# RCS - BELTROL
## 2.4 Ghz RADIO CONTROL

PO BOX 1118 BAYSWATER, VIC 3153, AUSTRALIA
PHONE: INTERNATIONAL ++614 2902 9083
AUSTRALIA (04) 2902 9083    (03) 8685 8230
Website: http://www.rcs-rc.com
Email: info@rcs-rc.com

# PLANET TWISTER
# 5 ch TX-RX

R/C ELECTRONIC SPEED CONTROLLERS
THIS BRAND OF R/C IS A "B" GROUP & MUST ONLY USE
THE BTL GROUP "A" SERIES OPERATING PROGRAM.

## TABLE OF CONTENTS
## CONTAINED IN INSTRUCTIONS.

PLEASE NOTE. PDF WIRING DIAGRAMS ARE AVAILABLE HERE.

http://www.beltrol-rc.com/p1332-Instructions.html

# INSTRUCTIONS.

Thank you for purchasing this Microprocessor (µP) based R/C Electronic Speed Control (ESC) system.

THIS SYSTEM REQUIRES THE PLANET TWISTER 2.4 GHZ R/C FOR ALL INSTALLATIONS.

EVERY RCS-BELTROL SYSTEM IS IN TWO PARTS CONNECTED BY A PLUG IN 4 X WAY CABLE.
1. THE POWER IN - MOTOR CONTROL - OUT, PCB &
2. THE DECODER PCB, INTO WHICH THE PLANET TWISTER RX IS SIMPLY PLUGGED.
SERVO LEADS ARE NOT NEEDED.

## USE ONLY OPERATING PROGRAM BTL-vA2

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

RCS-BELTROL ESC's ARE DESIGNED TO RUN ON BATTERIES.
THE # ECL-PnP5 CAN BE USED TRACK or BATTERY POWER.
THEY HAVE CONSTANT BRIGHTNESS DIRECTIONAL LIGHTS & SOUND TRIGGERS.

THE FOLLOWING MAXIMUM VOLTAGES MENTIONED ARE THE NOMINAL VOLTAGE &
TAKE INTO ACCOUNT FULLY CHARGED BATTERIES CAN & DO EXCEED THE NOMINAL VOLTAGE.
USE 7.2v - 18v for the RCS-BELTROL ECL-3r ESC.
USE 7.2v - 24v for the RCS-BELTROL BTL-6r, BTL-PnP5 or BTL-6rF ESC's.

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 ESC IS GUARANTEED FOR ONE YEAR.

INCLUDED ARE ONE OR THE OTHER OF THE FOLLOWING COMPONENTS:
BTL-3r, BTL-6r, BTL-PnP5 or BTL-6rF ESC.

You will supply the 2.4 Ghz 5 channel Digital Proportional PLANET TWISTER R/C.
You will supply a locomotive or trail car, the 7.2 - 24 volt traction batteries (depending on ESC), a fuse, an ON-OFF switch and wires to connect the ESC to the battery and motor(s).
Where soldering is necessary, we recommend a low wattage soldering iron and resin core solder.

### SPECIAL NOTE ABOUT CHANNEL # 5.

It has been brought to our attention that the PLANET T5 Ch # 5 OFF - ON switch is oriented differently in some markets. These instructions refer to "0" as being the ON position and "1" as being the OFF position. Ch # 5 should always be off unless calibrating or programming the system. If when you turn on the RX and the ESC front & rear lights flash rapidly, Ch # 5 is turned ON and the system is ready for calibrating or programming, not operation.

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## 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.

# INSTALLING *RCS-BELTROL* ESC's.

**PLANET IS A GROUP "A" R/C & THIS ESC MUST USE THE BTLvA2 OPERATING PROGRAM.**

*RCS-BELTROL* R/C **ESC's** can use a PLANET T5 5 channel 2.4 GHz digital proportional R/C R6M RX with servo outputs.

We have conducted development & testing with both Mode # 1 & Mode # 2 systems. See page # 4.

These have sprung Elevator & non sprung Throttle controls which are used to control the locomotive.

The *RCS-BELTROL* program uses the L to R Aileron & Rudder sticks to trigger 4 x sound effects or control accessories.

Channel # 5 (the Landing Gear control switch) is used for initial speed calibration, making system program changes such as Start/Max voltage, default direction start, system reset & sound trigger outputs from momentary to latch ON - OFF

See page # 7 for information as to how the TX sticks are used.

