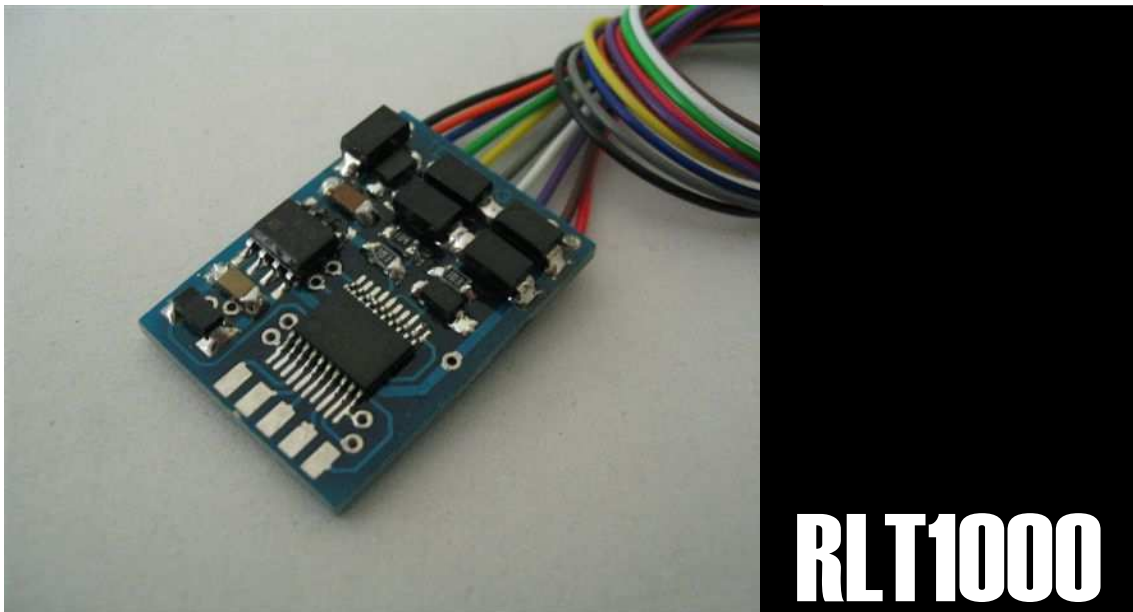




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**DECODER FOR AC MOTORS
LOCOMOTIVES**

Document History

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Index

| | |
|---|------------|
| DOCUMENT HISTORY | I |
| INDEX | II |
| FIGURES | III |
| IMAGES | III |
| HOW TO USE THIS MANUAL | 1 |
| INTENDED USE | 1 |
| SECURITY INSTRUCTIONS | 2 |
| MECHANICAL RISKS | 2 |
| ELECTRICAL RISKS | 2 |
| FIRE RISKS | 2 |
| BURNS RISKS..... | 2 |
| OPERATING DETAILS | 3 |
| AUTOMATIC ANALOGIC AND DIGITAL MODE RECOGNITION | 3 |
| MOTOR DRIVING | 3 |
| FUNCTIONS IN DIGITAL MODE | 3 |
| ILUMINACIÓN | 3 |
| SIMULATED INERTIA MODE..... | 3 |
| BLUE MÄRKLIN TRANSFORMER | 3 |
| INSTALLING THE DECODER INTO THE LOCOMOTIVE | 4 |
| INSTALLATION VIDEO | 4 |
| <i>Diagrams</i> | 4 |
| PROGRAMMING | 5 |
| SETTING THE CONFIGURATION VALUES (CV) WITH CONTROL UNIT (6021)..... | 5 |
| SETTING THE CONFIGURATION VALUES (CV) WITH CENTRAL STATION 1 | 5 |
| SETTING THE CONFIGURATION VALUES (CV) WITH CENTRAL STATION 2 | 5 |
| SETTING THE CONFIGURATION VALUES (CV) WITH MOBILE STATION 1..... | 5 |
| SETTING THE CONFIGURATION VALUES (CV) WITH MOBILE STATION 2..... | 5 |
| CV TABLE VALUES (CV)..... | 6 |
| SET THE FACTORY DEFAULT CV VALUES | 7 |
| FREQUENTLY ASKED QUESTIONS | 8 |
| WARRANTY CONDITIONS | 9 |
| TECHNICAL SPECIFICATION | 10 |

Figures

| | |
|--|---|
| FIGURE 1 – DECODER DIAGRAM CONECTION | 4 |
| FIGURE 2 – COLOR SCHEMA FOR THE DECODER CABLES | 4 |

Images

| | |
|---|---|
| IMAGEN 1 – MODIFICATION TO AVOID BLINKING IN OLD MÄRKLIN LOCOMOTIVES..... | 8 |
|---|---|

How to use this manual

Even if you have no technical training, this manual provides step by step instructions to ensure proper installation and operation of this decoder. Before you begin, please read the entire manual, including on the safety chapter and frequently asked questions. Keep this manual with you if you want to give this decoder to another person.

