

## IntelliSound Decoder 36 020 and 36 420 DCC and Motorola for DC and Faulhaber motors



### Features

#### Locomotive Decoder

- Multi-protocol decoder with load regulation for DCC and Motorola
- Suitable for DC and Bell armature motors up to 1A
- 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
- Minimum, maximum and middle speeds adjustable
- Speed step table for 14, 28 and 31 speed steps
- Main line programming (DCC)
- Shunting speed (half speed) switched with F3
- Acceleration and braking inertia switched with F4
- Direction dependent, dimmable lighting switched via F0
- 2 dimmable special function outputs switched with F1 and F2
- With SUSI connector (4 pole mini socket) for connection of sound modules or other modules for controlling auxiliary functions (F1 to F12)
- With output for LISSY mini-transmitter
- Reacts to DCC compatible brake signals and braking sections with DC voltage
- Over heating protection, all outputs have short circuit protection
- Conventional AC and DC operation with automatic switching between the various modes
- All CV's programmable by digital devices with DCC and Motorola
- Programmable via register, direct CV or page mode in DCC operation
- Updatable using Flash memory

The locomotive decoder can be used in DCC and Motorola digital systems and also runs in analogue mode with DC or AC and direction switching using over voltage switching (Märklin system).

The decoder operates with a frequency of 18.75KHz and is therefore well suited for DC and especially for Bell armature motors (e.g. Faulhaber, Maxon, Escap) up to a maximum power load of 1A. Short burst start up currents are tolerated.

Motor characteristics can be controlled either by setting the minimum, maximum and middle speeds or via various CV's for individual speed steps.

Load regulation can be control via regulation parameters to a variety of individual motors.

The decoder provides two direction dependent lighting outputs as well as two special function outputs controlled by F1 and F2. Using F3 and F4 a shunting mode for slow speeds and Start/braking inertia can be activated. The allocation of the switching tasks such as lighting, special function outputs, shunting and adjustable starting/brake inertia can be freely assigned to the function keys of the digital controller (Function Mapping). The decoder can be programmed with the Intellibox, DCC, and Märklin devices. CV's can be programmed with all devices.

In factory default the decoder automatically recognizes DCC and Motorola data formats and also analogue operation in DC and AC. The desired operating mode can also be fixed manually.

#### IntelliSound

- An intelligent sound control with 40 seconds of original digitized sound which matches the particular driving conditions
- Generates the diving sounds of the locomotive, brake screeching, incidental noise (Auxiliary devices, coal shoveling etc)
- 3 additional switchable sounds like whistle, bell, uncoupling or door warnings
- Sound changes according to motor operation such as up or down hill; the reaction according the work load can be adjusted to suit the locomotive

- Adjustable volume and mute switching: the Sound can switch on and off with a function key, e.g. entering and leaving a shadow station.
- Input for a wheel revolution sensor (Reed contact, Hall effect sensor) for smoke chuff synchronization with wheel rotation of steam locomotives
- Efficient digital output stage, output via 3 independent sound channels
- Two further Sound modules can be connected to the Sound decoder, e.g. for locomotives with multiple motors
- Supplied with speaker and sound capsule
- Locomotive sound reprogrammable; diverse selection of sounds are available on the Internet ([www.uhlenbrock.de](http://www.uhlenbrock.de))

IntelliSound delivers authentic sounds that are true to the prototype locomotive. Using an intelligent sound control the sounds are matched to the various operating conditions of the locomotive as for example up and downhill running. When the locomotive is stopped, screeching brakes will sound. When stationary, various sounds will be played randomly (Air compressor, auxiliary devices, coal shoveling). Diesel locomotives have the motor start and turning off sounds, when the Diesel sound is turned on and off. Additional to the running sounds of the locomotive 3 special sounds can be activated using function keys. These depend on the type of locomotive and are whistle, horn, bell, door alarms or sounds of uncoupling. When the locomotive goes to a part of the layout where it can't be seen, e.g. into the shadow station, the complete locomotive sound can be faded out using a special function key. A further operation of the special function key and the sound will slowly be faded back up, matching the driving conditions of the locomotive.