## LOCOMOTIVE SEPARATION.

It is not necessary to separate 2.4 GHz R/C R/C systems with crystals. They are all legal for air & ground use. Every TX has a unique identifier code and any R6M receiver (RX) can be **"BOUND"** to any T5 TX.

**"BINDING"** must be done before the system can be used. Ideally it should be done before the RX is plugged into the **# DEC-U** pcb. See page # 4 for the **"BINDING"** procedure.

You can mount the **# DEC-U** PCB with double stick tape or non conductive silicone. Do not allow metal objects to touch the rear of the PCB. Damage to the PCB may result.

## INSERTING THE R6M RX.

The T5 2.4 GHz R6M RX simply plugs into the **# DEC-U** & eliminates all servo leads. Be careful locating the pins into the pcb sockets. You must accurately align the RX pins to the numbers shows. 1 – 6.

It will be a stiff push fit, but do not force the RX home.

The **# DEC-U** provides a 5 volt BEC supply for the 5 channel R6M 2.4 GHz RX. You do not need batteries for the RX.



Hold one part in each hand.
Carefully line up pins # 1 – 6.



Then gently press onto socket.
The fit will be tight. Do not force.
**The BATTERY terminals must NOT be connected.**

Mounting the RX at right angles to the **# DEC-U** pcb may not be convenient. In this case it will be necessary to separately purchase the **# DEC-ADPT** kit with individual servo leads. This permits remote mounting of the RX.



Carefully align pins 1 – 6 of the small **# DEC-ADPT** kit pcb with the sockets marked 1 – 6.



Then gently press the pcb into the sockets.



Insert the supplied servo cables into the servo sockets on the **# R6M** RX.
The 3 x wire lead goes to # 1.

**PLACING RX ANTENNA.**
Other than with brass locos, it does not matter where you place the antenna(s).
We have 200' + range with the system in plastic locos.  There is **NO** "glitching" or "Rusty Bolt Effect".
**N.B.** With metal locos the antenna **may** need to be vented externally to maximise range.  Although there is evidence that
2.4 GHz RX's have been successfully used with the **RX & antenna** inside a dummy water tank of a live steam loco,.
Turn the T5 2.4 GHz TX OFF to save the batteries & the loco will "Cruise" along until the TX is turned ON again & manual
control resumed.  The *RCS-BELTROL* program ignores the PLANET TWISTER Fail safe.

**INSTALLING THE *RCS-BELTROL* ESC.**
Wiring diagrams for your specific ESC must be downloaded in pdf format from the *RCS-BELTROL* website.

http://www.BELTROL-rc.com/p1332-Instructions.html

**POWER SOURCES.**
You can use battery power.  OR:  Constant track voltage.  See below.
Maximum voltages for a particular ESC are shown on page # 1.
**BATTERY POWER.**
Connect the traction battery, which **MUST BE FUSED,** as per the wiring diagram.
*RCS-BELTROL* **R/C** offers a variety of installation kits for on board use such as the **# BIK-U3/6** which has screw
terminals to simplify installations.  For trail car installations we also have the **# BIK-TC5**.
When used with the Bachmann® K-27, we have a special kit, **# BIK-K27** to simplify installation.
**PnP TRACK POWER.**
The **# PnP-ADAPT** is a Plug'n'Play pcb designed to be used with AristoCraft® and Bachmann® locos equipped with the
standard PnP socket.  It will collect constant track voltage which is then polarised, filtered, fused & connects to any
BELTROL ESC w/screw terminals.  Filtered DC is recommended.  You may be able to use a non DC supply such as
DCC.
Battery back up of the track power is available via screw terminals on the **# PnP-ADAPT.**
Make sure the battery pack is fully charged before using the system.
**NON PnP TRACK POWER.**
Contact *RCS-BELTROL* for advice on how to set up a bridge rectifier and filtering capacitors circuit.

**MOTOR CONNECTION.**
Connect the motor(s) as per the wiring diagrams.  The **M +** motor output is positive (+) in a forward direction.
In most installations the system will function perfectly well without any extra motor "Noise" suppression.

The **# BTL-PnP** is a simple plug in installation.  No wiring to the motors or lights.
**AristoCraft®** locos.  We supply the **# BTL-PnP** programmed with the default pre-set to suit AristoCraft® locos.
**Bachmann® Spectrum® Fn3 locos**.  You can easily reset the **# BTL-PnP** default direction to suit the Bachmann®
Spectrum® Fn3 locos that have a PnP socket.  See page # 6, **3.4 Default Direction**.

