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RCS # "BASIC" & "ELITE" MOTOR DRIVERS

EL-102 μ P BATTERY POWERED "IN-CAB" R/C MOTOR DRIVERS.

INSTRUCTIONS

Thank you for purchasing this RCS Microprocessor (uP) based R/C Motor Driver (MD).
Please read these instructions before attempting to use the new system.

BATTERY VOLTAGES

B-2, B5 = 7 - 18v - 24. E-3 = 12v - 14v - 16v. B-5HV, E-3HV = 12v - 18v - 24. E-9HV = 12 - 24 - 30v.

1st figure is the minimum. 2nd figure is voltage stated on battery = 3rd figure, absolute maximum.

DO NOT CONNECT TO MAINS POWER (110 - 240V AC).

We tested this system three times during manufacture and it was working normally when it left our factory. If Damage in transit has occurred please return to place of purchase for attention.

THIS MOTOR DRIVER IS GUARANTEED FOR ONE YEAR.

INCLUDED ARE THE FOLLOWING COMPONENTS:

One **RCS TX-4** handpiece or one **RCS TX-24** handpiece, + one **RX-8** + one **RCS MOTOR DRIVER**.

One **RX-8** + one **RCS MOTOR DRIVER** may be supplied without a TX handpiece.

We include motor "NOISE" suppression components which do require gaining access to the motor(s).

If access to the motor(s) is difficult we offer a "NOISE" suppression kit **RF-CHK** which is easy to install.

You will supply a suitable locomotive or trail car, the 7.2 - 24v volt traction batteries (depending on MD), fuses, an ON-OFF switch and wires to connect the throttle to the battery and motor(s).

The system uses screw terminals for connecting most wires.

Where soldering is necessary we recommend a low wattage soldering iron and resin core solder.

TRANSMITTER (TX) HANDPIECE CONTROLS.

TX-4 & TX-24 handpieces require an Alkaline (not carbon or Ni-Cd) 9V transistor battery (not included).

The **TX-4** handpiece has an audible buzzer when transmitting. Buzz tone changes when battery is flat.

The **TX-24** handpiece has an LED that comes on steadily when transmitting.

When TX battery voltage is low this LED will flash at 1 Hz when transmitting. Change the battery.

If you do not intend to use the **TX** for long periods we suggest you remove the battery.

You can write the Loco # or consist # on the **TX** label. See page # 7 for how to use the TX handpiece.

You must hold the **TX** "button" for at least 1/2 second for the **RX-8** and **MOTOR DRIVER** to respond.

Very little power is used until a command "button" is pressed. Battery life varies with the amount of use.

TX-4. This is our regular 4 function handpiece. Range is adequate when correctly installed. If the **RX-8** / Motor Driver combination is capable of lights & sound triggers the **TX-4** will have "Real Time" control of 1 x function plus 2 x automatic functions. Or you can have the "Kadee" switching feature. See page # 3. 2a.

TX-24 has "Real Time" control of all three accessory functions plus lights ON-OFF when stationary.

HOW MANY LOCOS PER TX HANDPIECE?

You can assign any number of same frequency locos to just one TX handpiece.

They can be used one at a time. **OR:** If the locos are performance matched they can be MU'ed together.

Extra TX handpieces are available separately if needed for extra operators. Change address codes easily.

CAUTION

DO NOT ATTEMPT TO ALTER THE TUNING OF THE RADIO EQUIPMENT

DO NOT USE RADIO CONTROL EQUIPMENT IN THUNDERSTORMS

CHILDREN UNDER 12: ADULT SUPERVISION RECOMMENDED DURING USE.

THE TX HANDPIECE IS GUARANTEED FOR ONE YEAR.

DAMAGE TO THE TX HANDPIECE IS OBVIOUS TO US AND IS NOT COVERED BY GUARANTEE.

LOCOMOTIVE BATTERIES. Your choice of battery voltage & type for the **RCS** throttle should be determined by how you operate. We often use two 7.2 volt Ni-Cad or NiMh packs in series to give a nominal 14.4 volts input. This gives most locomotives a realistic top speed. Although we prefer Ni-Cd or NiMh batteries it is OK to use Gel Cells (minimum 12 volts). Battery life depends entirely on the type of battery, the current rating (Mah) & the type of locomotive. A fully charged 2300 Mah 14.4 v "AA" Ni-Cad pack will give 2.3 amps for 1 hour. A 20192 LGB mogul draws about .9 amp at 12 volts = to a non stop run of about 2½ hours. Charging instructions are included with the chargers.

