



# Switcher DIN Tx / Rx™

DIN Rail ZigBee HC-L Switching Units – Basic Guide

## Summary

Switcher Tx and Switcher Rx are ZigBee radio devices for remote control switching. Switcher Tx provides up to 3 control switch inputs. Switcher Rx provides up to 8 outputs for driving relays. If required, a control switch input can control several output relays; multiple inputs can control one relay.

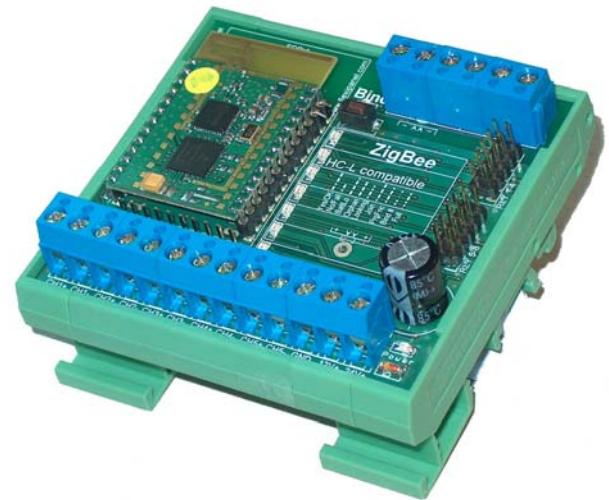
This data sheet is the *Basic Guide* and only discusses the most common switching applications. Refer to the *Advanced Guide* for details on extra features which are available, including failsafe alarm switches.

## Features

- Tx has 3 inputs for connection to pushbutton or latching switch.
- Rx has 8 output channels for driving relays
- 2 connectors for 4-channel relay accessory boards
- Part of a family of compatible products such as mains load controllers, key fobs, wall switches, etc.
- Zigbee mesh messaging for extended range
- Signature 'G' antenna, free-space range 120m, compact, low 'hand-effect' design. (In-building range may be lower.)
- FCC / CE compliant
- Wide temperature range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Tx power: 2 x AA battery, or 3V–24V DC
- Rx power: 3V–24V DC

## Applications

- Lighting control
- Appliance remote control
- Security and burglar alarms
- Access control systems
- Electrically isolated switching



Manufactured to ISO9001:2000



## Ordering Information

Table 1. Ordering information	
Part No	Description
SW DIN Tx BAT ED	3-input ZigBee switch, battery or DC line powered
SW DIN Rx LP RT	8-output ZigBee load controller / router, DC line powered
SW DIN Rx LP CD	8- output ZigBee load controller / coordinator, line DC line powered
230	4-channel relay board

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## Switcher Tx Terminal Connections

