

Class V200

Instruction manual

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RailCom
plus

M4



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1. Declaration of conformity

We, ESU electronic solutions ulm GmbH & Co. KG, Edisonallee 29, D-89231 Neu-Ulm, Germany, declare in sole responsibility that the product Product description: V200

Part number: 31080, 31081, 31082, 31083, 31084, 31085, 31088

complies with all relevant regulations of the Directive for Electromagnetic Compatibility (2004/108/EG). The following harmonised standards have been applied:

EN 55014-1:2006 + A1:2009: Electromagnetic Compatibility - requirements for household appliances, electric tools, and similar apparatus - Part 1: Emission - Product

EN 55014-2:1997 + A1:2001 + A2:2008: Electromagnetic Compatibility - Requirements for household appliances, electric tools, and similar apparatus - Part 2: Immunity - Product family standard.

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V200 007, the second locomotive out of the series production, in service in the Emsland pulling a light express train. Picture: Slg. Rolf Wiemann.

2. Prototype

The class V200 was THE locomotive face of the German Railways (Deutsche Bundesbahn - DB) during the 1950-ties. No other diesel locomotive coined the image of the young DB as much as the long locomotive with the characteristic aluminium strips along the sides that merged to a stylised "V" at the front and rear. In their early days these locomotives were often hauling high class (light) fast trains whose consist was made up of blue or green express train coaches.

As early as shortly after World War II the DB, founded in 1949, intended to change its tractive power also for medium weight passenger service and freight trains.



V200 076, one of the last V200 delivered is pulling the famous Rheingold train. Picture: Slg. Rolf Wiemann

Prototype

A four axle diesel hydraulic locomotive with a maximum speed of 140 km/h was also on the drawing boards of the DB. The type designation V200 simply indicated the required power of the diesel engines, namely 2000 HP. Since diesel engines with that power rating were not yet available at the time, the DB decided jointly with Krauss-Maffei, the responsible locomotive manufacturer, to build a locomotive with two power plants. Various auxiliary units were also found in the five units of the class V80 locomotives manufactured as from 1952 as well as in the rail cars VT08 and VT12.5. The latter also had the same primary power plant as the V200, because the 800 HP engines of the V80 were considered insufficient for the intended range of use. While the engines of the pre-series production of the V200 built commencing in 1953 were set to 1000 HP, the series production V200 locomotives were equipped with 12-cylinder engines generating 1100 HP at 1500 revs/min. These power plants were supplied by Daimler-Benz (MB 820 Bb), MAN (12 V 18/21) or Maybach (MD 650). The latter were the most

commonly used power plants for the V200. Since the DB had no practical experience with such large diesel locomotives for mainline service, the five pre-production models were subjected to an extensive test program including hauling regular trains. Thus these locomotives were running up to 722 km per day. V200 005 was sent on a one-month presentation run to Turkey, Greece and Yugoslavia amongst others travelling about 10,000 km in one month.

In September 1956 the delivery of the serial production models started with V200 006. Their appearance differed due to a modified roof ventilator system, smaller engine compartment windows, the installation of the third headlight above the cab windows and the covered openings above the lower headlights. A Hagenuk steam boiler located at the centre of the locomotive served as power source for train heating capable of heating an express train with twelve coaches. One peculiarity was the multiple-unit control system version 1949 of all V200.0 facilitating double headers and push-pull service. Only



The ESU prototype V200 015 is arriving at Hamm train station pulling a through train. Picture: Klaus Grunwald, Collection Rolf Wiemann



In April 1980, 220 022 is still carrying the characteristic aluminum stripes. In the 1980s, this engines was – along with others – rented to the Danish State Railway (DSB) Picture: Rolf Wiemann

two of the potential manufacturers, namely Krauss-Maffei (V200 001 – 005, V200 026 – 086) and MaK (V200 006 through 025) built and delivered the 86 units to the DB. The MaK locomotives could easily be recognised by the somewhat shallower “V” at the front and rear compared to the Krauss-Maffei locomotives. Initially the series production V200 locomotives were stationed at the depots (BW) in Frankfurt-Griesheim (15 units, Hamburg-Altona (19), Hamm P (32) and Villingen/Black Forest (20). In their early days the V200 were well appreciated for their high degree of availability and reliability. However, since the DB tended to display the new level of quality achieved with the V200 compared to the class 01.10 steam locomotives by realising shorter travelling times, the number of break downs due to regular overload became more frequent. Furthermore the DB had decided to increase the permitted maximum speed on certain lines from 120 to 140 km/h causing the V200 to continuously run at full load resulting in more frequent damage to the engines and the power transmission. In the mountainous region of the Black Forest the locomotives had

to haul heavy trains for which they originally had not been dimensioned. Again the only drawback of this locomotive design became apparent – the locomotives were simply underpowered. Ultimately this led to the development of a more powerful version of the V200 (2700 HP) that were built by Krauss-Maffei and numbered 101 through 150. Delivery commenced in 1962.

After commissioning the latest series, the older V200 were renumbered as class V200.0. Of course a number of modifications were implemented over time. The V200 056 through 086 were equipped with larger front doors ex factory and the very conspicuous lettering “Deutsche Bundesbahn” was replaced with the simple DB logo on the sides. Subsequent modifications encompassed the closing of the water inlet hatches, the removal of the covers of the fuel inlets, the installation of Indusi magnets (inductive train safety device) and the decoupling of the bogies from the chassis. As from the early 1950-ties the Aluminium decorative strips were removed and instead a new decorative line was painted as

Prototype



220 056 belongs to the group of locomotives equipped with enlarged front doors. It is approaching Osnabrück train station. Picture: Rolf Wiemann

border between the red and the grey part of the body. Since these decorative strips were applied uniformly in the Krauss-Maffei style, there were only a few locomotives in 1980 that travelled with the distinctive "V" across the country. The prototype of the ESU model class 220 022 manufactured by MaK was still bearing the typical MaK "V". The 220 022 also was one of the 19 locomotives of this class that were rented to the Danish State Railways (DSB) in order to overcome their shortage of motive power. One can admire the new livery, introduced in 1974, with ocean blue and ivory as the base colours on several V 200 locomotives. The reason why they were occasionally called "Easter eggs" is due to the fact that the designer "invented"



The ocean blue cream colored 220 060 is arriving Wieren train station at april 4th, 1983. Picture: Rolf Wiemann

the rather boring horizontal ivory strip around the entire body.

Since the DB started decommissioning the class 220 locomotives as early as 1978, these only twenty-year-old locomotives were put up for sale and were offered to other railway companies. A total of 30 locomotives were sold to clients in Italy, France (Algeria) and Spain. In Algeria and Spain they were used for construction and maintenance service while the Italian Ferrovie Emilia-Romagna (FER) also used them in regular service. An exception represented the seven locomotives sold to the Swiss Federal Railways (SBB) in 1986, which have been considerably modernized at the works of the Regentalbahn prior to their handover. The most noticeable modifications were the conversion of the third headlight and the different exhaust system with large sound absorbers. With the exception of the prototype of the ESU model, the 18462, all locomotives, known as the Am 4/4 in Switzerland, returned to Germany after their service period of ten years at most. In 1999 the Eisenbahnen und Verkehrsbetriebe Elbe-Weser GmbH (EVB) purchased Am 4/4 18466 (ex 220 053) and put it into freight service in Northern Germany. In 2006 the EVB sold this locomotive to the Brohltal-Eisenbahn (BE) where it was renumbered to D9 and where it is still hauling freight trains. Since 2007 the locomotive bears a very distinctive green livery with identical boundaries between the areas of different colours exactly as was the case with the classic DB paint scheme.