Intended Use

This locomotive decoder is designed to be installed in ac motors. Only recognizes the Motorola digital data format. These data is normally sent by Digital Central Device and will control the motor and functions of the locomotive. Any other use or misuse voids the warranty.



Please note that the integrated components and circuits used in this decoder are sensitive to static electricity. Before handling the decoder please discharge yourself touching any metal object (radiator, etc).

Security Instructions

Mechanical Risks

Be careful to cut the wires, the cutting tools may have sharp edges and can cause serious injury. Visibly damaged tools can cause unpredictable damage.

Electrical Risks

When you connect the decoder must take special care to avoid :

- Short circuit.
- Connect the decoder to a different voltage than that specified.
- High humidity. Condensation can cause serious injury from electrical shock. You must installing the decoder only in dry clean rooms.
- Connect high current devices to the decoder outputs.
- Only use transformers and welders in approved outlets installed by a licensed electrician.
- Respect the needs of cable diameter.

Fire Risks

Touching flammable materials with a hot soldering station can cause fire, which may result in injury or death from burns or suffocation. Connect the welding or soldering station only when needed. Never leave a hot soldering without paying enough attention.

Burns Risks

A hot welder accidentally touching your skin can cause burns:

- *Always place the soldering station on a suitable support.*
- *Remove the tin from the soldering tip with a wet cloth or a thick sponge.*

Operating details

The decoder is designed to operate with the Motorola II format and can be configured with one of the 80 addresses also can be used with Motorola I (Delta) controllers if you configure one of the 16 Motorola I (Delta) addresses but some control parameters and functions are limited due to the characteristics of the protocol. The data sent by the Digital Central is used to control the locomotive engine, driving characteristics and lighting.

Address can be programmed without removing the locomotive from the track with any Märklin central (MS1, MS2, CS1, CS2 and 6021) Also can be programmed with any ESU Central.

Automatic Analogic and Digital mode Recognition

The decoder is programmed to analyze the type of the signal coming from the rails and switch automatically the mode.

The decoder is highly protected to support short circuits and overvoltages that normally occurs in analog environment.

In analogue mode the decoder reacts proportionally to command knob. The lighting is always on indicating the direction of travel. On or off the light and functions is not possible.

Motor Driving

The decoder will drive the motor with a frequency around 110 Hz, which is optimized for most AC motors.

Functions in digital mode

The functions F1, F2, F3 y F4 are activated using the corresponding buttons in the digital central.

Iluminación

La iluminación puede ser activada o desactivada pulsando la F0 o función luz de la central digital. Cuando la luz esta encendida indica la dirección de viaje.

Simulated Inertia Mode

The decoder has a simulated inertia mode. Use the F4 function to connect and disconnect the simulated inertia. This option is normally off.

Blue Märklin Transformer

The decoder was designed to be used with “Blue Märklin Transformers” because has the proper protection to support the Knob inversion of old devices.

Installing the decoder into the locomotive

Before installing the decoder into the locomotive be sure that the total consumption of the lamps, accessories and motor added doesn't exceed the maximum admissible value of 1500mA. The decoder can be damaged if it's exposed for a long time to high currents that exceed the specified value.

Installation Video

<https://www.youtube.com/watch?v=SQcjBn5a9Ts>

Diagrams

Read and understand the installation diagram before installing the decoder.