The power ratings have been based on a mean of 14.4 volts. Power output is reduced at higher voltage. The **ELITE-3/3HV** & **E9HV** self protect for short circuit, over current & over temp. 2 amp & 6 amp at 24 volts. The **BASIC-2**, **B5**, & **B5HV** are protected by 3 & 5 amp fuses. At 18 - 24 volts use 2 amp & 3 amp fuses. **WARNING!** The fuse rating must not be exceeded.

RF RECEIVER (RX-8). There are no user accessible components on the metal cased R/C **RX-8**. Some experimentation may be required for the best signal reception. See below.

INSTALLATION OF MOTOR DRIVER (MD) & RX-8.

RCS offers a number of kits to assist installation. See our accessories price list for full details.

1. Use Silicon, double sided tape or Velcro to mount the **RCS** MD pcb in any convenient location. Some "0" scale locomotives will have room for the 2 & 3 amp versions. Do not allow the rear of the PCB to make contact with any metal objects. Damage to the throttle may occur and is not covered by warranty.
2. The metal cased R/C **RX-8** and the throttle PCB should be kept as far away as possible from motors, speakers and any BATTERIES. **THE MAGNETIC FIELD AFFECTS TUNING.** You may need to carry the battery in a trail car or dummy loco. For best RF signal see above.
3. You must place an ON - OFF switch and fuse in the Battery Circuit. See wiring diagram on page # 8. For the systems rated up to 3 & 5 amps we have available the # **BIK-U** kit of parts to assist installation. The **ELITE-9HV** must use heavy duty wiring & components. See page # 8 for fan cooling advice. Only connect the RED **[+]** & BLACK **[-]** "DC IN" battery wires after wiring is finished & double checked.

DO NOT CONNECT THE BATTERY TO THE ORANGE/GREY OUTPUT WIRES, SEVERE DAMAGE TO THE THROTTLE MAY RESULT. IT WILL BE OBVIOUS TO US AND IS NOT COVERED BY WARRANTY.

4. You must isolate the motor(s) from ALL pick ups on BOTH sides of the loco. If you don't isolate the motor(s) from the track it is possible to feed voltage down to the track and cause a short. The throttle has some built in motor "RF Noise" suppression. Poor range can be improved by fitting one of the supplied .1µf (# 104) Monolith caps from each of the motor terminals to the motor case. Enough components are supplied to do two motors. See page # 8 diagram. It is also desirable to add the black ground (-) wire from the motor case to the battery (-). Now connect the ORANGE/GREY wires from the throttle PCB to the motor(s). Alternately you can fit # **RF-CHK** pcb's as suppression. See wiring diagram on page # 8.

WIRING CONSTANT LIGHTS & SOUND TRIGGERS.

If you decide to use our constant and directional lighting outputs the bulbs **MUST** be rated for whatever the traction voltage is. ie 7.2 - 24 volts. If you are using LED's you must place a 470-1000 ohm resistor in series with each diode to drop the traction voltage to an acceptable level. See wiring diagrams.

To access the lighting functions & sound triggers on the **BASIC** series you must also have the **BASIC-SW**.

MAXIMISING RANGE & REACH.

RANGE is defined as how far away from the loco (and track) you can stand and still operate.

REACH is defined as how far away along the track the loco is when you are standing beside the track.

Getting the maximum range for an On Board R/C depends on a number of factors.

1. The higher the track is above the ground the better. Ground, ie horizon level reduces range.
2. Antenna location. Place as high as possible and stretched out straight. For large diesels & steam locos with tenders, mounting the antenna up high & in a straight line works well. We have found the base loaded **AZARR** antennas from E-Cubed R/C are excellent when installed correctly.
3. For smaller locos mounting the RX-8 & antenna up in a cab roof will keep them well away from the speaker magnet and batteries. The AZARR antenna will work well provided that when you coil it around the inside roof edge you ensure the wire does not cross over itself.
4. Connecting the antenna to the rail via an insulated track pick up will often work just fine. This makes the rail a large antenna & gives reasonable "range" when standing away from the track and very good "reach" when you are standing close to the track and walking around with your train. The wheels and track need to be reasonably clean for the rail to be an effective antenna.

