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NMRA-DCC/Motorola Locomotive Decoder with Load Control

1. Introduction

The decoders N025, T125 and T145 are compatible with NMRA-DCC-standard and the Marklin Motorola digital format (old and new), therefore can be used with command stations by various suppliers such as Marklin, Lenz, Uhlenbrock (Intellibox), Fleischmann Twin-Center, Arnold, Digitrax, SystemOne, Roco, Zimo, etc. . The decoder can be used with DC motors and coreless motors (for example Escap, Faulhaber).

Decoder types :

decoder	Function outputs (including light outputs)	Interface plug as per NEM652	Order-no.
T125	2	no	81610
T125-P	2	yes	81620
T145	4	no	81710
T145-P	4	yes	81720

Technical specifications and Features :

- short and extended (4-digit) addresses and 14, 28 und 128 speed steps (DCC-mode)
- with Motorola digital format 255 addresses and 14 or 28 speeds steps
- adjustable load control
- high frequency (approx. 16 kHz) and low frequency motor control
- switchable shunting gear, adjustable low-, medium- and maximum speed
- programming on the mains
- function outputs with programmable light effects and dimming
- maximum operating voltage (track voltage)   24 V
- maximum motor current   1.1 A
- maximum current per light output   0.15 A
- maximum current per function output (only T145)   0.30 A
- total load (analogue/digital operation)   1.1 A/1.2 A
- operating temperature   0 ... 60°C
- dimensions (mm)   approx.. 13.9 x 24.6 x 2.9

The motor and light outputs of the decoder are protected against excess current. However, damage may be caused by short circuit between current pickup and motor, short circuit between motor output and locomotive chassis or overloading the decoder. This locomotive decoder is intended for installation in model railroads.

Please note : This decoder is not suitable for operation with conventional AC supply and the voltage pulse for change the direction! The high voltage of this pulse will cause the destruction of the decoder.

2. Safety instructions

This product is not a toy! Not suitable for children under 14 years. **Not suitable for children under 3 years because of danger of their swallowing the small constituent pieces!** At an incorrect use there exist a danger of hurting because of cutting edges and tips. Please retain these instructions for further reference.

3. Installing the decoder
3.1. Preparation

Only locomotives, which run smoothly in analogue mode, should be equipped with a digital decoder. A secure and uninterrupted current pickup is important especially in digital mode. Change worn coal brushes and defect lights and clean wheel pick-ups. The decoder should be installed inside the locomotive in such a way as to avoid overheating.

Tools : For installing the decoder please use a soldering iron with 30 Watts max. (if possible with temperature control), electronic solder (no soldering paste), side cutters (to shorten the leads) and small screw drivers. You also need insulation tape (to cover any metal parts of the locomotive) and double sided tape to fasten the decoder.

Before installing the decoder you have to **completely insulate the motor**, which means there should not be any electrical connection between motor and wheel pick-up. Don't forget which motor terminals were connected with the right or left wheel pick-up.

Advice for older Fleischmann locomotives: Often in these locomotives the motor shield is part of the motor's power supply and therefore connected with one of the wheel pick-ups. To insulate the motor you have to cut off this connection or replace the motor shield.

3.2. Maximum current load capacity

Besides the desired functions and the available installation space the current draw of the motor under full load determines the selection of a suitable decoder.
The decoder supplies a motor current of 1.1 A. Values regarding current draw of locos generally refer to a voltage of 12 or 14 Volts. Is the digital voltage of your command station higher (e.g. Roco "Lokmaus", LGB, Intellibox), the current rises and could potentially exceed the permitted value of 1.1A. For operating H0 gauge we recommend a track voltage of 16 V.
The total current load capacity of the decoder in digital mode is 1.2 A. If the motor draws e.g. 1.0 A, then the total current available for all light and function outputs is 200mA. The partitioning of the current for example could look like this: For directional headlight 50mA (outputs A and B), output C=50mA (e.g. for interior lighting). Then at output D 100mA are still available (e.g. for a smoke generator).
Each light output of the decoder can supply 150mA. The two function outputs have got a

load capacity of 300mA each.
Please observe the maximum load capacity of the decoder and each individual output. The decoder may be destroyed through overload!

