Uhlenbrock digital

RailCom by Lenz Elektronik GmbH

IntelliDrive Deluxe 76 560

Multi-protocol Decoder with Load Regulation and RailCom® for Locomotives with a 22-pole PluX-Interface

Characteristics

- Regulated Multi-protocol decoder for DCC, Motorola
- Quiet motor running with 18.75KHz control frequency
- 14, 27, 28, 31 and 128 speed steps depending on the data format
- Short (1-127) and long (128-9999) addresses
- NMRA compatible
- RailCom
- Minimum, maximum and middle speeds adjustable
- Speed step table for 14 and 28 Speed Step modes
- Mainline programming (DCC)
- Switchable shunting speed (half Speed)
- Switchable start/stop inertia
- Direction dependent, dimmable lighting switched via F0
- Switchable Train Lighting
- 7 special functions, dimmable, time switched
- Configurable blink generator for all Function outputs
- Two time switched function outputs for electric couplings
- Speed step dependent control for smoke units
- SUSI-Interface for connecting Sound modules or other modules for controlling switchable auxiliary functions (f1-f12) via the PluX-Interface
- Generates the identification address for controlling the LISSY Mini-transmitter module 68400 via the PluX-Interface
- Reacts to DCC brake signal or braking section in DC operation
- Protected against overheating, all outputs have short circuit protection
- Conventional DC operation with automatic switching between DC and digital mode
- All CVs programmable by digital devices with DCC and Motorola formats
- Updatable using Flash memory

Description

The 76 560 locomotive decoder is a small, efficient Multi-protocol decoder. It can be used in DCC and Motorola digital systems and runs equally as well in analogue mode with DC or AC current and travel direction changing by an over-voltage pulse (Märklin-System). The operating mode is automatically detected.

The Decoder is suitable for DC, and also bell armature motors (e.g. Faulhaber, Maxon, Escap) with continuous power consumption of 1.2A. Higher switching currents are briefly tolerated. Configuration of the motor characteristic curve is done either by setting the minimum, middle and maximum speed or via various CV's for the individual speed steps.

The load regulation can be adapted for the different locomotive motors.

The decoder provides two travel direction dependent light outputs and 7 Special function outputs, which can be controlled by function keys f1 to f12 (function mapping). All outputs are connected to the 22-pole PluX-Interface on the designated pin. They are dimmable and can blink at a programmable frequency. Two time switched outputs are available for operating electrical couplings. For dynamic smoke generation from a smoke generator, these can be operated depending on the speed step.

Head and Tail light can be switched off depending on the travel direction.

Installing the locomotive Decoder 76 560

Connecting the Module

Remove the bridging plug from the locomotive and plug decoder interface plug into the vacant PluX 22 socket (note the coding).

Connecting Special functions

The Special function outputs A1 to A7 are integrated into the 22-pole PluX-Interface.

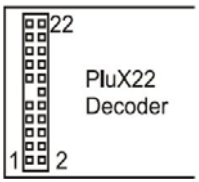
Connecting a Sound module

A Sound module can be connected if the locomotive is fitted with SUSI-Interface socket or when the decoder is installed with a 71680 adapter board with SUSI-Interface, in a locomotive without SUSI-Interface.
Insert the connector from the Sound module into the 4-way SUSI-socket.

Pin assignment of a 22-pole PluX-Interface

Pin	PluX22 Interface
1	General input and output
2	Special function output 3
3	SUSI - clock
4	SUSI – data
5	Decoder earth (post-rectifier)
6	20 V (post-rectifier)
7	Light front
8	Motor output 1
9	20 V (post-rectifier)
10	Motor output 2
11	Missing = coding

Pin	PluX22 Interface
12	2-rail: right track / 3-rail: pickup
13	Light rear
14	2-rail: left track / 3-rail: track
15	Loud speaker A
16	Special function output 1
17	Loud speaker B
18	Special function output 2
19	Special function output 4
20	Special function output 5
21	Special function output 6
22	Special function output 7



Digital and analogue Running

On digital layouts the decoder can be controlled with Motorola or DCC data formats. Enter address 3 on the control device. The decoder runs according to the data format with which it was addressed, in Motorola mode, or in DCC mode with 28 speed steps.
If the decoder is employed on conventional analogue layouts, then it can operate either with DC or AC transformer (System Märklin). All operating modes are automatically detected by the decoder.