## Installing the sound decoder

### Connecting the sound decoder

Remove the bridging plug from the locomotive and push the plug from the decoder into the vacant socket.

If locomotive does not react then re-insert the decoder after turning it over 180 degrees.

Note: If the travel of the locomotive does not coincide with the indication on the control centre you can change the value of CV29 bit to 0 to reverse the direction.

### Pin outs of the NEM 652 connector

1	●	●	8	1 Motor (orange)
2	●	●	7	2 Rear Light (yellow)
3	●	●	6	3 Auxiliary (green)
4	●	●	5	4 Track left (black)
				5 Motor (grey)
				6 Front Light (white)
				7 + common lights (blue)
				8 Track right (red)

### Connection of special functions

Besides lamps for lighting you can also use different items on the special functions outputs, such as a smoke generator.

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 blue wire of the decoder or the locomotive chassis.



### Loud Speaker

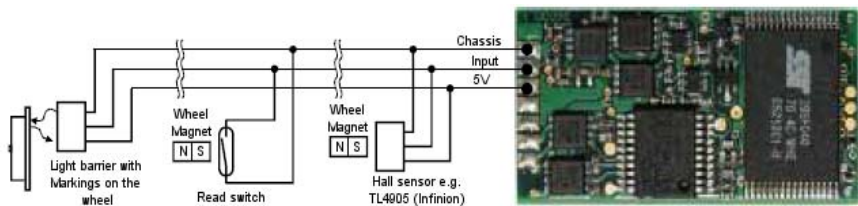
Every speaker requires a resonance shell. Sometimes the locomotive or wagon body can be used as a resonance shell. If this is not possible the supplied resonance shell can be used.

If the resonance shell is used then it must be 'glued' to the speaker so it is airtight. Also seal the cable hole and the mounting holes on the speaker.

The speaker is then mounted in the vehicle so that the sound can exit to the outside via as big an opening as possible.

### Wheel Rotation Sensor

In order to synchronize the steam engine chuffs to the wheel rotation, the sound module has an input for a wheel rotation sensor. A reed contact or a hall effect sensor can be used together with a magnet attached to one of the wheels, or with a light barrier sensor on one of the wheels.



The reed switch, Hall sensor or light barrier are connected to the solder pads as show in the above diagram.

### Connecting the LISSY Mini-Transmitter module 68 400

LISSY Mini-Transmitter modules must always be soldered to the pads on the sound decoder.

Therefore, remove the connector from the LISSY Mini-Transmitter module and solder the wires directly to pads as shown.



### Connecting further Sound or Special function modules

A maximum of two sound or special function modules can be connected to the Sound decoder. One module is connected directly to the 4-pole SUSI-connector. When two additional modules are connected, this is done using a SUSI-distributor 71 100.

### Fastening the decoder in the Vehicle

Using the double sided adhesive pad provided, affix the decoder to the desired location in the locomotive. The adhesive pad protects the decoder from contacting conducting surfaces and holds it in place.

### Start-up

Double check the correct installation with a continuity tester or an Ohmmeter.

When placing the device make sure it does not come into contact with any conducting surfaces in the vehicle! Also ensure that a short circuit cannot occur when the locomotive is close, and that the wire is not cinched.

**A short circuit with the Motor, lighting, third rail pickup and wheels can destroy the device and eventually the locomotive's Electronics!**

## 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 (system Märklin). All operating modes are automatically recognized by the decoder.

### Switching the sound on and off

The decoder has 4 different switchable sounds and a mute function:

Sound number	Type of sound	Factory default
1	Bell, whistle or horn	Function f4
2	Whistle or horn	Function f2
3	Running noises of the locomotive	Function f1
4	Uncoupling or door alarm	Function f3
5	Mute function	Function f8

The individual sounds can be switched on and off with the special function keys of the digital controller. The mapping of the sounds and the special function keys can be changed via CV's 903 to 915. The factory default settings are shown in the above table.

Additionally sound number 5 can be used as a mute function and mapped to a function key. If the locomotive drives into a section of the layout where it is not visible, e.g. into the shadow station, the sound can be muted using this special function key (f8 by default) and the total sound will be faded out. Internally the sound will continue to be matched to the running state. When the sound is eventually switched back on using the function key it will be faded up and immediately match the running state.