**SHORT CIRCUIT & OVERLOAD PROTECTION.**
All *RCS-BELTROL* **ESC's** are self protecting.
Although there is output overload and short circuit protection built into them, it is essential the track power and battery
supply be fused for overall system protection.  See the wiring diagram pages.

*RCS-BELTROL* **ESC's** have transistor controlled directional lighting.  Maximum current is 100 ma per terminal.

**IT IS MOST IMPORTANT THAT THE LIGHT BULBS BE COMPLETELY ISOLATED FROM ANY OTHER WIRING.**

Instead of rewiring some locos, sometimes it is much simpler to control the regular loco wiring by simply reversing the
traction battery voltage.  You can use the **# RELAY-1a** to do this as it can save a lot of wiring in many locos.  It is
especially useful in USA Trains® locos to control incandescent bulbs or LED's up to 1 amp & smoke features.
Please note:  If the **# RELAY-1a** has been used, the lights will flash alternately, not together as with transistor outputs.
When the system is in neutral only one set of lights will be lit.

The instructions assume the operator has used the available front & rear transistor lighting outputs or **# RELAY-v5.**
If you do not have any lighting outputs connected you MUST be able to observe the LED on the ESC.

# SETTING UP THE *RCS-BELTROL* ESC's.

**THESE INSTRUCTIONS REFER TO THE TWISTER T5 2.4 GHz 5 CHANNEL R/C.**
**LAYOUT OF THE T5 TRANSMITTER.**

| | |
|---|---|
| Shown above is a Mode # 1 TX. | Shown above is a Mode # 2 TX. |
| The Elevator & Rudder stick is on the left. | The Elevator & Rudder stick is on the right. |
| The Throttle & Aileron stick is on the right. | The Throttle & Aileron stick is on the left. |
| The Ch # 5 switch is in top left corner. | The Ch # 5 switch is in top left corner. |

**Prior to using this system there are two procedures that must be carried out by the operator.**

## 1. "BINDING".

The 1st procedure is to "BIND" the R6M Receiver (RX) to the T5 Transmitter (TX).
"BINDING" is accomplished by following a few simple steps that are outlined in the R/C system instructions.
In case you don't have those instructions here is how we go about it.

Although the *RCS-BELTROL* program ignores the RX Fail Safe commands, before "BINDING" the operator should nevertheless set up the failsafe as TWISTER intended.
The operator must have the spring loaded TX stick positions in neutral & the throttle stick to zero. Stick down.
All the servo reversing switches must be set to normal.

**Firstly set up the TX trim tabs on all four control sticks. These MUST be in the middle.**

The TWISTER T5 has regular slide type trim tabs.
Once the trim tabs are in neutral you can proceed with the **"BINDING"** process.
There is no trim switch on Ch # 5 which must be set to the "1" position. This is opposite to SPEKTRUM DX5e.
**The TRIM tabs are easy to accidentally move. Re-center them occasionally. No need to rebind.**

**HOW TO "BIND".**
**1.1** The Twister uses a tiny pushbutton on the R6M RX & does not have a removable plug. This makes rebinding the loco to a different TX impossible when the RX is mounted inside a loco.
Turn the loco power ON. The loco will always give a very slight jerk at switch ON. See page # 9.
Then press the small "pushbutton" on the side of the R6M RX.

**1.2** .The RX LED will repeatedly blink 3 x times rapidly to indicate it is ready to be bound.
Please note the green LED on the **ESC** pcb & the front and rear lights (if fitted) will stay OFF.

**1.3** Turn the TX power switch to ON. Almost immediately the RX LED on the will blink very rapidly three times and then go solid ON to indicate "BINDING" is complete. The **ESC** LED & both loco lights will immediately blink three times & then go to solid ON.
Binding is complete.

## CARE & FEEDING OF THE PLANET TWISTER TX.

The PLANET TWISTER transmitter uses 4 x AA size batteries. Either, Alkaline dry cells, or rechargeables.
We use Sanyo ENELOOP rechargeable AA cells which are guaranteed to hold 85% of their charge for 12 months if not being used. Always recharge them after the TX has been used for any length of time.
It is most important to ensure the batteries always have plenty of charge in them when using the TX.
If the voltmeter is less than 4 volts, the batteries are getting low. This may result in loss of control. If you have chosen to use Alkalines, we advise you to replace them immediately.