After returning from Switzerland, 220 053 is used by the Brohltal-Eisenbahn today servicing freight trains mainly. Picture: Rolf Wiemann



Drivers cab of V200 033, which is owned by the Hamm Train Museum today. Picture: Jochen Fricke

3. Model

3.1. Important remarks - please read this first

Congratulations to your purchase of the H0 diesel locomotive V200. Your H0 model offers various innovative functions. This manual provides a step by step insight into the features of the V200. Therefore we have one request:

Please read this manual prior to operating the model carefully. Although the model is quite robust, inappropriate handling could lead to injury of the operator or to damage of the locomotive. Do not indulge in "costly" experiments.

- This locomotive is not a toy and should only be operated under supervision.
- Please make sure that the room has adequate ventilation when operating the smoke generator continuously!
- Keep the smoke distillate away from children. It contains substances that may damage your health if consumed. In case of contact with your eyes consult a doctor immediately.
- Please return the pipette only into the packaging after you have emptied it completely. Otherwise you may risk draining the smoke distillate.
- Protect the model against wet conditions and humidity.

Model

- When working on the locomotive (maintenance) always make sure there is no power connected to the model. Replace the housing on the chassis prior to operating the locomotive after maintenance work.
- Make sure that no wires are squeezed or that no short circuit may occur.

3.2. Unpacking the model

Pull the model screwed to the plastic holder with both hands out of the foam insert. At the bottom of the plastic holder you will find a hexagon spanner.



Figure 1: release the loco

Now place the model on its side, hold the model and the plastic holder with one hand and release the hexagon bolt with the other hand.

For safe keeping of the spanner there are two retaining clips at the bottom of the plastic holder.

Please keep all parts of the packaging and this manual for later use. Only the original packaging guarantees proper protection against transport damage. Please fix the locomotive by means of the hexagonal bolt to the plastic holder and place it into the foam insert and put it into the carton and the transport box prior to shipment.

3.2.1. Mounting & removing the centre pick-up

Removal: Put the locomotive on its roof. Then you apply the tool in such a way that the ends of the four wire brackets fit into the four holes below the base plate of the centre pick-up. Carefully(!) squeeze the tool and then lever the centre pick-up with a slight tug from its position.



Figure 2: pickup shoe removal

Mounting: For re-converting your locomotive to a three-rail vehicle again hold the centre pick-up between thumb and index finger and place it in the receptacle. Please note that the centre pick-up must be attached to bogie "1". Finally press the centre pick-up until there is an audible "click". That's it!

3.3. Outward appearance and special functions

With your new V200 you can operate your model trains prototypically like never before. There are many separately applied detail parts on the metal housing as well as on the metal chassis. Of course, such details and modifications of the housing are correct for the respective locomotive number. All grab irons are made off sturdy plastic and are separately applied. Separate plastic pipes are attached to the bogies.

The large speaker powered by the LokSound V4.0 M4 decoder distributes its powerful sound through the cut-through radiator grills. New is also the sensor triggering the squealing noise in curves and on turnouts.

The ESU 5-pole high performance motor with a virtually silent commutator and two flywheels assure plenty of power and smooth running. All four axles are powered.

Four traction tires assure considerable tractive effort. Model train enthusiasts who prefer to run their locomotives without traction tires and rather enjoy more prototypical wheels sets find a voucher for six wheel sets (2-rail system) with RP 25 wheels (please also refer to page 26!). In order to obtain these wheel sets, simply send this voucher to ESU. In order to assure perfect driving dynamics and excellent sound without interruptions due to dirty tracks the locomotive is equipped with a "PowerPack" energy storage module.

A coupler shaft as per NEM 362 with short coupler kinematics provides close coupling between loco-

motive and train in any situation. In terms of its lighting the V200 is just as prototypically versatile as its full scale counterpart. Of course there is directional lighting generated by warm white LEDs that can be turned off at one end, wherever the train is coupled to the locomotive. During shunting all three headlights at either end are switched on. In addition there is directional cab lighting as well as illuminated driver's cab-control panel.

4. The technology of the ESU model

The new LokSound V4.0 M4 decoder is a central part of your new V200. Its circuitry is responsible for design and control of all running and sound functions of the V200:

- Driving forward and in reverse
- Lighting functions
- Sound functions
- Smoke generator

Besides M4 the LokSound V4.0 M4 also supports DCC with RailComPlus, Motorola® and Selectrix® and also be operated on analogue layouts. Programming can be done either with DCC command stations or with Märklin® central units, etc. the decoder automatically detects the mode of operation; therefore you do not have to set anything in this regard.

In case you wish to change any of the default settings of the locomotive (such as the address or the sound volume) we recommend to first reading chapter 5. This chapter lists all parameters of the LokSound V4.0 M4decoder and how to change them with the various command stations available on the market.

4.1. Possible operating modes of the V200

4.1.1. Analogue mode

The V200 may also be operated on conventional (=analogue) DC or AC model train layouts. The number of available functions is, however, quite limited:

- Driving forward and backwards
- Directional lighting
- Engine sounds (automatic)

The smoke generator cannot be turned on in analogue mode. The engine sound sets in at about 6.5 V track voltage. At 8.5 V the locomotive slowly starts moving. Both DC transformers (throttles, e.g.: ROCO®) and AC transformers (e.g.: Märklin®, Titan) are suitable for analogue operation. Please note, that due to the large number of different systems on the market you may not achieve trouble-free operation with electronic throttles employing PWM (pulse width modulation).

Attention: the V200 must have come to a complete standstill before you activate the change-of-direction command! Never switch to the opposite direction while the locomotive is moving.

4.1.2. Digital mode

For prototypical operation we recommend using a digital command control system. The numerous functions are only available in digital mode.

The default address (ex works) is "03" (DCC and Märklin® Motorola®)

14 speed steps with Märklin® Motorola®. In DCC mode the decoder automatically detects the speed steps set in the command station.

4.1.2.1. Digital operation with DCC-systems

The V200 can be operated with any DCC compliant system. Sounds and other functions of the V200 can be triggered with the function buttons F0 through F21.

