Designed for use on all XpressNet systems
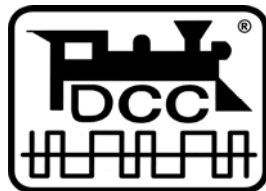

Digital *plus*
by Lenz ®

XpressNet ®

LH90 Engineer's Throttle

Version 3.6
art. no. 21090
June 2008

DCC

THIS PRODUCT CONFORMS TO ALL APPLICABLE NMRA STANDARDS

Lenz ELEKTRONIK GMBH

Contents

Welcome!

Congratulations for purchasing the **Digital plus by Lenz**® LH90 throttle. We wish you much enjoyment with using this **X**press**N**et based throttle with your NMRA DCC model railroad control system.

The LH90 hand held controller is a universal data input device in the *Digital plus by Lenz* ® system. With it you can:

- operate your locomotives
- use smart-consisting to assemble, operate, and disassemble multi-unit consists.
- throw turnouts, set signals or activate uncoupling tracks
- program locomotive and accessory decoders as well as feedback devices
- read out and set handheld configurations

This operation manual is intended to make using the LH90 easy for you. To get started, first read the section "First Steps". After you have understood the basic locomotive control, you can familiarize yourself with the full range of functions of this hand held controller step by step and put them to use.

If after reading this operating manual you have unanswered questions, please contact your dealer or Lenz directly. You can contact us in the following ways:

	Europe	North America
Postal address:	Lenz Elektronik GmbH Huettenbergstrasse 29 D-35398 Giessen	Lenz Agency PO Box 143 Chelmsford, MA 01824
Phone	++49 (0) 6403 900 133	++1 978 250 1494
Fax	++49 (0) 6403 900 155	++1 978 455 LENZ
Email	info@digital-plus.de	support@lenz.com

Do you have everything?

You should have the LH90, Coil cord and DIN and Manual.
If an item is missing, please contact your retailer or Lenz to have the item replaced.

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1   Overview

Important advice, please read first!

Your **LH90** hand held throttle is a component of your ***Digital plus by Lenz***® system and was submitted to intensive testing before delivery. Lenz Elektronik GmbH guarantees fault-free operation if the advice given below is followed:

The **LH90** is authorized for operation only with a system that fully supports **X**press**Net** such as any ***Digital plus by Lenz***® system. Any use other than the one described in this operating manual is not permitted and all guarantees become invalid if the **LH90** is used in an inappropriate way.

The operation of **LH90** requires Digital plus system version 3 or greater. The **LH90** cannot to be used with devices which use older software versions.

> ☞   *Do not connect the **LH90** to any other device. Even if other devices use the same connectors, you must not operate the **LH90** with those devices. The fact that the connectors are similar does not automatically mean that you may use them for operation, even if you are dealing with other model railroad control systems.*

Do not expose the **LH90** to moisture or direct sunlight.

1.1   The range of functions of the LH90

- With the LH90 you may control up to 9999 digital locomotives independently. With address 0 you control a conventional locomotive without a decoder with your system.

- You can address up to 28 functions in your locomotive decoders, if your command Station supports F0 and F1-28. You can on a locomotive per locomotive basis set F1-F28 to be momentary or on/off.

- Depending on the command station used (LZ100, LZV100, SET02, "compact"), you can control, assemble and delete multiple units (consists).

- You can set the running-notches (speed steps) mode for the locomotive address currently displayed.

- Locomotive features such as starting and braking delay can be set through "programming on the main" (operations mode programming) or through "programming in service mode".

- The LH90 can also switch turnouts. Depending on the command station used, you can switch up to 999 turnouts (and signals).

1.2   What's New in Version 3.6?

We have added several major improvements in Version 3.6. These Include Shortcut Menu Keys for the most important operations support for functions F1-F28, ability to set up momentary functions and improving throttle handoff of operating locomotives.

1.3   Notations and symbols:

(⇨P. 23)   This shift indicates particular pages of the operating manual which contain further information on the subject under discussion.

> ☞ Texts marked with this symbol and a frame contain information and advice of special importance.

2   Your First LH90 Session

2.1   Connecting the LH90 to your DCC System

Plug one end of the coil cable with the phone connector into the socket of the LH90. Pug the end of the cable with the 5 pin din plug into your *Digital plus by Lenz*° **X**press**Net**.

As is the case with all **X**press**Net** devices, your LH90 can be disconnected and reconnected during operation. To make use of this feature of **X**press**Net**, install several LA152 adapters or din sockets around your layout. This keeps operators close to the action.

Connecting to a LZ100 or LZV100 command station

Plug the 5-pole DIN-plug

- into the 5-pole DIN-socket at the rear of your LZ100/LZV100
   or
- into a LA152 adapter (or Atlas Panel #322), or din socket on the back side of the Command Station, the LZ100/LZV100.

Connecting to a "compact" or Atlas Commander

Plug the 5-pole DIN-plug into a LA152 adapter or din socket that is connected to the "compact" or Atlas Commander.

Setting the XpressNet address

For fault-free exchange of information with the command station, each input device connected to the **X**press**Net** must have its own unique *device address.* It is necessary to ensure that all connected devices have different addresses. Up to 31 devices can be connected to the **X**press**Net**, i.e. the addresses 1 to 31 can be used. From the factory each LH90 throttle is set to the address 02. If you are already operating another **X**press**Net** device with this address, you will have to assign a different address to your LH90. You will find information on the setting of the **X**press**Net** address in section 13.1 (⇨P. 35).
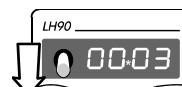
2.2 Running trains the first time

We assume in this example that you are operating a locomotive with the address "3". On delivery you can access the addresses 1 to 8 quickly and easily by pressing key "A" repeatedly.

1. Connect your LH90 to your Digital plus system (⇨P. 5)

2. Place the locomotive with address 3 on the track.

3. Turn the rotary control-knob to the left-hand limit-stop.

4.   If the number 3 is not on the display, press the "A" key repeatedly until address "3" is shown on the display.

5. 5.1 If there are no flashing dots on the display, set the direction switch to up. (direction of locomotive is forward)

    5.2 If you see a flashing dot in the centre of the display "0003", the LH90 is instructing you which way the direction switch must be set to control the locomotive. To control the locomotive, set the direction-switch as follows:
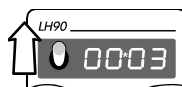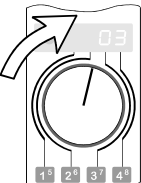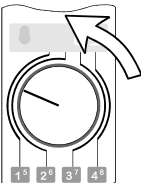

Up, when the upper dot flashes.   Down, when the lower dot flashes.
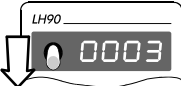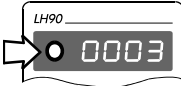
6.   Turn the rotary control-knob to the right. The locomotive speeds up.   Turn the rotary control-knob to the left. The locomotive slows down.

Turn the knob as far to the left as possible: the locomotive stops.

7.

LH90
O 0003

LH90
O 0003

Flick the direction-switch downwards through the centre position. This will change the direction of motion of the locomotive from forwards to backwards.

If you flick the direction-switch to the centre position while the locomotive is in operation, the locomotive will stop with the amount of delay in braking that is set in the locomotive decoder. If you afterwards flick the switch in a different direction, the locomotive will speed up again, also with the amount of delay that is set in the decoder.

8.

0 M

In order to switch on the light function of the locomotive decoder, press key "0M ". Press the key once and you will turn the light on, press it again and you will turn it off.

3   The operational controls of the LH90

In this section you will learn about:

- the display information and how it is presented in the operating manual
- the functioning of the LH90 rotary control-knob
- the functioning of the direction switch
- the functions of the LH90 keys

3.1   The LED display

The LH90 has a luminescent, 4-digit LED display. Each digit is able to display the numbers 0 to 9 as well as other special symbols.