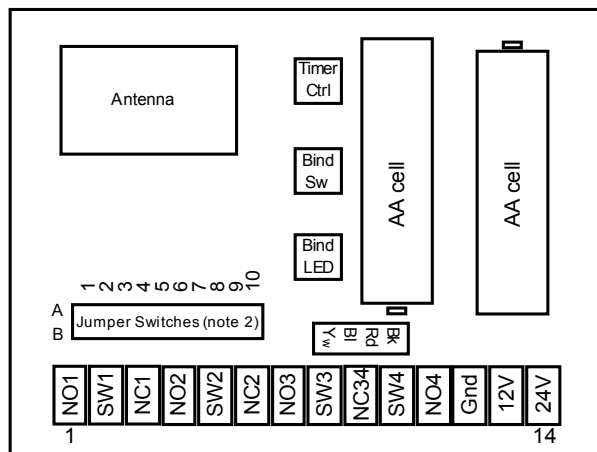


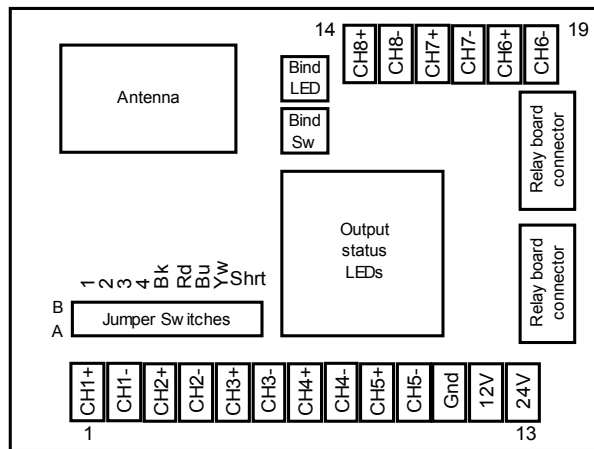
Figure 1. Switcher Tx Layout

Terminal	Description
1	Input 1, Pushbutton contact / Normally open contact
2	Input 1, Pushbutton contact / Changeover contact
3	Input 1, Normally closed contact
4	Input 2, Pushbutton contact / Normally open contact
5	Input 2, Pushbutton contact / Changeover contact
6	Input 2, Normally closed contact
7	Input 3, Pushbutton contact / Normally open contact
8	Input 3, Pushbutton contact / Changeover contact
9	Input 3, Normally closed contact
10	Do not connect
11	Do not connect
12	Gnd power input
13	3V – 12V power input (note 1)
14	12V – 24V power input (note 1)

Table 2. Pin descriptions for Switcher Tx

1. An unregulated supply may be used. Connect to one of 2 x AA battery, 3V-12V or 12V-24V supply, not a combination.
2. Take care fitting jumpers. If incorrectly fitted, the unit may appear to function correctly but drain the battery quite quickly.

## Switcher Rx Terminal Connections



**Figure 2. Switcher Rx Layout**

<b>Terminal</b>	<b>Description</b>
1	Channel 1 output + (note 3)
2	Channel 1 output ground rail
3	Channel 2 output + (note 3)
4	Channel 2 output ground rail
5	Channel 3 output + (note 3)
6	Channel 3 output ground rail
7	Channel 4 output + (note 3)
8	Channel 4 output ground rail
9	Channel 5 output + (note 3)
10	Channel 5 output ground rail
11	Power input ground rail (note 3)
12	3V – 12V power input (note 1, 2)
13	12V – 24V power input (note 1, 2)
14	Channel 8 output + (note 2,3)
15	Channel 8 output ground rail (note 2)
16	Channel 7 output + (note 2,3)
17	Channel 7 output ground rail (note 2)
18	Channel 6 output + (note 2,3)
19	Channel 6 output ground rail (note 2)

**Table 3. Terminal connections for Switcher Rx**

1. An unregulated supply may be used. Connect to either 3V-12V supply or 12V-24V supply, not both.
2. Line powered version only.
3. Open drain output for switching up to 180mA loads.

## Choosing the Parts To Use

- If you just want one Tx and one Rx, make sure the Rx is a Coordinator.
- If you have multiple Switcher Rx units, they will be able to forward messages to each other. One Switcher Rx must be the Coordinator, the others must be Routers.
- If you have multiple Switcher Rx units, each must be within 'hop range' of at least one other Rx, and no more than four 'hops' to the Coordinator.
- Each Tx must be in hop range of at least one Rx, but not necessarily one that it is controlling.
- If you want to span a distance greater than the hop range, consider using a Switcher Rx as a 'repeater'.

## Choosing Locations

- The DIN Switcher range is designed to be DIN rail mounted, but the mounting clip is removable.
- Unhindered 'hop' range is approximately 120m. Inside a building, a 'hop' range of 20m to 40m would normally be possible.
- Try not to locate units in or near large pieces of metal, reinforced concrete or water. A high location is usually better.
- Try to orient with the antenna at the top and the screw terminals at the bottom.

## Connecting Power

Rx devices should be powered by applying either 3V – 12V DC or 12V – 24V DC to the appropriate terminals as detailed in Table 3.

Tx devices may be powered by two AA batteries or by applying either 3V – 12V DC or 12V – 24V DC to the appropriate terminals as detailed in Table 2. Referring to figure 1 fit one jumper as follows:

- For line power, connect a jumper across A8-B8.
- For battery power, connect a jumper across A9-B9.

When the battery power is low, the Bind LED will flash the Morse **B** signal (--- ·) 3 times when a message is transmitted. To maximize battery life, the Power LED will not light on battery powered units.

When power connection is complete, keep all units powered down until you are ready to start the radio setup.

## Connecting Tx Inputs

To use a pushbutton as an input, connect it across the terminal connections marked 'pushbutton contact'.