Function mapping (ex works):

Button	Function
F0	Directional lighting
F1	Engine sound (on/off)
F2	Horn (high)
F3	Both smoke generators onn/off
F4	Cab lighting
F5	Headlight off at cab 1
F6	Headlights off at cab 2
F7	Directional cab-control iighting
F8	Shunting lights
F9	Engine room lighting

Technical functions

F10	Air compressor
F11	Station announcement 1
F12	Turnout sensor off
F13	Coupler sound
F14	Heating
F15	Air release
F16	Short horn (high)
F17	Station announcement 2
F18	Short horn (low)
F19	Emergency stop
F20	Sanding
F21	Start- and slowdown delay off

4.1.2.2. DCC with RailComPlus®

The LokSound V4.0 M4 supports RailComPlus®, which was jointly developed by Lenz® and ESU. This means that the decoder automatically reports to RailComPlus® capable command stations. You will never ever have to change a locomotive address manually! Simply put the locomotive onto the track.

4.1.2.3. Prerequisites for RailComPlus®

RailComPlus® implies an accordingly equipped digital command station. The ESU ECoS command station supports RailComPlus®-capable decoders from software 3.4. You don't need to change anything about the decoder settings. It will be automatically recognised.

Of course you can change the locomotive name, all functional key and locomotive symbols and after that write it back on your decoder. This happens automatically in the background.

If you do not wish to have the automatic recognition, you can switch it off by deleting CV 28, bit 7.

4.1.2.4. M4 registration

If you use a Märklin® systems Central Station®, Central Station 2 or mobile station®

The locomotive will be automatically detected and registered by the system once you have put it onto the track. This process occurs completely automatically, you do not have to adjust any settings.

DCC with RailComPlus® has the highest priority when registering the locomotive. Therefore the decoder will always register with RailComPlus® and DCC on an ESU ECoS command station even when M4 is active. If RailComPlus® is not available then

M4 will be treated as the second priority. Therefore the decoder will register with M4 on a Märklin Central Station®.

Whenever you run your V200 with a Märklin® central unit under M4, then the system limits the number of available functions to 16

4.1.2.5. Digital operating with Märklin® Digital (6021)

You may operate the V200 with the Märklin® 6021 central unit without any problems. A special feature allows you to assign three more addresses besides the "actual locomotive address". They are known as following addresses. This enables you to access 16 functions with your 6021. Details on how to do this are described in chapter 5.3.3.1

4.2. Your first ride

Most certainly you wish to test your new locomotive right away. We recommend going about this step by step. Put the locomotive onto the track call it up on your handheld throttle.

4.2.1. Lighting functions

First turn on the lights by pressing F0. Then the white forward headlights as well as the red rear lights of the V200 should light up. If you wish you may switch on the cab lighting with F4 in order to better see the cab interior.

If you now press F7 (while the headlights are turned on) then the illuminated driver's cab-control panel will come to life. You will clearly see this through the side windows of the cab.

It is common practice to turn of the head and tail lights at the cab where a train is coupled to the locomotive. Press F5 is the train coupled to cab 1 in order to switch off the head (tail) lights at that end. When shunting without any vehicle coupled to the locomotive you should press F8 in order to have prototypical lighting for shunting.

In each bogie there are 4 LEDs, which are activated during braking and thus simulate the sparks of the brake shoes on the wheel rim as can be observed on locomotives hauling heavy trains.

4.2.2. Sound functions

After pressing F1 (preliminary lubrication and starting sequence) your V200 comes to life and continues with the typical sound of an idling two stroke engine.

Once you go to speed step 1 the prime mover will

rev up before the locomotive slowly starts moving. The response of the prime mover to different throttle settings is for both - acceleration and slowing down - somewhat delayed compared to diesel-hydraulic locomotives, as is the case with the prototype. Shortly before coming to a standstill you will hear the squealing brakes.

Of course you may trigger various user sounds with your throttle (refer to the table on page 8). You may also adjust the volume of each individual sound sequence. How to do this is described in chapter 5.6. Another special feature is the station announcements in different languages to suit different countries. Simply write the following values in the CV mentioned below:

4.2.3. Curve and turnout sensors

The V200 has been equipped with a comprehensive set of sensors in order to reproduce prototypical sounds in curves and across turnouts.

Please take note of the following:

These sensors function only when the locomotive is travelling at low speed. As soon as the locomotive stops or drives faster than speed step 7 (of 28) the squealing in curves and over turnouts will not be replayed.

The curve and turnout sounds will only be active if the engine sound is turned on. The curve sensor works for radii of about 80 cm. The sensors may not detect very large radii. Unfortunately certain mechanical limits are unavoidable.

The contact brackets for the turnout sensors are located below the axles 1 and 6 (in other words, the outer axles). Also refer to Fig. 11 on page 18. These brackets should not be pushed or bent manually! Treat these brackets with great care.

Occasionally there may be some sparks at the contact brackets when traversing a turnout. The curve sensors have been tested with all commonly available DC and AC systems. While traversing a turnout the bogies may be raised slightly.

If you do not wish to hear any sounds in curves or on turnouts you can switch off this function with function button F12.

4.2.4. Synchronised smoke generator

The V200 is equipped with a load dependent, synchronised smoke generator that can be controlled with your command station respectively handheld throttle. The system consists of a holding tank for the smoke distillate, an evaporator unit with tem-

perature control and a blower that exhausts the smoke in a controlled manner.

This system can adjust both the amount and the intensity of the smoke discharged subject to the operating conditions and thus assures prototypical performance. This system has been especially tuned for the V200 and also comprehensively tested.

Please bear in mind the following remarks in order to assure safe operation:

Only use the ESU smoke distillate part NO. 51990. Other liquids may lead to damage of the paint finish, choking the system or a faulty heating unit due to unwanted deposits. Only activate the smoke generator while observing the model and in a well ventilated room.

4.2.4.1. Filling the smoke generator holding tank

First take the pipette from the packaging of the model and pull about 0.4 to 0.5 ml smoke distillate into it. Please observe the index markers on the pipette in order to establish the appropriate quantity. Then carefully inject the distillate into the large opening of the red-brown silencer.

Do not exceed the maximum quantity of the holding tank of 0.5 ml. If in doubt rather put less liquid into the system! Due to the integral temperature sensor the smoke generator will not be damaged even if there is no liquid in the system!

Fill the smoke system only while the locomotive is on a horizontal sector but never on a gradient. Do not turn the locomotive with liquid in the tank sideways or upside down! This avoids the drainage of the distillate.

4.2.4.2. Operating the smoke generator

The smoke generator only works in conjunction with the sound. Smoke without sound is not possible.



Figure 3: Filling the smoke unit

First activate the smoke generator with the function button F3. As long as the engine (prime mover) is not running nothing happens just like with the pro-

Technical functions

totype. After pressing F1 you will hear the sounds of the starter motor. As soon as the prime mover is firing acoustically the diesel locomotive blows a strong cloud of smoke from the exhaust into the “model sky”. Like with the prototype the intensity of the smoke from the exhaust is reduced as soon as the prime mover begins to idle. More intense smoke will be emitted during acceleration and, of course, there is no smoke when the locomotive slows down.

- In order to protect the model the smoke generator is turned off automatically after 6 minutes. Thus overheating is avoided in case there is no distillate in the holding tank. Switch off the F3 button and then on again in order to reactivate the smoke function.
- The maximum capacity of the holding tank is 0.5 ml and is sufficient for about 10 to 15 minutes operation.
- In some instances it may happen that the system is clogged up due to an excessive amount of distillate in the holding tank. Simply blow some air through the exhaust opening in order to remove the drops of condensation.
- The smoke generator system as well as the entire locomotive gets quite warm. Let the model cool down before putting it back into its packaging.