1234

In normal operation the address of the locomotive which you are presently controlling is constantly shown.
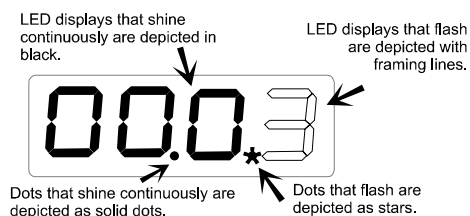
1234 (with stars)
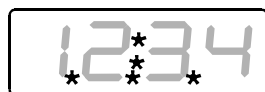
Dots below left, in the centre and below right are helpful for
- adjusting the direction switch when you take over a different locomotive.
- showing the functions which are on or off
You will find more detailed information on this below.

In this operating manual the display is presented as follows:

LED displays that shine continuously are depicted in black.

LED displays that flash are depicted with framing lines.

00.0.3

Dots that shine continuously are depicted as solid dots.

Dots that flash are depicted as stars.

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3.2 The rotary control-knob

Turn it to the right and you increase the speed of the locomotive. Turn it to the left and you decrease the speed of the locomotive. Since the rotary control-knob has a limit-stop to the right and to the left, you will know without actually having to look, when you have reached the maximum speed or have come to a complete stop.

3.3 The forward/brake/reverse switch

The direction switch on the LH90 has 3 positions:

|		
Switch up: The locomotive moves forward when the control knob is set to a speed other than stop.	Switch to centre: causes the locomotive to slow down and stop using the pre-programmed braking rate. Turning the rotary control-knob does not influence the locomotive.	Switch down: locomotive moves backwards when the control knob is set to a speed other than stop.
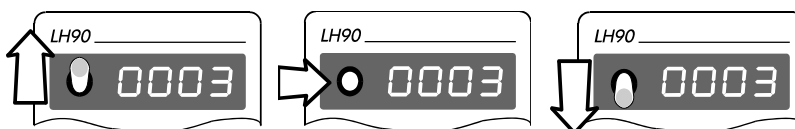
3.4 The keys

Only a few well-arranged keys are necessary for controlling your locomotives:

With this key you scroll through the addresses which are saved in the "stack". When using menus this key is used to confirm a specific action

Or think of it as the "ENTER" key.
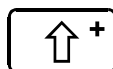
"Shift" key: when you press this key, the numbers and symbols in smaller print on the other keys become active. This key is comparable to the "Shift" key on a typewriter or computer. It also, ESC key.
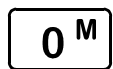
Function 0 on/off. Function 0 is used by most decoders for the front lighting which is dependent on the direction of motion. If the "shift" key has been pressed, then this key is used to scroll through the menus (see section 5 ⇨P. 13.)

These 4 keys are used to switch functions of the locomotive decoder. The large number is the primary number and the small number is the shifted number. (See MENU- FunC for discussion about F9-F12).

When using a menu, these keys are used to alter the value of the digits.

Emergency stop. The function of this key is settable: switching off the voltage on the track, stopping all locomotives, or stopping the locomotive indicated.

3.5   Emergency Stop Key

If you want to immediately stop operation press the [⊚] key.

The voltage on the track will be switched off, and all locomotives will immediately stop. During an emergency stop, the LED of the power station LZV flashes, and the LH90 display flashes.

$$\boxed{\mathsf{OFF}}$$

> ☞   Whenever "OFF" flashes in the display the system has been shut off. To resume operation, press the key again.   [⊚]
>
> ☞   You can customize the operation of the Emergency Stop key. See section 13 (⇨P. 33)

4   Operating Locomotives

In this section you will learn about:

- the LH90s stack
- how you select a locomotive address that is in the stack
- setting the direction switch and rotary control knob to match the locomotives speed and direction
- how to acquire a locomotive that is being used by another handheld
- how to control the locomotives functions

4.1   The LH90s stack

The LH90 contains a stack of 8 current locomotive addresses that the LH90 can quickly switch between. When you plug your LH90 into your **X**press**N**et, the displays shows the address of the locomotive that is being controlled.   To control a different locomotive you will have to select a different address. There are two ways of changing the address of the locomotive that the LH90 will control.

Either you scroll through the stack until the desired address is displayed or, if the address is not currently in the stack, enter a new address in the stack.

4.1.1   Scrolling through the stack

The "stack" of addresses facilitates quick access to up to 8 locomotive addresses. The stack size is adjustable from 2 to 8 address slots using the SYS menu (see section 13). Each position within of the stack can be assigned to any locomotive address

between 0 and 9999. From the factory the stack size is set to 8 and the loco addresses 1 to 8 are located in the stack. Changing the address contained in a stock location is easy and is shown in the Address Menu section (see section 6 ⇨P. 15). The stack size can be changed by changing a system setting. See section 13 (⇨P. 33). The locomotive addresses entered in the stack are remembered by the LH90, even if the LH90 is switched off.

A✓ When pressed, this key causes the LH90 to display the next locomotive address in the stack. Having reached the bottom of the list, the following key stroke will again display the locomotive address at the top of the list. This means that you are scrolling through the stack in a forwards direction.

A✓ When you hold the "A" down, the current stack location is displayed.

⇧⁺ **A✓** Press "Shift" and then "A" to switch to the previous address in the stack or scroll backwards through the stack.

> ☞ **If the locomotive address is an MU address (see section 7 for an explanation of MUs) then Shift "A" will scroll between different locomotives within the MU.**
>
> ☞ **If the display is blinking this means that another throttle currently has control of the locomotive. If you change the speed or change a function you take control from the other throttle and his or her display will start blinking.**

4.2   Adjusting the rotary control-knob position to the speed of the selected locomotive

If the direction switch is in the forward or reverse position and you move the knob, the locomotive will immediately change its speed to the new knob position. To prevent an immediate change in speed, it is often better to adjust the position of the rotary control-knob in the manner described below before taking control of the locomotive. This step is totally optional.

After having selected the desired address, and before moving the rotary know, the display will indicate in which direction you have to move the rotary control-knob so that the speeds of the knob and locomotive match.

When this LED flashes turn knob clockwise.

When this LED shines the knob is in the correct position.

When this LED flashes turn knob counter clockwise.
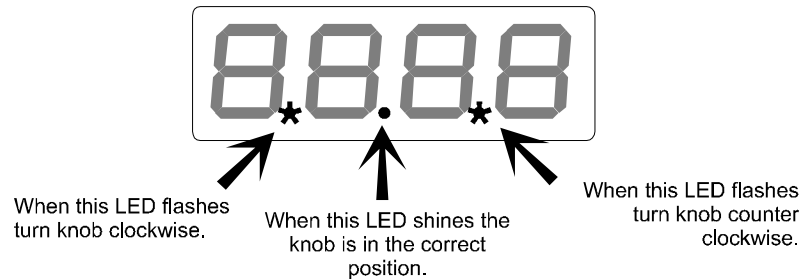
If you wish to adjust the rotary control knob, but do not wish to affect the speed of the locomotive move the direction switch to the **center** position. Once the direction switch is in the center position you can adjust the rotary control knob until the center led is lit indicating that the speeds of the locomotive and knob are the same. This optional step is only necessary if the position of the knob is different from the speed of the locomotive you wish to control.

After you are satisfied that the speeds are similar or match set the direction switch to the desired position. Once the direction switch is set turning the knob will cause the speed of the locomotive to change.

4.3   Setting the Direction Switch for the correct direction of travel

Before you can control the locomotive the direction switch must match the direction of travel the locomtive was last run in. Once you have the address of the locomotive on the display and you have optionally adjusted the position of the rotary control knob, you still need to set the direction switch to the correct position as indicated by the LED in the center of the display..

Dot is not flashing:
direction switch is in correct position. Take over the locomotive by turning the rotary control-knob.

Dot is flashing:
direction switch is in wrong position. In order to take a locomotive over, simply change the position of the direction switch.

