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1 Welcome!

We would like to congratulate you on your acquisition of the **Digital plus by Lenz®** LZV100 and we hope you will enjoy working with this model-railway control.

This operating manual is to explain the use of the LZV100. If you still have unanswered questions even after reading this operating manual, then please contact us. There are four different ways of contacting Lenz Elektronik GmbH:

Postal address: Lenz Elektronik GmbH
Hüttenbergstrasse 29
D-35398 Giessen

Telephone: ++49 (0) 6403 900 133

The recorded message
will inform you of times
when we are available
for consultation.

Fax: ++49 (0) 6403 900 155

E-mail: info@digital-plus.de

If you have any problems, just contact us, stating the following information together with a description of the problem:

- Version number of the LZV100
- Correct designation, version and service number of the connected XpressNet devices

This will help our service department to resolve the problem. Thank you.

All present?

Please check whether all the components have been delivered:

LZV100 device

Operating manual (this booklet)

If any component is missing, please ask your specialist supplier for a supplementary delivery.

2 Important advice, please read first!

Your **LZV100** is a component of the *Digital plus by Lenz®* system and was submitted to intensive testing before delivery. Lenz Elektronik GmbH guarantees fault-free operation provided you follow the advice given below:

The **LZV100** is only authorised for operation with other components of the *Digital plus by Lenz®* system. Any use other than that described in this operating manual is not permitted and all guarantees will become invalid, if the **LZV100** is used inappropriately. Connect your **LZV100** only to devices which are designated for such connection. This operating manual will inform you which devices are suitable. Do not expose the **LZV100** to damp or direct sunlight.

The heat produced by the device during operation is normal. You must provide sufficient air circulation around the device in order to prevent the internal protective system from reacting prematurely, that is, during normal operation.

WARNING!

Do not leave your model railway system unsupervised when it is in operation! If a short-circuit goes unnoticed, the heat produced creates a fire risk!

Conventional locomotives placed on *Digital plus by Lenz®* layouts will produce a whistling tone. This is normal due to a continuous rapidly alternating voltage on the track and in the motor of conventional locomotives.

This type of voltage is not suitable for locomotives with bell type armature motors such as Faulhaber high-efficiency motors. Locomotives with these types of motors must only be operated on digital layouts with locomotive decoders. Without locomotive decoders, these motors would be damaged or destroyed within a short period of time due to overheating. There are a few types of motors which are subject to the same restrictions as the bell type armature motors. If in doubt, ask the manufacturer of the locomotive.

3 Technical data of the LZV100

Locomotive addresses

Locomotive addresses range from 1 - 9999. Address '0' can be used for controlling a conventional locomotive.

In the range 1-99, the LZV100 uses the so-called basic address of the locomotive decoder, stored in CV1 of the locomotive decoder. In the range 100-9999, the extended locomotive address is used, stored in CV17 and CV18 of the locomotive decoder.

All *Digital plus by Lenz*® locomotive decoders produced in accordance with the NMRA standard (all from end of 1996 onward), are capable of the address range up to 9999. This means that you will not need new locomotive decoders for this new function.

Detailed information on both ranges of addresses can be found in the operating manual "Information Locomotive Decoders". This brochure is available in specialist dealer shops, directly from Lenz Elektronik or online (www.digital-plus.de).

Locomotive functions and configuration

Up to 28 functions are available for each locomotive address. When using a LH100, version 3, or an Interface (with suitable software) you can make settings for each of these 28 functions separately regardless of whether it is a permanent or a temporary function. This setting is stored with the locomotive address.

Permanent function:

Press the key once to activate this function and once more to deactivate it.

Temporary function:

This function is activated as long as the corresponding key is pressed. As soon as the key is released, the respective function is deactivated.

Running notches

The LZV100 supports the running notches modes 14, 27, 28 and 128. The running notches mode can be set separately for each locomotive address.

Double traction

Two locomotives can be assembled in a double traction and controlled simultaneously.

Multiple traction

Several locomotives are controlled simultaneously with one common address.

All Digital plus locomotive decoders produced in accordance with the NMRA standard (all from end of 1996 onward), are capable of multiple traction.

Programming in operational mode (PoM)

Here, you can program the features of a locomotive decoder while the locomotive is placed somewhere on the track system. Drive your locomotive to the front of a heavy goods-train and then adjust the starting delay to suit the train!