You may adjust the amount and the intensity of smoke as you desire. You find more information on how to do this in chapter 5.10.

4.2.5. PowerPack energy storage

The V200 is equipped with a maintenance free “PowerPack” energy storage module. This facilitates uninterrupted power supply even on dirty tracks. The PowerPack is only active in digital mode. In analogue mode it will be automatically switched off. After turning on the power supply the “PowerPack” must first be charged. This may take up to 60 seconds. Only then the full capacity will be available. The system supplies power to the lighting, the motor and the sound functions. The maximum time that the system should cover can be set (also refer to chapter 5.7.).

5. Decoder settings (Programming)

Chapter 5 covers setting various parameters of the LokSound decoder. Should you not be familiar with the handling of CVs please take the time to read these occasionally quite complex instructions.

After an introduction into the world of parameters in chapter 5.1, we explain in the following section 5.2 how to change various parameters in DCC mode and with Märklin® central units.

The following chapters explain which parameters have what kind of influence on the behaviour of the LokSound decoder.

5.1. Configuration Variables (CVs)

LokSound decoders follow the CV concept developed in the US. CV stands for „Configuration Variable“ and indicates that the storage cells described above are not only variable but they also determine the behaviour of the decoder.

5.1.1. Standardisation in the NMRA

The NMRA (National Model Railroad Association) has defined which CVs determine certain parameters of a decoder. The DCC standard allocates fixed numbers for certain CVs (adherence is obligatory). This greatly simplifies things for the user since decoders of most manufacturers comply with this standard and therefore dealing with CVs requires the same process with the same CV-numbers regardless of the manufacturer.

The DCC concept permits to enter numbers ranging from 0 to 255 into CVs. Each CV carries only one number.

While the position number is predetermined, the range of values may vary. Not all CVs must accept values ranging from 0 to 255.

The permitted values for LokSound decoders are listed in the table in chapter 20.1. showing all available CVs.

5.1.2. Bits und Bytes

Most CVs contain numbers: CV 1 for instance contains the locomotive address. This can be any number between 1 and 127. While most CVs expect numbers to be entered, some others are rather like a „collection point“ of various „switches“, that administer different functions in one CV (mainly „on“ or „off“: CVs 29 and 49 are good examples: you must calculate the value for these CVs yourself. The value depends on which settings you want to program:

Have a look at the explanations for CV 29 in the table in chapter 10: firstly, decide which options should be active. The column „Value“ has two numbers for each option. If the option is switched off, the value is 0. Otherwise, it is a number between 1 and 128. Add all the values for the respective options to arrive at the correct value for this CV.

Example: Let us assume you want to run trains with the ECoS in DCC mode with 128 speed steps. Analogue detection should be active (because you also want to drive your locomotive in analogue mode). All other options are not active.

Therefore you must write the value 6 in CV 29 ($0 + 2 + 4 + 0 = 6$).

5.2. Programming the decoder

In this paragraph we explain how you can program the decoder with the most commonly available digital systems.

5.2.1. Programming with DCC Systems

LokSound decoders support all NMRA programming modes as there are the programming track modes (Direct Mode, Register Mode, Paged Mode) and the mode for the main („POM“, „Programming on the Main“).

Programming on the Main enables you to program your decoders comfortably without having to remove the locomotive from the layout. In this case, the command station talks directly to the decoder by using its locomotive address, for instance: „Locomotive number 50, write the value 7 into CV 3!“. Thus knowing the locomotive address is a precondition. Unfortunately, you cannot read CV values.

However, with RailCom® you can read CV values on the main. More on this topic in chapter 15.

Assuming you have a suitable DCC system you can read CV values on the programming track. You can also reprogram the locomotive address without knowing the old address since the command station simply transmits the command „Write value 7 in CV 3!“. Each decoder receiving this command will execute it.

ESU counts the bits from 0 to 7 as laid out in the standards while others (e.g.: Lenz®) count the bits from 1 to 8.

5.2.2. Programming with Märklin® 6021

The LokSound V4.0 M4 decoder can be programmed with all mfx® compatible central units directly via the decoder menu. However, in some cases not

all decoder options can be accessed. This compromise is necessary in order to assure that all mfx® central units on the market can be supported. Read the manual of your central unit in order to find out how to program mfx® capable decoders. The procedure is identical to programming Märklin® locomotives

5.2.2.1. Changing in the programming mode

Enter the programming mode with the 6020/6021: The throttle must be set to „0“. No other locomotives may be on the layout. Watch out for flashing signals of the locomotive!

- Press the „Stop“ and „Go“ buttons of the 6021 simultaneously until a reset has been triggered (alternately pull the mains plug of the transformer). Press the „Stop“ button in order to switch off the track voltage. Enter the current decoder address. If you do not know the current address, simply enter „80“.
- Activate the change-of-direction button (turn the throttle knob to the left beyond the arrestor until you hear a click sound), hold it in this position and then press the „Go“ button.
- Please bear in mind that the 6020/6021 only permits you to enter values from 1 to 80. The value 0 is missing. Always enter „80“ instead of „0“.

5.2.2.2. Short mode

The decoder is in the short mode (the headlights flash periodically in brief intervals).

- Now enter the number of the CV that you want to adjust e.g.: „01“. Always enter this number with two digits.
- For confirmation activate the change-of-direction routine (now the lights flash twice very quickly).
- Now enter the new value for the desired CV, e.g.: 15 (two digits).
- For confirmation activate the change-of-direction routine (now the lights light up for about one second).
- Then you can enter other CVs as desired.

Selecting „80“ allows you to exit the programming mode. Alternately you can switch off the track voltage and then on again (press the „Stop“ button on the 6021, then the „Go“ button).

Decoder settings

5.2.2.3. Long mode

You access the long mode by entering the value 07 in CV 07 while in the short mode. The decoder confirms the change to the long mode by slowly flashing lights.

- Enter the hundred-digit and the ten-digit (decade) of the CV that you want to change. Example: If you want to adjust CV 124, you enter „12“.
- For confirmation activate the change-of-direction routine (now the lights flash periodically: long – short – long – short - etc.)
- Now enter the unit of the CV („04“ in this example).
- For confirmation activate the change-of-direction routine. Now the decoder expects the entry of the CV value. The lights flash periodically: long – short – short).
- Now enter the hundred-digit and the ten-digit (decade) of the new CV value (as a two-digit number). Example: You want to write the value 135. Therefore, you enter „13“.
- For confirmation activate the change-of-direction routine. Now the lights flash periodically: long – short – short – short).
- Now enter the unit of the new CV value as a two-digit number („05“ in this example).
- For confirmation activate the change-of-direction routine (now the lights light up for about one second).
- Now you can adjust more CVs in long mode.

Exit the long mode by switching off the track voltage and then on again (press the „Stop“ button on the 6021, then the „Go“ button).

