micron radio control

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Micron Receiver Features

Micron receivers implement a set of features for model rail locomotives and land-based vehicles. The majority of features are common to all receivers, but some will be specific - refer to a receiver's user manual and programming table for details:

- MR001c: micronrc.co.uk/mr001c, micronrc.co.uk/mr001c_progtable
- MR603: micronrc.co.uk/mr603 micronrc.co.uk/mr603_progtable

Although most users will not need all functionality, it is there and easily accessed by programming the receiver.

Each receiver is configured with a default set of features which is described on the receiver's web page and in the user manual for the receiver. Most receivers contain 4 pre-set configurations which can be selected using a power-on jumper or by programming the receiver (see the user manual for details). Different configurations are always available to special order - contact us.

Radio

The radio part of the receiver is responsible for connecting with a transmitter and decoding the control data. Some receivers have a separate RF module with its own LED to indicate signal quality, others integrate the RF and receiver behaviour into one chip with a common status LED. Almost all Micron model rail and land vehicle components use the Spektrum DSM2/DSMX protocols which gives access to a wide variety of 3rd party products. it also means that a Micron receiver can be used with any real Spektrum or third party transmitter that implements the Spektrum protocols. This includes all Micron model rail transmitters.

DSM2/DSMX uses a spread-spectrum type radio protocol where the contol information is 'encrypted' using the transmitter ID. Thus, only a receiver which has stored a transmitter's ID is able to decode the control data. That is how many R/C systems can be used within a small space without interferring with each other.

R/C CHANNELS
The controls on a transmitter (knobs, switches, push buttons, joysticks, ...) are encoded into separate R/C channels which are combined into the radio signal. The way that this is done is called the 'over-the-air protocol' - e.g DSM2 and DSMX. The channels are numbered (ch1, ch2, etc) and are represented as a digital value, usually 0..1023 but can be a higher precision 0..2047 or 0..4095. The association of transmitter control to R/C channel convention for a model aircraft transmitter is:

ch1: throttle
ch2: aileron
ch3: elevator
ch4: rudder

The association of Tx control to R/C channel and channel values for Micron model rail transmitters is described in the user manual for each transmitter. All of them provide these common mappings:

ch1: throttle/regulator
fwd/rev: full reverse=chan low, stop=chan mid, full forward=chan high
low-off: stop=chan low, full throttle=chan high

ch2: Selecta (if implemented on that transmitter)
#1=chan low, #6=chan mid, #12=chan high

ch3: toggle switch for direction (if low-off throttle) or auxiliary functions, also used for Rx programming
reverse/down=chan low, forward/up=chan high

ch5: bind button
pressed=chan low, not pressed=chan high

Micron receivers have a variety of outputs, each type is denoted by a letter (H, F, P, etc):

- H: one or more fwd/rev motor speed controllers
- F: switch (usually 2A capable), used as an on/off switch to control an external device (e.g. high current LED, smoke generator, ...) or with PWM as a single direction motor speed controller or light dimmer
- P: low current logic level, usually 0V when off and 3.3V when on; used to control low-current LEDs or can output a servo signal

The receiver firmware associates each of these outputs with a R/C channel so that changing values on the channel (i.e. moving the transmitter control) affects the output state. For example, R/C ch1 is usually mapped onto H1 so that the transmitter throttle/regulator knob changes the motor speed. The mapping for each output is independent and multiple outputs can use the same R/C channel.

Receivers are provided with a set of predefined R/C channel to output mappings - the configuration. Most receivers have 4 selectable configurations for common usage.

BINDING WITH A TRANSMITTER
A receiver has to be linked to a transmitter before it can be used. This process is called 'binding' and involves the transmitter transferring a piece of data (the ID) to the receiver which the receiver uses to identify 'its' transmitter and ignore all others. Binding has to be done only once, unless you need to change to a different transmitter - in that case, you simply bind to the new transmitter.

A transmitter can be bound with any number of receivers, so long as they use compatible protocols, but a receiver can normally be bound to only one transmitter. All receivers will respond to the transmitter, so only one receiver should normally be switched on at any time. An exception to this is for receivers and transmitters that support the Selecta feature (all Micron receivers support Selecta and some of the Micron transmitters also support Selecta).

The general process for binding is:

1. receiver is placed into bind mode - usually indicated by a rapid LED flash
2. the transmitter is then switched on in bind mode - the method for doing this varies, refer to the transmitter manual

Most Micron receivers support manual and auto binding:

Manual Bind: either a jumper plug is inserted or 2 pads must be connected and then the receiver switched on. The receiver enters bind mode immediately and the jumper or pad connection can be removed.