3.3. Installing in locomotives with interface as per NEM652

figure_1
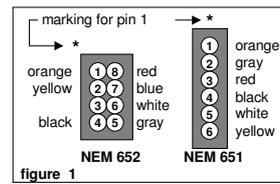
Once you have opened the locomotive remove the bridge plate from the interface socket on the circuit board and insert the plug of the decoder instead. Please make sure that the orange and red cables from the plug are on the side of the socket where a mark (often a "*" or a "+") is printed on the circuit board.
The decoder should be put into the place designated fort he decoder by the loco manufacturer. Is no specific place, you can place the decoder in the roof area or in the driver's cab. Insulate all metal parts close the decoder but don't wrap the decoder with insulation tape to avoid overheating. Otherwise the decoder may be thermally overloaded. If necessary fix the decoder with a double sided adhesive pad.
Connect the cables of the 2 function outputs to the specific extra functions. If you don't use these wires, insulate the ends of the wires.

> **Under no circumstances should components of the decoder touch any metal parts of the chassis or the locomotive body. Resulting short circuits will destroy the decoder!**

3.4. Installing in locomotives without interface

Before you start, completely insulate the motor and its terminals against the chassis of the locomotive and the current pick-ups (wheel pick-ups). Remember which motor terminal was connected with the right or left wheel pick-up.
1) Before you start, you have discharge any electrostatic charge by touching a water tap (or radiator) to avoid damage through an electrostatic discharge. Clothes made of cotton are best suited for working with decoders.
2) If there is a interface in your locomotive the installation of the decoder is very easy. At first remove the bridge plate from the interface socket. If you look now on the top of the interface socket in the loco, you will see a marking on one side – this is pin 1. Now solder the wires from the decoder according to figure 1 onto or next to the individual contacts of the NEM socket or insert the soldered wire ends into the socket. Disregard following paragraphs 3 to 5. The are only valid for locos without interface.
3) If the locomotive has no NEM-interface socket, connect the red wire to the right wheel pick-up, the black wire to the left wheel pick-up. In locomotives with centre

figure 2 / figure 3
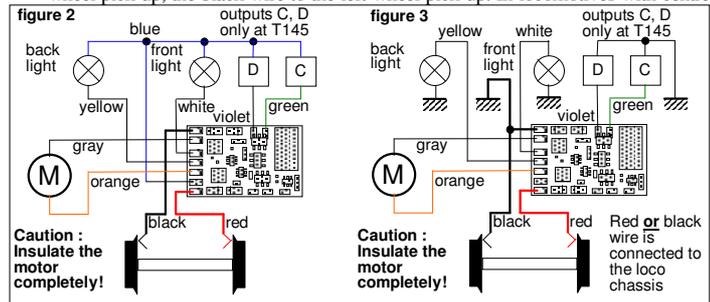
pick-up the red wire is connected to the centre pick-up while the black wire is soldered to the chassis.
4) To connect DC motors solder the orange wire to the motor terminal, which was connected to the right wheel pick-up before installation. Solder the grey wire to the motor terminal, which was connected to the left wheel pick-up. **The RFI suppression components, which were connected to the motor before installation, should remain in the circuit in front of the motor.** Otherwise disturbances, generated by the motor, could impair the functionality of the decoder.
5) If your locomotive has got an AC or universal motor (e.g. Marklin) two 1 A diodes (e.g. 1N4002) are required. The cathode of the first diode is connected to the field coil of the motor and the anode with the grey wire of the decoder. The anode of the second diode is connected to the other field coil while its cathode is also connected to the grey wire (see figure 4). However, you have to select the low tact frequency for motor control (see CV#9). **Load Control (see CV#56) has to be switched off regardless !**

figure 4
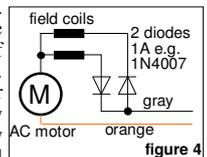
Instead of this you can convert a Marklin universal motor to DC by replacing the field coil with a HAMO permanent magnet. Then the field coil can be dropped completely and the two extra diodes are not necessary. A further advantage is that the load control can be left on and stay effective.
6) Connect the light and function outputs with the wheel pick-ups according to either of the following two methods:
- If the light sockets of the loco are insulated against the chassis (potential free), wire the outputs as shown in figure 2.
- In locomotives, where one pole of the light sockets is electrically connected with the chassis, wire the outputs as shown in figure 3. Please note, that with this wiring method the light and function outputs don't work in analogue mode depending on the polarity of the track voltage. Also short circuit protection only works partially. This wiring method may result in variations of brightness if used with command stations, with transmit signals in Marklin Motorola digital format or signals in Marklin digital format and DCC-signals simultaneously.