Function outputs in Analogue operation

Prior programming with a digital center determines which function outputs, light to A7 are active in analogue mode. For this CV 13 must be programmed according to the appropriate CV-table. Each output has a corresponding Bit 0 to 7 which must be set.

If, for example, only the light (Bit 0 = 1) and function output A1 (Bit 1 = 1) are to be on then Bits 0 and 1 must be set. So a value of 3 must be programmed into CV 13.

Function Mapping

The light outputs and A1 can be assigned to special functions f0-f3 according to the above table. Outputs A2 to A6 can be assigned to all special functions f0-f12. Output A7, and also the shunting mode, start and brake inertia can only be assigned to special functions f4-f12. Each Bit in CV's 33-46 assigns a switching task to the corresponding special function key.

If a number of bits are set the special function will operate a number of outputs together.

Example: *If e.g. special function key f4 is to switch the shunting mode (RG), start/brake inertia (ABV) and output A4, then CV 38 must have the value 196, i.e. Bits 2 (value 4*), 6 (value 64*) and 7 (value 128*) must be set.*

CV	Function Key	ABV	RG	A7	A6	A5	A4	A3	A2	A1	A0h Light Rear	A0h Light Front	Value
33	f0f				128	64	32	16	8	4	2	1	1
34	f0r				128	64	32	16	8	4	2	1	2
35	f1				128	64	32	16	8	4	2	1	4
36	f2				128	64	32	16	8	4	2	1	8
37	f3				128	64	32	16	8	4	2	1	16
38	f4	128*	64*	32	16	8	4*	2	1				4
39	f5	128	64	32	16	8	4	2	1				8
40	f6	128	64	32	16	8	4	2	1				16
41	f7	128	64	32	16	8	4	2	1				32
42	f8	128	64	32	16	8	4	2	1				128
43	f9	128	64	32	16	8	4	2	1				64
44	f10	128	64	32	16	8	4	2	1				0
45	f11	128	64	32	16	8	4	2	1				0
46	f12	128	64	32	16	8	4	2	1				0

Switch off train lighting front and rear

In CV107 (front) and CV108 (rear) the special function number 1-12, which will turn off the white and the red light front and rear, can be entered. It can also be programmed here which function output has the red end of the train light connected to it.

The function entered here must be configured in the Function-Mapping so that it switches no other outputs. Further, the Function-Mapping must be configured so that the outputs for the red lights are not switched off or on by other function keys, i.e. the Function-Mapping CV for f-key which is entered here must be set to zero. So that the switching off of the lights functions correctly both CV's 107 and 108 must always be programmed. If one of CV's 107 or 108 is programmed with the value 0 the function is considered to be deactivated.

The value programmed into CVs 107 and 108 consists of two parts.

Firstly, to which of the outputs A1 to A7, the light to be turned off is connected and secondly with which function key f1 to f12 the lighting is to be switched. Because a CV can only contain a single value it is calculated according to the follow schema:

Light allocation: A0v = white light front, A0h = white light rear
CV107 for red light front
CV108 for red light rear

Calculation: Output * 16 + function key
Example: the red front light is to be connected to A3 and controlled by f5.
CV 107 = 3 * 16 + 5 = 53
The red front light is to be connected to A4 and controlled by f6.
CV 108 = 4 * 16 + 6 = 70

Blink generator for all Function Outputs

The On and Off time of the blink generator is configurable. The light outputs and outputs A1-A7 can be connected with the blink generator.
CV109: Blink assignment Bit 0-7 = light, A1-A7
CV110: Blink generator Off time in 100ms steps
CV111: Blink generator On time in 100ms steps

Dimming of the Function Outputs

Each output can be configured via various PWM values (Pulse width modulation). The PWM values amount to 0 (0%) to 32 (100%). The PWM frequency is around 52 Hz.
The dimming for light upto A7 is configured with CV's 116 (light) to 123 (A7).