Auto Bind: the receiver enters bind mode automatically after a few seconds if it is unable to find a previously bound transmitter.

'SELECTA' OR LOCO SELECTION
Selecta allows receivers to be made active or inactive from the transmitter. This allows the number of functions controlled to be expanded using two or more receivers, or allows multiple models to have control switched between them. Selecta uses one of the R/C channel (default 2), to carry the selection data; only when a receiver gets its selection code does it respond to the transmitter.

Selecta enabled transmitters have a 12-way rotary switch for controlling the value (i.e. code) sent on the Selecta channel. A receiver's Selecta code is store during bind. Simply rebind if you need to change Selecta switch position for a model.

The default receiver action when deselected is to maintain all outputs, including the speed controller, at the current setting. This is useful on a continuous run type layout allowing a deselected loco to continue running. The deselection behaviour can be changed to stop so that the loco decelerates smoothly to a stop when deselected - see the programming table for your receiver for details on how to change the Selecta behaviour.

Speed Controller (ESC)

Micron receivers have at least one integrated bi-directional ESC (Electronic Speed Controller) for brushed motors. Some receivers also support the connection of an external ESC for either brushed or brushless motors - this is done by configuring an output as a SERVO-ESC.

MOTOR CONTROL, CENTRE-OFF
One R/C channel is used to control the motor in both directions. With a rotary control, centre is off, left is reverse, right is forward. With a joystick transmitter, up is forward, down is reverse.

MOTOR CONTROL, LOW-OFF
One R/C channel is used to control the motor speed and another R/C channel is used to control motor direction: the default is ch1 and ch3. The direction control is actually an intent to change direction - i.e. it only takes effect when the throttle is closed. On a joystick transmitter, direction is usually the elevator control which is self-centring; the stick is simply pushed in the desired direction and then released. Model rail transmitters either have a toggle switch or a rotary control (e.g. Tx24v2) for direction.

The default direction control behaviour is latching - i.e. the centre position is not a neutral gear. This is essential when using a joystick type transmitter where the control is self-centring. The mode may be changed by programming to implement a neutral gear where the throttle/speed control has no effect when the direction control is centred.

MOTOR CONTROL, LOW-OFF TO FWD/REV
This is like low-off with separate speed and direction controls, but the channels are combined to support connection of an external forward/reverse ESC. This is useful for large battery electric locos where the operator prefers low-off control for compatibility with their live-steam locos.

ESC START/MIN POWER
The motor power level can be made to go quickly to a minimum value as the throttle is opened. It can be set from 0 to 100% and is useful when a motor requires a high starting voltage. The default is 0%.

ESC MAX POWER
The maximum power level available at full throttle can be reduced; the reduced range is spread over the full throttle control. This can be used to match engine speeds for a consist or to reduce the maximum speed of an overpowered vehicle or when children are controlling the locomotive. The maximum power can be set from 0 to 100%, the default is 100%.

ESC PWM FREQUENCY
Motor speed is controlled using Pulse Width Modulation (PWM). This works by rapidly switching the motor voltage on and off, the ratio between on and off giving an effective lower voltage. The PWM frequency can be varied by programming a receiver; the default is the maximum supported by a particular receiver (usually 16kHz, which is silent). Lower frequencies produce more torque but the motor runs less smoothly and can make a noise if the frequency is within hearing range.

ESC REVERSE
The motor rotation direction can be reversed by programming the receiver. This can be useful if the motor has been wired incorrectly or to make a temporary change when a locos are coupled into a consist. Reversing motor direction does not change the directional lighting operation.

ESC SOFT START/STOP (INERTIA)
Soft start/stop alters the rate of acceleration and deceleration. It can be used to simulate the inertia of a heavy train when moving off or its momentum when slowing down. Many Micron transmitters include an inertia facility which is applied equally to start and stop. Micron receivers have an inertia function which can either be the same for start/stop or specified separately for start and stop.

ESC ARMING
In order to prevent a model moving off as soon as a receiver is switched on, the speed controller is disabled until an off/stop throttle signal is received. The speed controller will be disarmed should any of LVC, Emergency Stop, or Sleep conditions be triggered.

THIS IS A SAFETY FEATURE AND DISABLING IS DISCOURAGED.