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Light outputs A (white) and B (yellow) may be operated in two different ways. The adjustment is done with CV#56:

- When using the outputs for directional headlights connect the white wire with the forward bulb and the yellow wire with the rear bulb. Connect the other pole of the bulbs with the blue wire. When using LEDs, connect the anodes to the blue wire and the cathodes via a resistor (approx. 1kOhms/0.125W) to the yellow respectively white wire.
- When using the function outputs A and B for non-directional head light and an auxiliary function, connect the white wire with the lights and the yellow wire with the auxiliary function. Connect the other pole of the head lights and the auxiliary function to the blue wire.

7) Afterwards check the entire wiring, the decoder and the motor connections for possible short circuits.

8) Are there any metal parts close to the decoder, cover them with insulation tape. Don't wrap the decoder in insulation tape to avoid overheating. Fasten the decoder with a double sided adhesive tape inside the locomotive.

> **Under no circumstances should components of the decoder touch any metal part of the chassis or the locomotive body. The motor terminals must not have any connections to the wheel pick-ups or chassis. Resulting short circuits will destroy the decoder.**

4. Checking for correct installation

The first test should be carried out on track with current limiter e.g. on the programming track of your DCC command station. If you use the Intellibox or the Twin-Center **previously** switch it to the programming mode. Put the locomotive onto the programming track and read out the primary address (CV#1). All new decoders are set to value 03. If there is no feedback, check the wiring of the wheel pick-ups and motor connections. If you use an "old" Arnold command station you cannot read out the address. Instead read out the start voltage (R2= 2 bars). The start voltage of all new decoders is set to value 1, 3 or 7. Once this first test was successful, you may put the locomotive onto any normal track connected to the DCC command station.

> **The decoder T125/T145 indicates a short circuit (or an overload) through blinking headlights. In this case switch off the power immediately! Warning: Even in case of a motor short circuit the decoder may provide feedback to the command station when standing on the programming track. Therefore check very carefully that the wiring is correct.**

Now try to operate the locomotive under address 03 (initially switch off any functions) and check the direction of travel. If not correct, the wheel pick-ups or motor connections have been swapped. Now you can test the lights and auxiliary functions. If the headlight don't match the direction of travel, change the connecting wires (white, yellow). If the locomotive stops when lights or extra functions are switched on, there is a short circuit in the wiring or an overload of the light or function outputs. An overload can occur for example through high digital voltages and the starting current of the bulbs. If necessary, put a resistor of 47Ohm/0.25 W between the headlight and the light output.

If the overload protection trips during acceleration, the track voltage may be too high. A locomotive, which according to the data sheets, draws a current of 0.8 A at 12 V, will draw a current of approx. 1.4 A at 21 V (e.g. Roco „Lokmaus"; Lenz „compact" or the Intellibox in setting „gauge H0":

5. Programming of the decoder

Kuehn-decoders can be adapted to your locomotives and the desired operating characteristics through programming of so called configuration variables (CVs). Follow the instructions of your digital command station when programming. Programming on the programming track can be done through "*Physical Register Addressing*", "*Paged CV Addressing*" or "*Direct Mode Addressing*". In mode "*Physical Register Addressing*" only certain CVs can be adjusted. The following allocation applies:

Register	R 1	R 2	R 3	R 4	R 5	R 6	R 7	R 8
bar	1	2	3	4	5			
CV-No.	CV#1	CV#2	CV#3	CV#4	CV#29	-	CV#7	CV#8

Additionally all configuration variables of the Kuehn-decoder (except the addresses) can be changed during operation with "*Operation mode programming*" (also called 'programming on the main').

Programming with the "old" Arnold command station, equivalent to Marklin digital "=" (6027) : The command stations by Arnold and Marklin operate with programming mode *Physical register addressing* and can only program registers R1 to R5. Please refer to the above table for the correct number of bars for each CV. The address and all register, which contain a value of 0, can be programmed but not read out. The decoders cannot be fully programmed since the range of values of these command stations is limited from 1 to 99.

Programming with Lenz "*compact*" command station : With Lenz „compact" version 3.1 you can only program registers R1 to R6. With later versions you can program and read out all CVs.

Programming with Trix "*Command Control 2000*" : The Trix Command Control 2000 cannot program DDC-decoders. Limited operation is possible in 14 speed step mode for the addresses 2, 4, 6 and 8.

Programming with Marklin „Control Unit" 6021: Programming of all parameters is carried out electronically without opening the locomotive (no DIP-switches required). Proceed as follows:
Make certain, that only the locomotive to be programmed is on the track. Now switch on

the Marklin command station or press the 'Stop" and 'Go" buttons at the same time until a reset is triggered. Enter the address (alternately address 80 if you don't know the correct address), turn the speed control knob as far left as possible (change of direction) and hold it down for about 8 to 12 seconds. Thus the decoder changes to programming mode, which is indicated by the blinking lights. Release the speed knob now.