Configuration of the Function Outputs A1 and A2 for electrical Coupling

An electric coupling can be connected to A1 and A2. When the corresponding output is switched on it is first fed with PWM1 for a time of T1 and after that for a time period of T2 with PWM2. Subsequently the output is turned off for a period of T3. The sequence can be repeated up to 255 times.

Configuration via:

CV124 – Coupling repetitions	0=none, couplings	0-255
CV125 – Coupling-PWM1	Switch on-PWM	0-255
CV126 – Coupling-PWM2	Halt-PWM	0-255
CV127 – Coupling time T1 x 50ms	On time	0-255
CV128 – Coupling time T2 x 0.1s	Hold time	0-255
CV129 – Coupling time T3 x 0.1s	Pause time	0-255

Note: *In order to protect the coupling, the number of repetitions should be minimized.*

Dynamic Smoke Generator control

A Smoke generator can be connected to output A1 or A2. On departure the output for the smoke unit is fed with PWM1 for a programmable time T1.

After the timeout the output is switched over to PWM2, for as long as the speed step is larger than 0. If the Motor speed step is 0, it is switched to PWM3 (idle running).

Configuration via:

CV130 – Bit 7=1 A1 = Smoke generator operation,
Bit 6=1 A2 = Smoke generator operation
Bit 5-0 Acceleration time x 0.2s
0=no Smoke generator operation

CV131 – PWM1 Starting	(from stop to wanted speed step)
CV132 – PWM2 Normal operation	(wanted speed step)
CV133 – PWM3 idle	(stationary)

RailCom

If the locomotive decoder is to operate with RailCom Bit 3 of CV 29 must be set. Additionally the Motorola Format in CV 12 must be switched off.

Märklin Braking section

The decoder reacts to a Märklin Braking section (Braking with an analogue voltage on the track), if CV 29 Bit 2 and CV 49 Bit 7 are set to 1 (Default 1 and 0).

Programming

In factory default state, all decoder options are changed using configuration variables (CVs) according to the DCC standard. The decoders can be programmed by an Intellibox, DCC Centre and Motorola Centre.

Programming with the Intellibox

We recommend programming the decoder using the programming menu for DCC decoders irrespective of the format in which it is to be driven later.

The Intellibox supports DCC programming with a user friendly input menu. Long addresses do not have to be laboriously calculated and can be entered directly. The Intellibox calculates the values for CV 17 and CV 18 automatically.

In addition it sets bit 5 of CV29 to 1, so that the decoder also uses the long address.

For the exact approach please read the appropriate chapter in the Intellibox manual.

Special case Locomotive addresses 80 to 255 in Motorola Data format

In the Motorola data format the Intellibox supports an address range to 255. Addresses 1 to 80 can also be programmed using DCC programming. However if locomotive addresses larger than 80 are to be used the address must be programmed as in chapter “Programming with a Märklin center”.

After this programming is completed the CV1 has the value 0 and the decoder uses the Motorola address larger than 80.

Programming with DCC devices

Use the programming menu of your DCC center to select and program the decoders CV's by register, direct CV or Page programming. It is likewise possible to program the decoder by main line programming with a DCC digital center.

For the exact approach please refer to the manual for your center.

Programming of long Addresses without Programming menu

If programming is to be done with a center which does not support programming with an input menu, the value for CV17 and CV18 must be calculated.

Here is a guide for programming address 2000.

- Divide the address by 256 (2000/256 = 7 remainder 208).
- Take the integer value (7) and add it to 192.
- Enter the result (199) as the value for CV 17.
- Enter the remainder (208) as the value for CV 18.

Important: *Set bit 5 of CV 29 to 1, so that the decoder uses the long address.*

Calculation of the Configuration Variable values

CVs 29 and 49 are to be used for defining different modes for the decoder.

The value to be entered is calculated by the CV-table by adding the values of the desired functions.