5.2.3. Programming with Märklin® Mobile Station®

With the Mobile Station®, you can also adjust some of the CVs. Use the Register Programming Menu to facilitate this.

As with the 6021, you can only enter values between 1 and 80. The possible CV values are also limited to that range from 1 to 80.

You will find the programming menu in the locomotive menu of the Mobile Station®. It is only available for certain locomotives. Of course, this works only for a programmable locomotive.

5.2.4. Programming with ESU LokProgrammer

The LokProgrammer 53451 offers the easiest and most comfortable way of setting the CVs of LokSound decoders: simply by a few mouse clicks on an MS-Windows® computer. The computer saves you to look for the various CV numbers and values. More information is contained in the manual for the LokProgrammer.

You can access all properties of ESU decoders with the LokProgrammer. Since this works independently from the data format it also works for mfx® decoders.

Please use the software version from V4.3.0 onwards for the LokSound V4.0 decoder. The software is available for download on our website!

5.3. Address settings

Each LokSound decoder requires a definite address to be addressable for the central unit. Depending on the type of decoder and the digital system, there are several possibilities how to allocate addresses.

5.3.1. Short addresses in DCC mode

Normally you would control LokSound decoders with the short address that is stored in CV 1. In DCC mode, the permitted values range from 1 to 127. In order to enable the decoder to „listen“ to the short address you must delete bit 5 in CV 29.

Some digital systems (e.g. ROCO® Lokmaus II, Lenz® digital plus, Lenz® compact) only support the values 1 – 99 as short address.

5.3.2. Long Addresses in DCC mode

You can operate LokSound decoders also with long addresses (4-digit addresses). The supported values range from 128 – 10239. The long address is stored in the CVs 17 and 18. You must activate the long address by setting bit 5 in CV 29.

Bit 5 in CV 29 switches between short and long address. The decoder can only respond to one address at a time.

If you want to use your LokSound with the long address it is practical to program this address directly with your digital system: most modern digital systems (e.g. ESU ECoS, Bachmann E-Z Command® Dynamis®) have a menu for programming long addresses. The command station not only programs CV 29 correctly but also assures the correct storage of the values for the long address in CV 17 and 18. If you want to enter the long address manually in CV 17 and 18 please refer to 5.2.2.3.

5.3.3. Motorola®-address

You can also operate many LokSound decoders with the Motorola® format. The address for this operating mode is stored in CV 1.

This address is identical to the short address in DCC mode as described in chapter 5.3.1. The LokSound decoder responds both to commands in DCC and in Motorola® mode at the same time.

Märklin® digital devices (6020, 6021, Delta®) can only work with addresses from 1 to 80. Should you have entered a higher value in CV 1 you will not be able to drive this locomotive with these central units.

5.3.3.1 Consecutive addresses for more functions

The extended Motorola®-Format covered only the lighting function (F0) and the auxiliary function F1 to F4. Of course, this is far too few for the many functions of the LokSound V4.0.

Therefore one can assign up to three additional addresses (4 addresses in total). The so called consecutive addresses follow immediately after the actual address stored in CV 1 and serve to trigger functions. Motor control is solely accomplished via the base address in CV 1.

Example: select address 20 for a class V200 locomotive. You want to set 3 consecutive addresses. They are 21, 22 and 23. They will then switch the consecutive functions whenever you call up these addresses on your 6021:

Name	Example	Functions
Base address	20	F0, F1 – F4
Consecutive address 1	21 (20+1)	F5 – F8
Consecutive address 2	22 (20+2)	F9 – F12
Consecutive address 3	23 (20+3)	F13 – F16

Please make sure that no other vehicle is programmed to any of the consecutive addresses (in this example 51 to 53). Otherwise you will inadvertently run several vehicles at the same time!

The consecutive addresses are activated with bits 3 and 7 in CV 49. For reasons of compatibility they are not next to each other. The relationship is as follows:

Bit 7	Bit 3	Description	Value to be added to CV 49
0	0	No consecutive address	0
0	1	Consecutive address 1 active	8
1	0	Consecutive address 2 active	128
1	1	Consecutive address 3 active	136

First read out the value in CV 49 (default value: CV 49 = 1) and the value shown in column 4. If, for instance, you wish to activate 3 consecutive addresses then you must write the value $136 + 1 = 137$ into CV 49. Consecutive addresses are only active in Motorola® mode.

5.4. Adapting the Driving Characteristics

5.4.1. Acceleration Deceleration

Acceleration and brake time can be set independently from each other. Therefore, you could for instance program a short acceleration and a much longer brake time.

The time for accelerating is adjusted in CV 3 while deceleration is set in CV 4. Permitted values are 0 (no delay) to 255.

The times set in these CVs work speed dependant. Therefore, the acceleration distance and the brake distance are longer at high speeds. In other words, the faster the locomotive moves, the longer is the distance until it stops.

5.4.1.1. Shunting mode

The default setting for the shunting mode is F3. It reduces the speed to about 50%. Thus, you have smoother control of your locomotive in the lower speed ranges, which is important for shunting, particularly in the 14-speed-step mode.

5.4.2. Starting voltage, Vmax

LokSound decoders know internally 256 speed steps. They can be adapted to the characteristic of the locomotive and allocated to the actually available speed steps (14, 28, or 128).

The NMRA defined two options to facilitate this:

Motor characteristic via CV 2, 5, and 6. Enter the start voltage in CV 2 and the maximum speed in CV 5. CV 6 corresponds with the speed at a medium speed step. Thus, you can define a “kink” in the speed curve. This mode is active if bit 4 = 0 in CV 29.

The values of the start, mid and maximum speed are dependent on each other. Selecting a mid speed

Decoder settings

that is lower than the start speed or higher than the maximum speed could lead to some erratic driving performance. Therefore always adhere to the principle: start voltage < mid speed < maximum speed.

5.5. Break sectors

Brake sectors have the purpose to slow down the locomotive independently from the commands issued by the command station. Frequently, this function serves for stopping a train in front of a red signal. If a LokSound detects a brake command, it will slow down with the programmed deceleration and then stop. After this enforced stop, the locomotive will accelerate again as per the programmed values in CV 3.

Depending on the type of digital system, there are several options on how to influence the decoder so that it stops the train.

5.5.1. DC brake mode

In order to activate the DC brake mode you must set bit 3 in CV 27. The LokSound decoder will start brake once it moves from a digital sector into a DC sector provided the brake mode is active and the polarity of the track voltage does NOT match the current direction of travel. The locomotive will stop taking into account the programmed deceleration.

5.5.2. Märklin® brake mode

In principle, the Märklin® modules 72441 / 72442 apply a DC voltage to the track instead of the digital signals. Provided bit 3 and bit 4 in CV 27 is set, then LokSound decoders detect this voltage and will stop the train (CV 27 = Value 24).

The signal generated by these modules looks the same as DC from conventional DC-transformers. The LokSound could possibly misinterpret this and switch to the analogue mode instead of brake.

