Uhlenbrock Elektronik

Multi-Protocol decoder 76 200 with Load regulation

DIGITAL 2

SUSI

For locomotives with universal motors on digital layouts operating in the DCC and Motorola data format.

Features 76 200
- Load regulated multi-protocol decoder for Motorola and DCC
- Suitable for universal (Märklin) motors to 1.2 A
- Operates with the original field coil without modification of the motor
- Quiet motor running by using 18.75 kHz control frequency
- Speed step tables for 14 and 28 speed step modes
- Starting/brake inertia switched using F4
- Direction dependant headlights switched using F0, dimmable
- 2 special function outputs switched using F1 and F2, dimmable
- With SUSI sound interface (4 pole mini socket) for the connection of sound modules or other modules controllable using auxiliary functions (f1 to f12)
- Reacts to brake sections with constant voltage (Uhlenbrock signal module, Märklin signal module) and DCC conforming brake signal (e.g. Power 3)
- Overheating protection
- All outputs are short circuit protected
- Conventional DC or AC operation with automatic change-over to the respective operating mode
- Updateable using Flash memory
- Programmable with Motorola or DCC devices
- Prepared for connection of the LISSY mini transmitter 68 400

In Motorola mode
- 14 speed steps
- Address range 1-80

In DCC mode
- 14, 27, 28 and 128 speed steps
- Short address (1-127) and long address (128-9999)
- NMRA compliant
- Main track programming (DCC)
- In DCC layouts programmable using register, CV direct or PAGE programming

Description

The locomotive decoder 76 200 is an efficient multi-protocol decoder with load regulation and SUSI connector. It is intended for motors with drum or disk commutators. The motor does not have to be modified because it works with the original field coil. It can be used in DCC and Motorola systems and operates equally well in analog mode with DC or AC power and direction of travel change-over using high voltage pulse (Märklin system).

The decoder works continuous power of 1.2 A. Short term higher switching on current are tolerated.

The motor characteristics are setup either by means of the minimum, middle and maximum speeds or by different CV's for the individual speeds.

Load regulation can be individually adapted to different locomotive motors by setting these control parameters.

The decoder has two travel direction dependent lighting outputs, as well as two additional special function outputs, which are switched using function keys f1 and f2. Function keys f3 and f4 can be used to switch a shunting mode with extended low-speed operating range and the starting/brake inertia. The allocation of the switching tasks such as lighting, special function outputs, shunting mode and adjustable starting/brake inertia can be freely assigned to the function keys of the digital center (Function Mapping). The decoder is programmable with the Intellibox, Märklin and DCC controllers. All CV's are programmable with these devices.
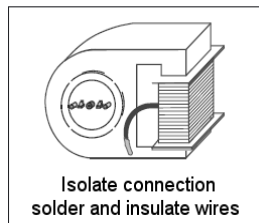
In the default condition the decoder automatically recognizes the DCC and Motorola data formats, as well as the respective analog mode with DC or AC voltage. The desired operating mode can also be specified manually.

Installation of the locomotive decoder 76 200

Connection of the motor

Separate the connection between the motor shield and the field coil. The two wire ends from the field coil must be soldered to one another. Insulate the wire end. In is no longer needed for operating with the decoder. Remove all other connections between the motor shield and chassis.

The wires from the decoder are connected as follows: the two white wires to the inputs of the field coil, the green and blue wires to the two connections on the motor shield, the brown wire to chassis and the red wire direct to the centre pickup. The EMI components remain on the motor.

Isolate connection
solder and insulate wires

Connection of the light functions

Connect the grey wire to the front light and yellow wire to the rear light. For direction independent switching the yellow and grey wires must connected together. The second pole of the light remains connected to the chassis.

Test if the travel direction is correct. If the lamps do not match the direction the motor direction must be reversed by swapping the blue and green wires on the motor.