Example

Normal driving direction Value = 0
28 Speed steps Value = 2
Auto. Analog/Digital detection Value = 4
RailCom switched off Value = 0
Speed steps using CV 2, 5, 6 Value = 0
Long address Value = 0
The sum of all the values is 6.
This value is set to CV29 as Factory default value.

Bit	CV 29 function	Value
0	Normal driving direction Reverse driving direction	0 1
1	14/27 speed steps 28/128 speed steps	0 2
2	Only digital operation Automatic analog/digital change over	0 4
3	RailCom switched off RailCom switched on	0 8
4	Speed steps using CV2, CV5 and CV6 Characteristics using CV67-CV94	0 16
5	Short address (CV1, register 1) Long address (CV17 and CV18)	0 32

Programming with a Märklin Center

With a Märklin center all CV's can be programmed, but not read.

1. Switch the Center off and on.
2. Select the address of the decoder and switch the light on.
3. Operate the direction change-over 5 times in quick succession with the stationary locomotive (speed step 0), until the light turns off.
4. Set the speed controller to “zero”. The rear light flashes slowly 4 times.
5. Enter the number of the CV that is to be programmed.
6. Briefly operate the direction change-over.
   The rear light flashes fast 4 times.
7. Enter the desired value for the CV e.g. a locomotive address.
8. Briefly operate the direction change-over.
   The rear light flashes slowly 4 times.

If further CVs are to be programmed, repeat points 5-8.

If programming is to be terminated switch the center to “STOP” or set the address to 80 and briefly operate the direction change-over.

Note: *Since programming with a Märklin Motorola digital center accepts only inputs of 01 to 80, the value “0” must be entered by entering the address as “80”.*

Page-Register for inputting CV-Numbers greater than 79

CV addresses larger than 79 can only be programmed with the help of the page register, CV66. If CV66 has a value higher than 0, then the contents of CV66 times 64 will be added to every address entered. The entered value must lie in the range 1 to 64. When leaving Motorola programming mode the page register (CV66) automatically resets to zero.

Example

If CV82 is to be programmed with a value of 15, then CV66 must first be programmed with a value of 1. Subsequently, CV18 can be programmed with a value of 15. The decoder places

the value 15 into CV82, which is derived from multiplying the contents of the CV66 (in the example 1) by 64 (thus 64) and then adding the entered CV address (18).

Offset-Register for entering CV values greater than 79

CV values larger 79 can be programmed only with the help of the offset register. The offset register is CV65. If CV65 contains a value > 0, then all following programmed values are calculated by multiplying the contents of CV65 by 4 and adding the result to the entered value. When leaving Motorola programming mode the offset register (CV65) automatically resets to zero.

Example

CV49 is to be programmed with a value of 157 then CV65 must first be programmed with the value of 25. Subsequently, CV49 can be programmed with a value of 57. The decoder places the value 4 * 25 + 57 into CV49.

Note: *When programming CV65 and CV66 the contents of the offset and page registers have no effect.*

Programming with a Mobile Station

The programming menu is available under the Mobile Station Locomotive menu for particular locomotives. A locomotive which has a programmable decoder must be selected from the database. Proceed as follows:

1. Enter a new locomotive and select Part No. 36330. The display indicates the Locomotive Ee 3/3.
2. Press the "MENU/ESC" key and select the entry "LOK ÄNDERN". Here you will find among other things the last item Register Programming with the designation "REG". Use this function to change CV's in the decoder. The CV's can only be written with this function.
3. Enter the CV number and confirm with the reversing button.
4. Afterwards enter the new value for the CV and press the reversing button. The Mobile Station now programs CV with the desired value.

Note: Before programming, remove All locomotives which are not to be programmed from the track!