**Official PLANET TWISTER system instructions are available here:**

**http://attachments.modelengines.com.au/products/files/7710202[460].pdf?r=1256277491**

# 2. CALIBRATION.

The 2nd step in system preparation is to calibrate the direction & throttle sticks.  Even though this step is only needed once when first setting up a new ESC, from time to time it is advisable to run through the procedure.

**2.1**  Turn ON power to the loco which will give a slight jerk.  The RX LED will blink slowly. Other lights OFF.



**2.2**  Set the Mode # 1 T5 channel # 5 switch on the TX to **"0"** ON, i.e. push switch away from you.

**2.3**  Turn the TX ON.  Screen will show TX voltage. Make sure Throttle stick is down.  Zero output.

After 2 - 3 seconds the RX & TX will recognise each other & the RX blinking LED will go to solid ON.
The **ESC** LED & both front & rear lights will flash rapidly.



**2.4**  From zero (down position), gently stroke the Throttle stick backwards & forwards full travel a couple of times.  Pause briefly (less than 1 second) at end of each stroke.  Then return stick to zero (down position).



**2.5**  Gently stroke the Elevator stick backwards & forwards full travel a couple of times & let stick go.

**2.6**  Turn the Channel # 5 switch to **"1"** OFF. i.e. pull the switch towards you.

The **ESC** LED & loco lights will immediately blink three times at a slower rate & both lights will go to solid ON.
The system is in neutral and ready to operate.

**2.7**  Either turn the loco and TX OFF for later use, or proceed to page # 6.

# 3. PROGRAMMING.

Operating features of the *RCS-BELTROL* system can be programmed from the TX by turning on CH # 5.
Channel # 5 is turned ON by pushing the switch away from you to **"0"**. This is backwards to other R/C's.
**Programming can only take place when the system is in neutral.**

**3.1 START VOLTAGE.** This feature is designed to equalise the starting voltage of dissimilar locos.
**3.2 TOP SPEED VOLTAGE.** This can limit the top speed available. Either for speed matching locos or, for limiting the top speed of one loco, say for when the system is being operated by children.
**3.3 MOMENTUM.** Toggle momentum control ON or OFF.
**3.4 DEFAULT DIRECTION.** Re-set the direction of a loco when it is to run back to back with another loco.
**3.5 SYSTEM RESET.** This takes # 1 & # 2 back to the factory default if incorrectly set.
**3.6/7/8/9 SET SOUND TRIGGERS** 1, 2, 3 & 4 from MOMENTARY (Default) to Latch ON - OFF.

**HOW TO USE THE PROGRAMMING FEATURE.**
Turn ON the loco power. The loco will give a slight jerk & the RX and loco lights will stay OFF.
After switch ON, the system will be, & must stay, in neutral. If running, return to neutral before programming.
Only turn the Ch # 5 switch ON **AFTER** the TX has been turned on. **Do not turn the Ch # 5 switch on first.**

**SPEED MATCHING.**
If you have two or more locos that have dissimilar starting and top speeds, you can adjust those voltages so the locos will be fairly accurately speed matched across the speed range. It has been our experience that absolutely accurate matching is not really needed for smooth performance. The trade off is the top speed of a consist of locos controlled by one TX will be limited to the top speed of the slowest loco.

**3.1 START VOLTAGE.** We suggest you test the locos you wish to match one at a time to find out the stick setting at which the **slowest** starting locos begin to move. Count the number of clicks on the throttle stick from OFF (down).
Then, with the slowest loco stopped and the direction set to neutral:
Move the throttle stick to the loco start speed desired. i.e. to the stick position where the loco started moving.
Then push the direction (elevator) stick forwards once only. The lights will blink **ONCE** with the push.
Wait a couple of seconds for the lights to blink **ONCE** again indicating the new start voltage setting has been stored in the system memory. Then move the throttle stick back to zero (OFF) position. i.e. stick down.
Then turn channel # 5 OFF. The lights will blink three times and then go to all solid ON. i.e. Neutral.
Repeat the procedure if the setting is incorrect.