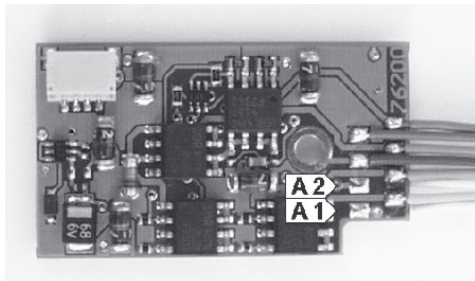| white | - field coil |
white	- field coil
green	- motor shield
blue	- motor shield
brown	- chassis
red	- pickup
grey	- front light
yellow	- rear light

Connection of special functions

Instead of lamps for lighting other devices such as smoke generator, telex coupling can be connected to the light outputs.

For travel direction independent switching the outputs can be paralleled.

Note: If the driving direction of the locomotive does not agree with the indicator of your digital center, you can reverse it by changing bit 0 of CV 29.

Additional special functions such as smoke generator, telex coupling or driver compartment lighting can be connected to the special function outputs A1 and A2. The feed to the device is soldered directly to the decoder circuit board. The return line is connected either to the black wire of the decoder or the locomotive chassis.

Located on the top side of the decoder, right beside the notch are the solder pads for A1 and A2 for connection of the special functions.
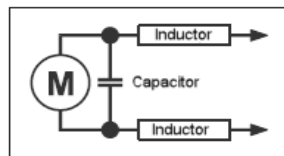
Mounting the decoder in the locomotive

The decoder has a mounting hole and can be mounted on the chassis in Märklin vehicles in place of the reversing switching using the original mounting screw. In case this is not possible use the enclosed double sided tape to fasten the decoder in the desired place in the locomotive.

Motor EMI filter

If the motor runs at the incorrect speed or suddenly changes direction the decoder is getting interference. The motor has no or insufficient EMI filtering and must therefore have the EMI filter fitted.

A capacitor of 100nF is fitted across the motor terminals and a 10µH is inserted into each of the motor feed wire.

The components can be purchased as Uhlenbrock Motor filter set 71 500.
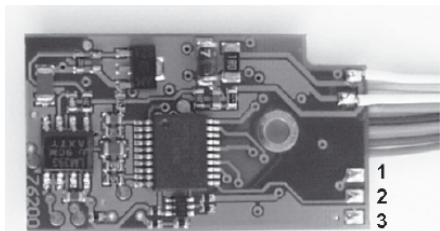
Start-up

Examine the correct installation with a continuity tester or an ohm meter. Ensure that the unit is placed in the vehicle where a conducting connection cannot develop. Ensure that even after re-assembly of the locomotive no short-circuits occur from jammed wires.

Connection of the LISSY mini transmitter 68 400

If no sound module is used a LISSY mini transmitter can be connected to the SUSI interface socket. To operate the module bit 1 of CV 49 must be set to 1. If both a sound module and a LISSY mini transmitter are to be used the sound module is always plugged into the SUSI interface socket and the LISSY

1 +20V (red)

2 LISSY signal (blue)

3 Decoder Earth (black)

transmitter to the solder pads shown in the diagram:

Note: Because the devices receive their commands differently it is not possible to use the SUSI distributor to connect both modules to the SUSI interface.

For the operation of a sound module on the SUSI interface bit 1 of CV 49 must be set to the value 0 (factory setting).

A short-circuit in the area of the motor, lighting, pick-up and wheel contacts can destroy the component and electronics of the locomotive!

Digital and analog Operation

On digital layouts the decoder can be controlled in the Motorola or DCC data format. For the DCC operation 28 speed steps are preset.

If the decoder is used on conventional layouts it can be controlled either with a DC or an AC controller (Märklin system). All operating modes are automatically recognized by the decoder.

Programming

The Configuration variables (CV's) form the basis of all possible operations of the decoder in accordance with the DCC standard. The decoder can be programmed with the Intellibox, DCC controllers and Motorola controllers.

Programming with the Intellibox

We recommend, that irrespective of the data format that will eventually be used, the decoder be programmed using the menu for DCC decoders.

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

For precise instructions please read the appropriate chapter in the Intellibox manual.

Programming with DCC devices

Use the programming menu of its DCC controller, to select and program the decoders CV's by register, CV directly or page mode programming. With a DCC controller it is also possible to program the decoder using main line programming. For the exact procedure refer to the manual of the controller used.

Programming of long addresses without programming menu

If programming is to be done with controllers that do not support programming with an input menu, the values for CV 17 and CV 18 must be calculated. Here is a guide for programming of address 2000.

