS ("drive to stop"): here, you can start with the following values:

Lüfter	42
Temperatur	235
Filter	0
Dampfstoß	Nicht gesetzt

States 'Coast' and 'DCX'

Lüfter	42
Temperatur	155
Filter	0
Dampfstoß	Nicht gesetzt

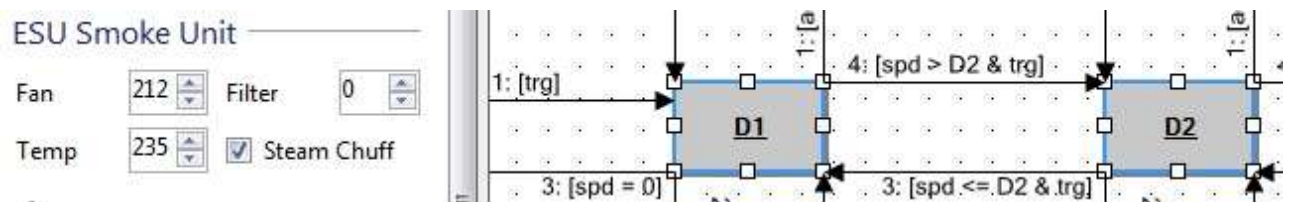
The actual speeds are referred to in all ESR projects with DX. Some sound projects include D1 to D4, others go to D8. These are the normal steam. Here, you should experiment with the following values:

Lüfter	212
Temperatur	220
Filter	0
Dampfstoß	Gesetzt

For the acceleration levels A (mostly from A1 to A4, A8, sometimes), you should pretend higher calorific values and fan speeds, E.g.

Lüfter	245
Temperatur	235
Filter	0
Dampfstoß	Gesetzt

You can select multiple States at once by holding down the "shift" key (often also called "shift" button) and then check the box. If you now change the fan and temperature values, these changes apply to all currently selected States.



If using both Slot 1 & 2 for drive sounds only make changes in Slot 1 as Slot 2 is just a copy.

### 6.1.3. Optimization of function

In the last step, you can optimize more options of the smoke generator in the 'Smoke generator' tab. Figure 14 shows all the available options.

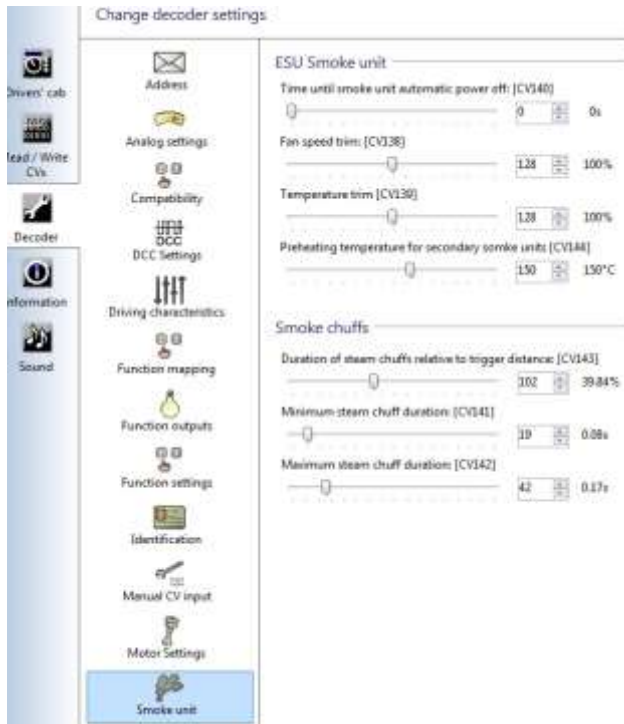


FIG 14

#### The automatic shut off time:

Here you can set whether the smoke generator shuts down automatically after a certain time. Normally a time of 10 minutes is useful. This prevents an excessive current consumption when the tank is empty. If the automatic shut-off time out occurs, the smoke generator must be switched off and on again to re activate.

#### Adjusting the fan speed:

Here you can change the fan speed relative to the values set in the sound.

#### Adjustment of the heating temperature:

Here, the heating temperature relative to the values set in the end of the sound can be changed.

#### Preheat temperature for secondary smoke generators:

On request the cylinder steam can be pre-heated in order to ensure a faster function. Keep in mind that this pre-heating is always active when the smoke generator is turned on and according to current needs.