To use a latching switch, it must be of the changeover type. Connect the changeover contact to the 'changeover contact' terminal. The contact connected to the changeover when the switch is in the 'off' position is the 'normally closed contact'. The contact that is connected in the 'on' position is the 'normally open contact'.

Referring to figure 1, fit jumpers as required:

- Ensure a jumper is connected between B2 and B3.
- If a pushbutton is connected to Input 1, or if it is unused, fit a 'pull-up' jumper across A4-B4. If a changeover switch is connected, omit the jumper.
- If a pushbutton is connected to Input 2, or if it is unused, fit a 'pull-up' jumper across A5-B5. If a changeover switch is connected, omit the jumper.
- If a pushbutton is connected to Input 3, or if it is unused, fit a 'pull-up' jumper across A6-B6. If a changeover switch is connected, omit the jumper.

## Connecting Rx Outputs

Referring to figure 2, ensure a jumper is connected across the two pins labeled 'Short' in row B, and across A2 to A3.

Relays may be connected to the Switcher Rx outputs as shown in figure 3. The output terminals can switch DC voltages up to 28V, but you must get the polarity right. The power supply can be the same as the supply for the Switcher Rx, but it does not have to be, provided they can be common grounded. (Inside the unit, all the ground terminals are connected together.)

Do not attempt to use the output terminals to switch mains loads directly. You must use relays. The terminals are not isolated.

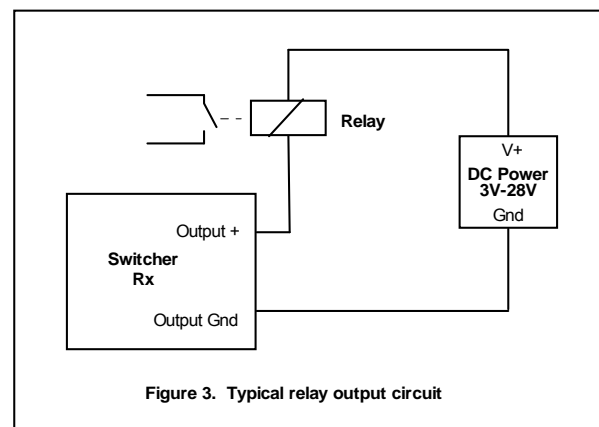


Figure 3. Typical relay output circuit

Each output status LED will light when its output is on.

A range of compatible DIN rail output relay boards is available from RF Solutions, containing up to 4 relays capable of switching mains loads. Up to two units may

be connected as shown in figure 4, with the red lead towards the bottom.

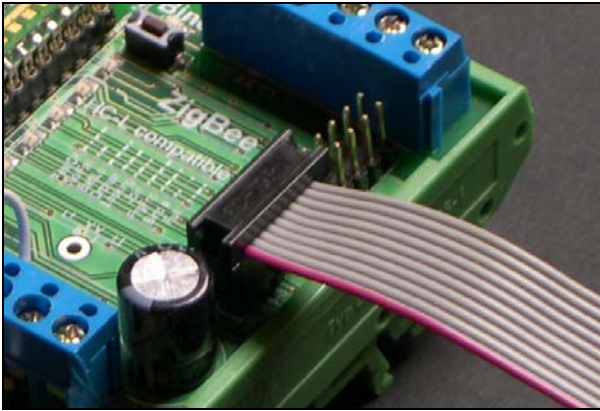


Figure 4. Connecting a relay board. The red lead on the flat cable should be at the bottom.

## Radio Setup

There are two steps to the radio setup process. The first is *joining*, where you tell a unit which radio network it is a member of. The second is *binding*, where you specify which inputs control which outputs.

### Joining

The first device to be set up is the Coordinator Switcher Rx. Simply power it up and it will start the radio network. Then you can work outwards from the Coordinator, joining new devices.

When you power up the Coordinator, the LED will flash the Morse letter **L** (·-·) to indicate that it is looking for a good frequency to operate on. The LED will flash the letter **Y** (-·-·) when it has started the network and is ready.