- Divide the address by 256 (2000/256 = 7 remainder of 208).
- Take the integer result (7) and add 192
- Program the result (199) into CV 17
- Program the remainder (208) into CV 18
- *Important:* Set bit 5 of CV 29 to 1, so that the decoder uses the long address.

Values for calculating the CV value

CV's 29 and 49 can be used to set the decoder into different modes.

The value to be programmed is calculated by using the CV and adding the values of the desired functions.

Example

Normal driving direction	value = 0
28 speed steps	value = 2
Auto Analog/digital change over	value = 4
Speed steps using CV 2, 5, 6	value = 0
Short address	value = 0

The sum of all values is 6. CV 29 is preset to this value ex factory.

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
4	Speed steps using CV2, CV5 and CV6	0
	Characteristics using CV67-CV94	16
5	Short address (CV1, register 1)	0
	Long address (CV17 and CV18)	32

Programming with a Märklin Center

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

1. Switch 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 now 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 CV e.g. a locomotive address.
8. Briefly operate the direction change-over. The rear light flashes slowly 4 times.

If further CV's 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.

Since a Motorola digital center from Märklin only accepts 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) is automatically reset 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 the 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) is automatically reset 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.

Table of CVs (Configuration Variables)

CV	Description	Value range	Default value
1	**Locomotive address**	DCC 1-127 Mot 1-80	1
2	**Minimum Speed**	1-63	2
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	63
6	**Middle speed** (must be greater than CV2 and less than CV5)	1-63	31
7	**Software version** (The processor can be updated)	-	14
8	**Manufacturer ID**	-	85
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** Value Bit 0=0 Normal direction 0 * Bit 0=1 reversed travel 1 Bit 1=0 14 speed steps 0 Bit 1=1 28 speed steps 2 * Bit 2=0 Only digital operation 0 Bit 2=1 automatic analog/digital switching 4 * Bit 3 Not used - Bit 4=0 Speed steps using CV 2, CV 5, and CV 6 0 * Bit 4=1 Characteristics using CV 67 to CV 94 16 Bit 5=0 Short address (CV 1) 0 * Bit 5=1 Long address (CV 17/18) 32 Bit 6/7 Not used -	0-255	6
33	**Configuration of the Auxiliary outputs that are active in the forward direction together with the light function.** Bit 0 Light operation forwards 1* Bit 1 Light operation backwards 2 Bit 2 Auxiliary function A1 4 Bit 3 Auxiliary function A2 8 Bit 4 Shunting mode 16 Bit 5 Start/brake inertia 32	0-63	1
34	**Configuration of the Auxiliary outputs that are active in the reverse direction together with the light function.** Bit assignment same as CV33	0-63	2
35	**Configuration of the Auxiliary outputs that are actived by function key f1.** Bit assignment same as CV33	0-63	4
36	**Configuration of the Auxiliary outputs that are actived by function key f2.** Bit assignment same as CV33	0-63	8
37	**Configuration of the Auxiliary outputs that are actived by function key f3.** Bit assignment same as CV33	0-63	16
38	**Configuration of the Auxiliary outputs that are actived by function key f4.** Bit assignment same as CV33	0-63	32
39	**Configuration of the Auxiliary outputs that are actived by function key f5.** Bit assignment same as CV33	0-63	0
40	**Configuration of the Auxiliary outputs that are actived by function key f6.** Bit assignment same as CV33	0-63	0