## Volume

The volume of the sound can be adjusted with CV 902. The factory default setting is to maximum volume.

## Setting the dynamic Characteristics of the Sound

Some sound characteristics change according to current running state of the vehicle and can be adapted to the type of locomotive being used. The settings affect load regulation (up/down hill), the speed step at which the brake squealing cuts in and the speed step at which the cooling fan cuts in for electric locomotive.

**CV 923** specifies the speed step at which an electric locomotive turns on the sound for the cooling fan.

**CV 924** specifies the speed step at which the brake squealing cuts in when the speed of the locomotive is reduced.

**CV 925** changes the sensitivity to load regulation. If this is set to a value of 1 then the sound reacts to the load change rapidly. A value of 8 results in a slower reaction. Using **CV 921** you can set the speed step at which the sound changes with up hill (load increase) running and with **CV 922** the speed step at which the sound changes when running down hill (load reduction). All values depend on the decoder and the locomotive being used and must be determined by test runs.

**CV 939** determines the time between 2 chuffs at the lowest speed step. The repetition rate at the highest speed step is fixed. A value of 255 sets the greatest time between two chuffs. With a value of 1 in CV 939 the repetition rate at the lowest and highest speed are the same. Sensible values are between 70 and 255!

All factory default values for Uhlenbrock Locomotive decoders are usable with H0 Locomotives, but can be changed to suit other locomotives without problems.

## Operation of Sound or Special function modules on a Sound decoder

The Sound decoder can have two further sound or special function modules connected via the SUSI connector. In this case every module can be assigned its own CV-range via CV 897 so that all modules can be independently programmed. For this you firstly assign an address of 3 to the attached module in CV 897 and then external modules are assigned an address in range 1 and/ or 2. If after that all the modules are connected together, then each one can be programmed in its own address range. The changed CV addresses and address ranges are shown in the list of CV's. Please note that the explanations in the preceding sections refer to the address range 1. If the address range is changed you must use the appropriate CV addresses for address range 2. or 3. from the list of the CV's.

## Programming

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

### Programming with the Intellibox

Irrespective of the format to be driven later, we recommend that the decoder be programmed via the programming menu for DCC decoders.

The Intellibox supports DCC programming with a simple input menu. Long addresses do not have to be laboriously calculated, they can be entered directly. The Intellibox automatically calculates the values for CV17 and CV18.

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

### Programming with DCC devices

Use the programming menu in your DCC Centre to program the decoder CV's in either register, direct CV or page programming mode. It is also possible to program the decoder on the main line using a DCC Centre.

Refer to the manual of your control centre for full instructions on the process.

## 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 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

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
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

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

## 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 multiplying the contents of the CV66 (in 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.

## Märklin braking section

The decoder reacts to a Märklin brake section (brakes with analog power on the track), if CV29 bit 2 and CV49 bit 7 are set to 1 (factory setting 1 and 0).

### Loading New Sounds into the Decoder

On our Internet site "www.uhlenbock.de" you will find a large sound library to choose from. The sounds can be loaded into every IntelliSound decoder and every IntelliSound Module with the IntelliSound Loading adapters (Part No. 31 010).

## Technical Data

Addresses:	1-9999 (long DCC Address)
Max. Motor current:	1A
Function outputs:	1A each
Size:	29 x 15.7 x 5.7 mm
Sound channels for replay:	3
Max. duration of stored sound:	40 seconds
Power consumption:	max. 0.1A

### Factory settings

The decoder is preset to address 03, and 28 speed set operation and can be operated and programmed in DCC and Motorola Data format. It automatically switches between both formats. Additionally the decoder can be used in a DC or AC (Märklin system) on conventional two- or three rail operations.