OPERATING CAPABILITIES OF THE EL-102 μ P PROGRAMME.

REMOTE CONTROL SYSTEMS (RCS) is the only manufacturer of R/C model trains with PCB hardware that can be upgraded with a simple software change. As a new micro controller (μ P) programme is introduced any **RCS** μ P based MOTOR DRIVER can be taken to the next level of functionality by replacing one IC.

You must fully charge the batteries before attempting to use the system. Most Ni-Cads come with a surface charge that will allow the lights to function for a short time but not have enough energy for the MOTOR DRIVER to provide enough power for the motor(s) as well.

There are three R/C operating modes within the **EL-102** programme.

“BASIC”, “ELITE CENTRE OFF” & “ELITE POSI-CHANGE”. Read about them below before operating.

Changes from the default settings can be made at any time. See page # 4.

Code separation and system recognition must be programmed before use. See page # 4.

The way the throttle operates is also programmable. Programme setting **(1)** is always the factory default.


1. **“BASIC” CENTRE OFF** run mode is the default **(1)** and is operated like this:

▲ FORWARD MOTION button when pressed will accelerate the loco forwards to any cruise speed.

▼ REARWARD MOTION button when pressed will slow the loco down to any cruise speed.

Hold this ▼ button down long enough and eventually the loco will stop.

Then let the ▼ button go. Wait one second, then once again hold the ▼ button down and the loco will change direction and speed up the other way. To slow down in REARWARD MOTION use the ▲ button.

The  button is the double rate fast **STOP** button. See page # 4.

This control mode is ideal for MU'ing and adding helper locos. As forwards motion is always forwards for all locos in the consist there will never be any more missed direction signals. It is quite safe to use RF to communicate with all RX's in the consist. Same frequency and same address code will be required.


The  function is a trigger for playing the whistle function REAL TIME **(1)** or Latch ON-OFF.


Output function # 2 can be either Auto A **(1)** (a pulse at 25% down and another pulse 5 seconds after stop). Or, Auto B (2) on at 25% down & off 5 seconds after stop). OR OFF (3).

Output function # 3 can be either Auto ON when speed ramps up and OFF when ramping down **(1)**. OR, Auto ON when ramping down and OFF when ramping up (2). OR OFF (3).

2a. **“ELITE” FULL CENTRE OFF**. General functionality is the same as **“BASIC” CENTRE-OFF** mode.

The  STOP button stops the loco at double the set braking rate.

The  button has a **Kadee**® switching feature. This is where after uncoupling, the jaws of the Kadee® couplers remain open over the magnet. The loco can then push the uncoupled freight cars into any siding and leave them there. If the loco hesitates when depositing the cut of freight cars they may re-couple.

The  button ensures the last 25% of stopping is sudden to prevent accidental re-coupling.


The loco can then be ramped up to speed again in the opposite direction using the ▲. or ▼ buttons.

This control mode is ideal for MU'ing and adding helper locos. As forwards motion is always forwards for all MU'ed locos, there will never be any missed direction signals. Same frequency & address codes are required.


2b. **“ELITE” POSI-CHANGE** is operated like this:

The ▲ button is only used to ramp the speed up to any “Cruise” speed setting in the set direction.

The ▼ button is only used to ramp the speed down in the set direction. It does not change direction.



The  STOP button stops the loco at double the programmed Accel/Brake rate.

The direction is set sequentially by the  button and features **Kadee**® switching.

In this mode, once you have pressed the  button, the loco will ramp down to the last 25%, Stop and then change direction ready to ramp back up again by using the ▲ button.

This control mode is NOT really suitable for MU'ing locos.

“ELITE” accessory functions requires a TX-24 and are operated thus:

The  Whistle,  Bell & ▲ + ▼ Aux functions can be either Momentary **(1)** or Latch ON-OFF.

MOMENTARY suits both the Sierra and Phoenix Bell. They only need one press to self latch.

The third momentary function could be used to trigger another sound function or uncoupling device.

LATCH ON-OFF suits the Dallee Bell and forced RPM. Great for selecting prototypical Notch 8 diesel Rev Up before moving. When full revs have been achieved you can start loco and when under way back off just like the real ones do. Use full RPM to climb the steep grade then back off at the crest.