Upper LED (forwards) visible

Direction switch up (forwards)

LH90

Lower LED (reverse) visible

Directions switch down (reverse)

LH90
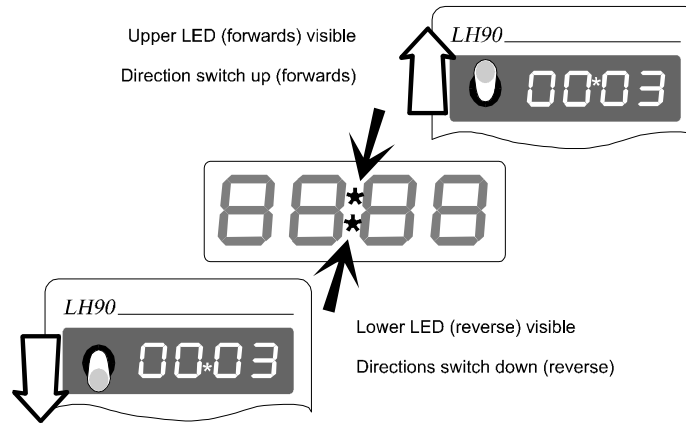
> ☞ **You will immediately take over control of the locomotive address that is in the display by moving the rotary control-knob once the direction switch is in the correct position. You will know that this is the case when the direction LED in the centre is not flashing.**

4.4 Quick function access

The LH90 can address up to 29 functions of a locomotive decoder. The status of the functions is displayed by dots on the display. The status of Functions F0-F4 is normally displayed. After the shift key has been pressed and released the status of F5-F8 are displayed instead of F1-F4 until another key is pressed. **All Functions F1-28 can be accessed via the Func Menu (see section 9 ⇨P. 28)**

Function 0

Function 1(5)
Function 2(6)
Function 3(7)
Function 4(8)
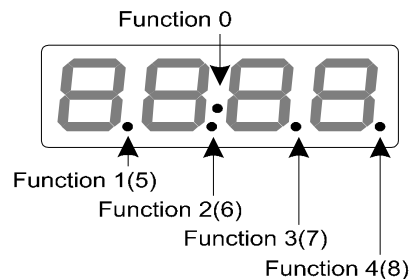
The functions 0 to 4 can be switched on and off by pressing the key once.

0 M switches function 0 on or off (normally the direction-dependent front lighting).

1 5 switches function 1 on or off.

2 6 switches function 2 on or off.

3 7 switches function 3 on or off.

4⁸   switches function 4 on or off.

For functions 5 to 8 you need 2 keystrokes.

⇧ + **1**⁵   switches function 5 on or off.   ⇧ + **2**⁶   switches function 6 on or off.

⇧ + **3**⁷   switches function 7 on or off.   ⇧ + **4**⁸   switches function 8 on or off.
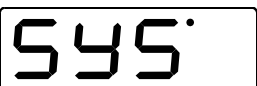
Of course you can only use these functions if the decoder installed in the locomotive has corresponding function outputs and if these are connected to specific functions within the locomotive (lighting, smoke generator, coupling, sound and so on).

5   The menus

The LH90 is a powerful handheld with a lot of unique features. These features are accessed by selecting a specific menu. Whether you can access all the menus listed, will depend on the command station (LZ100, LZV100, SET02, "compact") to which you have connected your LH90. All the LH90 menus are accessed in the same way:

⇧ +   First press the "shift" key. On the display a dot will appear on the upper right hand side.

0^M   You can now scroll through the menus using this key. Press the key briefly to scroll "forwards"(sequence as shown below). Press and hold the key a little bit longer before releasing to scroll "backwards".

Key	Display	Description
0^M	Adr·	Used to enter a new loco address into the stack. (see section 6 ⇨P.15)
0^M	MU	Used to add a locomotive to a multi-unit. (see section 7 ⇨P. 16)
0^M	MU-	Used to remove a locomotive from a multi-unit. (see section 7 ⇨P.19)
0^M	Pro	Used to access the programming sub menu when you want to read or set specific values within a decoder. (see section 8 ⇨P. 22)
0^M	SYS·	Used to read or set specific system or LH90 settings. (see section 13 ⇨P. 33)

0 **M** | `FUnc` | Used to access functions groups 1,2,3 (or F1-28). (see section 9 ⇨P. 28)

0 **M** | `NoN` | Used to set momentary functions (latching or non-latching). (see section 10 ⇨P. 30)

0 **M** | `Sch` | Used to switch turnouts and signals. (see section 11 ⇨P. 30)

0 **M** | `SPE` | Used to display or set the current number of speed steps being used by the LH90 for the locomotive address that was being displayed before the menu was entered. (see section 12 ⇨P. 31)

The "A" key is always used to select the menu that is shown on the display. After selecting with the "A" refer to the instructions specific to that menu.

☞ The LH90 "remembers" the menu which was chosen last, even after the LH90 has been switched off. Whenever you change a menu, the menu last selected is displayed first.

☞ If you wish to leave the menu selection and return to the last operation, press the 【⇧ **+**】 key

☞ Use the Shortcut Menu keys to quickly go to common menus (see section 5.2 below)

5.1 Entering a number into the menu

To enter numbers (such as a locomotive address) within a menu, always follow the same procedure:

Use key 1 to alter the first digit from the left; use key 2 to alter the second digit from the left and so on. Use key 4 to alter the fourth digit from the left.

See the illustration opposite for the allocation shown on the LH90. The lines show you which key controls which digit.
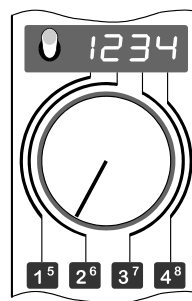
Press the key briefly to increase the displayed value by 1. Press the key and keep it pressed: the value keeps increasing automatically.

5.2   Menu Shortcuts

Menu Shortcuts quickly go to one of three commonly used menus.

| ⇧ + | First press the "shift" key. On the display a dot will appear on the upper right hand side. |

| 0 M | Press this key to enter the menus. You can scroll through the menus as described above or you can press a number key to immediately go to one of three menus. |

| 1 5 | The "1" shortcut key allows you to go immediately to the Address Menu. From this menu you can select a different locomotive address (see section 6) |

| 2 6 | The "2" shortcut key allow you to go the immediately to the turnout control menu. From this menu you can control turnouts and or signals. (see section   ) |

| 4 8 | The "4" shortcut key allow you to go the immediately to the Function Group menu (see section) |

| A ✓ | press the "A" select to confirm the menu selected |

6   Entering a new loco address into the stack - The ADR Menu (Menu Shortcut 1)

From the factory addresses 1 to 8 are stored in the stack. The following procedure is used to enter a new address in place of one address in one 8 stack positions. (remember this is NOT programming the decoder but is setting the address into the LH90's "STACK".)

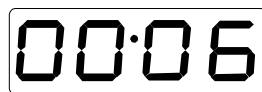In the following example the address 1234 is entered in stack location 6.
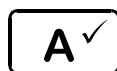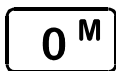
| A ✓ Hold | SP-6 | Go to the stack location of the locomotive address you wish to replace in the stack. In this example we will replace locomotive address 6 in stack location 6 with locomotive address 1234. |

| Release | 00·06 | When the "A" key is released the locomotive address in that stack location is displayed. In this example it is locomotive address 6. |

| ⇧ + | 0 M | Adr· | Go to the menu "Entering a new loco address into the stack". |

| A ✓ | Confirm the menu ADR selection by pressing "A" |

A✓	**0006***	The flashing dot indicates address entry mode. The address shown is the address of the locomotive in the display before you entered the address selection menu.
4⁸	**0004***	Alter the number in the right most digit by pressing the 4 key. Quick button presses raise the digit, long button presses lowers the digit. 2 long presses takes it down to 4.reducing the digit.
3⁷	**0034***	Alter the number in the tens digit by pressing key labeled "3
2⁶	**0234***	Alter the number in the hundreds digit by pressing key 2 twice briefly. Doing so will alter the value to 2.
1⁵	**1234***	Alter the number in the hundreds digit by pressing key 2 once briefly. Doing so will alter the value to 1.
A✓	**12*34**	After pressing the "A" key, you can adjust the position of the rotary control knob as described above.