Programming on the programming track	<p>All 3 programming options, in accordance with NMRA, are available for the LZV100:</p> <p>Programming by stating the CV, register programming and page mode.</p>
Magnetic articles	<p>The addresses available for magnetic articles (points and signals) range from 1 to 1024. The switch decoders LS100 and LS110 (version 2, identified by the LED and the push-button) are capable of this range of addresses. The actual points feedback is possible in the range 1 to 256.</p>
Automatic feedback	<p>All changes to components capable of feedback (points decoder LS100 or feedback module LR101) are automatically reported to all devices connected to the XpressNet. This procedure makes the feedback particularly quick, since there are then no query times for the individual devices.</p>
Automatic notification of switch commands	<p>The automatic reporting of switch commands is also effected for points which are not connected to switch decoders capable of feedback. The most recently effected switch command is communicated to all XpressNet devices. Thus computer programmes are capable of showing the correct status of these points and signals at all times.</p>
Data storage	<p>The LZV100 contains a storage in which the locomotive address and its corresponding data (running notch, function status) is stored every time you call up a locomotive. Data is sent continuously to all locomotives running on your layout from this storage. This is to ensure that each locomotive that is called up is continuously fed with information. This is particularly advantageous if a locomotive is located in a dead section, e.g. in front of a signal indicating "Stop". If the voltage in this section is reactivated (and the signal shows "Go"), the locomotive can accelerate with the most recently set running notch. If set in the decoder, it can even do this with a starting delay.</p> <p>The storage of the LZV100 is split into two sections and provides 99 spaces for the 2-digit locomotive addresses (1-99) and 128 spaces for the 4-digit locomotive addresses. The range of the 4-digit locomotive addresses can be occupied with addresses ranging from 100 to 9999. A further storage location is available for the speed of a conventional locomotive.</p>
AUTO mode	<p>This mode ensures that the locomotives are fed with stored data after the system is reactivated. If this mode is switched on, the operating commands are stored for the above-mentioned locomotives and sent after activation. Furthermore, the information of the functions F0 to F4 is also transmitted.</p>
XpressNet	<p>The communication to the input devices is effected via the XpressNet connection. Up to 31 devices can be used with the XpressNet.</p>

Power supply (input voltage)	with AC:	min. 14 Volt, max. 19 Volt
	with <u>pure</u> DC:	min: 14 Volt, max. 27 Volt
	When supplied with DC, it makes sense to select an input voltage which is approx. 3V higher than the set output voltage (voltage on the track) or, if supplied with AC, equally high or slightly lower. This avoids an unnecessary loss of heat in the device which in turn could lead to an early thermal switch off.	
Output voltage (voltage on the track)	Settable between 11V and 22V in steps of 0.5V. In case of a loads, this voltage can be lower depending on the transformer used. The factory voltage setting is 16V.	
Output current	The output current is limited to a maximum of 5A.	
	Depending on the transformer used, as well as its voltage and the set track voltage, the constant current, which the amplifier of the LZV 100 can supply, varies.	
	Example: When using the transformer TR150 and a track voltage of 16V, the constant current is 4.3A.	
Overload protection	Thermal overload protection. The switching off of the overload occurs after approx. 100ms in case of constant overcurrent (e.g. short-circuit).	
Housing	Metal	
Dimensions	W 120mm x H 55mm x D 120mm	

4 The connections

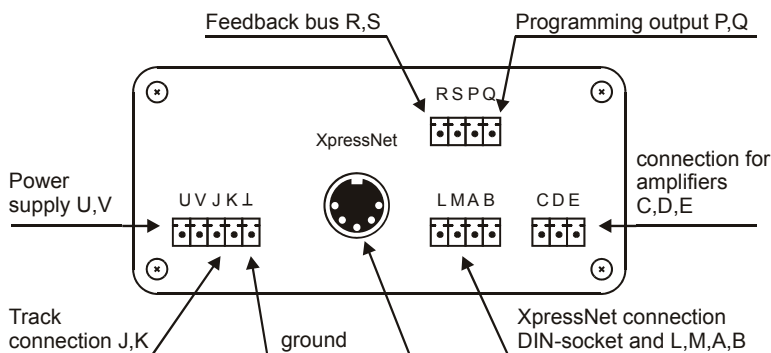


Fig. 9: The connections of the LZV100

4.1 Power supply: terminals U,V

The LZV100 is connected to the transformer via two cables at the terminals U and V.