Servo Output

Any P output can be configured as a servo with the normal 1ms-2ms pulse width signal repeated every 20ms. For rotary or stick-type transmitter controls, the position of the servo arm is proportional to the position of the controlling channel. Transmitter push buttons and toggle switches may also be used to control a servo output, in this case the servo arm moves immediately to the low, mid or high position as specified in the transmitter user manual.

Many Micron receivers have a 3.3V output which can be used to power a small servo. The maxium current is usually limited to no more than 200mA - see the receiver user manual for the specific max current.

NORMAL SERVO
This is normal servo operation where the rotation is directly proportional to transmitter control movement. Servo rotation speed can be slowed by programming the receiver. Speed setting '1' is normal, settings 2 to 6 make the servo move more slowly; the actual speed depends on the type of servo.

THROTTLE SERVO
This is a P output connected to an external ESC. The configuration maps this to a virtual ESC (aka throttle) so that changes to the ESC behaviour (centre-off, split, inertia, emergency stop, etc) affect the servo output signal.

MIXED SERVO
This feature supports servos on 2 P outputs with travel controlled by the mixing of 2 R/C channels. A typical use is to drive 2 external ESC mixing throttle and steering R/C channels for differential steering on a boat or tracked vehicle.

OFFSET SERVO
This feature gives full servo proportional travel over half transmitter control movement. It is useful for controlling 2 servos from one R/C channel; one servo moving for control value low to mid and the other moving for mid to high.

TOGGLE SERVO
The servo moves over its full travel when the transmitter control is set low or high. When the control is centred (mid value), the servo is at the low end (1ms) of its travel; when the control is low or high, the servo is at the high end (2ms) of its travel. The servo end points can be adjusted using Servo Travel Adjustment.

SERVO TRAVEL ADJUSTMENT
Servo throws (low and high end points) can be adjusted using a transmitter, the servo centre position will always be at the mid-point of the low and high travel. To adjust a servo, the servo output is selected first and then the travel adjusted using either the throttle control or direction toggle if the throttle servo is being adjusted.

One servo output may be adjusted at a time. The output is first selected by programming and then the transmitter control is used to increase or decrease the servo throw:

- R/C channel 3 (toggle switch on most Micron transmitters, elevator on stick type transmitters) is used for most outputs
- R/C channel 1 (throttle) is used when adjusting a servo on R/C channel 3

Consult the receiver's programming table for the program sequence to access servo adjustment, enter this sequence and then:

- within 5 seconds, move the control for the output being adjusted to the end that needs adjustment
- increase or decrease the servo end-point:
  - on Micron or stick type transmitters, use the throttle control if a servo on R/C channel 3 is being adjusted:
    - hold throttle knob fully CCW or throttle stick at low throttle to decrease travel
    - hold throttle knob fully CW or throttle stick at high throttle to increase travel
  - use the direction toggle, reverser control or elevator stick for servos on all other R/C channels:
    - hold toggle down, reverser to REV or elevator stick down to decrease travel
    - hold toggle up, reverser to FWD or elevator stick up to increase travel

    The receiver LED will flash twice per second as the servo travel is being adjusted and stop flashing when the limit is reached. Take care: the servo may reach its mechanical stop before the increase side adjustment limit is reached.
  - move the servo control to the opposite side if you also need to adjust that end-point
  - centre both controls to finish the adjustment, the receiver will return to normal operating mode after the control corresponding to the P port being adjusted has been centred for 5 seconds.

Go through the above steps to adjust a different servo output pin.

SERVO THROW EXPANSION
The full range of R/C channel values is from 0 to 1023 (10 bits) or 0 to 2047 (11 bits). Most R/C transmitters generate a restricted range of approximately 170 to 853 and this is referred to as 100% travel. Many stick type transmitters allow the travel to be increased up to the maximum and this is called 150%. The Micron model rail transmitters are setup to have 100% throw on the throttle channel and 150% on all other channels.

The standard servo range for 100% is 1.1ms to 1.9ms and 0.9ms to 2.1ms for the full 150%. Sometimes this is not enough, e.g. to control bespoke electronics or for a servo with extended travel (the Emax ES9052D can handle a pulse width range of 0.6ms to 2.4ms). This feature allows the servo pulse width range to be increased by up to 200% (3 x the base range or 0.3ms to 2.7ms for a 100% R/C data input).

Note: increasing the output pulse width range beyond +50% should be used with care if a servo is connected - make sure that your servo and control linkages can handle the increased range. If you are not sure, it is recommend to increase the range incrementally.