**3.2 TOP SPEED VOLTAGE.** If speed matching, we suggest you test the locos you wish to match one at a time to find out the stick setting at which the **fastest** loco matches the top speed of the slowest loco.
Then, with the fastest loco stopped and the direction set to neutral:
Move the throttle stick to the lower top speed desired for the loco. i.e. to the stick position where the fastest loco matched the top speed of the slowest loco.
Then push the direction (elevator) stick forwards **TWICE** only. The lights will blink once with each push.
Wait a couple of seconds for the lights to blink **TWICE** again indicating the new top speed voltage setting has been stored in the system memory. Then move the throttle stick back to zero (OFF) position. i.e. stick down.
Then turn channel # 5 OFF. The lights will blink three times and then go to all solid ON. i.e. Neutral.
Repeat the procedure if the setting is incorrect.
**OR:** When children are using the loco, you can follow the same steps to limit the top speed of any loco.

**3.3 MOMENTUM.** Toggle momentum control ON or OFF.
Press the elevator stick forwards **THREE** times only. The lights will blink once with each push.
Wait a couple of seconds for the lights to blink **THREE** times again indicating the default momentum ON – OFF setting has been stored in the system memory.
Then turn channel # 5 OFF. The lights will blink three times and then go to all solid ON. i.e. Neutral.

**3.4 DEFAULT DIRECTION.** To re-set the default direction of a loco to run back to back with another loco:
Push the direction (elevator) stick forwards **FOUR** times only. The lights will blink once with each push.
Wait a couple of seconds for the lights to blink **FOUR** times again indicating the default direction setting has been stored in the system memory.
Then turn channel # 5 OFF. The lights will blink three times and then go to all solid ON. i.e. Neutral.

**3.5 SYSTEM RESET.** To take **# 3.1** & **# 3.2** back to the factory default if incorrectly set:
Push the direction (elevator) stick forwards **FIVE** times only. The lights will blink once with each push.
Wait a couple of seconds for the lights to blink **FIVE** times again indicating the start & top speed voltage settings have been returned to default in the system memory.
Then turn channel # 5 OFF. The lights will blink three times and then go to all solid ON. i.e. Neutral.

**3. 6/7/8/9 SET SOUND TRIGGERS F1, F2, F3 & F4 from MOM (Default) to Latch ON - OFF.**
For trigger **# 1** Push the direction (elevator) stick forwards **SIX** times only. The lights will blink once with each push.
Wait a couple of seconds for the lights to blink **SIX** times again, indicating the trigger has toggled to latch ON-OFF.
Then turn channel # 5 OFF. The lights will blink three times and then go to all solid ON. i.e. Neutral.

Repeat procedure for trigger **# 2** (**SEVEN** pushes), trigger **# 3** (**EIGHT** pushes) & trigger **# 4** (**NINE** pushes).

Repeat procedure to change any of these 3 x triggers back to MOMENTARY from Latch ON – OFF.

# OPERATING THE *RCS-BELTROL* ESC's.

## 4. HOW TO OPERATE AFTER COMPLETING CALIBRATION & PROGRAMMING.

**N.B.  The TX Ch # 5 switch must be set towards you, "1" OFF**

Always turn ON the loco first.  The loco will give a slight jerk.  See page # 9. The **ESC** & loco the lights will stay OFF.
Then turn the TX ON.  After between 2 - 8 seconds the TX & RX will recognise each other.  The RX LED will come ON & not blink.  The **ESC** LED & both front & rear loco lights (if fitted) will blink three times & then all lights will go to solid ON.

**N.B. In order to select a direction the throttle stick must be OFF and the system must be in neutral.**

**4.1  FORWARDS.**  To select forwards direction push the Elevator stick fully forwards once & then release it.
The rear light will go out.  The green LED on the **ESC** pcb & the front light will stay ON.
If the # **BTL** **ESC** default motor & lights direction is incorrect please see TROUBLESHOOTING on page # 9.

**4.2  SPEEDING UP**.  Gently push the Throttle stick forwards.  The loco will accelerate away after 3 - 4 clicks.
The speed is proportional to the stick position with a small amount of momentum built in to prevent sudden jerky movements.  Let the stick go once the desired speed has been reached.  The speed will stay the same until the Throttle stick is moved either up or down.