Now enter the number of the configuration register, which you want to change (e.g. 05 for CV#5: maximum speed). Confirm this entry by turning the speed control knob to the far left. The lights will flash repeatedly. Now you can enter the appropriate value of the configuration register. Should you want to reduce the maximum speed of the locomotive enter for instance 48. This entry also has to be confirmed by turning the speed control knob to the far left. Now this entry is stored in the memory of the decoder. The lights come on for about three seconds. Then the decoder is ready fort he next entry, which is indicated by the blinking lights.

To exit the programming mode enter number 80 or press the 'Stop" key of the command station.

You can only enter the values 1 to 64 for configuration registers (and 80 to exit), thus the registers 0 to 63 can be programmed. To write a value of 0 into the decoder you have to enter the address 80 at the control unit.

The values entered for the maximum and medium speed (CV#5 and CV#6) are multiplied by 4 within the decoder to achieve the correct adaptation to the values used in DCC mode (from 0 to 255).

> **Decoder - Reset : If you don't know how to proceed after programming and you want to restore the factory settings of the decoder, you have to program a value of 8 into CV#8.**

**Table 1: configuration variables of the decoder :**

CV-No.	Description	Range of values	Factory settings	Your values
CV#1	Primary (short) address	1...127	3	
CV#2	Start voltage	0 ... 255	1	
CV#3	Acceleration rate	0 ... 63	2	
CV#4	Deceleration rate	0 ... 63	2	
CV#5	Maximum voltage	0 ... 255(15)	0	
CV#6	Medium voltage	0 ... 255	0	
CV#7	Manufacturer version number	-	min. 32	
CV#8	Manufacturer ID number	-	157	
CV#9	Motor control frequency	0,1	0	
CV#17	Extended address, part 1	192...231	192	
CV#18	Extended address, part 2	0 ... 255	0	
CV#19	Consist address	0 ... 255	0	
CV#29	Configuration register	0 ... 63	6	
CV#49	Special effects output A (white)	0 ... 255	0	
CV#50	Special effects output B (yellow)	0 ... 255	0	
CV#51*	Special effects output C (green)	0 ... 255	0	
CV#52*	Special effects output D (violet)	0 ... 255	0	
CV#53	I-value for load control	0...63	2	
CV#54	P-value for load control	0...63	16	
CV#55	Cycle time of effects	0 ... 7	0	
CV#56	User configuration register 1	0 ... 7	6	
CV#58	Mapping output B (yellow)	0 ... 255	0	
CV#59*	Mapping output C (green)	0 ... 255	1	
CV#60*	Mapping output D (violet)	0 ... 255	2	
CV#67-94	Speed table	0 ... 255	Curve 1	
CV#95	Reverse trim	0 ... 255	0	
CV#105	User-ID 1	0 ... 255	0	
CV#106	User-ID 2	0 ... 255	0	

*) Diese Konfigurationsregister gelten für Decoder T145, beim T125 wirkungslos

Description of configuration registers :

- **CV#1** (primary address) ,**CV#17,18** (extended address) : The primary address can have values from 1 to 127. If you need more addresses, then use the extended address mode (CV#17,18). Only one type of address can be active (primary or extended address). The type of address can be selected in CV#29.
- **CV#2** (start voltage), **CV#6** (medium voltage), **CV#5** (maximum voltage) : Each speed step must relate to a certain motor voltage dependent on the number of speed steps. The allocation can be done by calculating the start, medium and maximum voltage or by using a table, which contains the motor voltage for each speed step (CV#67 to CV#94). The higher the motor voltage, the higher is the speed of the loco. With CV#2, 5 and 6 you can adapt the speed curve (see graphic) very easily and quickly. When using the speed table you may have to adapt all 28 CVs.
The start voltage is the voltage provided to the motor at speed step 1. The medium voltage is applied at a medium speed step (depending on the mode 7, 14 or 64) and the maximum voltage is applied at the highest speed step. Value of 2 equals about 0.8%, a value of 255 equals 100% of the maximum motor voltage. The values of all other speed steps are calculated from these edge values. CV#5, for instance, allows the reduction of the maximum speed of "racing locomotives". When entering a speed curve the values must always be as follows: start voltage (CV#2)<medium voltage (CV#6)<maximum voltage (CV#5)!
If CV#5 and/or CV6 are set to 0 or 1, they will not be used for calculating the speed curve. If CV#6=0, an exponential curve is used. That means, that the changing of speed depends on the speed step (see graphic).
Nutzer der Lokmaus 2 können zur Einstellung der Maximalspannung keine Werte >99 eingeben, verwenden Sie deshalb den Wertebereich von 0...15 (15 entsp. 100%).

