FlexiPanel

Switcher DIN Tx / Rx™

DIN Rail ZigBee HC-L Switching Units – Advanced Guide

Summary

Switcher DIN Tx / Rx are DIN rail members of the Pixie Switcher system providing on/off switching solutions using ZigBee wireless mesh networking. Using the Home Control – Lighting (HC-L) ZigBee profile, *Switcher Tx* provides up to provides up to 4 control switch inputs. *Switcher Rx* provides up to 8 outputs for driving relays. They may be bound to any HC-L compatible devices in the ZigBee network. For example, a control switch input could control several output relays; multiple inputs could control one relay.

This data sheet is the *Advanced Guide*. The *Basic Guide* introduces essential concepts and should be read prior to reading this data sheet.

Hardware Features

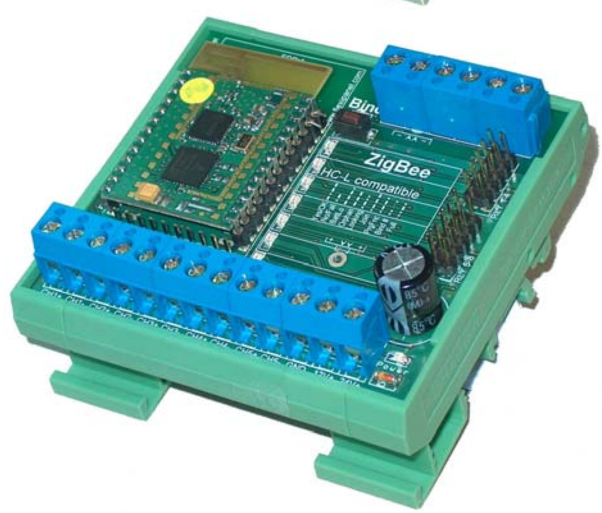
- *Part of a family of compatible products such as mains load controllers, key fobs, wall switches, etc.*
- *Zigbee mesh messaging for extended range*
- *Signature 'G' antenna, free-space range 120m, compact, low 'hand-effect' design*
- *FCC / CE / IC compliant*
- *Wide temperature range –40ºC to +85ºC*
- *2 x AA battery or 3V – 24V DC supply*

Firmware Features

- *Tx devices have 4 inputs (3 when battery powered), configurable as On, Off, Toggle or Time Delay inputs*
- *Rx devices have 8 output channels with open drain outputs for driving relays (5 for battery version)*
- *2 connectors for 4-channel relay accessory boards (Rx line powered version only)*
- *Failsafe alarm reports when contact is lost, out of range, low battery or device fault*
- *Battery monitoring & signal strength indication*
- *Serial port for configuration and diagnostics tool*
- *ZigBee 1.0 HC-L compatible*

Applications

- *Lighting control*
- *Appliance remote control*
- *Security and burglar alarms*
- *Access control systems*
- *Electrically isolated switching*
- *Device fault/missing/stolen alert*
- *Battery needs charging alert*



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 Tx LP ED	4-input ZigBee switch, 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, DC line powered
SW DIN Rx BAT ED	5- output ZigBee load controller / end device, battery powered
SW DIN Rx BAT CD	5- output ZigBee load controller / coordinator, battery powered
230	4-channel relay board
USB Config Tool	USB configuration tool
USB Sniffer	ZigBee packet sniffer

Contents

Switcher Tx Terminal Connections

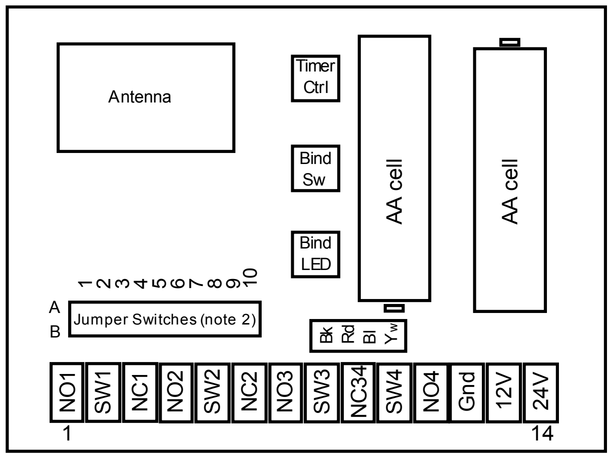


Figure 1. Switcher Tx Layout

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 & 4, Normally closed contact (note 3)
10	Input 4, Pushbutton contact / Changeover contact (note 3)
11	Input 4, Pushbutton contact / Normally open contact (note 3)
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 either 3V-12V or 12V-24V supply, not both.
2. Take care fitting jumpers. If incorrectly fitted, the unit may appear to function correctly but drain the battery quite quickly.
3. Fourth channel with line powered version only.