*Ex-factory values are marked with *.*

CV	Description		Value range	Default value
49	**Locomotive decoder configuration** Value		0-255	128
	Bit 0=0 Motor load regulation On	0 *		
	Bit 0=1 Motor load regulation Off	1		
	Bit 1=0 SUSI configured for Sound module	0 *		
	Bit 1=1 SUSI configured for LISSY Mini transmitter	2		
	Bit 2=0 brakes to 0 in brake section	0 *		
	Bit 2=1 brakes to speed step in CV52	4		
	Bit 3=0 Data format DCC and Motorola	0 *		
	Bit 3=1 Data format only DCC	8		
	Bit 4=0 Data format DCC and Motorola	0 *		
	Bit 4=1 Data format only Motorola	16		
	Bit 5=0 Dimming for A1 and A2 Off	0 *		
	Bit 5=1 Dimming for A1 and A2 On	32		
	Bit 6=0 Light outputs not swapped	0 *		
	Bit 6=1 Light outputs swapped	64		
	Bit 7=0 Brake only with brake signal	0 *		
	Bit 7=1 Brake with analog potential	128		
	Attention: When the Motorola data format is selected by Bit 3 and the DCC data format by Bit 4, the decoder no longer receives speed commands and can only be programmed.			
50	**Dimming of Function outputs A1, A2 and Light outputs**		0-63	32
51	**Configuration of analog operation** 1 = only AC operation, 2 = only DC operation 3 = AC and DC operation with automatic recognition		1-3	1
52	**Final speed in a braking section** Effective when CV49 Bit 2=1 and Bit 7=1		0-255	30
53	**Motor regulation repetition rate** (CV49, Bit 0=1) Rate = Value * 53us Note: if the locomotive is not running smoothly this value can be altered. Valid values range between 60 and 255		0-255	150
54	**Motor regulation parameter 1**		0-255	130
55	**Motor regulation parameter 2**		0-255	30
56	**Reference scaling rule**		0-127	48
57	**Motor regulation parameter 3**		-	10
58	**Time slot for AD transducer measurement**		0-255	25
59	**Reset to factory defaults** If this CV is set to 1, the decoder will be returned to factory setting.		0, 1	0
60	**Short circuit monitoring** 0 = inactive, 250 = active (do not change)		0, 250	250
61	**Shutdown temperature in °C (90°C)** 0 = Temperature monitoring Off		0-255	varies
62	Not used		-	-
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	**Characteristic curve for speed step 1**		0-255	5
68	**Characteristic curve for speed step 2**		0-255	7
69	**Characteristic curve for speed step 3**		0-255	10
70	**Characteristic curve for speed step 4**		0-255	12
71	**Characteristic curve for speed step 5**		0-255	15
72	**Characteristic curve for speed step 6**		0-255	32
73	**Characteristic curve for speed step 7**		0-255	20
74	**Characteristic curve for speed step 8**		0-255	22
75	**Characteristic curve for speed step 9**		0-255	25
76	**Characteristic curve for speed step 10**		0-255	27
77	**Characteristic curve for speed step 11**		0-255	30
78	**Characteristic curve for speed step 12**		0-255	32
79	**Characteristic curve for speed step 13**		0-255	35
80	**Characteristic curve for speed step 14**		0-255	37
81	**Characteristic curve for speed step 15**		0-255	42
82	**Characteristic curve for speed step 16**		0-255	50
83	**Characteristic curve for speed step 17**		0-255	55
84	**Characteristic curve for speed step 18**		0-255	60
85	**Characteristic curve for speed step 19**		0-255	65
86	**Characteristic curve for speed step 20**		0-255	70
87	**Characteristic curve for speed step 21**		0-255	75
88	**Characteristic curve for speed step 22**		0-255	80
89	**Characteristic curve for speed step 23**		0-255	85
90	**Characteristic curve for speed step 24**		0-255	90
91	**Characteristic curve for speed step 25**		0-255	95

CV	Description	Value range	Default value
92	**Characteristic curve for speed step 26**	0-255	100
93	**Characteristic curve for speed step 27**	0-255	105
94	**Characteristic curve for speed step 28**	0-255	110
115	LISSY Train catagory	1-4	1

Technical Data

Addresses:	1-9999 (long DCC address)
Max. current consumption:	1.2 A
Function outputs:	1 A each
Size:	33.5 x 19 x 5.5 mm

The decoder is preset to address 03 and 28 speed step mode and can be used and programmed in DCC and Motorola data format.

Factory defaults

The factory setting places the decoder in DCC/Motorola operating mode. It automatically switches between both formats. Additionally the decoder can operate on conventional analog layouts with a DC or AC controller (Märklin system).

Guarantee declaration

Each component is tested for its complete functionality before distribution. If a fault should arise within the guarantee period 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 regulation, the component may only be installed in vehicles which carry the CE logo.

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Our contact Details:
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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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