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⇒*Hints :* Shunting locomotive is too fast, then CV#5=128 (maximum speed set to 50%). If the locomotive drives troubledly at speed step 1, then enter 3...7 in CV#2.
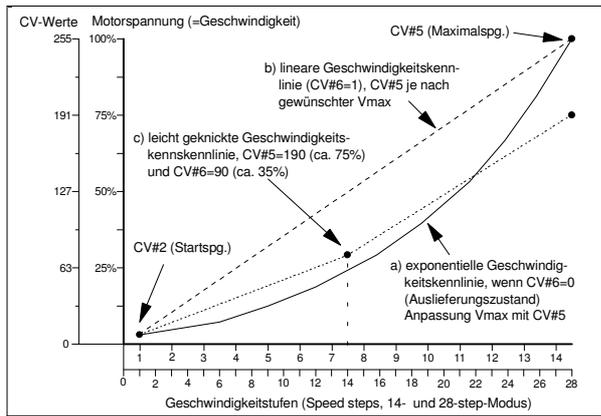
- **CV#3** (acceleration rate) : The content of this CV corresponds to the time in seconds needed for accelerating from 0 to maximum speed. The value of 0 represents an immediate change of speed. The maximum value is 63.
- **CV#4** (deceleration rate) : The value in this CV defines the deceleration similar to CV#3.
- **CV#7,8** : Here you find the manufacturer identification number (Ⱪuehn-decoder have got the 157) and the version number of the decoder.
- **CV#9** (motor control frequency) : This CV defines the motor control frequency. The possible values for CV#9 you can find in the table:

Bit-No.	Description	Bit value	CV value
0	High frequency motor control (15.6kHz) for modern DC and coreless motors (for example Escap,Faulhaber)	0	0
	Low frequency motor control (120Hz) for older DC motors or AC/universal motors (for example Marklin)	1	1

- **CV#17,18** (extended address) : See CV#1 (primary address)
- **CV#19** : The consist address in this register is set by the command station, provided it supports this feature. You don't have to program this register yourself. It is preset to 0.
- **CV#29** (configuration register) : Configuring of basic properties of the decoder, e.g. number of speed steps (14 or 28 resp. 128) and addressing mode (short or extended addresses). The values of your desired functions must be added and entered into CV#29.

Bit-No. *)	Description	Bit-value	CV-value
0	Normal direction of travel	0	0
	Reverse direction of travel	1	1
1	14 speed step mode (resp. 27 speed steps too)	0	0
	28/128 speed step mode	**1**	**2**
2	No analogue operation	0	0
	Permit analogue operation	**1**	**4**
4	Form the speed curve with CV#2,5,6	0	0
	Use speed table (CV#67-94)	1	16
5	Use primary (short) address (CV#1)	0	0
	Use extended address (CV#17,18)	1	32

*) Lenz digital plus system counts the bits in reverse order from 1 to 8 unlike the NMRA standard.

⇒*Hint :* frequently used values for CV#29 (factory setting is 6):

CV#29=	Description
0 (8)*	14 (27) speed steps, short address, no analogue mode
2	28/128 speed steps, short address, no analogue mode
4	14 (27) speed steps, short address, analogue operation possible
6	28/128 speed steps, short address, analogue operation possible
38	28/128 speed steps, extended address, analogue operation possible

* : When using the "old" Arnold command station, the input of 0 is not possible, instead enter value 8

- **CV#49, 50, 51, 52** (special effects) : With this registers you can set special lighting effects for light and function outputs A, B, C and D.

CV-No.	Colour of wire	CV-No.	Colour of wire
49	white	51	green
50	yellow	52	violet

Add the required value (1, 2, 4, 8 or 16) for the desired lighting effect to the operation conditions and enter the result into the appropriate register. Value '0' switches off all effects of the output, only ON and OFF is active. If the intensity of the lamps is too high because of the high digital voltage, you can reduce that by dimming. Enter a value 16 into the CV of the appropriate light or function output. The operation conditions "off, when forward" and "off, when reverse" will be set automatically for directional lighting and should remain 0. If you use outputs C or D with F1 to F8 you can set a directional condition.