Input/Output

Receivers have a number of general purpose input and outputs (GPIO) ports, mostly used for output. There are 2 types:

- **P** - these are logic level outputs that can supply a low current (typically 20mA max), 0V when off and 3.3V when on. They can be used to power LEDs via a series resistor suitable for the desired LED current and for driving servos where the P pad provides the control signal to the white or yellow wire of the servo lead. Some receivers are able to provide 3.3V to micro servos, larger servos must be powered from a separate source - e.g. a 5V regulator connected to the battery. P pads can also be used for input - e.g. shuttle control, remote sensors; see the receiver user manual for information.
- **F** - these are switches and can control up to 2A; they are open when off and connected to negative when on. For programming, F switches are given numbers sequentially after all P outputs, e.g. if a receiver has 6 x P and 4 x F, the F outputs are numbered 7 to 10. For compatibility with Deltang receivers, F outputs are also labeled with letters, e.g. F1 is A, F2 is B, etc.

MOMENTARY ACTION
Momentary outputs are activated when a transmitter control is at the specified value. They can be set normally on or normally off and switched to the opposite by the transmitter control, e.g.:

- prog 3,4,1,5,1 = P4, normally off, on when Ch5 is low
- prog 3,6,1,3,6 = P6, normally on, off when Ch3 is high

LATCHING ACTION - TYPE 1
Outputs switch state (toggle on and off) each time the transmitter control is actioned. Most transmitter controls may be set to low, mid and high values and this allows them to control 2 outputs - one toggled at low and the other toggled at high. The initial output state can be set to on or off.

LATCHING ACTION - TYPE 2
This feature uses time as well as control value to toggle up to 4 outputs: 2 outputs are toggled by control actions < 1 second and another 2 outputs by control actions > 2 seconds. The initial state of all outputs is off.

AUTO LIGHTS
Outputs may be assigned as front, rear, brake and reversing lights. They are controlled by the state of the speed controller (or servo output for type SERVO-ESC).

Front and rear lights are switched based on motor direction. Both start off and either the front or rear light is switched on when the throttle is opened for the first time and stays on when the loco/vehicle stops, changing when the motor direction is changed.

The brake light comes on briefly when the motor stops. The on duration defaults to 1 second and can be set using one of the General Configuration program options.

The reverse light is similar to the rear light and is on when the motor is moving in reverse. It goes off when the vehicle stops.

All auto-light action can be disabled and enabled using a transmitter control by programming the receiver. This feature is off by default and can be configured by programming the receiver.

INDICATOR & HAZARD FLASHERS

AUTOMATION

Automation functions set a P port to input mode with an internal pull-up resistor so it idles high (3.3V). An input action is triggered by connecting the pad to negative. This can be done using a reed switch activated with a track mounted magnet or a phototransister activated with a track mounted LED (infra-red to avoid false triggering by room lights).

Automation functions are enabled as soon as they are programmed and may optional be disabled or enabled again using a transmitter control.

The available automation features are:

Buffer Stop:

This allows a loco to be stopped automatically to avoid hitting a buffer or other obstacle. When triggered, the train will decelerate to a stop over a configurable 1 to 6 seconds. The throttle must be closed before the loco can be moved again. The trigger input is deactivated for a period so that the loco can be reversed out of the dead-end and over the trigger magnet (or IR LED) without causing the loco to stop again. This reactivation delay can be set between 10 and 60 seconds in 10 second increments.

Example using P5:

1. Enable Buff Stop by entering the program sequence 6,5,1,3,2 = Menu6, P5, 3 seconds deceleration time, 20 seconds delay before reactivation of trigger
2. Wire a reed switch between P5 and nagative
3. Place a magnet between the tracks 2 seconds travel from where you want the loco to stop (some experimentation may be needed)

Stop & Reverse:

Similar to Buffer Stop except that the loco reverses direction after the pause time. The same throttle setting is used for the reverse motion and changing the transmitter throttle control has mostly no effect once the first stop has been triggered. If the transmitter throttle is closed, the automation is cancelled and the loco can be moved manually until the stop is again triggered. The pause time spent stationary is adjustable for a fixed delay between 10 and 60 seconds plus a set of random delay ranges (4-8s, 8-15s, etc.)

After the pause, the loco will accelerate in the opposite direction and over the same time period specified for stopping. The trigger input is reactivated 10 seconds after the loco has started moving again.

Stop & Continue:

General Configuration

This section comprises a collection of functions that apply to the receiver as a whole.