Switcher Rx Terminal Connections

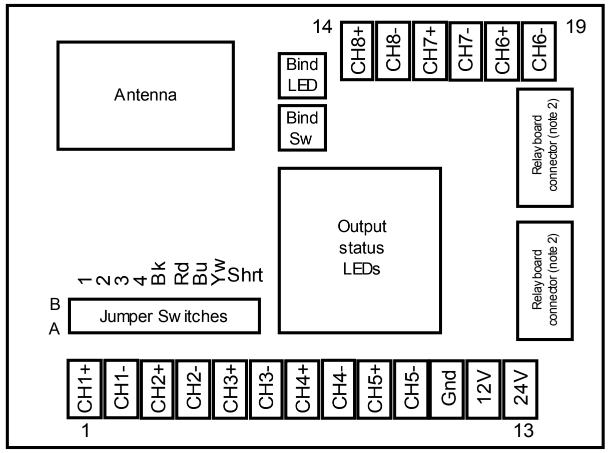


Figure 2. Switcher Rx Layout

Terminal	***Description***
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 no one of 3V-12V supply, 12V-24V supply, or 2 x AA batteries.
2. Line powered version only.
3. Open drain output for switching up to 180mA loads.

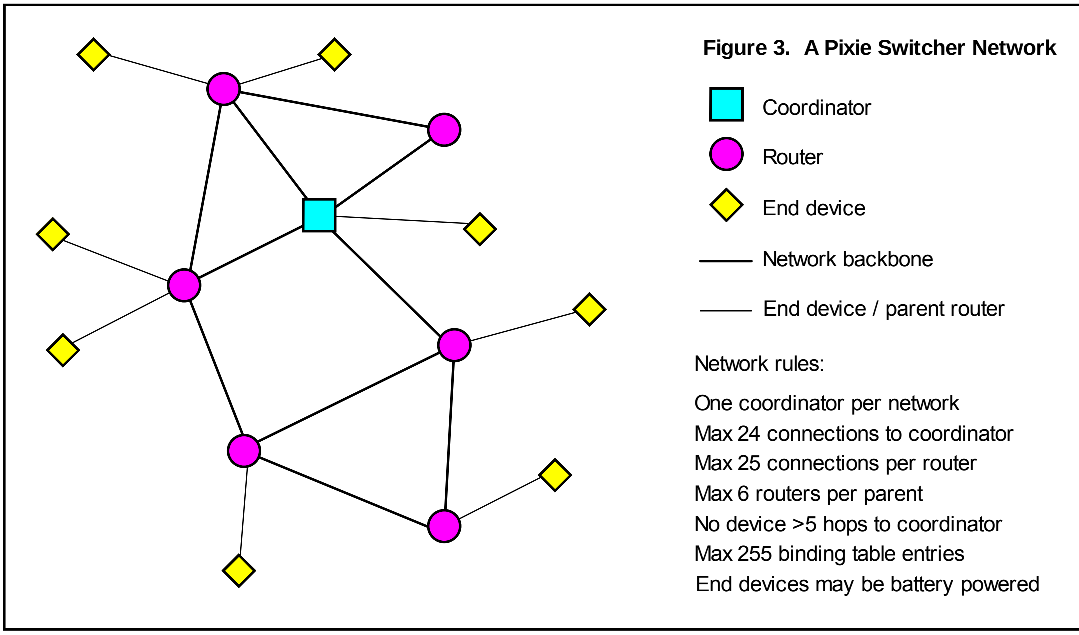


Figure 3. A Pixie Switcher Network

Operational Overview

- Switcher Rx's control loads according to the switching messages they receive. Every Switcher Rx must be in range of at least one other Switcher Rx unit in order to pass switching messages along. Switcher Rx's are called *routers* because they can pass on messages. They must always be on and are usually mains powered.
- Switcher Tx devices are connected to switches and transmit the switching messages. Each Switcher Tx only needs to be in range of one Switcher Rx, and not necessarily one it is controlling. Switcher Tx's are called *end devices* because they cannot pass on messages. They can be battery powered and spend most of their lives in sleep mode.
- One Switcher Rx must be a *coordinator*, which is a special type of router. In a system with one Tx and one Rx, the Rx must be a coordinator.
- To span a range greater than the transmit range of Tx and Rx devices, install intervening Rx devices as message repeaters.