#### The steam duration:

Depending on the wheel diameter and installation situation, it may be that the pulses are too short. In this case, increase the value. The duration is specified in relation to their ratio in %. Therefore, a value of 50% ensures hits, which are half as long as its distance.

### Minimum duration of steam:

No matter how fast the wheel pulses, the minimum length of the steam will never be below the value set here.

**Maximum duration of a steam:** Here you can limit the length of the steam.

#### 6.1.4. Cylinder steam function (Drain cocks)

You can adjust the "big" smoke generator 54679 so that it works for either (Cylinder Steam) drain cocks or (Steam) Chuffs (See figure 2). In practice two smoke units are required and must be wired as follows:

Red wire to U + terminal of the decoder, Black wire to the GND terminal of the decoder, Yellow wire to AUX1 terminal of the decoder.

Note: Only the Green wire from the (Steam) chuffs smoke unit is required to provide a trigger and wired to a spare AUX output. No green wire is needed for the (Cylinder steam) drain cocks.

You must set appropriate values for the temperature and fan speed (Cylinder steam) drain cocks, in the aux sound slot. In our example this is the sound lot 9 (See figure 16).

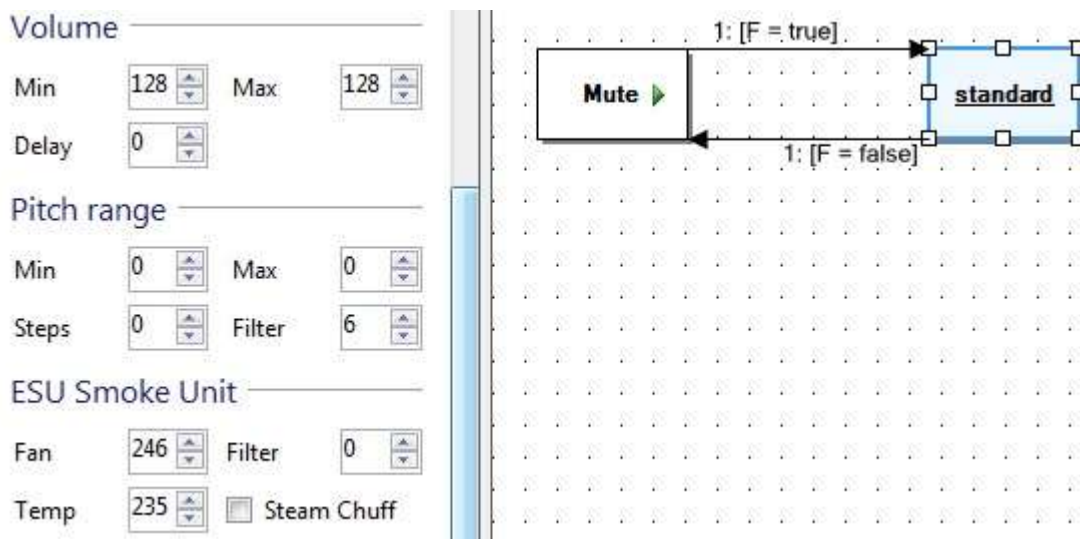


FIG 16

Make sure the CV values as well as the sound are written to the decoder. The smoke settings are written only with the sound data.

#### 6.2. For other decoders (SUSI)

When operating with other decoders, usually only the current speed level, as well as the State of the function keys are transmitted via the SUSI interface. The smoke generator uses this data in conjunction with the steam-pulses and the required operating mode to "sync together". ESU smoke generators have some SUSI CVs. Once you have connected the smoke generator, you need to program these matching CVs. This is also done on the programming track like with 'normal' CVs. The decoder usually passes the SUSI-CVs to the smoke generator. This way it can also be read.