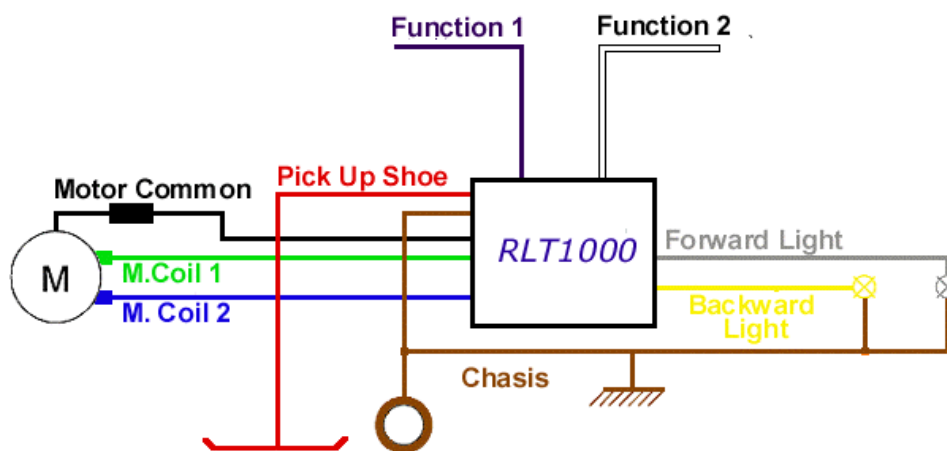


Figure 1 – Decoder Diagram connection

| | |
|-----------------|---|
| Rojo | Pick Up Shoe |
| Marrón | Chasis |
| Violeta | Function 1 |
| Blanco | Function 2 |
| Gris | Principal Function Front Light |
| Amarillo | Principal Function Rear Light |
| Verde | Connection to the stator |
| Azul | Connection to the stator |
| Negro | Comon conection to the motor |
| Naranja | Current Path return to the accesories and lights |

Figure 2 – Color schema for the decoder cables

Programming

The decoder has the possibility to program the CV parameters "on track" without opening the engine. The decoder has been tested with all the Märklin centrals and also with the ESU centrals. Before starting the programming remove all the other locomotives from the track. The default decoder address is number 40.

Setting the Configuration Values (CV) with Control Unit (6021)

To enter in program mode you must remove the digital power from the track pressing the "STOP" button, then press "START", and as fast as you can, change the direction with the red knob several times until the front and rear light begin to blink. This procedure must be done during the first 5 seconds since the locomotive gets power . You can repeat this procedure as many times as you want until enter in programing mode. The decoder will show the entering into the programming mode blinking the lights five times.

When you were sure that the locomotive is into the program mode, follow the steps below to program the CV:

- 1) Write the CV that you want to modify (for example the CV1 corresponds to the address).
- 2) Invert the direction with the red knob. The lights will blink one time during one second, indicating that the CV number was correctly received by the decoder.
- 3) Write the value you want to store into the selected CV.
- 4) Invert the direction with the red knob. The lights will blink several times during one second, indicating that the CV value number was correctly received by the decoder.
- 5) Press "STOP".
- 6) Press "START". The decoder will startup with the new modified CV value.

To modify another CV, enter again into the programm mode and follow the programming procedure .

Setting the Configuration Values (CV) with Central Station 1

Refer to the manual of the Central Station to find the CV programming procedure

Setting the Configuration values (CV) with Central Station 2

Refer to the manual of the Central Station 2 to find the CV programming procedure

Setting the Configuration values (CV) with Mobile Station 1

Refer to the manual of the Mobile Station 1 to find the CV programming procedure

Setting the Configuration values (CV) with Mobile Station 2

Refer to the manual of the Mobile Station 2 to find the CV programming procedure

CV Table Values (CV)

This firmware version allows you to set several parameters to modify the behaviour of the decoder or set different light effects.

| CV | Function | Note | Values | Factory Default |
|----|---------------------------|--|---|-----------------|
| 1 | Address | This CV store the digital address to be recognized by the decoder | 1-80 | 40 |
| 2 | Acceleration | This CV store the motor acceleration step | 1-10 | 4 |
| 3 | Deceleration | This CV store the motor deceleration step | 1-10 | 4 |
| 4 | Motor Start Speed | This CV store the motor start speed | 1-80 ¹ | 10 |
| 5 | Motor Maximum Speed | This CV store the motor maximum speed | 1-80 ² | 80 |
| 6 | AC Change Direction Level | This CV allows to set the level of AC voltage that generate an Change In the Direction of the Engine | 1-80 | 56 |
| 7 | - | - | - | - |
| 8 | Reset to Factory Default | Writing 08 in this CV the decoder will reset all the configurations values to the factory default | 08 | - |
| 9 | Disabling Analog Mode | 00-Analog mode enabled 01-Analog mode disabled | 00-Analog mode enabled 01-Analog mode disabled | 00 |
| 10 | Front Light Effect | This CV configure the different light effects that can be set to de Front Light | 01 – Normal Light 02 – Blink 1 04 – Blink 2 08 – Random 1 16 – Random 2 | 01 |
| 11 | Rear Light Effect | This CV configure the different light effects that can be set to de Rear Light | 01 – Normal Light 02 – Blink 1 04 – Blink 2 08 – Random 1 16 – Random 2 | 01 |
| 12 | Function 1 Light Effect | This CV configure the different light effects that can be set to de Function 1 Light | 01 – Normal Light 02 – Blink 1 04 – Blink 2 08 – Random 1 16 – Random 2 | 01 |
| 13 | Function 2 Light Effect | This CV configure the different light effects that can be set to de Function 2 Light | 01 – Normal Light 02 – Blink 1 04 – Blink 2 08 – Random 1 | 01 |

¹ La velocidad de arranque debe ser menor a la velocidad máxima para evitar problemas operativos.