If you wish to control the LokSound decoder with DCC signals and keep your Märklin® brake sectors then you should switch off the DC analogue mode by deleting bit 1 in CV 50. The LokSound will stop as desired.

5.5.3. Lenz® ABC brake mode

As a new function the LokSound V4.0 decoder supports the ABC braking technique introduced by Lenz®. In order to use this function a group of anti-parallel diodes will be soldered to one half of the track. The resulting fall of voltage generates an asymmetrical DCC signal. LokSound decoders are able

to detect the potential difference between the left and right half of the signal. If desired, the decoder will be stopped.

To be able to use the ABC technique you also need, beside the adequate LokSound V4.0 decoder, an appropriate brake module. The ABC technique can only be operated with boosters offering an exact symmetrical output. All command stations and boosters by ESU and Lenz® guarantee a symmetrical output. We don't recommend to use other boosters for the ABC technique.

- If you wish to stop the LokSound decoder when the track signal is stronger on the right side than on the left side (and the diodes are also installed on the left side), set bit 2 in CV 27.
- If you wish to stop the LokSound decoder when the track signal is stronger on the left side than on the right side (and the diodes are also installed on the right side), set bit 1 in CV 27.
- If you want to stop the decoder no matter in which half of the track the diodes are set, please set bit 2 and bit 1 in CV 27 (CV 27 = 3).

5.6. Adjusting the volume

The volume of all individual sounds of the class 66/77 can be independently adjusted. This enables you to tune the model optimally according to your preferences.

5.6.1. Overall sound volume

If you wish to reduce the overall volume simply enter a lower value in CXV 63 (master volume). All sounds will be adapted in the correct ratio.

5.6.2. Adjust individual sounds

If you wish to adjust the volume of individual sounds you must set the volume for each individual sound by changing the value of its corresponding CV. In order to enable the decoder to describe these CVs correctly you must assure that the so-called "Index CV" CV 32 has the correct value.

Before you change any volume CV please make sure that CV 32 = 1.

The CVs for the sounds are defined as follows:

CV	Function	Value
259	Motor #1	128
267	Motor #2	90
275	Horn 1	128
299	Air compressor	62
307	Announcement	128
315	Coupler	100
323	Air release	128
331	Conductor's whistle	128
339	Sanding	32
347	Short horn #1	128
363	Announcement #2	128
371	Sequel in curves	80
379	Short horn #2	128
387	Turnout sound	115
403	Train heating (Steam boiler)	30
411	Emergency brake	60
459	Brake squeel	100
451	Random sounds	55

5.6.3. Motor sound

Of course the sound of the prime mover can also be adjusted individually.

5.6.4. Auxillary sounds

Auxiliary sounds can also be adjusted individually. If you wish not to hear a certain sound (for instance, no sanding) then you set the corresponding CV to the value of "0".

5.7. Smoke generator

You may also adjust the smoke generator as you desire.

5.7.1. Blower of the smoke generator

The revs of the blower can be set with CV 138 (default value: 128). A higher value results in higher revs and thus in more smoke. However, this also means higher consumption of the distillate and a somewhat "thinner" smoke plume.

5.7.2. Heating temperature

The temperature of the heating element can be ad-

justed with CV 139 (default value: 128). Only increase this value slightly in order to avoid excessive wear and tear of the smoke generator. The settings in CVs 138 and 139 are dependent of each other and should be adjusted together.

5.8. PowerPack

The PowerPack energy storage module continues to provide electric current to the decoder in case of a power interruption. Should you have installed isolate track sectors ahead of signal where the sector is disconnected from the power source if the signal aspect shows "red", the locomotive will still be powered by the "PowerPack" and will therefore continue running? Of course, in such a situation this may be undesirable. Therefore it is possible to adjust the buffer time in CV 113 as a multiple of 0.016384 seconds. The default value facilitates about 2.9 seconds. For smooth running the time should not be set to any value lower than 0.3 seconds.

5.9. Decoder reset

You may reset the decoder to default values at any time.

Simply write the value 8 in CV 8.

5.10. Brightness of the lighting

The brightness of all LEDs of the Class 66/77 can be changed. The range is from value 31 (maximum brightness, default value) down to the value 0 (lights are almost off, very dark).

Please change the following CV values:

Description	Decoder output	Index CV 31	Index CV 32	CV	Value
Cab 1 left	Light forward[1]	16	0	262	31
Lower right cab 1	Light backw.[1]	16	0	270	31
Cab 2 left	AUX1[1]	16	0	278	31
Lower right cab 2	AUX2[1]	16	0	286	31
Cab 1 red	AUX3	16	0	294	31
Cab 2 red	AUX4	16	0	302	31
Interior lighting cab 1	AUX5	16	0	310	31
Interior lighting cab 2	AUX6	16	0	318	31
Cabcontrol panel	AUX7	16	0	326	31
Enginge room	AUX8	16	0	334	31
Brake lights	AUX9	16	0	342	31

Maintenance

6. Maintenance

6.1. Removing the housing

Put the model on its roof. You will find four Phillips screws at the bottom of the chassis located between the bogies and the fuel tank. Remove these screws and put the model back on its wheels. Now you can easily remove the housing. The yellow circles point to the screws to be removed in order to take off the housing.

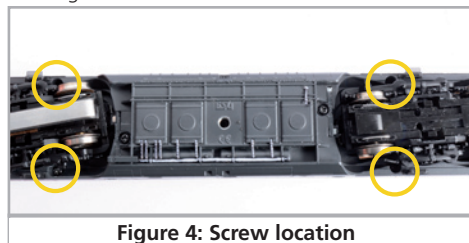


Figure 4: Screw location

6.2. Lubrication

We have equipped the V200 with durable mechanical components. All moving parts have been permanently lubricated with durable grease and oil. Additional lubrication of these individual components is therefore not required.

6.3. Replacing traction tires

Traction tires do age and must be replaced after wearing. ESU supplies suitable traction tires with each locomotive. For exchanging the traction tires you must remove the side parts of the bogies (also refer to chapter 6.3.).

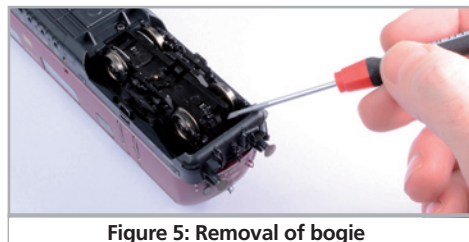


Figure 5: Removal of bogie

Please make sure that the traction tires are put onto the wheels uniformly and without any tension in order to avoid out-of-round running characteristics of the model. It has proven quite useful to place the traction tires prior to mounting into some low surface tension water (a drop of dishwashing liquid is sufficient).

6.4. Installing a coupler

A standard coupler is mounted ex works at the cab 2 end of the locomotive. At the other end the deflector is closed and prototypical hoses have been mounted. Installing a model train coupler takes about two minutes. You will find the required parts in the packaging. The only tool you may need is either a pair of flat nose pliers or tweezers and a thin screw driver.

Remove the coupler shaft and the coupler from the accessory bag.