Then, to join a new device to the network:

- Choose a Switcher Rx which is already a member of the network and which is in range of the new device. Press the Bind button once. The Bind LED will flash the Morse letter **J** (·- - -). You have 60 seconds to join the new device.
- Power up the new device. While it is looking for the network, it will flash the letter **L** (·-·). When it finds the network, both devices will flash the letter **Y** (-·-·). If for some reason it fails, the new device will flash the letter **N** (-·) and then enter a low power state. Cycle the power to try again.

### Binding

Binding is very flexible. You can bind each input to many outputs, and many inputs to each output.

Binding involves pressing the Bind switch a specific number of times on the Tx and the Rx devices involved.

The presses need to be in fairly rapid succession, each within about a second of the previous one. Take a few moments to work out how many presses will be required on each unit before starting.

To bind an input to an output:

- On the Tx device, press the Bind button as many times as the input channel number, plus one. The LED will flash the channel number selected. For example, to bind input 2, press the button 3 times. The LED will flash twice. You have 60 seconds to complete the next step.
- On the Rx device, press the Bind button as many times as the output channel number, plus one. The LED will flash the channel number selected. For example, to bind output 4, press the button 5 times. The LED will flash 4 times.
- If the bind is successful, the Rx device will flash the letter **Y** (-·-·). The Tx device will flash the letter **P** (·- - ·) indicating it wants you to tell it what kind of message to send when the switch is activated. Press the bind button a specific number of times according to Table 4.
- Activating the switch should now switch the output.
- To 'unbind' an input from an output, repeat the same process as used for binding.

Once all required inputs and outputs are bound, network installation is complete.

Number of presses	Message (Note 1)	Confirmation code
1	Send 'toggle' message when pressed	·
2	Send 'off' message when pressed	··
3	Send 'on' message when pressed	···
4	Send 'toggle' message when pressed or released. (Note 2)	····
5	Send 'on' message when pressed and 'off' when released. (Note 3)	·····

- The message specified will apply to all outputs bound to the input, not just the most recently bound input.
- Used for latching inputs when other inputs also control the output. The state of the switch will not indicate whether the output is on or off.
- For latching inputs where no other inputs control the output. The state of the switch will indicate whether the output is on or off.
- Time delay set by timer control position, refer to table 5.

Position %	Time delay
0% → 20%	1 second → 10 seconds
20% → 40%	10 seconds → 60 seconds
40% → 60%	1 minutes → 10 minutes
60% → 80%	10 minutes → 60 minutes
80% → 100%	1 hour → 18 hours

Note: With some presets the 0% position may be fully clockwise rather than the more usual fully counterclockwise position.

### Power Interruption

In the event that power to the coordinator is interrupted, any Switcher Rx devices that did not also lose power

will have to be powered down and up again. Switcher Tx devices will not operate correctly on the first switch activation after power interruption, but should work normally thereafter.

### Erasure

To erase all the joining and binding information on a device, power it up with the Bind button held down. Once the Bind LED lights, you may release the button. The joining and binding data will have been erased and the device will have returned to its factory settings.

Use the erase process with care. Erasing a Switcher Router will require any devices that were joint to it to be erased also. Erasing the Coordinator will erase all binding data for the entire network.

### Reference

#### Electrical

Supply Voltage (unregulated) Vunreg	3V – 12V or 15v – 24V line power 2.1V – 3.6V battery power (Switcher Tx)r
Current consumption, active	30mA
Current consumption, sleep mode	2µA

#### Radio Frequency

Max RF output power	1mW = 0dBm
RF frequency range	2400MHz to 2485MHz
Communications protocol	IEEE 802.15.4 (DSSS O-QPSK chip encoding) ZigBee HC-L profile
Raw data rate	250kbit/s
RF channels	16
Free space range	Approx 120m node-to-node, freespace

#### Mechanical

Max operating/storage temperature	-40°C to +85 °C
Dimensions W×H×D mm (D = depth from top of DIN rail)	78×75×33

#### Regulatory

FCC compliance	G-antenna version compliant, awaiting certificate
CE compliance	G-antenna version compliant, awaiting certificate
IC (Industry Canada) compliance	G-antenna version compliant, awaiting certificate
ZigBee compliance	Awaiting compliance testing by Microchip Technology Inc

## Sales & Technical Support

The Pixie range is assembled and distributed under agreement by RF Solutions Ltd:



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