4.2 Track connection: terminals J,K

Only use cables with sufficiently large cross-sections to connect the tracks and then twist this cable (we recommend 0.25 mm^2). For extended routes you need additional points of current supply at regular intervals.

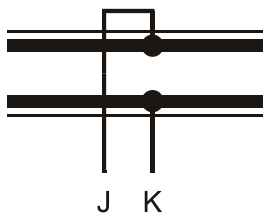


Fig. 10: Connection 2-wire tracks

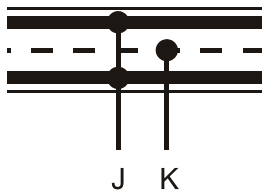


Fig. 11: Connection track with neutral wire

No radio interference suppression capacitor may be installed in the track system. This capacitor is necessary only for the interference suppression in conventional operation. If used with the Digital plus system, however, it would distort the data format and interfere with the fault-free transmission of data.

Important:

A mixed digital operation using overhead and track lines is not permitted. In this type of operational mode, if the locomotive is sitting on the track in the wrong direction (which might be the case e.g. after having driven through a terminal-loop), the installed locomotive decoder can be destroyed by overvoltage! We recommend operation using track pick-up, because the reliability of contact (and therefore the transmission of digital signals to the locomotive decoder) is substantially greater than it is when operating with overhead lines.

Conventional and digital electric circuits must always be thoroughly separated from each other, for example, by installing contact-breaker tracks or insulating rail joiners between digital and DC sections. In order to prevent the digital operation from being influenced by the normal DC and vice versa, when a sectioning point is being driven over, install the sectioning module LT100. If a vehicle bridges the sectioning point between the two systems, the sectioning module immediately disrupts the conventional power supply. You will find detailed information on the use of a sectioning module LT100 in the operating manual for this component. You can order operating manuals directly from us (send a stamped addressed C5 envelope) or download them from our web page www.digital-plus.de.

4.3 Programming output: terminals P,Q

Connect the programming track to the terminals P and Q. This track must be electrically isolated from the remaining system. However, it can be part of your model railway system, so use a siding which is easily accessible:

Separate this siding at both ends from the remaining layout and supply the track with a bipolar change-over switch as shown in the illustration below. This allows you to change between normal operation and programming at all times.

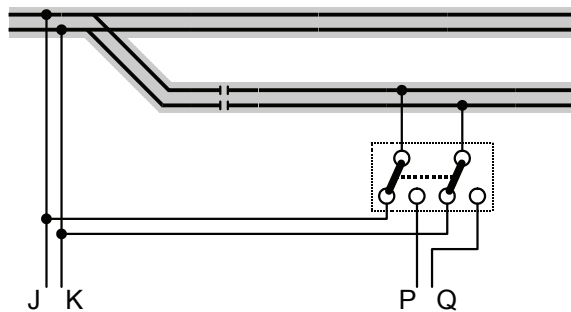


Fig. 12: The programming track

4.4 XpressNet connection: terminals L,M,A,B and 5-channel DIN-plug

It is possible to connect the LZV100 to the XpressNet via the 5-channel DIN-plug as well as via the terminals L,M,A and B. The devices exchange information with the command station via the terminals A and B. The connected XpressNet devices are supplied with power via the terminals L (plus) and M (minus). You can connect the first manual control directly to the 5-channel DIN-plug of the LZV100.

If you would like to connect several manual controls LH100 (or other input devices), use the terminals L,M,A and B on the LZV100. Starting from these terminals, lay the cables (XpressNet cable) to one or several adapters LA152 (art. no. 80152). If you want to use several adapters LA152, simply connect these adapters to the XpressNet cables LY160 and LY161. These are plug-type connections which facilitate easy cabling.

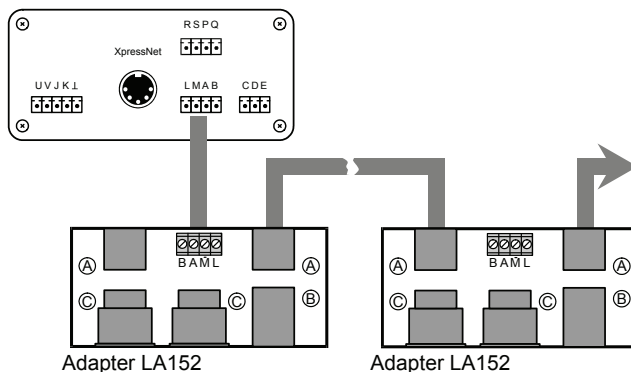


Fig. 13: Using the adapters LA152

Information on the XpressNet components is contained in our *Digital plus by Lenz*® Product Overview available on our web page.