Until you press the "A" the digits can be changed, Once the "A" is confirmed, the addresses is now located in the stack. You do not have to alter all 4 digits of the display. If certain digits already have the correct value, you can leave them as they are and go to the next digit.

☞ The new locomotive address will replace the old address in the stack position as soon as you confirm it with the "A" key

7   Multi-unit/consisting – The MU and MU- Menus

In this section you will learn:

- what a multi-unit actually is
- how to add a locomotive to a multi-unit and how to delete it afterwards
- how you set the functions of the locomotive while it is in a multi-unit

The abbreviation "MU" stands for "Multi Unit" which describes a collection or a consist of locomotives, which are operated together as a single unit.

☞ The MU function requires the use of a LZ100, LZV100 or a "compact/commander" version 3.2 or greater.
When using SET02, locomotives may only be added to or

> deleted from a MU using the LH200 which functions as a
> command station. All other functions for multi-units such as
> the controlling and accessing of functions of locomotives
> within a MU, are available from any connected LH90.

7.1   What is a multi-unit/consist?

A multi-unit is a group of locomotives that is controlled as a single
unit by using a common address, referred to as the **multi-unit or
consist address**. This multi-unit address always has two digits
(1-99).

During the assembly of the MU each locomotive forming part of
the MU is assigned this multi-unit address, and this is saved by
the locomotive decoder in addition to its individual address. Once
given a MU address, locomotive decoders forming part of the MU
no longer "listen" to their own unique addresses for speed and
direction commands. Instead these commands are sent to their
multi-unit address. Never fear, the locomotive decoders do not
forget their own unique addresses, these are saved and used
when the locomotive is removed from the MU.

When you break up the MU, the multi-unit address in the
locomotive decoder is deleted and the locomotive again listens to
its own address.

> ☞ All locomotives which you wish to add to or delete from a MU
> **have to be located on the track** while you are in the "MU"
> menu! Special MU commands, are sent via the track, to
> locomotives during this operation. This is especially
> important when removing a locomotive from a multi-unit: if
> the remove command does not reach the locomotive
> decoder (due to a bad contact or because you have taken
> the locomotive off the track), the MU address in the decoder
> will not be deleted and the locomotive cannot be run at its
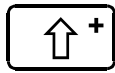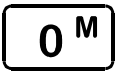> own address!

7.2   Adding a locomotive to a multi-unit (MU)

Move the locomotive that you want to add into the MU to the place
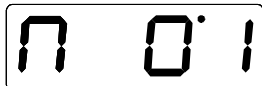on your track system where you want to start controlling the MU.

Make sure that the locomotives will operate in the **same direction**
as the MU when you add them to the MU. If your MU is supposed
to run to the right when you select the forward direction then each
locomotive has to be set in this same direction when it is added to
the consist. This is done by using the direction switch. When
confirming the locomotive address being added to the consist, if

the direction switch is up the locomotive will operate in the same direction as the consist.   If the direction switch is down the locomotive will operate in the reverse direction when you operate the consist in a forward direction.

|		
A ✓ (possibly more than once)	`0003`	Scroll through the stack until the first locomotive that you want to tie into the MU is shown.
⇧ **+** **0 M**	`Adr`	Enter the menus by pressing the shift key followed by the "0^M" key.
0 M	`NU`	Scroll through the menu until "MU" is shown in the display and confirm the selection with the "A" key.
A ✓	`N 01`	You are now asked to enter the desired multi-unit address. A multi-unit address must be between 1 and 99.
4 8	`N 05`	Use the "4" key to alter the value of the ones digit.
3 7	`N 55`	Use the "3" key to alter the value of the tens digit.
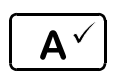
|		
LH90 `0 0003`	LH90 `0 0003`	Before confirming the selected multi-unit address ensure that the locomotive direction is correct.
Up, the locomotive will move in the same direction as the consist.	Down, the locomotive operates in a direction opposite to the consist. direction.	

A ✓	`0003`

Confirm the selected MU address by pressing the "A" key. The locomotive with address 3 has now been added into the multi-unit with multi-unit address 55.

Scroll further through the stack until you reach the next locomotive that you want to tie into the MU or enter the loco address. Again, change the menu and repeat the steps that you have already executed in order to tie the first locomotive into the MU. Proceed until you have tied all locomotives into the MU according to plan. Locomotives can be added or removed from a MU at any time.

☞   You must operate a locomotive before it can be entered into a MU. If the locomotive has not been operated first you will

> get an ER03 message and the operation will not be performed.
>
> ☞ Once the locomotive is in a MU the center LED on the display will light solid to indicate that the locomotive is in a consist.
>
> ☞ If you want to operate the MU using the new MU address, you can either enter this new address into the stack (see section 6 ⇨P.15) or press the Shift key followed by the A to scroll through the addresses in the consist.
>
> ☞ Pressing the ⟦⇧+⟧ key before you have entered the new MU address will exit the MU operation

7.3   Removing a locomotive from a multi-unit (MU-)

Scroll through the stack until the MU is displayed or enter the address of the MU in the stack. You can also begin this operation by selecting any locomotive that is within the MU.

⟦⇧+⟧ ⟦A✓⟧ **0003**	Use the shift "A" sequence to scroll through the addresses within the MU until the first locomotive that you want to remove from the MU is shown. (not the lit LED in the center of the display.)
⟦⇧+⟧ ⟦0ᴹ⟧ **ПU-**	Enter the menu and scroll to the display "MU-" (Removing a locomotive from a MU).
⟦A✓⟧ **ПU-·**	The display flashes. Now you have the possibility to interrupt the removal process. Press "shift" if you wish to cancel the process.
⟦A✓⟧ **0003**	To remove the locomotive from the MU, press the "A" key a second time. (Note the MU LED is no longer lit.)
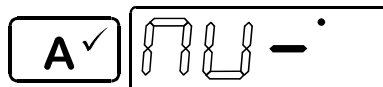
At the completion of the operation, the multi-unit address is displayed again. When you have deleted the last loco address from the MU, the next loco address in the stack will be displayed.

7.4   Operating locomotives in a MU

With Set-01, Set90, Set100 and Set-02, you can control the speed and direction of the MU from the MU address of from any

individual locomotive address that is within the MU. Locomotive functions can only be controlled at the specific locomotive address.

7.4.1   Displaying a multi-unit address

If you use the LH90 with a V3 or later LZ100or LZV100 command station, all multi-unit addresses are marked with the letter "M" and members of a multi-unit are marked with the center LED lit.

� M 55	A MU address is indicated by the letter "M" in the display.
0003	If the upper center LED is on in the display, the locomotive address displayed is part of an MU.

If you wish to view the locomotive addresses that are currently within the MU, proceed as follows:
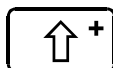
| ⇧ + | | A ✓ | Whenever you see the address of the MU or a member of a MU on the display, you can scroll through the locomotives in the MU by pressing the shift key followed by pressing the "A" key. |

After the last address in the MU has been displayed, the multi-unit/ multi unit address will be displayed when you press the shift "A" key sequence again.

7.4.2   Controlling functions of a locomotive within a multi-unit

The speed and direction of all the locomotives within a MU is controlled via the multi-unit address. If the system implements "Smart Consisting". Speed and direction can also be controlled using any locomotive within the multi-unit. Controlling locomotive functions for a locomotive within the multi-unit can only be done via their respective locomotive address.

If you have the MU address on the display you can scroll through the MU using the shift "A" sequence until the individual locomotive address is on the display.. Now you can control the functions as desired.