Motor Regulation

The motor regulation can be fitted to locomotives with CV's 53 to 58. The individual CV's have the following meaning:
CV53 Regulation Repetition rate
CV54 P-constant for the PID Regulator
CV55 I-constant for the PID Regulator
CV56 Regulator frequency
CV57 D-constant for the PID Regulator
CV58 Length of time slot for measuring the EMF voltage

Guide for changing the regulation parameters P, I, D:

1.) Preset the decoders CV 2, 5 and 6 (min., max. and middle speed.) the Motor regulation in CV54, 55 and 57 to factory default.
2.) Set CV55 and 57 to zero
3.) Set CV54 so that the locomotive just starts to move on speed step 2.
4.) Increase CV55 so that the locomotive starts to run during the change from speed step 0 to 1 and runs as desired on speed step 1. (The incremental change should be 1.)
5.) Jerkiness at a speed step can be compensated in CV57. (The incremental change should be 1.)
6.) If necessary adjust CV2 and start the setup again from step 2.).

If you don't get a satisfatory result, then try:

a) Changing the regulation repetition rate CV53.
b) Increasing the measuring time of the EMF voltage CV58. (With some Motors smooth running at low speeds can only be achieved this way)
c) Decrease the regulation frequency in CV56. (Applies when the locomotive already runs at top speed when it is set to a speed step lower than the maximum and after which the speed no longer changes)

Apply the various changes to CV 53, 57, 58 in small steps and if necessary repeat the settings to the PID regulation, as in points 1.) to 6.).

Table of individual CV's (Configuration Variables)

CV	Description	Value range	Default value
1	**Locomotive address**	DCC 1-127 Mot 1-80	3
2	**Minimum Speed**	1-63	1
3	**Acceleration** 1 means that every 5 ms the actual speed is increased by 1 If the internal maximum speed is set to 200 (CV5=50 or CV94 = 200), then acceleration time from 0 to Fmax is 1sec.	1-63	2
4	**Braking inertia** (time factor CV3)	1-63	2
5	**Maximum speed** (must be greater than CV2)	1-63	48
6	**Middle speed** (must be greater than CV2 and less than CV5)	1-63	24
7	**Software version** (The processor can be updated)	-	Varies
8	**Manufacturer ID**	-	85
12	**Digital Format** Bit 0=0 Data format DCC off Bit 0=1 Data format DCC on Bit 1=0 Data format DCC off Bit 1=1 Data format DCC on *Note: If both formats are switched off the decoder only can be programmed*	1-2	3
13	**Function Outputs in Analogue operation** Bit 0-7 = Light and A1 to A7; on (Bit = 1), off (Bit = 0)	0-255	1
17,18	**Long locomotive address** 17 = high byte 18 = low byte	1-9999 199-231 0-255	2000 199 208
19	**Consist address** (double traction) 0 = Consist address inactive When bit 7=1 the driving direction is reversed The desired speed CADR + 128 = reverse direction	1-127	0
29	**Configuration for DCC** Bit 0=0 Normal direction Bit 0=1 reversed travel Bit 1=0 14 speed steps Bit 1=1 28 speed steps Bit 2=0 Only digital operation Bit 2=1 automatic analog/digital switching Bit 3=0 RailCom switched off Bit 3=1 RailCom switched on Bit 4=0 Speed steps from CV 2, 5 and 6 Bit 4=1 Speed characteristics from CV67~94 Bit 5=0 Short address (CV 1) Bit 5=1 Long address (CV 17/18)	Value 0 * 1 0 2 * 0 4 * 0 * 8 0 * 16 0 * 32	0-255	6
33-46	**Function mapping** (see Table "function mapping")	0-255	Varies
47	**Speed Correction forwards**	0-63	32
48	**Speed Correction reverse**	0-63	32
49	**Locomotive decoder configuration** Bit 0=0 Motor load regulation On Bit 0=1 Motor load regulation Off Bit 2=0 Brakes down to 0 in brake section Bit 2=1 Brakes to speed step in CV 64 Bit 5=0 Voltage divider load regulation EMF / 2 Bit 5=1 Voltage divider load regulation EMF / 3 Bit 6=0 Light outputs not swapped Bit 6=1 Light outputs swapped Bit 7=0 Brake only with brake signal Bit 7=1 Brake with analog potential	Value 0 * 1 0 * 4 0 * 32 0 * 64 0 * 128	0-255	0
51	**Configuration of analog operation** 1 = only AC operation 2 = only DC operation	1-8	3
53	**Motor regulation repetition rate**	1-63	35
54	**Motor regulation P constant for PID regulators**	0-63	20
55	**Motor regulation I constant for PID regulators**	0-63	10
56	**Regulation Frequency**	0-63	32
57	**Motor regulation D constant for PID regulators**	0-63	2
58	**Time slot for AD transducer measurement**	0-63	12
59	**Reset to factory defaults**	0, 1	0
60	**Short circuit monitoring** 0 = inactive, 9 = active (do not change)	0, 9	9