**4.3  SLOWING DOWN**.  Pull the Throttle stick back to the desired speed.  Max - Zero speed takes 2 x seconds.

**4.4  STOPPING**.  Pull the Throttle stick back all the way back to stop.  The **ESC** LED & front light will be ON.

**4.5  REVERSE**.  You must completely stop the loco first.  The Throttle stick must be all the way down.
Then pull the Elevator stick fully back once & release it to return the system to neutral from forwards.
The **ESC** LED plus both front and rear lights will be ON.
Then pull the stick back again & release it.  The **ESC** LED & front light will go out.  The rear light will stay ON.
To speed up, slow down & stop in reverse see **SPEEDING UP, SLOWING DOWN & STOPPING** above.

# CONTROLLING MOMENTUM & SOUND TRIGGERS.

The *RCS-BELTROL* **ESC's** feature controllable momentum.  An operator can control precisely how much or how little momentum effect is applied whilst accelerating and braking.  The default is Momentum enabled.
Momentum can either be ignored or switched off.  See page # 6 - # **3.3** for how to switch momentum OFF.

**BRAKE RELEASE**.
Once direction has been set (see **4.1** above) pull the direction stick back (down) fully & **HOLD** stick in place.
Then use the Throttle stick to set the speed you wish to attain.
If you hold the direction stick down the loco will start to accelerate up to the set speed at the slowest rate of acceleration (30 seconds from zero to top speed).
The acceleration rate is proportional to the stick position.  Fully down = 30 seconds, half down = 15 seconds.
Let the direction stick go & the loco will accelerate at the fastest rate (2 secs from zero to full speed) up to the set speed.

**BRAKE APPLY**.
Whilst the loco is running pull the direction stick all the way back (down) fully and **HOLD** stick in place.
Then use the Throttle stick to set the speed to zero.
If you hold the direction stick down the loco will start to decelerate to the set speed at the slowest rate of braking (30 seconds from top speed to zero).
The braking rate is proportional to the stick position.  Fully down = 30 seconds, half down = 15 seconds.
If you let the stick go the loco will decelerate at the fastest rate (2 x seconds from full speed to zero).

**SOUND SYSTEM TRIGGERS**.
*RCS-BELTROL* **ESC's** have 4 x four manual sound triggers controlled by the sprung left to right Aileron & Rudder stick controls.  Outlets are marked 1 – 4 on the row of 8 x screw terminals on the **# DEC-U** pcb.  Max current is 500 ma.
You can activate any sound with any trigger depending on which TX stick you want to operate the sound with.

**Mode # 1 & Mode # 2 sound triggers are both the same.**
**RH** stick to the left is **F 1**.  **RH** stick to the right is **F 2**.  **LH** stick to the left is **F 3**.  **LH** stick to the right is **F 4**.
The default for each is Momentary.  **F1, F2 & F3** are programmable for latch ON – OFF instead.  See page # 6.  **3.7/8/9**.

If you prefer the trigger outputs the other way around, it is OK to reverse the Aileron & Rudder reversing switches.
**Do not reverse the THROTTLE & ELEVATOR switches.**
When using with Momentary function, press the stick until the sound is activated.  Release stick to turn sound OFF.
When using with a Latch ON – OFF function, press and hold the stick for one second until the sound is activated.  Then release the stick and the sound will stay ON.  Press the same stick for one second & release to turn the sound OFF.
They can be used as is with most sound systems such as Sierra®, Phoenix®, Dallee® & MyLocosound®.

Sierra will require the additional purchase of one **# SSI-12v5** so that Sierra can function correctly.

# *RCS-BELTROL* ESC MU'ing LOCO CONSISTS.

## MULTIPLE LOCOS IN A CONSIST.
The *RCS-BELTROL* ESC's are capable of MU'ing multiple locos in one consist of locos.
You can add as many speed matched locos to the loco consist, as you like.  Each loco must be bound to the controlling TX.  Follow the "BINDING" procedure described above on page # 4.
If the loco to be added has already been speed calibrated, there is no need to repeat the calibration step.
The *RCS-BELTROL* program permits reversing default direction & speed matching of locos.  Settings for these features are stored in the ESC so that any loco can be acquired by any TX.  See page # 6.

## HOW TO ADD LOCOS TO A CONSIST.
Turn the first loco OFF.  Turn the second loco ON and drive it into position.  Turn the first loco back ON.
The lock in feature of the system ensures the direction is set positively.  Just make sure both locos are at zero output before changing direction.  To make sure the direction is set correctly for all locos in a consist, press the direction stick twice from neutral.  Once the direction is set it cannot accidentally change back to neutral.