7.5   Errors during MU operations:

Multi-units can be used with any decoder that supports "advanced consisting". All locomotive decoders of the Digital plus system which have NMRA C&I warrants support this feature.

| Er03 | If displayed during adding a locomotive to a MU: You have not operated this locomotive address. You must operate a locomotive before you can add it to an MU. |

| ☞   To use MU operations, locomotive decoders have to be set to run with 28/128 speed steps (CV29 Bit 2 is set). |

8   Programming specific decoder features- The PRO Menu

In this section you will learn:

- which programming methods can be used
- how to proceed when programming

☞ The menu "Programming" is only available when the LH90 is operated with a LZ100 or LZV100 command station.

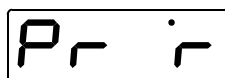☞ Pressing the ⎡⇧⁺⎤ key multiple times during programming will return the LH90 to normal operation.

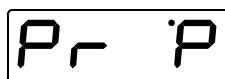There are five different methods for using the LH90 for programming specific decoder features:

Adr·	Smart Addressing-One step process for programming the locomotive address on the programming track, with an address of between 1 and 9999. The system will set all the necessary CVs for you.
Pr ·c	Programming using "Direct Mode" on an isolated programming track.
Pr ·r	Programming using "Register Mode" on an isolated programming track.
Pr ·P	Programming using "Page Mode" on an isolated programming track.
PoΠ·	Programming using "Operational Mode Programming" anywhere on the layout..

The LH90 "remembers" the last programming method used and will display this mode first during the next programming session.

8.1   The difference between "Service Mode" and "Operations Mode" programming methods

During **"Programming in operational mode"** the locomotive with the decoder can be situated anywhere on the layout. To address this locomotive precisely and to distinguish it from the others, it is necessary to know the address of the locomotive. During programming in operational mode the locomotive receives an order that can be described as follows:

"Locomotive number 1234, enter value 15 in CV4!"

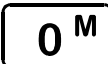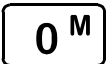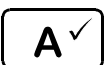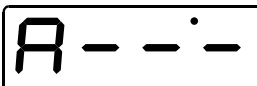Only the locomotive with address 1234 will execute this order.

During **"Programming in Service Mode",** a dedicated section of track is used for the programming function. It is not necessary to know the address of the decoder. During this procedure the decoder receives the order:

"Enter value 15 in CV4!"

Every decoder which receives this order will also execute it. To make sure that only the desired locomotive receives the command, it is necessary to use an isolated programming track. If you wish to alter the address of a locomotive decoder then you must use "Programming in Service Mode". It should also be noted that not all decoders have the "POM" feature.

8.2   Reading and writing a locomotive address using "Service Mode"

The LH90 implements a one step programming mode for reading and writing a locomotive address. Using this mode all the relevant CVs are read or written in one user operation. Make sure that the locomotive whose address you wish to program is located on an isolated programming track and that this programming track is connected correctly to your command station.

⇧ +	0 M	Pro	Enter the menus by pressing the shift key followed by the "0^M" key and scroll through the menus using the "0^M" key until the display reads "Pro".
A ✓	0 M	Adr˙	Confirm by pressing the "A" key and scroll, if necessary, using the "0^M" key until the display reads "Adr"
A ✓		A－－˙－	Confirm the selection by pressing the "A" key.

At this point you must decide whether you wish to read out the address first or whether you wish to enter a new address directly.

If you wish to read out the address, proceed with the next section. If you wish to program a new address directly, proceed to section 8.2.2.

8.2.1   Reading out a locomotive address
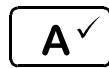
| A✓ | ⌐EAd˙ | Confirm again by pressing the "A" key. "READ" is shown during the reading out process. |
| | 1234* | The result of the read operation is displayed. The example shows locomotive address 1234 was read. |

If you wish to alter this address, proceed with section 8.2.2. If you wish to terminate the reading procedure, press

| ⇧+ | Adr˙ | Press the "0ᴹ" key. You have now returned to the selection of the programming mode. |
| ⇧+ | 0003 | Pres the "0ᴹ" key a second time. The locomotive address that was last controlled last again displayed. |

8.2.2   Setting a locomotive address

First press one of the keys "1" to "4" to begin selecting the new address to be written into the decoder.

| 1⁵ ... 4⁸ | 0001˙ | The display shows the result if the "4" key is pressed first. |

Now, alter the respective digits in the display with keys "1" to "4". Proceed as if you were entering a new locomotive address:

4⁸	0004˙	Alter the value of the ones digit by pressing the "4" key.
3⁷	0034*	Alter the value of the tens digit by pressing the "3" key.
2⁶	0234*	Alter the value of the hundreds digit by pressing the "2" key.
1⁵	1234*	Alter the value of the thousands digit by pressing the "1" key.
A✓	⌐EAd˙	Pressing the "A" key starts the programming procedure. During the programming process, "Read" is displayed first, then "Send".
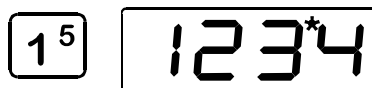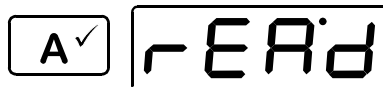
```
 SEnd
```

```
 1234*
```
If the programming was successful, the address is displayed again.

If an error occurred during the programming procedure, a corresponding message is displayed. See section 8.3.6 (⇨P 27). Delete the error message by pressing the "A" key.

8.3   Reading and writing CVs or registers - step by step.

Reading and setting decoder features is always carried out as follows:

1.   Select the programming mode (CV, register, page)
2.   Select the CVs or registers to be read out/programmed
3.   Read out the content of the CV/the register
4.   Set a value into the CV/the register.

Make sure that the locomotive whose address you wish to program is located on the programming track and that this programming track is connected correctly.

8.3.1   Selecting the programming mode

```
 ⇧ +    0 M    Pro
```
Enter the menus by pressing the shift key followed by the "0^M" key and scroll through the menus using the "0^M" key until the display reads "Pro".

```
 A✓    0 M    Pr c
```
Confirm by pressing the "A" key. Press the "0^M" key to scroll through the programming menus until the desired programming mode is displayed.

Confirm your selection with the "A" key. In the example above, the "CV" mode was selected.

8.3.2   Selecting the CV or the register

The section shows the options in CV mode. This same display will also be shown during the selection of "Page" mode. If the "Register" mode is shown, an "r" is displayed instead of the "c".

A ✓   **c001**   "c" flashes to indicate that you may enter the desired CV. If you have chosen programming in the "register" mode, an "r" will flash instead.

4 8   **c003**   Press the "4" key to alter the value of the ones digit. Press the "3" and "2" keys to alter the number of tens or hundreds. For this example CV3 was chosen.

A ✓   **u - - -**   Confirm your selection by pressing the "A" key.
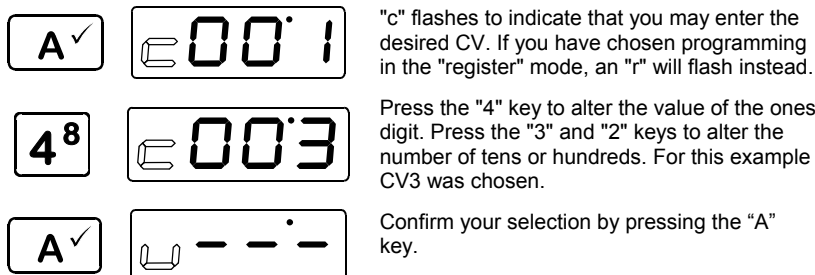
If you wish to read out the content of the CV/the register, proceed with the next section. If you wish to enter a different value into the CV/the register immediately, proceed with section 8.3.4.

8.3.3   Reading out the content of the CV or the register

☞ Carry out steps in sections 8.3.1 to 8.3.2 if you have not yet done so.
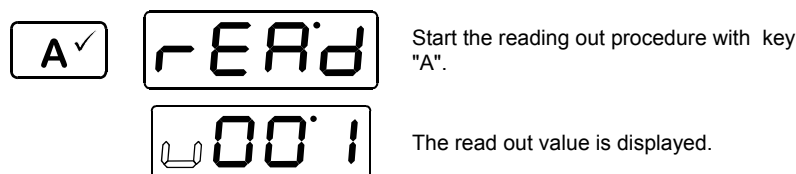
A ✓   **rEAd**   Start the reading out procedure with key "A".

u001   The read out value is displayed.