LED2

The LED on the receiver indicates the state it is in but it cannot be seen if the receiver is enclosed within a model. LED2 allows another LED attached to one of the P or F outputs to mirror the onboard LED. As this second LED may also be used for directional lighting, the default behaviour is to stop mirroring once the speed controller arms; thus, the front light on a vehicle or loco can show what the receiver is doing as it starts up, during bind, while programming and then operate as a front light in normal use.

LED2 mode options:

- disabled
- normal (as described above)
- as above including when deselected
- always

LOW VOLTAGE CUT-OFF (LVC)

The receiver provides low voltage detection to protect batteries that must not be discharged too far; these are mostly lithium based (LiIon or LiPo). The receiver cuts power and disables the motor when the voltage falls too low. As the battery voltage will usually recover when the load is removed, the motor may be restarted by closing the throttle and re-opening. This should not be done too often as the battery is near exhaustion and should be recharged.

The LVC trigger point is set automatically based on the battery voltage measured on start-up.

- 3V for < 6V at start-up
- 6V for 6V to 9V
- 9V for 9V to 12V
- 12V for 12V and above

The trigger threshold can also be set automatically in 0.1V increments with a minimum of 2.5V.

Receivers also have an 'L' input which is used when an external booster module is used to raise a low voltage battery to a higher voltage (e.g. single LiPo cell to 12V). The 'L' input takes priority over the main positive pad.

SLEEP
The receiver will go into sleep mode if the throttle is not moved for an extended period - the default is 1 hour and can be programmed up to 6 hours or never. The receiver must be switched off and on again to get out of sleep mode.

Although the receiver draws a low current in sleep mode, this is not a substitute for an on/off switch.

Sleep mode can also be configured to be activated after the LVC has triggered. When enabled, the receiver goes into sleep mode 5 minutes after LVC to avoid further draining the battery.

CRUISE / FAILSAFE
Cruise control keeps the motor running if the transmitter signal is lost - e.g. if the loco goes through a tunnel or behind a large bush. If cruise control is disabled, the receiver enters failsafe mode several seconds after no signal. Failsafe stops the motor and can be used as a form of emergency stop.

The default configuration for all receivers has cruise control enabled 'cruise control' and allows the loco to keep running if the transmitter is switched off. The cruise control / failsafe mode can be set either using a power-on change or by programming.

EMERGENCY STOP
The emergency stop function uses a transmitter control to rapidly bring all vehicles controlled with that transmitter to a halt. The throttle must be closed and the triggering control released to start the motor again.

ARMING
When arming is enabled, the speed controller will not start the motor until a 'off' throttle signal is received. This is a safety feature and should not be disabled unless really necessary.

SELECTA
Selecta allows receivers to be made active or inactive from the transmitter. Selecta operates using one of the R/C channels (default is 2); the value of which is stored by a receiver when bound. During normal operation, a receiver responds to transmitter controls only when the received Selecta channel value matches its stored value, +/- a small delta.

The default action when deselected is for the motor to continue running at the last setting; this is appropriate for a continuous loop type layout. This behaviour can be changed to stop when deselected by programming the receiver.

BACKUP AND RESET CONFIGURATION
Configuration data is stored in non-volatile memory - a type of stable storage that is retained when the receiver is not powered. Any changes you make, either using a power-on change or by programming, is also written to the memory. When the receiver is first powered, or when an alternative configuration is selected, the data is also written to a backup store. A reset (power-on change or programming) copies the backup data over the top of the current configuration; thus any modifications are are lost. You can update the backup at any time by programming.

MULTIPLE CONFIGURATIONS
Receivers contains several alternative configurations - a preset collection of features. These can be selected by a power-on jumper setting or by programming the receiver. Once selected, the receiver will use that configuration each time it is powered on; any changes made to the previous configuraion (e.g. by programming) are lost when an alternative configuration is selected. See the receiver user manual for details of the configurations.

FIRMWARE VERSION
The receiver firmware version comprises 2 numbers separated by a dot (e.g. 1.6). This will be written onto the receiver label or, if no label, onto one of the larger chips. If this information is lost (or rubbed off the chip), the program sequence 4,14 can be used to display the version as 2 sets of repeated LED flashes: 1-flash 6-flash, for 1.6.

Programming

Receiver behaviour can be changed using the transmitter to which the receiver is bound. The receiver must first be put into programming mode and then the direction toggle switch, or reverser knob on Tx24v2, or elevator on a stick type transmitter, is used to enter a program sequence one digit at a time. The receiver LED (and LED2 if enabled) flashes to indicate the value of the current step in the programming sequence. For example, if the current value is 4, the CPU LED flashes 4 times, pauses and repeats - this is called a 4-flash. Where it is possible for the current value to be zero (e.g. low voltage cut-off tenths), this is shown as a single brief flash much shorter than the normal value flash.