## DELETING LOCOS FROM A CONSIST.
Turn OFF the **"to be retained"** loco.  Leave the **"to be deleted"** loco ON & drive it away, or, **rebind** it to a different TX for use by another operator.  See page # 4.

# *RCS-BELTROL* ESC used with the current model QSI® sound.

**DO NOT** use the PWM ESC's at present.  Only the **BTL-6rF** *RCS-BELTROL* ESC can be used with a QSI® sound system fitted to a PnP socket inside an AristoCraft® loco. The **BTL-6rF** controls QSI® sound correctly with outstandingly smooth slow speed acceleration & braking.  The only practical way to use it is in a trail car with the batteries etc. We recommend a minimum of 18 volts nominal.  You can safely use up to 24 volts nominal.
It may possible in the future to use the PWM ESC's

Simply connect the output of the *RCS-BELTROL* ESC to the pigtails on the back of the AristoCraft® loco.
For other brands of locos refer to the QSI® instructions.  The track pick ups **MUST** be disabled.
You can use the QSI® as delivered with default "REGULATED THROTTLE CONTROL". We recommend resetting to "STANDARD THROTTLE CONTROL" with level 2 load **BEFORE** setting an idle voltage.

The QSI® sound system needs to have an idle voltage applied so that when the loco has stopped the sound system is kept alive.  The *RCS-BELTROL* system can be programmed to do this.  Here is how to do it.
Once the TX & RX have been bound together you need to calibrate the loco speed as described on page # 4.
Once calibrated you now need to set the idle voltage which in effect is the same as setting the start speed.
With the loco switched on gradually apply throttle until the sound system comes ON.  Note TX stick position
Continue to carefully apply throttle until the loco just begins to move.  Once again note the stick position.
You need to decide at which point it is that best suits your application.  We suggest the idle (i.e. start) voltage should be set midway between the two stick positions you have just determined.  Once you have determined what the start voltage is to be, take the throttle stick back down to zero and set the direction to neutral.

Now go into *RCS-BELTROL* programming mode (see page # 6 section **3.1.**).
After entering programming mode, set the throttle stick position as recommended above.
Then push the direction (elevator) stick forwards once only.  The lights will blink **ONCE** with the push.
Wait a couple of seconds for the lights to blink **ONCE** again indicating the new start voltage setting has been stored in the system memory.  Then move the throttle stick back to zero (OFF) position.  i.e. Stick down.
Then turn channel # 5 OFF.  The lights will blink three times and then go to all solid ON.  i.e. Neutral.
The QSI® sound system will come on and you are now ready to operate.

## CONTROLLING THE SPEED OF A QSI® EQUIPPED LOCO.

To control the loco see page # 7 section **4.1.** etc.  The loco will **NOT** jerk when power is switched ON.
If the direction is wrong, simply swap over the two wires coming from MM on the *RCS-BELTROL* ESC.
When stopped the sound will remain in idle.

### CAUTION.   DO NOT CONNECT THE OUTPUT OF THE ESC TO ANY NON QSI® EQUIPPED LOCOS.

## TRIGGERING THE QSI® SOUND SYSTEM WHISTLE/HORN & BELL.
Shortly QSI® will be releasing an add on pcb that can take two trigger functions.  The wiring should be straightforward, but, as yet we have not seen the proposed pcb so cannot give an exact description on how to wire it correctly.
It will likely require three wires from the *RCS-BELTROL* ESC.
One or the other of the sideways sticks will trigger the output functions.  Only one half of the stick is used.
The stick should be moved one way very briefly to turn the Bell ON & very briefly again to turn the Bell OFF.
Move the same stick the same way & hold it to play the Whistle/Horn.  Let the stick go & the play will cease.

# *RCS-BELTROL* ESC TROUBLESHOOTING.

### IF NOTHING WORKS AT ALL:

### IT IS MOST IMPORTANT THAT YOU ARE USING THE CORRECT OPERATING PROGRAM.

**SPEKTRUM & PLANET MUST USE BTLvA2.**     **E-SKY & HOBBY KING MUST USE BTLvB2.**

Before operation it is most important to make sure Ch # 5 is **OFF** unless you intend calibrating the system.

### IF THE LIGHTS START FLASHING IT MEANS CH # 5 IS TURNED ON. NEVER SIMPLY TURN CH # 5 OFF.  (SEE BELOW).

### WHAT TO EXPECT WHEN FIRST TURNING SYSTEM ON.

**WHEN THE LOCO IS SWITCHED ON THE LOCO MAY JERK SLIGHTLY.**
This is normal.  The slight jerk indicates power is connected to the system and the IC has powered up.