	Operating conditions				Lighting effects			
Bit-No.	7	6	5	4	3	2	1	0
Descrip-tion	Dimming, when F3	Off, when	Off, when	Dim-ming	Blinking phase A	Blinking phase B	Flash light	Pulsing light

	ON	forward	reverse					
CV-value	128	64	32	16	8	4	2	1

- **CV#53,54** (parameters of load control) : With this CVs you can adapt the load control to many different motors and drive systems. The factory settings provide satisfactory results with many newer type motors. For older types of motors the parameters may have to be adjusted. Besides the adaptation of the parameters, the motor control frequency (see CV#9) has a tremendous influence on running properties, particularly with older type motors. The parameter 'P' in CV#54 determines the intensity of load control. The greater the 'P'-value (16…32) the stronger the control effect (and reduce speed fluctuations at medium speed steps), however, this results in a higher creeping speed. The parameter 'I' in CV#53 determines how quickly the decoder responds to deviations from the desired speed. If the 'I'-value is too high it may lead to speed fluctuations. The 'I'-value should be reduced for coreless motors (1...3), while it should be increased for motors whit large flywheels (2…8). If you increase the 'I'-value you should also increase the 'P'-value. If the locomotive runs unevenly in speed step 1 the set CV#2 to 3…4.
- **CV#55** (cycle time of effects/dimming rate as of SW33) : Mit der Einerstelle (x0..x7) von CV#55 wird die Dimmrate (wenn in CV#49...52 aktiviert) für die Funktionsausgänge eingestellt, Null bedeutet volle Helligkeit, 7 geringste Helligkeit. Mit der Zehnerstelle von CV#55 (0x...9x) kann die Wiederholgeschwindigkeit der Effekte eingestellt werden (Wert 0 entspr. einer Zykluszeit von 0,5s ; Wert 9 entspr. einer Zykluszeit von 3,0s. Bis SW32 beinhaltet die Einerstelle von CV#55 die Zykluszeit der Effekte.
- **CV#56** (user-configuration register 1) : Here you can select additional features of the decoder, for example activating the load control or selecting the function of output B. Add the values for the desired function and enter the result into CV#56.

Bit-No. *)	Description	Bit-value	CV-value
0	Directional lighting (FL/F0 controls the white and yellow wire = output A and B)	0	0
	Non-directional lighting (the selected function in CV#58 controls the yellow wire = output B)	1	1
1	Load control off	0	0
	Load control on	**1**	**2**
2	Shunting gear of	0	0
	Shunting gear switchable with F4 (on/off)	**1**	**4**
3	Reserved	0	0
	Reserved	1	8

*) Lenz digital plus system counts the bits in reverse order from 1 to 8 unlike the NMRA standard.

At a value 1 (or 3, 5 or 7) the directional lighting feature is deactivated. F0 (light) now controls output A. With the yellow wire the output B will be controlled through the function in CV#58.

- **CV#58, 59 and 60:** Here you can program which function controls which output (function mapping). Output A (white) is always controlled through F0 (light). Should, for example, output B (yellow) be controlled with F1, enter value 1 into CV#58 and set non directional lighting in CV#56. Should, for example, output C (green) be controlled with F5, then set CV#59 to value 16. Factory settings is: Output C=F1, output D=F2.

Bit-No.	7	6	5	4	3	2	1	0
CV#58 output B (yellow)	F8	F7	F6	F5	F4	F3	F2	F1
CV#59 output C (green)	F8	F7	F6	F5	F4	F3	F2	**F1**
CV#60 output D (violet)	F8	F7	F6	F5	F4	F3	**F2**	F1
Value	128	64	32	16	8	4	2	1

- **CV#67** (speed step 1) **to CV#94** (speed step 28) speed table: Represents the motor voltage for each of the 28 speed steps. A value of 1 represents 0.4%, 255 corresponds to 100% motor voltage. With 14 speed step mode only the odd positions in the table are utilised (#CV#67, 69, 71 etc.). With 128 speed steps the table is not utilised.
- **CV#95** (reverse trim) : You can lower (or higher) the speed for reverse travel with CV#95 using the following formula: motor voltage reverse = (motor voltage forward) * (CV#95/128). At value 128 (or 0) the speed is the same in both directions. If CV#95, for example, is set to 64, then the reverse speed is only half the speed when travelling forwards.
- **CV#105,106** (User-Data) : You may store any date in these registers. The values in these registers have no impact on the operation of the decoder.