SETTING THE SYSTEM SEPARATION CODES.

RCS Motor Drivers are shipped with the address codes set to 0. ie. **TX-4** & **TX-24** dip switches are OFF. The system can be used as is but we strongly recommend resetting the codes to a new combination. Full instructions on how to do this and how to LINK locos are on page # 7.

PREPARATION FOR PROGRAMMING CHANGES.

Unlike earlier RCS systems programming changes with the **EL-102** μ p are made at the MOTOR DRIVER pcb. The bracketed number eg **(1)** indicates how many times the light(s) will flash in a pre-arranged sequence after a programming change has been made. The LED on the Motor Driver pcb is connected to the front light. To make any programming changes the loco must always be switched **OFF** before you start.

DO NOT accidentally set DIP codes to all on (BC # 7) and then turn power ON.

If you do & power is turned ON-OFF the lights will flash twice and change the system to “**ELITE**” mode.

If this happens the system can be reprogrammed back to the default “**BASIC**” mode by turning ON all three DIP switches (BC # 7) and toggling the power ON-OFF until lights flash once.

Then turn all three DIP switches to the OFF position before switching the system ON again.


Refer to DIP switch chart on page # 6 to get correct button settings for each function.

Batteries must be charged before use.

“BASIC” RUN PROGRAMME (Mode # 1)

1. “BASIC” CENTER-OFF is the default **(1)** mode. How to select if changing from a different control mode. Set DIP switch to BC # 7 ON, then turn loco on. If lights flash twice toggle loco ON-OFF until lights flash just once in the ON position. Then turn loco OFF.

Set DIP switch to BC # 0 ON and turn loco ON. The LED on pcb will come on and you are ready to go.

The whistle function is controlled by the  button # 4. How to change from Mom to latch ON-OFF.

Set DIP switch to BC # 2, then turn loco ON. If lights flash once (MOM) toggle loco ON-OFF until lights flash twice in the ON position. Then turn loco OFF.

Set DIP switch to BC # 0 ON and turn loco ON. The LED on pcb will come on and you are ready to go.

To change automatic BELL and AUX functions in “BASIC” see the chart on page # 6.

“ELITE” RUN PROGRAMME (Mode # 2)

2a. “ELITE” FULL CENTER-OFF. Is the default **(1)**.

2b. “ELITE” POSI-CHANGE. Selecting from default. You only need to do this once.

Set DIP switch to BC # 6 ON, Then turn loco ON. Toggle power ON-OFF until lights flash once in the ON position. Then turn loco OFF.

Set DIP switches to BC # 0 and turn loco ON. The LED on pcb will come on and you are ready to go.

CHANGING THE ACCELERATION RATE FOR ABOVE MODES.

To change from the slow 10 second **(1)** setting to the fast 5 second rate:

Set DIP switch to BC # 1 ON, then turn Loco ON. If lights flash once (10 sec) toggle loco ON-OFF until lights flash twice in the ON position. Then turn loco OFF.

Set DIP switches to BC # 0 and turn loco ON. The LED on pcb will come on and you are ready to go.

CHANGING THE ACCESSORY FUNCTIONS FOR ABOVE MODES.

1. WHISTLE: To change from Momentary to Latch ON-OFF:

Set DIP switch to BC # 2 ON, then turn Loco ON. If lights flash once (MOM) toggle loco ON-OFF until lights flash twice in the ON position. Then turn loco OFF.

2. BELL: To change from Momentary to Latch ON-OFF:

Set DIP switch to BC # 3 ON, then turn Loco ON. If lights flash once (MOM) toggle loco ON-OFF until lights flash twice in the ON position. Then turn loco OFF.

3. AUX: To change from Momentary to Latch ON-OFF:

Set DIP switch to BC # 4 ON, then turn Loco ON. If lights flash once (MOM) toggle loco ON-OFF until lights flash twice in the ON position. Then turn loco OFF.

Set DIP switches to BC # 0 and turn loco ON. The LED on pcb will come on and you are ready to go.

AUTOMATIC OPERATION.

If you desire to have automatic operation with this motor driver contact RCS to exchange this **EL-102** operating programme μ p for the **EMP-103** version which does have the automatic programme, but does not have the POSI-CHANGE method of operating.