**WHEN THE LOCO IS SWITCHED ON, THE ACCESSORY OUTPUT # 1 MAY TRIGGER BRIEFLY.**
This is also normal.  A sound system function connected to output # 1 may trigger.  Our testing shows no sign of this actually happening with Phoenix and Sierra.  But, it is possible.

**WHEN FIRST TURNED ON WITH CH # 5 ON, THE LIGHTS WILL BLINK FOR CALIBRATION MODE.**
However, after calibration the lights keep flashing when you switch OFF **Ch # 5**.
You may have mis-plugged the RX into the channel sockets.
**SOLUTION.**  Turn system OFF.  Remove & replace the RX into the correct channel # sockets.  See page # 2.
As odd things can happen if this occurs, we strongly suggest you reset the system.  See page # 6.  3.5.
Then re-calibrate the speed and direction settings.  See page # 5.

**WHEN THE SYSTEM IS FIRST TURNED ON THE LIGHTS UNEXPECTEDLY BLINK RAPIDLY.**
This is because the **Ch # 5** switch/knob is **ON** & the system has entered calibration mode.
**CAUTION: DO NOT SIMPLY TURN CH # 5 OFF.  You will lose any previous calibration settings.**
You can proceed with Calibrating the system.  (See page # 5 of the instructions).  **OR:**
**SOLUTION (i).**  Turn TX OFF, then turn **Ch # 5** switch/knob OFF.  Normal system control will be restored.
**SOLUTION (ii).**  Turn RX OFF, then turn **Ch # 5** switch/knob OFF.  Normal system control will be restored.

**WHEN THE LOCO IS SWITCHED ON, ALL LIGHTS COME ON WITHOUT BLINKING & NOTHING WORKS.**
This can occur when the TX is switched ON after the loco, with the throttle stick not fully OFF (down).
**SOLUTION.**  Ensure the throttle stick is completely OFF.  The lights will then blink to indicate linking.

**THE LOCO DIRECTION SET STICK & OR SPEED CONTROL IS BACKWARDS.**
It is most important to ensure that the servo reversing switches are ALL set to normal.
When the direction is set to forwards the front light must come ON.  If it doesn't, reverse the elevator switch.
Then, if the speed is backwards to the lighting direction, you must reverse the wiring to the motor(s).

### WEIRD ESC BEHAVIOUR FOR NO APPARENT REASON, DURING OPERATION.

**SITUATION # 1.**  You have been running, & for no apparent reason the lights started flashing.  This means the **Ch # 5** switch/knob was turned **ON** during running.  **CAUTION: DO NOT SIMPLY TURN CH # 5 OFF.**
**FIRSTLY STOP THE LOCO.  N.B.**  The throttle reaction will be quite slow.
**SOLUTION (i).**  Turn TX OFF, then turn **Ch # 5** switch/knob OFF.  Normal system control will be restored.
**SOLUTION (ii).**  Turn RX OFF, then turn **Ch # 5** switch/knob OFF.  Normal system control will be restored.

**SITUATION # 2.**  The system was working and for some reason you had a panic situation.  You stopped the loco and switched the TX off.  When you switched the TX back ON the loco lights were flashing, you moved the sticks to try and move the loco and now nothing works.  You have accidentally turned the **Ch # 5** switch/knob **ON** at some stage and altered the original speed and direction calibration.
**SOLUTION.**  Reset the system.  See page # 6.  3.5, then, Recalibrate the system.  See page # 5.

**DEFAULT START UP DIRECTION.**
When using the **# PnP-ADAPT**, the **# BTL-3r, # BTL-6r (& # BTL-PnP5)** ESC's are programmed to be the same as the AristoCraft® on board TE.  As such, the motor direction & lights for Bachmann® PnP socket equipped locos will need to be reset.  See page # 6 section **3.4**.
The PnP socket and lights are also wired backwards on some AristoCraft® locos.  In this case the default direction will also need to be reset.  See page # 6 section **3.4**.  OR:
You can simply swap over the wires at the **# PnP-ADAPT** screw terminals.

### PLEASE ADVISE US OF ANY OTHER PROBLEMS ENCOUNTERED & WE WILL INCLUDE THEM HERE.