You can also install DIN-plugs, which are available in electronics shops, to your layout and solder the cables yourself. The assignment of the 5-channel DIN-plug is shown in the figure.

Make sure that you do not mix up the cables of the terminals L and M. This could result in a defect in the connected input devices.

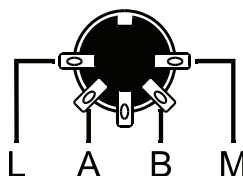


Fig. 14: Pin assignment DIN plug (solder side)

4.4.1 XpressNet devices which may be connected

The following table shows the devices which can be connected to the LZV100 as well as the functions that can be used.

Device / function	LH100 LI100	LH200	LH90	LH30 compact	XPA	LC100
Locomotive addresses	1 – 9999	1 – 9999	1 – 9999	1 – 99	1 – 9999	1 – 99
Conventional locomotive ("0")	yes	yes	yes	yes	yes	-
Selecting a locomotive address from the central storage	yes	yes	yes	-	-	-
Functions in locomotive decoders	F0 – F28	F0 – F8	F0 – F28	F0 – F4	F0 – F8	F0 – F4
Configuring locomotive decoders to continuous / impulse mode	yes	-	yes	-	-	-
Displaying and changing of running notches mode	yes	yes	yes	yes	-	-
Double traction (1)	yes	controlling	controlling	controlling	controlling	-
Multiple traction (1)	yes	j yes	yes	yes	controlling	-
Switching points / signals	1 – 1024	-	1 – 1000	1 – 100	1 – 1024	1 – 256
Query feedbacks	yes	-	-	-	-	-
Programming in operational mode (PoM)	yes	yes	yes	-	-	-
Programming on the programming track	yes	yes	yes	-	-	-

- (1): "Yes" means: Allocating, deleting and controlling of double or multiple tractions is possible.
 "Controlling" means: only the controlling of double or multiple tractions is possible.

Status: May 2008, provided that the latest software version is installed in the listed devices.

4.5 Connection for further amplifiers: terminals C,D,E

The data format needed for the connection of further amplifiers is on the terminals C and D. The terminals are connected to the terminals of the other amplifiers, which also have the same name, by means of a twisted cable. You can easily make one of these twisted cables by using two 'normal' cables.

When the terminal E of the command station is connected to the terminal E of the amplifier, the amplifier will communicate an overload or a short-circuit to the LZV100. The LZV100 then switches off all other amplifiers and communicates this to all connected input devices via the XpressNet.

Read more about the use of additional amplifiers in the section "Stromversorgung einer Modelleisenbahnanlage" starting on page 14.

The terminal E of the LZV100 can also be used for the connection of a "panic emergency shutdown push-button". Install one or several push-buttons at the edge of your layout and connect them with the terminals M and E.

If a crash is about to happen on the layout, simply press this emergency shutdown push-button. The LZV100 changes over to "emergency shutdown" and switches off the operation on the layout. The manual controls will show a corresponding message. Now you have time to solve the "precarious" situation. Afterwards, release the emergency shutdown on the manual control and resume operation.

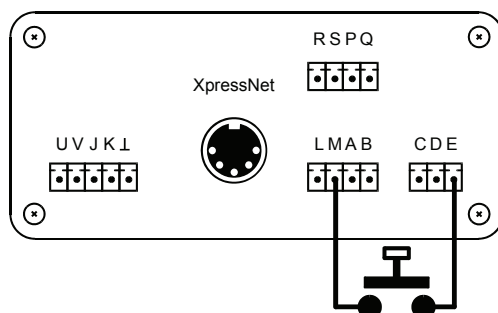


Fig. 15: Connecting an "emergency stop push-button"

4.6 Feedback bus: terminals R,S

The feedback bus is connected to the terminals R and S. The LZV100 queries the status of point settings or track occupation detectors via this cable which needs to be twisted. To this end, switch decoders LS100 and / or feedback modules LR101 are connected to the feedback bus.

Use twisted cables for this. *Do not on any account* lay out the feedback bus in multiwire cables with or parallel to live cables, e.g. the track connections J and K or the power lines U and V or supply mains. This could lead to malfunctions in the operation of the feedback bus.

Further information on the switch decoders and the feedback bus can be found in the respective operating manuals. You can order operating manuals directly from us (send a stamped addressed C5 envelope) or download them from our web page www.digital-plus.de.