If an error occurred during the programming procedure, a corresponding message is displayed. See section "Error messages during service mode programming " starting on page 27. Delete the error message with key "A".

If you wish to do so, you may enter a different value into the CV by proceeding with the next section.

8.3.4   Programming a value into the CV/ the register

☞ Carry out steps in sections 8.3.1 to 8.3.2 if you have not yet done so.

4 8   **u000**   Press the "2", "3", or "4" key to get to the value enter display. You are now asked to enter the desired value. A "u" flashes on the display. In the following example the value 10 is to be entered.

3 7   **u010**   Press the "2" to "4"keys to enter the desired value.

A ✓   **SEnd**   When you have the value you want to program press the "A" key to confirm. "Send" is displayed during the programming procedure.
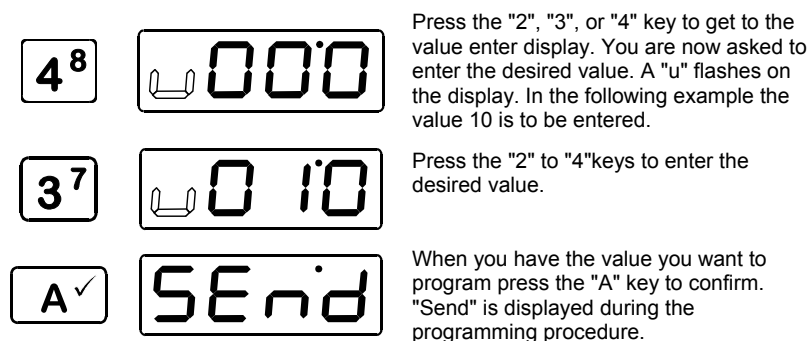
If the programming procedure was successful, the entered value is displayed.

You can alter the value again or return to the selection of a different CV with the "shift" key.

8.3.5   Setting individual bits

Some CVs have specific feature which are set by altering specific bits within the CV. In this case, it is much easier to alter the required setting by setting and deleting the respective bit, instead of calculating the relevant decimal value and programming it into the CV (which is of course also possible).

To alter individual bits in a CV (or register), proceed as if you were entering a value (sections 8.3.1 to 8.3.4) up to the point where you are able to enter a value for the CV. You will see the following displays
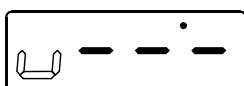
(during programming on the programming track)

or

(during PoM)
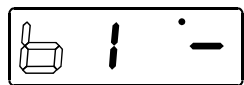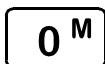
0 M   Press the "0" key to tell the LH90 you wish to program individual bits.
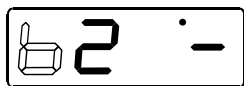
2 6   Use the "2" key to select the bit which you wish to set or delete.

During "programming on the programming track" you can read out the selected bit by pressing key "A". This is not currently possible to read using PoM. In the following sequence a "0" is shown instead of the line in the single digit space.
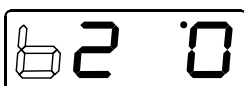
4 8   Use the "4" key to choose whether you wish to set (1), delete (0) or read out (-) the bit.
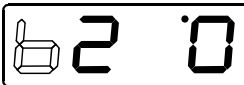
A ✓   Press the "A" key to program (set or delete) or read out the bit.

Press the "shift" key repeatedly to return to controlling locomotives (The LH90 displays the locomotive address).

8.3.6   Error messages during service mode programming

If an error occurs during the reading or writing procedure, you will receive one of the following messages:

E r 0 1

A Short-circuit or overload was detected on the programming track. The locomotive or decoder is drawing power when it is not supposed to do so.

Check the wiring of the decoder, the decoder is defective or there are external loads that must be disconnected

E r 0 2

No decoder acknowledgement was received during the programming operation. Possible cause is a bad contact between the locomotive on the programming track, a faulty connection or a decoder defect.

When an error message is displayed, press the "A" key to return to the selection of the programming mode.

8.4   Programming in operational mode - PoM

PoM (or Operations Mode Programming) allows you to set the value of any CV from 1 to 999 while the locomotive is anywhere on the layout. Please read the operational manuals of your locomotive's decoder to verify whether the decoder is capable of PoM. Locomotives which are not capable of PoM must be programmed on the programming track using service mode.

The procedures for using PoM are identical with the programming of a CV on the programming track. To enter PoM, select "PoM" during the selection of the programming method. Then

1.   select the CV which is to be programmed

2.   program a value into the CV

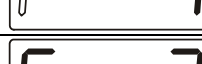During PoM, it is also possible to set or delete individual bits in CVs.
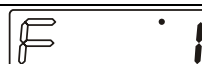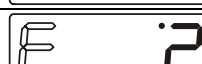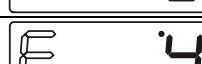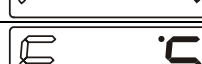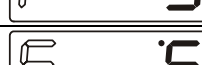
The step-by-step procedure or setting the value of a CV is described in section 8.3.

☞   If you are using a Gold decoder that implements RailCom and you have an LRC120, then it is also possible to read out the value of a CV using PoM. The read occurs each time you press the $\boxed{A^\vee}$ key after entering a CV number or value. The value of the requested CV is shown on the LRC120's display. It is not possible to read out values in a CV using PoM for any decoder that does not implement RailCom.

9   Function operations- The FUnc Menu (Menu Shortcut 4)

Function1 1-4 can be controlled by pressing the number key, Functions 5-8 can be controlled by pressing the shift key followed by the number key. The FUnc menu allows control of Functions 1-12. This is an alternative way to access functions. Enter the

FUnc menu and them press "A". Functions 1-28 can be accessed through this method.

0 M	FUnc	Used to access functions groups 1,2,3
A ✓	F 3	F is flashing use the 4 key to scroll through the 7 function groups. Select the group by pressing "A".
4 8	F 1	Function group 1 switches functions 1, 2, 3 and 4
4 8	F 2	Function group 2 switches functions 5, 6, 7 and 8
4 8	F 3	Function group 3 switches functions 9, 10, 11 and 12
4 8	F 4	Function group 4 switches functions 13, 14, 15 and 16
4 8	F 5	Function group 5 switches functions 17, 18, 19 and 20
4 8	F 6	Function group 5 switches functions 21, 22, 23 and 24
4 8	F 7	Function group 5 switches functions 25, 26, 27 and 28
A ✓	F. . .3.	Confirm your selection with the 'A' key.

After selecting Function Group, the F is solidly lit, and now the indication dots are at the bottom showing what functions is on or off. turn off and on the functions by using the 1,2,3,4 keys.

F. . .3.   Example at left indicates function group 3 with 9, 10, 11, and 12 are "ON". To turn "OFF" press Key 1 controls F9, Key 2 controls F10, etc.

If you are operating you can leave this screen displayed and continue to operate the functions. Or a quick exit using [⇧ +] returns you to the currently operating address.
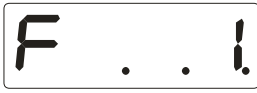
> ☞ With Set-01, Set90, and Set100 you can control the speed and direction of the MU from any individual locomotive address that is within the MU.   However, locomotive functions can only be controlled at the specific locomotive address.