6. Problem solving

Lights go on and off corresponding with the speed steps :
The different settings of the speed step modes in the command station and the decoder causes this effect. The command station transmits driving commands with 28 speed steps. The decoder is set to 14 (=27) speed step mode. The speed step mode of the command station and the decoder must be set to the same number of speed steps. You can set the decoder to 28 speed steps by programming for example the value of 2 or 6 into CV#29 (resp. R5).

Lights cannot be switched on or off :
The speed step mode of the command station and the decoder are not the same. The command station transmits driving commands with 14 (or 27) speed steps. The decoder is set to 28/128 speed step mode. The speed step mode of the command station and the decoder must be set to the same number of speed steps.

Locomotive does not operate in 128 speed step mode :
The decoder accepts the commands in 128 speed step mode only, when bit 1 is set CV#29, for example if you program the values of 2 or 6.

The locomotive "jerks" during fast acceleration :

The current draw during acceleration is particularly high. If the current exceeds the permitted maximum, the decoder switches off the motor for a short time and tries to accelerate once more. Reduce the track voltage (change settings of your command station or reduce the secondary voltage of the transformer) or increase acceleration rate in CV#3.

The lights blinking (and/or the locomotive jerk or stop) when the direction are changed or the lights are switched on :
    The light outputs are designed for a current of 150mA and have a short circuit protection. When turning on the lamp(s) t

The locomotive address cannot be read out with the 'old' Arnold command station :
    The command station uses obsolete DCC command, which is not used anymore. The address, however, can be programmed. The resulting error message may be ignored.

Locomotives with load control move slower without load control :
   The load control must have a reserve of power for proper operation at maximum speeds.

In analogue mode the direction of travel changes after the changing of track polarity :
    The decoder has a short time memory (some seconds) for proper operation on dirty tracks. .

> **Further hints for usage of the decoder you can find in the internet :**
> **www.kuehn-digital.de**

7. Anwendungshinweise für Decoder T125,T145

7.1.   Anschluss einer Zusatzfunktion an T125
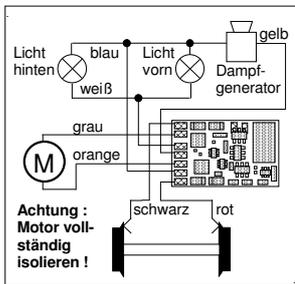
Um bei dem Decoder T125 eine Zusatzfunktion (z.B. Dampfgenerator anzuschließen, müssen die Funktionsausgänge auf richtungs**un**abhängigen Betrieb programmiert werden. Die Einstellung wird im User-Konfigurationsregister 1 vorgenommen (CV#56). Dazu ist in diesem Register Bit 0 zu setzen.

Nach der Programmierung schaltet die Funktion F0 (Licht) nur noch den Ausgang mit dem weißen Anschlussdraht, d.h. mit der Taste F0 schalten Sie das Licht der Lok ein bzw. aus. Der Ausgang ist nun unabhängig von der Fahrtrichtung der Lok. Der Ausgang mit dem gelben Anschlussdraht wird durch die in CV#58 festgelegte Funktion gesteuert (z.B. bei Wert 1 mit F1). Somit schalten Sie die Zusatzfunktion (z.B. Dampfgenerator) ein bzw. aus.

Bitte beachten Sie, dass für Ausgang B (gelb) nur ein Strom von 150mA zulässig ist! Die Auswahl eines Dampfgenerators erfolgt nach der Betriebsspannung: Bei einer Gleisspannung von 21 Volt (z.B. bei Intellibox, TwinCenter, Lokmaus) sollte der Dampfgenerator ebenfalls für etwa 21Volt ausgelegt sein. Bei dem Set 1 von Lenz (Gleisspannung etwa 15Volt) verwenden Sie einen Dampfgenerator mit 14-16 Volt Nennspannung.

⇒*Tipp* : Wenn Sie in CV#50 den Wert 128 programmieren, können Sie durch Einschalten der Funktion F3 die Dampfleistung (z.B. im Stand) verringern.

7.2.   Anschluss der Innenbeleuchtung bei einem Triebwagen

Für den Anschluss einer Innenbeleuchtung gibt es zwei Möglichkeiten :
- Die Stirnlampen des Triebwagens werden richtungsabhängig gesteuert, d.h. in Vorwärtsrichtung leuchten die Lämpchen vorne und in Rückwärtsrichtung leuchten die Lämpchen hinten, wenn die Funktion F0 eingeschaltet ist. Die Innenbeleuchtung ist ebenfalls eingeschaltet, wenn die Funktion F0 eingeschaltet ist.
- Die Stirnlampen des Triebwagens werden richtungsunabhängig gesteuert, d.h. in Vorwärtsrichtung und in Rückwärtsrichtung leuchten die Lämpchen hinten und vorne gleichzeitig, wenn die Funktion F0 eingeschaltet ist. Die Innenbeleuchtung kann separat durch die in CV#58 festgelegte Funktion (z.B. F1) ein- bzw. ausgeschaltet werden.