5 The power supply of a model railway layout

As with conventionally operated systems and layouts, a sufficient supply of electricity to the system is a precondition for the sure and safe functioning of the Digital plus system.

Locomotives, (coach) lights, points, signals etc. are power consumers. The amplifier installed in the LZV100 supplies this power and at the same time the control information required by the decoders. If the total current consumption of all consumers connected to the LZV100 exceeds the current that can be delivered by the LZV100, the protective system will be activated.

See the section "Technical data" above for information on how much current the LZV100 can supply.

To find out whether the maximum current of the LZV100 is sufficient for the supply of your model railway system, simply add up the power consumption of all locomotives running at the same time as well as that of all other consumers which are fed by the track output J,K of the LZV100. Use the following approximate values for your calculation:

- running locomotives – depending on gauge and attached load, the power consumption ranges from 200mA to 2000mA. Calculate per locomotive 500mA for gauge N, 1000mA for gauge H0 and 2000mA for larger gauges. This ensures that you still have some reserve left.
 - standing locomotives – not illuminated 2.5mA, illuminated approx. 50mA for each bulb.
-

- illuminated wagons – each bulb approx. 50mA

If the calculated sum exceeds the maximum current available from the LZV100 (see "Technical data"), you will need another amplifier. If this is the case, divide the layout into several supply areas. The additional amplifiers (LV102 or LV200) will then be used to supply these areas with current.

The additional LV102s receive the control signals from the terminals C and D of the LZV100. Each LV102 has to be connected to its own transformer TR150. The number of amplifier-transformer-units needed depends on the overall power consumption of your model railway.

It is absolutely necessary that the electric circuits of all amplifiers are of the same polarity. Thus, terminal J of one and terminal J of the next amplifier must be connected to the same side of the track in question. Otherwise short-circuits will occur when driving over sectioning points.

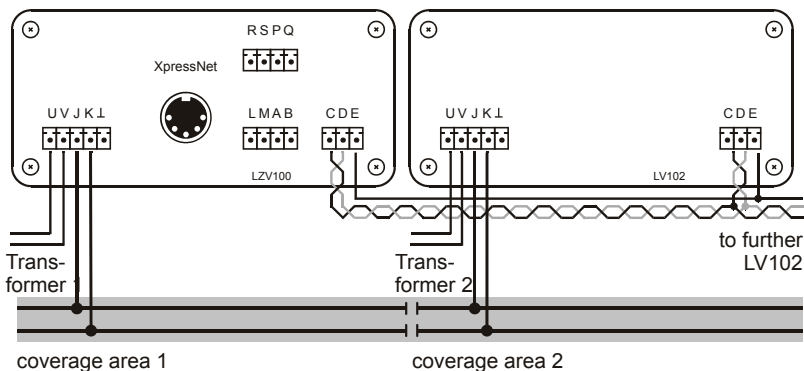


Fig. 16: Connecting an amplifier LV102 to the LZV100.

If you have several supply areas on your model railway layout, you will have to set the voltage on the track (output voltage) for the amplifiers in use to the same value.

6 Setting the voltage on the track

The limit of the track voltage of the LZV100 can be set. Limit means that the set voltage is not exceeded. However, the voltage on the track may actually be lower than the set value, depending on the voltage and the capacity of the transformer supplying the power.

Depending on the gauge for which the LZV100 is used, changing the factory setting of the track voltage may be advantageous (terminals J and K). Larger gauges in particular, are often operated with slightly higher voltages or if you want a lower output voltage for gauge N. If possible, the transformer voltage should be adjusted to the desired track voltage. A transformer voltage which is too high leads to an unnecessary loss of heat in the amplifier which in turn leads to an early switching off before the maximum output voltage is reached.

The factory setting for the output of the LZV100 is 16V; you can choose a range between 11V and 22V.

"PoM", "Programming in operational mode" is used to set the track voltage. Before making the settings, you should familiarise yourself with using PoM with your manual control LH100 or LH90.