The sound is set to maximum volume and configured as follows:

Special function f1 switches sound No. 3 (running sounds of the Locomotive)

Special function f2 switches sound No. 2 (Signal tone 2)

Special function f3 switches sound No. 4 (uncoupling noise or door alarm)

Special function f4 switches sound No. 1 (Signal tone 1)

Special function f8 switches sound No. 8 (Muting function)

## Table of individual CV's (Configurion Variables)

CV	Description	Value range	Factory default
1	<b>Locomotive address</b>	DCC 1-127 Mot 1-80	3
2	<b>Minimum speed value</b>	1-63	1
3	<b>Start Inertia</b> 1 means every 5ms the speed will be increased by 1 Sets the internal maximum speed e.g. 200 (CV5=50 or CV94=200) then starts the locomotive from 0 to Fmax in 1sec	1-63	2
4	<b>Braking inertia</b> (time factor like CV3)	1-63	2
5	<b>Maximum speed</b> (must be lager than CV2)	1-63	48
6	<b>Middle speed</b> (must be larger than CV2 and smaller than CV5)	1-63	24
7	<b>Software version</b> (The processor used can be updated)	-	varies
8	<b>Manufacturer ID</b>	-	85
17,18	<b>Long address</b> 17 = Long address high byte / 18 = Long address low byte	1-9999 192-231 / 0-255	2000 199 / 208
19	<b>Consist address (Multi-traction)</b> 0 = Consist address is inactive When Bit 7=1 the driving direction is reversed So the desired CADR + 128 = driving direction reversed	1-127	0
29	<b>Configuration DCC Standard</b> Bit 0=0 Normal driving direction Bit 0=1 Reversed driving direction Bit 1=0 14 speed steps Bit 1=1 28 speed steps Bit 2/3 not used Bit 4=0 Speed steps from CV2, CV5 and CV6 Bit 4=1 Characteristics read from CV67 to CV94 Bit 5=0 Short Address (CV 1) Bit 5=1 Long Address (CV 17/18) Bit 6/7 not used	Value 0 * 1 0 2 * - 0 * 16 0 * 32 -	0-255 2

CV	Description	Value range	Factory default
33-40	<b>Assignment of function outputs that can be activated with the light and special function keys</b> CV33 Light (function) forwards CV34 Light (function) reverse CV35 Special function f1 CV36 Special function f2 CV37 Special function f3 CV38 Special function f4 CV39 Special function f5 CV40 Special function f6 Assignment of individual bits Bit 0 Light output front 1 Bit 1 Light output rear 2 Bit 2 Special function output A1 4 Bit 3 Special function output A2 8 Bit 4 Shunting speed 16 Bit 5 Start/braking inertia 32	0-63	1 2 4 8 16 32 0 0
49	<b>Decoder Configuration</b> Bit 0=0 Load regulation on 0 * Bit 0=1 Load regulation off 1 Bit 1 Not used - Bit 2=0 Brake down to Zero in a brake section 0 * Bit 2=1 Brakes to speed step in CV52 4 Bit 3=0 SX programming off 0 Bit 3=1 SX programming on 8 " Bit 4=0 Data format Motorola and DCC 0 * Bit 4=1 Data format Motorola 16 Bit 5=0 Motorola Data format off 0 Bit 5=1 Motorola Data format on 32 * Bit 6=0 Don't swap light outputs 0 * Bit 6=1 Swap light outputs 64 Bit 7=0 Brake only with brake signal 0 * Bit 7=1 Brake with analog voltage 128 <i>Note: When Motorola program is enabled by Bit 3 or DCC data format by Bit 5 and decoder can only be programmed by a DCC device.</i>	Value 0-255	40
50	<b>Dimming of the function outputs A1, A2 and light outputs</b>	0-63	32
51	<b>Switching between analog and digital operation</b> 0=Digital operation, 1=Analog operation 3 = AC and DC operation with automatic detection	0-3	3
52	<b>Speed at the end of a braking section</b> Relevant when CV49 Bit 2=1 and Bit 7=1	0-255	30
53	<b>Repetition rate of load regulation</b> Lower when the locomotive run irregularly	0-255	120
56	<b>Regulation frequency</b> Lower when the top speed is too low Increase if the locomotive runs too fast at speed step 1	0-127	64
58	<b>Time slot for AD transducer measurement</b> Increase if the locomotive runs irregularly at low speeds Decrease when with lowering CV53 the top speed is too slow	0-255	10
59	<b>Reset to Factory default.</b> 1 = decoder is reset to factory settings	0, 1	0
60	<b>Short circuit guard</b> 0 = turned off, 250 = switched on (Do not change)	0, 250	250
61	<b>Switch off temperature °C (90°C)</b> 0=Temperature monitoring is switched off	0-255	Varies between decoders
64	<b>Speed correction forwards</b> Correction factor = value from CV64/128	0-255	128
65	<b>Offset Register</b> For programming CVs with a Motorola centre	0-255	0
66	<b>Page Register</b> For programming CVs with a Motorola centre	0-255	0
67-94	<b>Speed step curve for speed steps 1-28</b>	0-255	varies
95	<b>Speed correction backwards</b> Correction factor = value from CV64/128	0-255	128
115	<b>LISSY train category</b>	1-4	1