10 Setting up momentary functions- The NoN Menu

This menu allows the functions 1-28 to become momentary or non-latching for a particular locomotive. In other words the functions are active only while the key is pushed and turns off when released.

| 0 M | NoN· | Enter momentary functions (latching or non-latching) menu and select by pressing "A". |

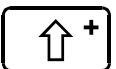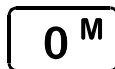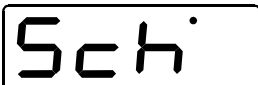| A✓ | F ·1 | F is flashing use the 4 key to access Group 1,2,3 Select the group by pressing "A". |

| A✓ | F . . 1 | By pressing 1,2,3,4 the functions become momentary. This example shows in function group 1, F2, F3, F4 have been set to momentary |

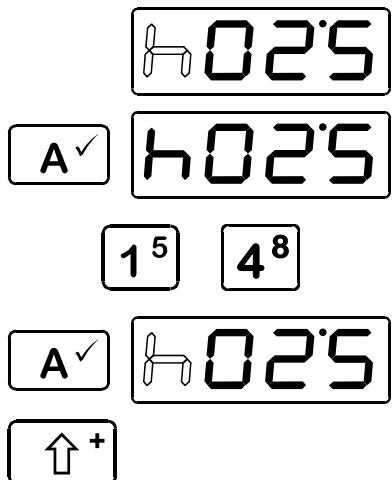| A✓ ⇧+ | Now press the "A" and Escape back to stack. Setting of momentray function control for funciotn 2,3, 4 is complete. |

> ☞ Each locomotive can have any combination of latching or non latching functions
>
> ☞ Function status is stored in the Command Station (LZV100). Database. Once set this information is stored and is usable by any handheld capable of using momentary functions.

11 Switching turnouts and signals- The Sch Menu (Menu Shortcut 2)

You can switch up to 999 turnouts and/or signals with the LH90 (depending on the command station used).

| ⇧+ 0 M | Sch· | Enter the menus by pressing the shift key followed by the "0^M" key and scroll through the menus using the "0^M" key to the turnout menu "Sch" which is used to control turnouts. |

| A✓ | h001 | Confirm the selection by pressing the "A" key. The display flashes "h" to indicate that you may now enter the desired turnout address. |

Use keys "2", "3", and/or "4" to enter the desired address of the turnout or signal.

Confirm your selection by pressing the "A" key.

Key "4" switches the turnout to straight "+". Key "1" switches the turnout to diverge "-".

Press the "A" key again to select a different turnout address.

Use the "shift" key to return to the display of the locomotive address.

☞ While you are in the "Switching" menu, you can use the rotary control-knob to control the speed of the locomotive whose address was shown on the display when the switching menu was entered.

While you are in the "Switching" menu you can press the "2" key to increase the turnout number being controlled or press the "3" key to decrease the turnout number being controlled
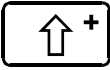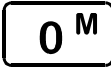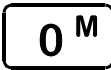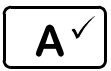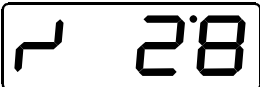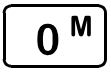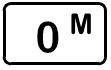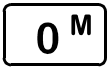
12 Matching Throttle-Notches to the Speed Steps- The SPE Menu

The range from a stop to the maximum speed of a locomotive is divided into throttle-notches. In the prototype locomotive there is only a need for a very limited number of throttle notches. For our models we often want much smoother operation than offered in the prototype. The LH90 rotary control knob has internally 256 different throttle positions to provide the maximum smoothness in operation.

DCC decoders support a variety of speed step modes. The most common are 14, 28, and 128. Speed step modes reflect the number of throttle notches that the decoder will support. The LH90 supports all three of these speed step modes. Since different commands are sent to the decoder in all three modes it is necessary to match the number of LH90 throttle notches to the decoder's speed step mode. The LH90 default is 28 throttle notches which in combination with the smoothness of the LH90 rotary control knob provides the smoothness that most modelers desire.

The "SPE" menu is used to set or display the current number of throttle-notches being used by the LH90 for the specific locomotive address that was displayed prior to entering the menu. Possible values are 14, 27, 28 or 128 throttle-notches. The modes which are available depend on the command station used. Today most decoders are delivered 28/128 speed step.

However, you might have some older decoders that support only 14 speed steps. If you desire to change the speed steps that the system uses for sending commands to the decoder, scroll through the stack until you reach the address whose throttle-notch you want to display or alter. Turn the rotary control-knob as far to the left as possible (throttle-notch 0).

⇧ +	0 M	Adr˙	Press the "shift" key and the "0" key to enter menu mode.
	0 M	SPE	Press the "0" key to scroll to the menu "Display/ Alteration of throttle-notch mode"
	A ✓	⌐ 28	Press the "A" key to select the menu. The current throttle-notch mode for the selected locomotive address is displayed.
	0 M	⌐ 128	Press the "0" key to scroll through the available modes to change the setting.
	0 M	⌐ 14	
	0 M	⌐ 27	When the mode you desire is displayed, confirm your choice by pressing the "A" key.
	A ✓	0003	Now the locomotive address whose throttle-notch you have altered is displayed again.
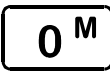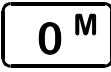
☞ Speed Step setting or display is only possible with the locomotive at a complete stop.

☞ The locomotive's speed step setting is stored in the command station database and once set is available to all handhelds.

☞ While in the "SPE" menu. if you only wish to display the current throttle-notch mode for the selected locomotive address and do not wish to make a change, press the ⬆+ key to exit the menu.

☞ For locomotive addresses 100-9999, only the 28 and 128-throttle-notch modes are available for use.

☞ The locomotive decoder's speed step mode (set via CV29) must match the LH90 throttle-notch mode. The default for all current production decoders is 28 speed steps.

13 LH90 system settings- The SYS Menu

LH90 system settings are settings that affect the control of all locomotives, rather than an individual locomotive. The function of the emergency stop key or the current software version are examples of system settings you can display any or adjust.

The reading or setting of all system features is performed in a similar way:

⬆+ 0ᴹ **Adr·**   Enter the menus by pressing the shift key followed by the "0ᴹ" key.

0ᴹ **SYS·**   Scroll through the menu, until "SYS" for System Settings is displayed.

Confirm your selection with key A.

A✓ **ɣ iO**   "y" flashes to indicate that you may alter the figure value.
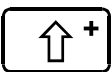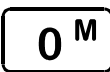
From here onwards the numerical values are altered in the same way as for other menus. Now choose the desired system feature:
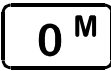
Y	Generates
7	Pressing the emergency stop key causes the voltage on the track is switched off.
8	Pressing the emergency stop key causes only the locomotive with the address shown on the display to be stopped.
9	Pressing the emergency stop key causes all locomotives to be stopped, but the voltage on the track remains on.
10	Alteration of the XpressNet – address.
11	LH90 Software release is displayed.
12	Version number of LH90 is displayed.
13	Version number of the command station is displayed.
14	Stack size – The stack size can be set by entering a value of between 2 and 8.
99	The configuration of LH90 is reset to factory default: 1. Addresses 1 to 8 are entered in the stack. 2. The XpressNet address is set to 2. 3. The voltage will be switched off when the emergency stop key is pressed. 4. The stack size is set to 8.

13.1 Altering the XpressNet address (Sys 10)

☞ When setting the XpressNet address, please bear in mind which device your LH90 is connected to.
The LZ100 and LZV100 command stations use XpressNet addresses 1 to 31.
SET02, uses XpressNet addresses 1, 2, 3, 29, and 31.
The address selected must not be used by any other XpressNet device connected to your layout!

To set the XpressNet address, proceed as follows:
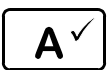
⇧ +	0 M	**Adr**	Enter the menus by pressing the shift key followed by the "0^M" key.
	0 M	**SYS**	Scroll through the menu, until "SYS" for System Settings is displayed.

Confirm your selection by pressing the "A" key.

A ✓	**Y 10**	"Y 10", the setting of the XpressNet address, is shown first.
A ✓	**LH02**	Press "A" to display the current XpressNet address of the LH90.
	LH04	Alter the address by using the "3" and/or "4" keys to set the desired address.
A ✓	**SYS**	Confirm by pressing the "A" key. The menu "SYS" will be displayed again. Use the "shift" key to view the display of the last locomotive address.