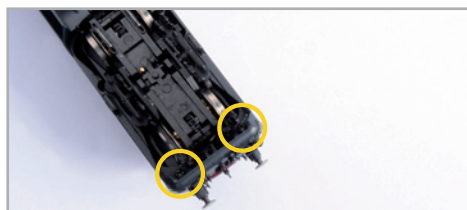


Figure 6: Screw location on bogie



Figure 7: Removal of small parts

The sprung socket for holding the coupler shaft is located between front deflector and the front of the bogie.

Pull off the hoses and the prototype coupler using the tweezers or the flat nose pliers and then press the deflector inwards.

Since the latter may sit quite firmly in its position push a thin screw driver next to the retaining clip between deflector and insert.

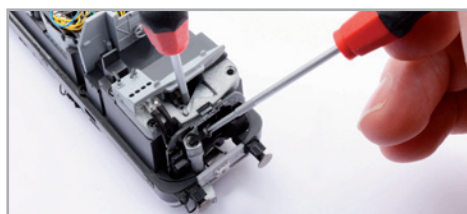


Figure 8: Screw up the drawbar

Place the coupler shaft onto the sprung socket that the front faces left in "driving direction".

Then press the shaft downwards and turn it by 90 degrees until it projects through the deflector at the front.

Now insert the coupler.

The first arresting position of the coupler may be needed in order to avoid the buffers of the locomotive and the first car missing each other in curves (Particularly S curves) when ever heavy trains are pushed through such curves. Generally you would push the coupler into its proper position.

7. Accessories

ESU is fully aware of the "challenges" of model train operations. Often enough small detail parts break off and "disappear". Since the V200 has quite a few details and we want to make sure that can enjoy your V200 for a very long time we have put a little plastic bag with small parts that could easily break or get lost. Make sure you keep these parts for the time when you may need them.

8. Technical support

Should you have questions regarding your V200 to which you have not found the right answer in this manual please first contact your hobby shop. The people there are your competent contact for all questions relating to model trains.

Should you not be able to get an answer to your question look up our homepage in the internet. We continuously publish topical questions and answers as well as the latest versions of manuals. Of course you will also find our postal address as well as our phone number on our site.

www.esu.eu

9. Spare parts

Due to the large number of parts built into V200 we have divided the spare parts in to component groups. Some parts belonging to large parts groups are also included in smaller groups.

Please bear in mind that only the spare parts listed in the supplied spare part list are available ex works as spare parts. Enquiries for individual parts are pointless.

Should you require a spare part you must first identify the spare part group containing the needed part. For rarely needed parts you may have to purchase a larger component group. You must state the listed ESU part number when ordering spare parts from your hobby shop

Important CVs

10. List of all important CVs

CV	Name	Description	Range	Value																																							
1	Loco address	Address of the loco	1 - 127	3																																							
2	Start voltage	Sets the minimum speed of the engine	1 - 75	3																																							
3	Acceleration	This value multiplied by 0.25 is the time from stop to maximum speed	0 - 255	40																																							
4	Deceleration	This value multiplied by 0.25 is the time from maximum speed to stop	0 - 255	40																																							
5	Maximum speed	Maximum speed of the engine	0 - 255	170																																							
8	Manufacturer's ID	Manufacturers's ID ESU - Writing value 8 in this CV triggers a reset to factory default values	-	151																																							
17 18	Long address of the loco	Long address of engine CV 17 contains the high byte (Bit 6 and 7 must always be enabled), CV 18 contains the Lowbyte. Active only if enabled in CV 29 (see below)	128 - 9999	192																																							
19	Consist Address	Additional address for consist operation. Value 0 or 128 means: consist address is disabled	0-255	0																																							
27	Brake mode	Allowed brake modes		24																																							
		<table><tr><th>Bit</th><th>Function</th><th>Value</th></tr><tr><td>0</td><td>ABC braking, voltage higher on the right-hand side</td><td>1</td></tr><tr><td>1</td><td>ABC braking, voltage higher on the left-hand side</td><td>2</td></tr><tr><td>2</td><td>ZIMO HLU brakes active</td><td>4</td></tr><tr><td>3</td><td>Brake on DC, if polarity against driving direction</td><td>8</td></tr><tr><td>4</td><td>Brake On DC, if polarity like driving direction</td><td>16</td></tr></table>	Bit	Function	Value	0	ABC braking, voltage higher on the right-hand side	1	1	ABC braking, voltage higher on the left-hand side	2	2	ZIMO HLU brakes active	4	3	Brake on DC, if polarity against driving direction	8	4	Brake On DC, if polarity like driving direction	16																							
Bit	Function	Value																																									
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2	ZIMO HLU brakes active	4																																									
3	Brake on DC, if polarity against driving direction	8																																									
4	Brake On DC, if polarity like driving direction	16																																									
28	RailCom® Configuration	Settings for RailCom®		131																																							
		<table><tr><th>Bit</th><th>Function</th><th>Value</th></tr><tr><td>0</td><td>Channel 1 Address broadcast not enabled</td><td>0</td></tr><tr><td></td><td>Channel 1 Address broadcast enabled</td><td>1</td></tr><tr><td>1</td><td>Data transmission not allowed on Channel 2</td><td>0</td></tr><tr><td></td><td>Data transmission allowed on Channel 2</td><td>2</td></tr><tr><td>2</td><td>Command Acknowledgement on Channel 1 not allowed</td><td>0</td></tr><tr><td></td><td>Command Acknowledgement on Channel 1 allowed</td><td>4</td></tr><tr><td>7</td><td>RailComPlus® automatic loco recognition not active</td><td>0</td></tr><tr><td></td><td>RailComPlus® automatic loco recognition active</td><td>128</td></tr></table>	Bit	Function	Value	0	Channel 1 Address broadcast not enabled	0		Channel 1 Address broadcast enabled	1	1	Data transmission not allowed on Channel 2	0		Data transmission allowed on Channel 2	2	2	Command Acknowledgement on Channel 1 not allowed	0		Command Acknowledgement on Channel 1 allowed	4	7	RailComPlus® automatic loco recognition not active	0		RailComPlus® automatic loco recognition active	128														
Bit	Function	Value																																									
0	Channel 1 Address broadcast not enabled	0																																									
	Channel 1 Address broadcast enabled	1																																									
1	Data transmission not allowed on Channel 2	0																																									
	Data transmission allowed on Channel 2	2																																									
2	Command Acknowledgement on Channel 1 not allowed	0																																									
	Command Acknowledgement on Channel 1 allowed	4																																									
7	RailComPlus® automatic loco recognition not active	0																																									
	RailComPlus® automatic loco recognition active	128																																									
29	Configuration register	This register contains important information, some of which are only relevant for DCC operation.		30																																							
		<table><tr><th>Bit</th><th>Function</th><th>Value</th></tr><tr><td>0</td><td>Normal direction of travel</td><td>0</td></tr><tr><td></td><td>Reversed direction of travel</td><td>1</td></tr><tr><td>1</td><td>14 speed steps DCC</td><td>0</td></tr><tr><td></td><td>28 or 128 speed steps DCC</td><td>2</td></tr><tr><td>2</td><td>Disable analog operation</td><td>0</td></tr><tr><td></td><td>Enable analog operation</td><td>4</td></tr><tr><td>3</td><td>Disable RailCom®</td><td>0</td></tr><tr><td></td><td>Enable RailCom®</td><td>8</td></tr><tr><td>4</td><td>-</td><td>0</td></tr><tr><td></td><td></td><td>16</td></tr><tr><td>5</td><td>Short addresses (CV 1) in DCC mode</td><td>0</td></tr><tr><td></td><td>Long addresses (CV 17 + 18) in DCC mode</td><td>32</td></tr></table>	Bit	Function	Value	0	Normal direction of travel	0		Reversed direction of travel	1	1	14 speed steps DCC	0		28 or 128 speed steps DCC	2	2	Disable analog operation	0		Enable analog operation	4	3	Disable RailCom®	0		Enable RailCom®	8	4	-	0			16	5	Short addresses (CV 1) in DCC mode	0		Long addresses (CV 17 + 18) in DCC mode	32		
Bit	Function	Value																																									
0	Normal direction of travel	0																																									
	Reversed direction of travel	1																																									
1	14 speed steps DCC	0																																									
	28 or 128 speed steps DCC	2																																									
2	Disable analog operation	0																																									
	Enable analog operation	4																																									
3	Disable RailCom®	0																																									
	Enable RailCom®	8																																									
4	-	0																																									
		16																																									
5	Short addresses (CV 1) in DCC mode	0																																									
	Long addresses (CV 17 + 18) in DCC mode	32																																									
48	Language selection	Selection of announcement languages for certain sound projects	0 - 255	0																																							