How Switcher Tx / Rx Networks Work

Switcher Rx and Tx devices are ZigBee network devices operating with the HC-L ZigBee profile.

Switcher Rx devices are routers. They form the backbone of the switching network and have the ability to forward messages to their destination. Neighboring routers must be within range of each other, but the overall network may be much larger.

Switcher Tx device are end devices. They are assigned to a single router within range, with which they communicate exclusively. This 'parent router' will forward messages to the rest of the network on its behalf.

The Switchers send on/off messages to each other. One switch input can control many outputs and/or one output can be controlled by many inputs. Which inputs affect which outputs is specified during installation in a process known as *binding*. These relationships are stored in a *binding table*.

The binding table may contain up to 255 *binding entries*. One binding entry is required for each switch input and one for each input / output relationship. For example, one switch controlling three lights uses 4 binding table entries. Three switches controlling one light use 6 binding table entries.

One router has a special role known as a coordinator. It sets network-wide rules such as operating frequency, stores the binding table, etc.

The battery powered Switcher Rx product has limitations. If it is a coordinator, it must be always on and therefore will demand a constant 30mA from the battery. It will only be useful for applications which are only powered up when needed. If it is not a coordinator, it is configured as an end device rather than a router. This allows it to sleep to conserve battery power. However, it will only change its output state when it wakes up, so a delay may be experienced when switching its outputs.

Physical Layout

Free space range is approximately 120m. In-building ranges of 20m to 40m would normally be expected. Devices must be located within radio range of at least one router in the network. If a device is an 'outpost' and is out of range of all other devices, install one or more repeaters to bring it into range. Any router device can function as a repeater. Please also contact us regarding custom repeater devices.

Devices should be located, where possible, far from conducting and/or strongly dielectric materials such as metals, water and body tissue. (See table 4.) Avoid the use of a metal enclosure for Switcher devices. Also, if possible, avoid high carbon-content plastics. The modules are designed for DIN rail mounting using the mounting clips supplied. If a DIN rail is not used, the clip may be removed by carefully pulling apart the case.

A high location is recommended to avoid interference. Where possible, orient all the antennas in the same direction. A highly attenuating medium such as a concrete floor may be bridged by placing two routers close to each other, one on either side of the barrier.

Table 4. Typical attenuation of bulk materials	
Material	***Reduces range by factor of***
Reinforced concrete floor	30
Brick wall	2
Brick wall with window	1.25
Metal cabinet	3
Vegetation	1.25 per meter
Compact materials, e.g. humans, have an complex effect, in general attenuating most noticeably when closest to the antenna.	

The signal strength indication can be used to measure the quality of a link two locations. To obtain a signal strength indication, press the Bind button on Tx device once. The LED will flash a signal strength value as follows: one long flash for each ten the one short flash for each unit. For example 32 would be represented by three long flashes followed by two short flashes. The value reported is the signal strength of the last packet of data received from the parent. Signal strength is on a scale of 0 (-110dBm, weakest) to 110 (0dBm, strongest).

To maximize performance, experiment with antenna orientation and small changes in physical location. Stand well back from the device when measuring signal strengths.

A sniffer tool may be used for further diagnostics. Please also contact us regarding sniffer tools.

Network Configuration

The first device to be installed should be the coordinator. When turned on, it will scan for an unused frequency on which to establish a network.

Other devices may then joined to the network. There is no strict joining order, but you will need to work outwards from the coordinator.

To join a new router to the network, select a router that is already in the network, or the coordinator itself, and that will be in range of the new router, and press its bind button. The LED will flash the Morse letter ***J*** (• – – –) to indicate that it is allowing a device to join. Then power up the new device. It will scan for the network and attempt to join it. The LED will flash the letter ***Y*** (– • – –) on both devices when joining succeeds.