CV	Description	Value range	Default Value
61	**Constant for over temperature shutdown** 0 = Temperature monitoring Off	0-255	32
62	**Short circuit monitoring function outputs**	0-255	249
64	**Speed at end of brake section**	0-63	30
65	**Offset-Register** For CV Programming with a Motorola center	0-255	0
66	**Page Register** For CV Programming with a Motorola center	0-255	0
67-94	**Characteristic curve for speed steps 1-28**	0-255	Varies
107	**Switch front light off**	0-127	0
108	**Switch rear light on**	0-127	0
109	**Assignment of Blink generator to the Function outputs** Bit 0-7 = Light and A1 to A7; on (Bit = 1), off (Bit = 0)	0-255	0
110	**Blink Generator off time in 100ms steps**	0-255	5
111	**Blink Generator on time in 100ms steps**	0-255	5
115	**LISSY Train catagory**	1-4	3
116-123	**Dimming of Light and Function outputs A1 – A7**	0-32	32
124	**Coupling repeats for electric couplings on A1 and A2** 0 = off, 32 = 100%	0-255	0
125	**On PWN for electric couplings on A1 and A2**	0-255	255
126	**Hold PWN for electric couplings on A1 and A2**	0-255	64
127	**On time of coupling, value * 50ms**	0-255	5
128	**Hold time of coupling, value * 100ms**	0-255	20
129	**Pause time of coupling, value * 100ms**	0-255	20
130	**Dynamic Smoke generator control on A1 and A2** Value 0 = no Smoke generator operation 0 * Bit 7 = 1 A1 = Smoke generator operation 128 Bit 6 = 1 A2 = Smoke generator operation 64 Bit 5 – 1 acceleration time x 0.2s 1-63	0-255	0
131	**Dynamic Smoke generator control PWM - Start**	0-32	31
132	**Dynamic Smoke generator control PWM - Normal**	0-32	16
133	**Dynamic Smoke generator control PWM - Idle**	0-32	8

*The asterisk * indicates the factory default values.*

Technical Data

Addresses: 1-9999 (long DCC Addresses)
Max. Motor current/Total load: 1.2 A*
Function Outputs: each 0.4 A
Dimensions: 22 x 15 x 3.8 mm
* Continuous load, can vary according to installation situation

Factory defaults

The decoder has a preset address of 03 and can be operated and programmed in DC format with 28 speed steps and in Motorola format. It automatically switches between both formats.

Additionally the decoder is able to operate with DC controller or AC controller (Märklin system) on analog 2 or 3 rail layouts.

Guarantee declaration

Each component is tested for its complete functionality before distribution. If a fault should arise within the guarantee period area of 2 years, we will repair the component free of charge upon production of proof of purchase. The warranty claim is void, if the damage was caused by inappropriate treatment.

Please note that, according to EMV law, the component may only be installed in vehicles which carry the CE logo.

Uhlenbrock digital

Our Contact Details:

We are available if you have any questions!

Internet: FAQs can be found on www.uhlenbrock.de

E-Mail: service@uhlenbrock.de

Hotline: +49 (0)2045 8583-27, Wed from 16:00 to 18:00 and Mon - Tue - Thu - Fri from 14:00 to 16:00

Service: In the event of a defect or failure send the unit together with the invoice and a short description of the fault back to us for repair.

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Made in Germany

Electronic devices do not belong in household rubbish

Part No. 76 560