The receiver feature set and, hence, the programming table is large. It is presented in a separate document for each receiver which lists all functions that may be changed by programming. The table is split into 5 blocks of related functions each with the same value in the first column.

The table columns contain the program values which must be entered to change a particular function. For example, to change the throttle behaviour from centre-off (forward and reverse on one control) to low-off (separate throttle/regulator and direction/reverser controls) the program sequence **1, 1, 2, 1, 3** is entered. Each digit of this program sequence is taken from the columns, left to right:

1 = ESC Configuration
1 = H1 (most receivers contains only only 1 ESC)
2 = Low Off Throttle
1 = Throttle on R/C channel 1
3 = Direction control on R/C channel 3

One function can be changed at a time. The general method is:

- set receiver into programming mode
- enter a program sequence
- repeat until all programming changes have been made

Enter Programming Mode
There are 2 methods of getting a MR6xx receiver into programming mode:

1. hold the transmitter channel 2 and channel 4 controls at high or low extremes and then switch the receiver on; these are the F1 and F2 buttons on a Tx20v2 and the Selecta switch and S2 button on a Tx22X; the receiver LED will flash rapidly shortly after switch on, centre one or both channel 2 & 4 controls (e.g. release the buttons on Tx20v2 or the S2 button on Tx22X)

2. switch the transmitter and receiver on (they must be bound), wait 5 seconds without touching any controls and then tap out morse SOS (... --- ...) on the transmitter bind button (or toggle the gear switch high to low for a stick transmitter);
   - dots (…) will be a quick press of the button and must be less than 1 second in duration
   - dashes (---) must be greater than 1 second and shorter than 5 seconds – 2 seconds is a reliable time
   - the time between each dot or dash must be less than 5 seconds

When programming mode has been successfully entered, the receiver LED will show a 1-flash - this is the **1** from the first column of the programming table. If you do not get the 1-flash, repeat the procedure to enter programming mode. It usually takes a couple of attempts to get the SOS method correct if you have never done it before.

Enter a Program Sequence
One programming change requires up to five choices to be made. These are called 'levels' and each has several options. They are documented in the programming table. Completion of a programming change exits programming mode and requires the receiver to be placed into programming mode again for the next change.

It is a good idea to write the programming sequence on a piece of scrap paper and cross off each digit as it is entered so that you don't lose track of where you are in the sequence. You always start at the top of the first column and 1-flash is displayed on entering programming mode.

- The flash count for a level is incremented by setting the R/C channel 3 control low and back to mid.
- The flash count for a level may be decremented by holding the R/C channel 4 control low while operating the R/C channel 3 control; R/C channel 4 is available on some Micron transmitters - e.g. F2 on Tx20v2 and S2 on Tx22X and Tx42v2
- The level value is accepted and the flash count for the next level is displayed by setting the R/C channel 3 control high and back to mid.

Most Micron transmitters have a toggle switch on R/C channel 3 which is marked A/B, or forward/reverse for a low-off transmitter:

- pushing the switch down (or toward 'reverse' for a low-off transmitter) sets the R/C channel to a low value and increments the flash count,
- pushing the switch up (or toward 'forward') sets the R/C channel to a high value, accepts the flash count and moves the program sequence on to next level or exits programming mode if the current level is the last in the sequence.

Always return the toggle switch to centre after pushing down or up. Refer to the transmitter user manual for specific information on the R/C channel 3 control - Tx24 has a rotary reverser control.

The receiver LED will flash rapidly while R/C channel 3 is high or low and then return to a slower repeated flash when the control is back to the middle.

After accepting the flash count for a level, the receiver LED displays a flash count for the current value of the next level. This could be higher than 1-flash if the function is set in the receiver configuration or has been previously programmed. For example:

- the default Selecta R/C channel is 2, so a 2-flash will be displayed after entering 4,8,2
- P1 is configured as a front light, so a 4-flash will be displayed after entering 3,1

When the last level for a sequence has been accepted, the receiver LED will light continously and the receiver is back in normal operating mode. The maximum number of levels is 5, but not all sequences use all 5; if level 5 in the table is blank, the CPU LED will light continously after level 4 is accepted.

Programming changes are accepted **only** when the receiver LED lights solid at the end of the sequence. If a mistake is made mid way through a sequence, switch the receiver off to abort.