End devices are joined in the same way as routers, except you can't thereafter join anything to the end device. The router you select for joining will become the end device's parent.

Binding

After devices have joined the network, inputs can be bound to outputs. To bind an input to output, press the bind button several times in reasonably quick succession. The number of times it should be pressed is equal to one plus the channel number of the input or output. The Bind LED will flash as many times as the channel number to indicate it is in the correct binding mode. When both input and output are in this state, they will locate each other and bind together.

For example, suppose you want Switcher Tx input 3 to control Switcher Rx output 5. Press the bind button on the Tx device four times and the Rx device 6 times. The LED in the Switcher Rx will flash the letter ***Y*** (– • – –) when binding has successfully completed.

Once binding has completed, the Switcher Tx unit bind LED will flash the letter ***P*** (• – – •). It is indicating that it needs to know what message to send when its input is switched. The bind button must be pressed a specific number of times to set what message to send as listed in table 5.

The selected mode will be indicated by the confirmation code shown in table 5. This code will be flashed 3 times before the device starts operating as normal again.

Table 5. Setting the Tx message		
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)	• • • • •
6	Send 'on' message when pressed and 'off' when timer time limit expires. (Note 4)	• • • • • •

1. The message specified will apply to all outputs bound to the input, not just the most recently bound input.
2. 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.
3. For latching inputs where no other inputs control the output. The state of the switch will indicate whether the output is on or off.
4. Time limit set by timer control as shown in table 6.

Table 6. Time delay settings	
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.	

To unbind two inputs, perform the binding process again. The Tx device will still need to have its switch mode programmed (Table 5), even though this has no effect.

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

Network Reboot

After a break in power, the network restarts as follows:

1. When the coordinator Switcher Rx powers up or is otherwise reset, it scans for, and selects, a free channel. All other devices must then rejoin the network.

2. Line powered Switcher Rx routers will automatically search for the network on power-up. If a device had a separate power source (e.g. battery) and did not go through a power-down power-up sequence, a network search must be initiated as described in step 5 below.

3. A battery powered Switcher Rx will wake up and notice it is no longer in contact with its parent. It will then initiate a network search. If it fails to find the network, it will enter a sleep state and a network search must be initiated as described in step 5 below.

4. Switcher Tx devices wake up when one of their inputs change. The device will notice it is no longer in contact with its parent and initiate a search. If it finds the network, it will resume normal service on the next change of input state.

5. A network search can be initiated at any time on any router or end device by:

   - cycling the power, or
   - changing a Switcher Tx input as described in step 4

Status LED Flash Codes

Table 7 summarizes the status codes which may be observed on the Bind LED. Note that the same codes are use to indicate attempting to bind and confirming programmable endpoint states. (The status codes are the values displayed by the diagnostic messages.)

Table 7. Pixie Switcher Device States

Status code	***State***	***Status LED***
00	Normal	Off
01	Initializing	On
02	Fatal Error	• • – • ***(F)***
03	Yes, operation succeeded	– • – – ***(Y)***
04	No, operation failed	• – ***(N)***
06	Report signal strength, tens	†
07	Report signal strength, ones	†
08	Getting programmable input endpoint setting	• – – • ***(P)***
09	Confirm *Toggle* programmable input	•
0A	Confirm *Off* programmable input	• •
0B	Confirm *On* programmable input	• • •
0C	Confirm *Toggle Latch* programmable input	• • • •
0D	Confirm *Latch* programmable input	• • • • •
0E	Confirm *Timer* programmable input	• • • • • •
0F	Battery Low	– • • • ***(B)***
10	Non-fatal error display	• – • ***(R)***
40	Permit node to join	• – – – ***(J)***
41	Binding / unbind endpoint 1	•
42	Binding / unbind endpoint 2	• •
43	Binding / unbind endpoint 3	• • •
44	Binding / unbind endpoint 4	• • • •
45	Binding / unbind endpoint 5	• • • • •
46	Binding / unbind endpoint 6	• • • • • •
47	Binding / unbind endpoint 7	• • • • • • •
48	Binding / unbind endpoint 8	• • • • • • • •
81	Looking for network Starting network (coordinators)	• – • • ***(L)***

† One slow flash for each ten plus one quick flash for each unit

Individual Device Setup

When delivered, Switcher Tx inputs are configured for connection to pushbuttons or latching switches.