Proceed as follows:

- Select any locomotive address on the manual control (**Don't worry:** If a locomotive with the address used above is placed on a track while you are setting the voltage, its settings will not be changed, since CV7 can only be read in the locomotive decoder, but not changed.)
 - Change over to "PoM"
 - Select CV7.
 - Program the value 50 into CV7. This switches the LZV100 into setting mode; the LED of the LZV100 shows a double-flash.
 - You have 15 seconds to program the value for the desired output voltage (compare below) into CV7. The LED will shine constantly, the track voltage on the track is altered.
-

See the following table for the value you will have to program into CV7 in order to set a certain voltage at the output (U_A):

U_A (V)	CV7
11	22
11.5	23
12	24
12.5	25
13	26
13.5	27
14	28
14.5	29

U_A (V)	CV7
15	30
15.5	31
16	32
16.5	33
17	34
17.5	35
18	36
18.5	37

U_A (V)	CV7
19	38
19.5	39
20	40
20.5	41
21	42
21.5	43
22	44

7 RailCom: Activating the blanking interval (cutout) in the LZV100:

Use "PoM" ("Programming in operational mode") to activate RailCom. Before making any settings, familiarise yourself with PoM practices in combination with the manual control LH100 or LH90. When activating the RailCom function, the LZV100 must be switched on.

The following procedure activates the blanking interval (cutout) both in the amplifier component of the LZV100 as well as in the each of the LV102 amplifiers that are connected to the terminals CDE of the LZV100.

Proceed as follows:

- Select any locomotive address on the manual control. **Don't worry:** If a locomotive with the selected address is placed on the track during activation, its settings will not be affected because CV7 can only be read but not changed.
- Change to "PoM"
- Select CV7
- Program the value 50 into CV7. This switches the LZV100 / LV102 into setting mode; the LED of the LZV100 / LV102 shows a double-flash.
- You have 15 seconds to program the value 93 for activating the RailCom function into CV7. The LED will shine constantly and RailCom is activated.

If you want to deactivate RailCom (i.e. disable the blanking interval (cutout)), proceed as follows:

- Change to "PoM"
- Select CV7
- Program the value 50 into CV7. This switches the LZV100 into setting mode; again, the LED of the LZV100 shows a double-flash.
- You have 15 seconds to program the value 92 for deactivating the RailCom function into CV7. Again, the LED will shine constantly and RailCom is deactivated.

8 The LED display

The various operating statuses of the LZV100 are indicated by the LEDs on the front plate:

LED shines constantly	Everything ok, device in normal operation
LED flashes slowly	Short-circuit on the track system, track voltage switched off or Distribution voltage too low (due to the load being too high) or Emergency stop, track voltage switched off at the operating device
LED flashes quickly	Overheating of amplifier or Transformer not connected to U,V (correct) but to J,K (incorrect).
LED double-flashes:	A programming procedure was started by means of PoM (see "Setting the voltage on the track")

9 Conventional locomotives and *Digital plus by Lenz*[®]

The *Digital plus by Lenz*[®] system also features a control facility for conventional locomotives (locomotives without a decoder). You call up a conventional locomotive in the same way as if you were calling up a digital one. Enter address '0' in the manual control. Control the locomotive as if it had a locomotive decoder installed. The conventional locomotive does not have a starting and braking delay in the *Digital plus by Lenz*[®] system. The lighting of the conventional locomotive (if installed) is switched on at all times. If you placed several conventional locomotives on the track, all of them would behave the same. Independent controlling of these locomotives is not possible.

WARNING!

Conventional locomotives placed on *Digital plus by Lenz*[®] layouts will produce a whistling tone. This is normal due to a continuous rapidly alternating voltage on the track and in the motor of conventional locomotives.

This type of voltage is not suitable for locomotives with bell type armature motors such as Faulhaber high-efficiency motors. Locomotives with these types of motors must only be operated on digital layouts with locomotive decoders. Without locomotive decoders, these motors would be damaged or destroyed within a short period of time due to overheating. There are a few types of motors which are subject to the same restrictions as the bell type armature motors. If in doubt, ask the manufacturer of the locomotive.

10 Help in case of malfunctions

Fault	Possible cause	Elimination of problem
LZV100 is not ready for work (LED does not shine).	Electric power supply is interrupted. Transformer mains-plug not plugged in.	Check wiring between transformer and LZV100, plug in transformer mains-plug.
LED flashes slowly.	There has been a short-circuit on the track system.	Deal with the short-circuit.
	There is overloading or	Divide the system into several coverage areas and supply them with additional amplifiers / transformers.
	The distribution voltage of the transformer is too low because the load is too high.	
LZV100 is ready to work (LED shines), locomotives do not run, points and signals can not be switched.	The connection of the amplifier and the track and / or the switch decoders is interrupted (terminals J and K not connected).	Check and correct the connections.