

## IntelliDrive Comfort 75330



### Multi-protocol Decoder with Load Regulation for Locomotives with 21-pole MTC Interface connector

#### Characteristics

- Regulated Multi-protocol decoder for DCC and Motorola
- Suitable for DC and Bell armature motors up to 650 mA
- Quiet motor running with 18.75 KHz control frequency
- 14, 27, 28, 128 speed steps depending on the data format
- Short (1-127) and long (128-9999) Addresses
- NMRA compatible
- Minimum, maximum and middle speeds adjustable
- Mainline programming (DCC)
- Switchable shunting speed (half speed)
- Switchable start/stop inertia
- Direction dependent, dimmable lighting switched via F0
- Additional switchable lighting
- 6 further switchable, dimmable, time switched special functions A1 - A6
- SUSI-interface (4-pole Mini-socket) for connecting Sound modules or other modules for control of switchable auxiliary functions (f1-f12)
- Generates the identification address for controlling LISSY Mini-transmitter modules 68 400
- Reacts to DCC conforming brake signal or brake section with track power
- All outputs with short circuit protection
- Conventional DC or AC operation with automatic switching between operating modes
- All CVs are programmable with Digital devices with DCC and Motorola formats
- In DCC operation, programmable by Register, CV or Page programming
- Updatable using Flash-Memory

#### Description

The 75 330 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 650mA. 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 with control parameters.

The decoder provides two travel direction dependent light outputs and 6 Special function outputs, which can be controlled by function keys f1 to f12 (function mapping). All outputs are connected to the 21-pole connector to the designated pin.

Head and Rear lights can be switched depending on the running direction.

Function keys f7 and f8 can switch a shunting mode with expanded slow speed range and the start/stop inertia.

The Decoder can be programmed with an Intellibox, DCC and Märklin-Controllers. All CVs can be programmed with all devices.

#### Installing the Locomotive decoder 75 330

##### Connecting the building block

Remove the bridging plug from the locomotive and plug the Decoder onto the 21 pins of the locomotive circuit board. The pins must pass through the circuit board holes. Because of the coded pin the Decoder can only be plugged in the right way.

##### Connecting the special functions

The special function outputs A1 to A6 are integrated into the 21-pole interface connector.

##### Connecting Sound modules

Insert the plug from the sound module into the SUSI-interface socket on the top side of the decoder. Ensure that Bit 2 in CV 49 is programmed to value 0 (factory setting), so the decoder controls the Sound module via the SUSI-interface.

## Connecting a LISSY Mini-transmitter module 68 400

Insert the plug from the LISSY Mini-transmitter module into the SUSI-interface socket on the top side of the decoder. Subsequently program Bit 2 in CV 49 to value 1, so the decoder controls the LISSY Mini-transmitter module via the SUSI-interface connector.

**Note:** The SUSI-interface can be used for either a Sound module or for a LISSY Mini-transmitter module.

## Assignment of the 21-pole Connector on the 75 330 according to NEM 660

PIN	Connection
3	Aux A6
4	Aux A4
5	SUSI Clk
6	SUSI Data
7	Light - Rear
8	Light - Front
13	Aux A3
14	Aux A2

PIN	Connection
15	Aux A1
16	Light and function return (+20V)
17	Aux A5
18	Motor output 2
19	Motor output 1
20	Decoder chassis
21	Left Wheels/Chassis
22	Right Wheels/Pickup

## Digital and analogue operation

The decoder can also be controlled by Motorola or DCC data format in analogue operations. Enter address 3 on the controller. The decoder runs using which ever data format is being used, in Motorola operation or in DCC operation with 28 speed steps.

If the decoder is used on a conventional layout it can be run with either a DC supply 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 A6, 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

CV	Function Key	ABV	RG	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			64
43	f9	128	64	32	16	8	4	2	1			128
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

The light outputs can be assigned to special functions f0-f3 in accordance with to the above table. Outputs A1 to A6 can be assigned to all special functions f0-f12. The shunting mode and the start/stop inertia can be assigned to special functions f4-f12. Each Bit in CV's 33-46 assigns a switch mode to the corresponding special function key. If multiple Bits are set, the special function key switches multiple outputs.

**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\* for A3), 6 (value 64\* for RG) and 7 (value 128\* for ABV) must be set.

## 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 A2, 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 value the operation value is calculated according to the follow schema:

Light allocation: A0v = white front light, A0h = white rear light

CV107 for red front light and CV108 for red rear light

Calculation: Output \* 16 + function key

**Example:** The red front light is to be connected to A1 and switched with f5.

$$\text{CV 107} = 1 * 16 + 5 = 21$$

The red rear light is be connected to A2 and switched with f6.

$$\text{CV 108} = 2 * 16 + 6 = 38$$

## 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.

Bit	CV 29 function	Value
0	Normal driving direction	0
	Reverse driving direction	1
1	14/27 speed steps	0
	28/128 speed steps	2
2	Only digital operation	0
	Automatic analog/digital change over	4
5	Short address (CV1, register 1)	0
	Long address (CV17 and CV18)	32

### Example

Normal driving direction Value = 0

28 Speed steps Value = 2

Auto. Analogue/Digital switching Value = 4

Short Address Value = 0

The Sum of all Values is 6.