² La velocidad máxima debe ser mayor que la velocidad de arranque máxima para evitar problemas operativos.

| | | | | |
|----|--------------------|---|---------------|----|
| | | | 16 – Random 2 | |
| 14 | - | - | - | - |
| 15 | - | - | - | - |
| 16 | - | - | - | - |
| 17 | - | - | - | - |
| 18 | Blinking Frecuency | Configure the frecuency of the Blinking Efect | 1-80 | 40 |
| 19 | Random Frecuency | Configure the frecuency of the Random Efect | 1-80 | 02 |

Set the factory default CV values

To reset the CV values to the factory default, write the value 08 into the CV 08. Please take note that the address of the decoder will be set to the number 40.

Frequently asked questions

The decoder is really hot or is smoking.

Remove the power from the decoder immediately!

Possible cause : One or more connections are wrong ,please recheck the connections.

Possible cause: Short circuit . Remove the cover and take a look to find if some cable or the decoder are touching the frame or the chasis .

The lamps are blinking (This is not a defect) .

Possible cause : The lamp is connected to the chasis. Isolate the lamp from the chasis and use the orange cable as the return current path. If it's impossible to isolate the lamp or you just want to maintain the locomotive without changes , the following schematic will help to reduce the blinking effect:

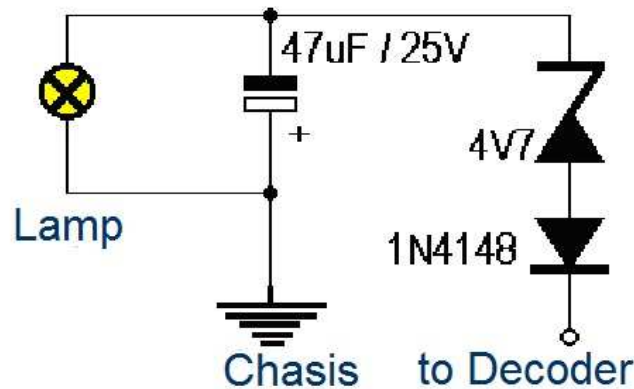



Imagen 1 – Modification to avoid blinking in old Märklin locomotives

 **ATTENTION:** This circuit is a recommendation, when you connect it to the decoder avoid leaving loose wires or poor insulation. The use of this circuit is at your sole responsibility.

The locomotive is not working in analog mode.

Possible Cause: If the engine is controlled by a speed control analog PWM, the decoder may not work because with this this driver you can generate a similar signal to the digital controller, causing the decoder does not come in analog mode. The AC analog mode is detected only with AC controls.

Warranty Conditions

All products are tested during production. This product is guaranteed for one year months. The warranty includes the correction of faults that are due to a defect in material or manufacturing. We guarantee the compliance of the technical specifications if the decoder was installed and connected according to the manual. We are not responsible for damages or consequential damages during the connection of this product. We reserve the right to make improvements, supply spare parts or return the purchase price.

The following invalidate the warranty:

- Misuse of soldering or tin.
- If the damage is caused by failure due to not following the instructions in this manual.
- If the module has been altered.
- If copper or copper tracks are lifted.
- If damage occurs due to an overload of the module.
- If you connected the decoder to a wrong voltage or over current.
- If it is damaged by negligent use or abuse.
- If it is damaged by electrostatic discharge on components.

Technical Specification

Digital Data Format : Motorola I y II

Power: 12-24 V

Load with all function and motor off: 6mA

Maximum motor Load: 1000mA

Maximum Function Load (F0F , F0B): 1000mA

Maximum Function Load (F1 , F2): 1000mA

Attention, the current consumption of all the decoder functions including motor can't be greater than 1500 mA.

Usage Temperature: 0 a 45 C

Humidity: 85 %

Dimensions: 25 x 18 x 5 mm

Weight: 2,1 g