7.2.1.   Stirnlampen richtungsabhängig
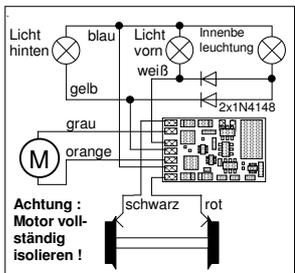
Die Funktionsausgänge werden auf richtungsabhängigen Betrieb programmiert. Diese Einstellung entspricht dem Auslieferungszustand des Decoders T125. Die Einstellung wird im User-Konfigurationsregister 1 (CV#56) vorgenommen. Dazu ist in diesem Register Bit 0 zu löschen.

Damit die Innenbeleuchtung eingeschaltet wird, wenn entweder das vordere Lämpchen oder das hintere Lämpchen leuchtet, sind zwei zusätzliche Dioden erforderlich. Diese können in jedem Elektronikladen gekauft werden (z.B. bei Conrad Electronic: Diode 1N4148, Best.-Nr. 162280). Die Kathoden der Dioden (Kennzeichnung an der Diode durch einen Farbring) werden an den gelben bzw. weißen Anschlussdraht gelötet. Die Anoden werden zusammen an den einen Pol der Innenbeleuchtung angeschlossen. Der andere Pol der Innenbeleuchtung wird mit dem blauen Anschlussdraht verbunden.

Die Funktionsausgänge sind in der gewohnten Weise richtungsabhängig, d.h. in Vorwärtsrichtung leuchten die Lämpchen vorne und in Rückwärtsrichtung leuchten die Lämpchen hinten wenn die Funktion F0 eingeschaltet ist. Die Innenbeleuchtung ist ebenfalls eingeschaltet, wenn die Funktion F0 eingeschaltet ist.

7.2.2.   Stirnlampen richtungsunabhängig

Die Verschaltung der Innenbeleuchtung entspricht dem Anschluss einer Zusatzfunktion (siehe Abs. 7.1). In der Schaltung ist der Dampfgenerator durch eine Glühlampe zu ersetzen.

7.3.   Operation of the decoder with Intellibox or TwinCenter

The Intellibox is preset to the Marklin-Motorola-format. If you want to use DCC decoders you have to change the format as per instruction in the Intellibox manual (special option 25=1, special option 907=4 or 5). If the Intellibox is not set to DCC operation, locomotives with DCC decoders may start moving uncontrolled after switching on the Intellibox, because some DCC decoders interpret the Motorola signal as an analogue signal. Set to 'N' gauge to limit the track voltage to 18V. This saves the motors of your locomotives.

Advice to the programming track : The first test after the installation of a decoder should be performed on a track with current limiter. First switch the Intellibox or TwinCenter to the programming mode! You will hear the click of a relay inside the command station. Only after that you can put the locomotive onto the programming track without risk for the decoder and read out the decoder.

The Intellibox recognized long addresses and automatically switch to extended address mode (CV#29, bit 5=1). Therefore the decoder does not operate with its shorts address. To activate the short address delete bit 5 in CV#29. Just program the short address and the decoder will delete CV#29, bit 5 automatically.

8. Warranty

Every decoder is fully tested before delivery. The warranty period is 2 years from date of purchase. Should a failure occur during this period please contact your dealer or manufacturer directly. Should the inspection of the decoder indicate faulty material or workmanship then we will replace this decoder free of charge.

Our warranty becomes null and void in case of damage caused by inappropriate use of the product, disregard of the instruction manual, abnormal operating conditions, overload, voltage pulse for change of direction (AC supply), faulty wiring (e.g. through short circuits between current pick-up and motor, short circuits between motor output and chassis), unauthorized modifications, overheating etc. .

We accept no responsibility for direct or indirect damage resulting from improper use, non observance of instructions, unauthorized modifications, abnormal operating conditions, overheating, overload, exposure to humidity etc. .

CE

Nicht für Kinder unter 3 Jahren geeignet.
Not suitable for children under 36 months.
Ne convient pas aux enfants en dessous de 36 mois.