Other options (for example fail-safe alarms) require the use of a USB Config Tool, available separately. Refer to the USB Config Tool Options section for more details.

Connecting power

Line powered units should be powered by applying either 3V – 12V DC or 12V – 24V DC to the appropriate terminals.

Battery powered units should be powered by two AA batteries. To conserve power, none of the LEDs except the Bind LED will operate when powered by batteries. If the battery power is low, the Bind LED will flash the Morse ***B*** signal (– – – •) three times after each message is transmitted or received.

When power connection is complete, keep all units powered down until they are ready to join the network.

Jumper Settings – Switcher Tx

Refer to figure 1 for locations of Switcher Rx jumper connections.

- A jumper should be connected across B2-B3.
- For line power, connect a jumper across A8-B8.
- For battery power, connect a jumper across A9-B9.
- If a pushbutton is connected on 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 on 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 on Input 3, or if it is unused, fit a 'pull-up' jumper across A6-B6. If a changeover switch is connected, omit the jumper.
- If a pushbutton is connected on Input 4, or if it is unused, fit a 'pull-up' jumper across A7-B7. If a changeover switch is connected, omit the jumper.

Jumper Settings – Switcher Rx

Referring to figure 2, ensure jumpers are connected across the two pins labeled 'Short' in row B, and across A2-A3.

Connecting switches to Switcher Tx

If Switcher Tx is line powered, four switch inputs are available. If Switcher Tx is battery powered, only three switch inputs are available.

If a pushbutton is used as an input, it should be connected across the terminal connections marked 'pushbutton contact'. The associated 'pull-up' jumper must be fitted.

Latching switches may also be used, but in order to minimize power consumption, they 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'. The associated 'pull-up' jumper must not be fitted.

If a switch is unused, the associated 'pull-up' jumper must be fitted in order to avoid accidental triggering of the input.

Connecting loads to Switcher Rx

The line powered versions of Switcher Rx provides eight load controlling outputs. The battery powered versions of Switcher Rx provide five load controlling outputs. The outputs are open drain MOSFET drivers for DC loads such as relays. Figure 4 shows a typical circuit.

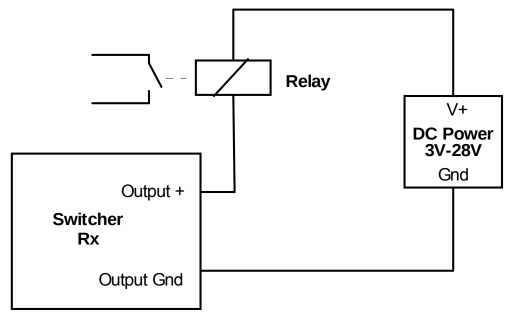


Figure 4. Typical relay output circuit

Loads may be connected to the Switcher Rx outputs as shown in figure 4. The output terminals can switch DC loads with 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.)

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 5, with the red lead towards the bottom.

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

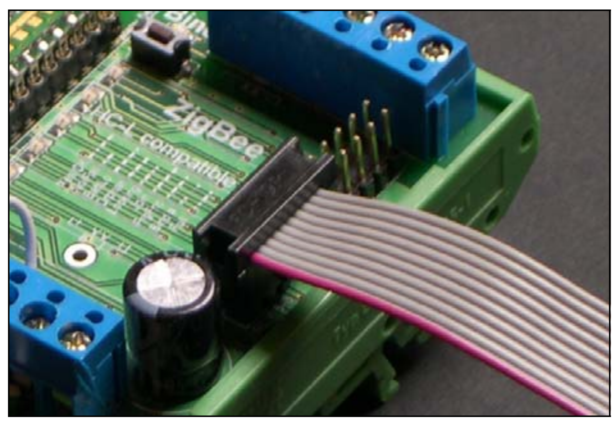


Figure 5. Connecting a relay board. The red lead on the flat cable should be at the bottom.

Erasure

Erasing all the joining and binding information on a device is known as an *erase reset*. To perform an erase reset, power up the device 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.