The factory default values in CV29 and CV49 are marked with \*.

## Table of CVs (Configuration Variables) for the Sound module

CV Address Range 1	CV Address Range 2	CV Address Range 3	Description	Value Range	Factory default
897	897	897	<b>SUSI Address range</b> 1 = from 900 to 925 2 = from 940 to 965 3 = from 980 to 1005	1-3	1
900	940	980	<b>Manufacturer ID</b>	-	85
901	941	981	<b>Software version</b>	-	varies.
902	942	982	<b>Sound Volume</b>	0-255	255
903	943	983	<b>function activated Sound Number x</b> (x = value of CV) x = 0 no Sound is activated x = 1 Bell or Horn 1 x = 2 Whistle or Horn 2 x = 3 operating noises of the locomotive x = 4 uncoupling or door alarms x = 8 All sounds On/Off	0-8	0
904	944	984	<b>f1 activated Sound Number x</b> value of x according to CV903/943/983	0-8	3
905	945	985	<b>f2 activated Sound Number x</b> value of x according to CV903/943/983	0-8	2
906	946	986	<b>f3 activated Sound Number x</b> value of x according to CV903/943/983	0-8	4
907	947	987	<b>f4 activated Sound Number x</b> value of x according to CV903/943/983	0-8	1
908	948	988	<b>f5 activated Sound Number x</b> value of x according to CV903/943/983	0-8	0
909	949	989	<b>f6 activated Sound Number x</b> value of x according to CV903/943/983	0-8	0
910	950	990	<b>f7 activated Sound Number x</b> value of x according to CV903/943/983	0-8	0
911	951	991	<b>f8 activated Sound Number x</b> value of x according to CV903/943/983	0-8	8
912	952	992	<b>f9 activated Sound Number x</b> value of x according to CV903/943/983	0-8	0
913	953	993	<b>f10 activated Sound Number x</b> value of x according to CV903/943/983	0-8	0
914	954	994	<b>f11 activated Sound Number x</b> value of x according to CV903/943/983	0-8	0
915	955	995	<b>f12 activated Sound Number x</b> value of x according to CV903/943/983	0-8	0
920	960	1000	<b>Configuration</b> Bit 0 = 0 The chuff of a steam locomotive is controlled by decoder data, and is also synchronized by the wheel sensor Bit 0 = 1 The chuff is only controlled by the wheel sensor Bit 7 = 0 The end step is always on Bit 7 = 1 The end step is off when the sound off	Value 0 * 1 0 128 *	0, 1, 128, 129
921	961	1001	<b>Trigger level with motor load increase</b> 128 = Tone change with load increase is off	0-128	5
922	962	1002	<b>Trigger level with motor load decrease</b> 128 = Tone change with load decrease is off	0-128	5
923	963	1003	<b>Trigger level for cooling fan in an Electric locomotive</b> 255 = no Cooling fan sound	0-255	128
924	964	1004	<b>Level for Brake screeching</b> 255 = no brake screeching	0-255	27
925	965	1005	<b>Sensitivity to load change</b> 1 = reacts rapidly to 8 = reacts slowly	1-8	4
939	979	1019	<b>Time between two chuffs at speed step 1</b> 1 = time corresponds to that of the maximum speed step 255 = maximum time	1-255	255

### 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 regulations, the component may only be installed in vehicles which carry the CE logo.

*The trade names mentioned are registered trade marks of the respective companies.*