### 6.2.1. Function button

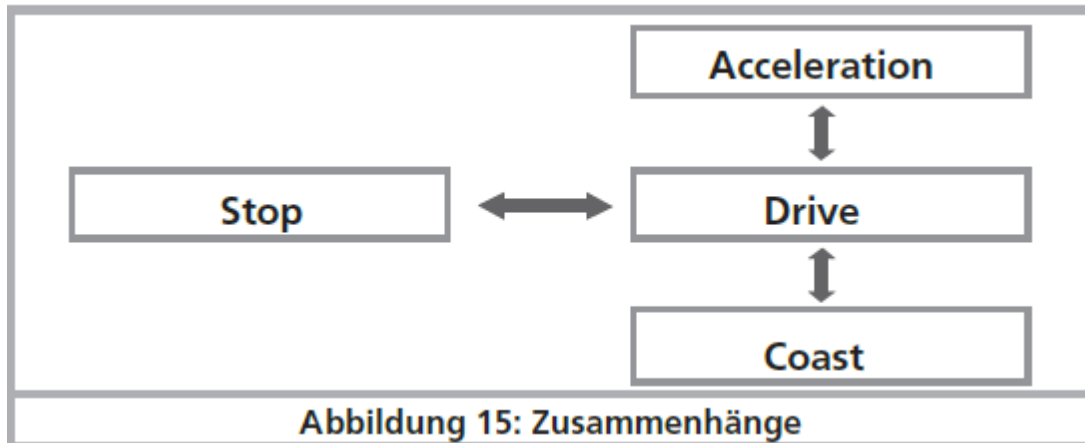
First, you must set up the smoke generator to work with the function key.

Setting the desired key in CV 902. The factory-set value "1" stands for F1.

### 6.2.2. Heating and fan values

Smoke generator knows in the SAR mode 4 States:

- Stop: the model, it is active
- Drive: the model drives
- Acceleration: the model accelerates
- Coast: The model rolls (control was turned back drive out of State)



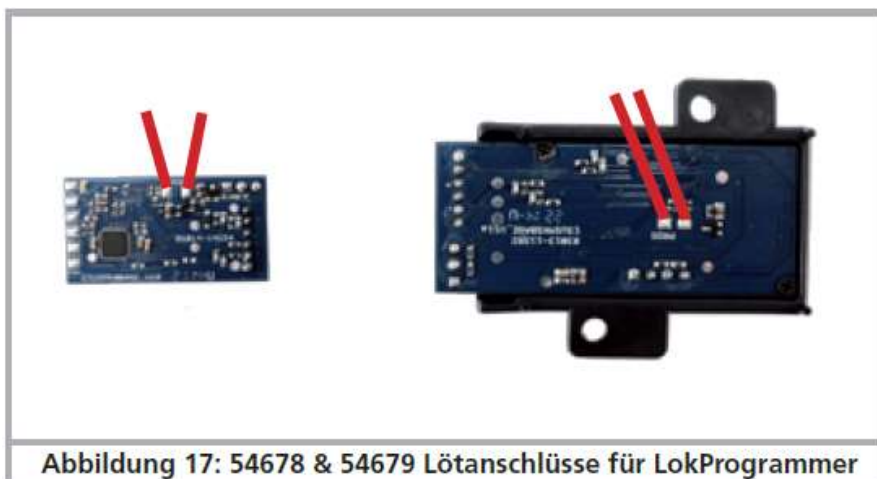
The link is as follows: For each State, the desired temperature and fan speed can be adjusted. Section 8 provides information on the numbers of CV.

In addition is adjusted still, when the transition from drive to acceleration and drive to coast can take place. The appropriate threshold defining the acceleration or brake values, from which the smoke generator requires to switch between modes.

Finally, the maximum steam shock length and the length of the steam in relation to their distance can be set in the operating mode the minimaleund SUSI.

### 6.3. Firmware update with the LokProgrammer

The ESU smoke generator can be uploaded with new firmware via the ESU Lokprogrammer. To do this, the two separate soldering connections are available. These are marked with "PROG" see Figure 17.



## 8 list of SUSI-CVs

CV	description	factory-set value
900	manufacturer ID	151
901	version number	0
902	function button to turn the smoke generator	1
903	State stop - temperature	175
904	state drive - temperature	190
905	acceleration - temperature	210
906	State coast - temperature	180
907	State stop - fan speed	30
908	State condition to drive - fan speed	80
909	State acceleration - fan	120
910	State coast - fan speed	40
911	threshold transition drive <=> acceleration	3
912	threshold transition drive <=> coast	3
913	minimum duration of steam	20
914	maximum duration of Dampfstoße	80
915	period of steam relative to trigger pulses	50