Important CVs

CV	Name	Description	Range	Value		
49	Extended Configurations	More important adjustments for the decoder	0 - 255	19		
		Bit			Description	Value
		0			Enable Load control	1
					Disable Load control	0
		1			20 kHz motor pulse frequency	0
					40 kHz motor pulse frequency	2
		2			Disable Märklin® Delta® Mode	0
					Enable Märklin® Delta® Mode	4
		3			Consecutive addresses for Motorola® Protocol „low“-Bit	0
						8
		4			Disable automatic DCC speed step detection	0
					Enable automatic DCC speed step detection	16
		5			DisableLGB® function button mode	0
		Enable LGB® function button mode	32			
	6	DisableZIMO® Manual Function	0			
		Enable ZIMO® Manual Function	64			
	7	Consecutive addresses for Motorola® Protocol „high“-Bit	0			
			128			
50	Analogue mode	Selection of allowed analogue modes	0 - 3	3		
		Bit			Function	Value
		0			DisableAC Analogue Mode	0
					Enable AC Analogue Mode	1
		1			Disable DC Analogue Mode	0
		Enable DC Analogue Mode	2			
52	Load control parameter „K slow“	„K“-component of the internal PI-controller for lower speed steps	0 - 255	15		
53	Control Reference voltage	Defines the Back EMF voltage, which the motor should generate at maximum speed. The higher the efficiency of the motor, the higher this value may be set. If the engine does not reach maximum speed, reduce this parameter.	0 - 255	110		
54	Load control parameter „K“	„K“-component of the internal PI-controller. Defines the effect of load control. The higher the value, the stronger the effect of Back EMF control.	0 - 255	50		
55	Load control parameter „I“	„I“-component of the internal PI-controller. Defines the momentum (inertia) of the motor. The higher the momentum of the motor (large flywheel or bigger motor diameter), the higher this value has to be set.	0 - 255	100		
56	Operating range of load control	0 – 100 % Defines up to which speed in % load control will be active. A value of 128 indicates that load control will be switched off after reaching half speed.	0 - 255	255		
63	Sound volume «Master»	Master volume for all sounds	0 - 192	192		
67-94	Speed table	Defines motor voltage for speed steps. The values „in between“ will be interpolated.	0 - 255	-		
113	Power Fail Bypass	The time that the decoder bridges via the PowerPack after an interruption of voltage. Unit: A multiple of 0.016384 sec.	0 - 255	125		
125	Starting voltage Analogue DC		0 - 255	70		
126	Maximum speed Analogue DC		0 - 255	100		
127	Starting voltage Analogue AC		0 - 255	90		
128	Maximum speed Analogue AC		0 - 255	130		
138	Smoke generator - Blower	Adjusting the fan speed. The higher the value, the faster operates the fan and the more smoke will be ejected.	0 - 255	90		
139	Smoke generator - Heating temperature	Adaption of the heating temperature of the smoke generator. The bigger the value, the higher the heating temperature.	0 - 255	130		
253	Constant brake mode	Determines the constant brake mode. Only active, if CV254 >0	0 - 255	0		
		Function				
		CV 253 = 0: Decoder stops linearly CV 253 > 0: Decoder stops constantly linear				
254	Constant braking distance forward	A value > 0 determines the way of brake distance it adheres to, independent from speed.	0 - 255	0		

Warranty

11. Warranty Certificate

24 months warranty from date of purchase

Dear customer,

Congratulations on purchasing this ESU product. This quality product was manufactured applying the most advanced production methods and processes and was subjected to stringent quality checks and tests.

Therefore ESU electronic solutions ulm GmbH & Co. KG grants you a warranty for the purchase of ESU products that far exceeds the national warranty as governed by legislation in your country and beyond the warranty from your authorised ESU dealer. ESU grants an extended

manufacturer's warranty of 24 months from date of purchase

Warranty conditions:

This warranty is valid for all ESU products that have been purchased from an authorised dealer.

No claims will be accepted without proof of purchase. The filled in warranty certificate together with your ESU dealer's receipt serves as proof of purchase. We recommend keeping the warranty certificate together with the receipt.

In case of claim please fill in the enclosed fault description as detailed and precise as possible and return it with your faulty product.

Extend of warranty/exclusions:

This warranty covers free of charge repair or replacement of the faulty part, provided the failure is demonstrably due to faulty design, manufacturing, material or transport. Please use the appropriate postage stamps when shipping the decoder to ESU. Any further claims are excluded.

The warranty expires:

1. In case of wear and tear due to normal use
2. In case of conversions of ESU - products with parts not approved by the manufacturer
3. In case of modifications of parts, particularly missing shrink sleeves, or wires directly extended on the decoder.
4. In case of inappropriate use (different to the intended use as specified by the manufacturer).
5. If the instructions as laid down in the user manual by ESU electronic solutions ulm GmbH & Co. KG were not adhere to.

Due to liability reasons any inspections or repairs can only be carried out on products that are not installed in a locomotive or carriage. Any locomotive sent to ESU for inspection will be returned without even touching it. There is no extension of the warranty period due to any repairs or replacements carried out by ESU.

You may submit your warranty claims either at your retailer or by shipping the product in question with the warranty certificate, the receipt of purchase and fault description directly to ESU electronic solutions ulm GmbH & Co. KG:

ESU GmbH & Co. KG
- Garantieabteilung -
Edisonallee 29
D-89231 Neu-Ulm
GERMANY



ESU P/N 03213-13445