14 Technical appendix

14.1 Error messages on the display

$$Er01$$

LH90 always shows a message if you have done something which is not permissible at the time or if a certain function cannot be executed. To undo the relevant step, simply press

A ✓
.

The following is a list of possible messages:

Er01	During service mode programming an overload (short-circuit) was detected. Perhaps the decoder is not connected properly or it is defective.
Er02	During the programming or reading a decoder CV no decoder confirmation was received. This can be caused by the decoder not being properly connected to the programming output, the decoder is defective or not installed correctly, or the programming track is not connected properly.
Er03	1. If displayed immediately after you plug in your LH90: the command station uses a software version which is older than version 3.0. 2. If displayed during adding a locomotive to a MU: You have not operated this locomotive address. You must operate a locomotive before you can add it to an MU.
Er97	The LZ100/LZV100 has encountered a data processing error. All information on speed, direction and special functions of the locomotives as well as on the status of turnouts and occupation detectors has been deleted. If this error occurs repeatedly, it may be the result of the power supply or it might be that the battery of the LZ100/LZV100 needs replacing. This battery makes sure that data are kept when the command station is switched off. Please contact your dealer or contact Lenz for further instructions..
Er98	The command sent from the handheld to the command station is not recognized by the command station. Normally this happens if the software version of the command station does not support this feature. Typical example You are trying to use Service mode Programming, but you have connected your LH90 to a Set-02.

14.2   Glossary

The most important terms of the *Digital plus by Lenz*® system:

Address	The number of a locomotive, comparable to a telephone number.
Acceleration and deceleration delay	Setting on a locomotive decoder. The acceleration delay determines how fast a locomotive reaches the speed belonging to a higher speed step, the deceleration delay determines how fast a locomotive reaches the speed connected with a lower speed step.
Configuration Variable (CV)	Address, starting voltage, acceleration rate and deceleration rate are examples of features which can be customized within the locomotive decoder. You will find detailed information on the features of Digital plus locomotive decoders in their respective manuals, available from your dealer from our WWW site (www.lenz.com) or direct from Lenz Elektronik GmbH (send a stamped addressed C5 envelope).
DCC	Abbreviation for "**D**igital **C**ommand **C**ontrol". This term has come to refer to the digital model railroad control system developed by Lenz and standardized by the NMRA.
Locomotive address	see address
Locomotive stack	"Index card box" that allows quick selection of a locomotive address.
Multi-unit consist	Controlling several locomotives at the same time with a common address
NMRA	**N**ational **M**odel **R**ailroad **A**ssociation, North American model railroaders organization
NMRA DCC Standards and RPs	A standard developed by the NMRA based on Lenz Digital plus, which determines the transfer of information to locomotive decoders and accessory decoders. These standards define the interchange of decoders produced by different manufacturers.
Packet format	The manner and method by which the information is transmitted from the command station to the decoder.
Decoder settings	see CVs
Throttle positions	The area on the handheld between the minimum and maximum speed is divided into individual sections called throttle positions.
Throttle-notches	Determines whether a locomotive is controlled with 14, 27, 28 or 128 speed step mode.
XpressNet	High speed data communication network for connecting DIGITAL plus input devices together
XpressNet input devices	Devices that are used to control the model railroad. In the DIGITAL plus system these are: hand held controllers, computer interface, etc.

15 <u>Help in trouble shooting</u>

Problem	Possible cause	Solution
Controlling locomotives:		
Locomotive does not run	Wrong locomotive address in the display	Enter the correct locomotive address.
	The system is set for 128 speed step operation and the decoder does not support this mode.	Change the system setting for this decoder to 14, 27 or 28 speed step operation depending on the capabilities of the decoder.
Locomotive does not react to the turning of the rotary control-knob.	Direction switch is in centre position.	Place the direction switch in the forwards or backwards position.
Locomotive does not react to the turning of the rotary control-knob.	Direction switch is in wrong position during the take over of the locomotive.	Place the direction switch in the position indicated by the flashing dot ($\Rightarrow$P. 7)
Unable to change the speed step mode	The speed of the locomotive is not 0	Set the speed to 0 **before** setting the speed step mode.
Locomotive does not react when speed step mode 128 is selected	The locomotive decoder does not comprehend this mode	Select the 14, 27 or 28 speed step mode for the use of this decoder.
Locomotive does not run using its basic address.	Locomotive is perhaps integrated in a multi-unit/consist	Control the locomotive using the multi-unit/consist address.
Locomotive address on the display flashes.	Selected address is already being used on a different manual control.	Select a different locomotive or take over the locomotive: place the rotary control-knob and the direction switch in the correct position (see "Adapting the rotary control-knob position") and move the rotary control-knob briefly.

Locomotive lighting

(F0) switches on and off when the rotary control-knob is turned.	Locomotive decoder is set at running-notch mode 14. In the LH90 the relevant address is allocated to the running-notch mode 28.	Alter the running-notch mode in the LH90 to 14 notches or set the locomotive decoder to 28 running-notches (set CV29 Bit 2).
The locomotive lights (F0) do not respond when the ⬚0 key is pressed.	Locomotive decoder is set at running-notch mode 28. In the system the relevant address is allocated to the running-notch mode 14.	Alter the running-notch mode in the system to 28 notches or set the locomotive decoder to 14 running-notches (delete CV29 Bit 2).
	Locomotive decoder is set at running-notch mode 14. In the system the relevant address is allocated to the running-notch mode 28.	Alter the running-notch mode in the system to 28 notches (set CV29 Bit 2).

Emergency stop and off:

The display shows a flashing "OFF"	An emergency off was initiated by another hand held controller	End the emergency off by pressing the ⊚ key.
	A power station has shut down because of a short circuit or overload.	Remove the cause of the short circuit. If the cause is an overload, consider dividing the layout into several power districts. Refer to "Power supply for a large model train layout" in the system operation manual.

16   North American Warranty

Lenz GmbH does everything it can do to ensure that its products are free from defects and will operate for the life of your model railroad equipment. From time to time even the best engineered products fail either due to a faulty part or from accidental mistakes in installation.   To protect your investment in Digital Plus products. Lenz GmbH offers a very aggressive 10 year Limited Warranty.

This warranty is not valid if the user has altered, intentionally misused the Digital Plus product, or removed the product's protection, for example the heat shrink from decoders and other devices. In this case a service charge will be applied for all repairs or replacements. Should the user desire to alter a Digital Plus Product, they should contact Lenz GmbH for prior authorization.

Year One: A full repair or replacement will be provided to the original purchaser for any item that that has failed due to manufacturer defects or failures caused by accidental user installation problems. Should the item no longer be produced and the item is not repairable, a similar item will be substituted at the manufacturer's discretion. The user must pay for shipping to an authorized Lenz GmbH warranty center.

Year 2 and 3: A full replacement for any item will be provided that has failed due to manufacturer defects. If the failure was caused by accidental user installation or use, a minimal service charge may be imposed. Should the item no longer be produced and the item is not repairable, a similar item will be substituted at the manufacturer's discretion. The user must pay shipping to and from the authorized Lenz GmbH warranty center during this portion of the warranty period.

Year 4-10: A minimal service charge will be placed on each item that has failed due to manufacturer defects and/or accidental user installation problems. Should the item no longer be produced and the item is not repairable, a similar item will be substituted at the manufacturer's discretion. The user must pay shipping to and from the authorized Lenz GmbH warranty center during this portion of the warranty period.

> **Please contact your dealer or authorized Lenz GmbH warranty center for specific instructions and current service charges prior to returning any equipment for repair.**

Hüttenbergstrasse 29 35398 Giessen Germany Hotline: 06403 900 133 Fax: 06403 900 155 info@digital-plus.de	**Lenz** Elektronik GmbH **www.lenz.com**	Lenz Agency of North America PO Box 143 Chelmsford, MA 01824 USA Phone: 978 250 1494 Fax: 978 455 LENZ support@lenz.com

Warning: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

This equipment complies with Part 15 of FCC Rules.   Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Please save this manual for future reference!