This value is set ex-factory in CV 29.

## Programming with a Märklin Center (ControlUnit 6021)

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 5-8 times in quick succession with the stationary locomotive (speed step 0), until the lights blink.
4. Enter the number of the CV to be programmed in the same way as a locomotive address.
5. Operate the reversing control quickly. Now the rear light blinks quickly 4 times.
6. Enter the desired value for the CV, as with a locomotive address
7. Operate the reversing control quickly. Now the rear light blinks slowly 4 times.

If further CVs are to be programmed, repeat points 4-7.

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

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".

**Attention:** it is essential to remove all locomotives that are not to be programmed from the track before any programming starts!

## 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.

**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 1 and Central Station 1 (without upgrade)

Programming is carried out in the same manner as the above scheme as programming with the Control Unit 6021.

## Programming with a Mobile Station 2 and Central Station 2

Programming is carried out using the Menu for DCC Programming. The precise method can be obtained from the corresponding manual for the Center.

## Märklin Brake section

The decoder reacts to a Märklin Brake section (Braking with an analogue potential on the track), when CV 29 Bit 2 and CV 49 Bit 7 are set to 1 (Factory default 1 and 0).

**Table of CVs (Configuration Variables) of the Decoder**

CV	Description	Value range	Default value
1	<b>Locomotive address</b>	DCC 1-127 Mot 1-80	3
2	<b>Minimum Speed</b>	1-63	1
3	<b>Acceleration</b> 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	<b>Braking inertia</b> (time factor CV3)	1-63	2
5	<b>Maximum speed</b> (must be greater than CV2)	1-63	48
6	<b>Middle speed</b> (must be greater than CV2 and less than CV5)	1-63	24
7	<b>Software version</b> (The processor can be updated)	-	varies
8	<b>Manufacturer ID</b>	-	85
13	<b>Function Outputs in Analogue operation</b> Bit 0-7 = Light and A1 to A7; on (Bit = 1), off (Bit = 0)	0-255	1
17,18	<b>Long locomotive address</b> 17 = high byte 18 = low byte	1-9999 199-231 0-255	2000 199 208
19	<b>Consist address</b> (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	<b>Configuration for DCC</b> 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 5=0 Short address (CV 1) Bit 5=1 Long address (CV 17/18)	Value 0 * 1 0 2 * 0 4 * 0 * 32	0-255 6
33-46	<b>Function mapping</b> (see Table "function mapping")	0-255	varies
49	<b>Locomotive decoder configuration</b> 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  <i>Note: When the Motorola format is switch off by Bit 3 and DCC is switched off by Bit 4 the decoder will no longer receive commands and can only be programmed.</i>	Value 0 * 1 0 * 4 0 * 32 0 * 64 0 * 128	0-255 0
50	<b>Brightness of light outputs (Dimming)</b> 0 = Light off 1-32 = Dimming (32 = max. brightness)	0-32	16
51	<b>Configuration of analog operation</b> 1 = only AC operation 2 = only DC operation 3 = AC and DC operation automatically recognized	1-3	3
52	<b>Dimming for outputs A1 to A6</b> (0 = off, 32 = 100%)	0-32	32
53	<b>Motor regulation repetition rate</b> Lower the value if the locomotive is not running smoothly	0-255	40
54	<b>Decoder Configuration</b> Connected to 12V motor Connected to 14V motor Connected to 16V motor Motor regulation repetition rate constant Motor regulation repetition rate depending on speed step with large speed steps <i>Bit 3-7 must not be changed</i>	Value 0 * 1 3 0 4 * 128 *	0-255 132
58	<b>Time slot for AD transducer measurement</b> Increase the value if locomotive runs roughly at slow speeds Lower the value, if by lowering CV 53 the maximum speed of the locomotive is too low	0-255	8
59	<b>Reset to factory defaults</b> The value of 1 resets the decoder back to factory settings	0, 1	0
60	<b>Short circuit monitoring</b> Active (do not change)	0, 28	28
61	<b>Constant for over temperature shutdown</b> Active (do not change)	0, 40	40
62	<b>Short circuit monitoring light and function outputs</b> Active (do not change)	0, 20	20

CV	Description	Value range	Default value
65	<b>Offset-Register</b> For CV Programming with a Motorola center	0-255	0
66	<b>Page Register</b> For CV Programming with a Motorola center	0-255	0
100	<b>Error Register</b> 0 = No Error (reset error register) 1 = Short circuit Motor 2 = Short circuit light, function outputs	0-2	0
107	<b>Switch front light off</b>	0-44	0
108	<b>Switch rear light on</b>	0-44	0
115	<b>LISSY Train category</b>	1-4	1

The asterisk \* indicates the factory default values.

## Technical Data

Addresses: 1-9999 (long DCC Address)  
 Max. Motor current/Total load: 650 mA  
 Function outputs: 650 mA each  
 Dimensions: 20.5 x 15.4 x 5 mm

## Ex-factory state

The decoder is preset to address 3 and can operate in DCC Data format with 28 speed steps and in Motorola Data format. It switches between the formats automatically.

Additionally, the decoder can operate with DC power supply or AC transformer (Märklin System) on two or three 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.

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### Our Contact Details:

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**Part No. 75 330**