In the case of routers and end devices, an erase reset causes all network membership information to be deleted. In the case of coordinators, all binding information for the network will be deleted. The device may then be re-used in a new network.

USB Config Tool Options

USB Configuration Tool

When delivered, Switcher Tx inputs and Rx outputs are configured for normal switching. Each time a switch is activated, the corresponding output will turn on or off.

Further options are possible using the USB Config Tool, including pulsed outputs, battery alarms and fail-safes. The USB Config Tool is available separately and plugs into a Windows PC. It has a color coded connector (Black – Red – Blue – Yellow) which should be connected to the pins marked Bk-Rd-Bu-Yw.

To use the USB Config Tool you will need to run the Windows HyperTerminal application. This is in the Accessories section of the Windows Start menu. It is used to send commands to the Switcher unit and read the responses. It must be configured to communicate with the COM port that the USB Config Tool adopted when it was installed.

NOTE: A jumper switch protects commands being sent accidentally. On Switcher Rx, remove the jumper over pins A2-A3 and place it over A1-A2, then power up the unit. On Switcher Tx, remove the jumper over pins B2-B3 and place it over B1-B2, then power up the unit. When you have finished sending commands, return it to its original position.

Commands

The key-press commands in table 8 may be used to diagnose and configure the device. Table 7 lists only those commands that have an effect with Switcher Tx and Switcher Rx are detailed here. Avoid using other commands since this may have unpredictable effects.

Battery devices are designed to fall asleep, in which case they will not notice a key press command. To wake a battery operated device, press the bind button once before sending a command.

Table 8. Configuration commands

Key Press	*Command*
A	Failsafe & low battery alarm settings †
E	Set input & output channel types †
F	Factory reset †
M	Show messages ‡
P	Press bind button †
R	Reset †
S	Set status indication
V	Report supply voltage
W	Set watchdog mode
Z	Erase reset †

† = device will reset when command is completed
‡ = Rx devices only

Set failsafe & low battery alarm settings (A)

If an ***A*** command is sent, the failsafe input *re-transmit period* and output *quiet period* are set. The values are in hex seconds, range 0001 to FFFF (18 hours approx). If you are unfamiliar with hexadecimal notation, use Table 9 as a guide.

The under-volt trigger level is specified in hex milliVolts, range 0000 to 0E10. Specify 0000 for no under-volt alarm. Note that below 2.1V, the device may cease to function and will not be able to generate an under-volt alarm. The undervolt trigger level applies to the failsafe alarm and also to the low battery ***B*** indication on the Bind LED.

The quiet period should be greater than the re-transmit period to ensure that the failsafe alarm is not triggered during normal operation. Usually it would be several times longer, to allow for the occasional lost transmission.

Table 9. Hex notation examples

Hex value	Time value	Voltage value
0000		(no alarm)
003C	1 minute	
012C	5 minutes	
0384	15 minutes	
0834	35 minutes	2.1V
0898		2.2V
0834	40 minutes	2.4V
0A8C	45 minutes	2.7V
0E10	1 hour	3.6V
1C20	2 hours	
3840	4 hours	
5460	6 hours	
A8C0	12 hours	
FD20	24 hours	

The following example sets the retransmit period to 1 hour, the quiet period to 4.2 hours and the under-volt alarm to 2.2mV. These are the default values.

```
A
Enter new re-transmit period, hex seconds
>0E10
Enter quiet period, hex seconds
>3B10
Enter under-volt level, hex mV
>0898
```

(Device then resets)

Set input and output channel types (E)

If an ***E*** command is sent, the endpoint (input and output channel) types are set. One command is used for both Switcher Tx and Switcher Rx, so take care to specify output channels only for Rx and input channels only for Tx.

When the ***E*** command is sent, the current endpoint types are first listed. The new endpoint settings may then be entered as a series of characters, one each for each of channels 1-8, as summarized in table 10 and detailed below. Enter a ***C*** at any time to cancel. If the Switcher device has fewer than 8 channels, the non-existent channels should be set to the 'unassigned' ***U*** input type.

Table 10. Endpoint Types	
Code	***Function***
N	*On* input endpoint
F	*Off* input endpoint
T	Toggling input endpoint
L	Latching input endpoint
H	Toggling latch input endpoint
G	Programmable input endpoint, set to *toggle* or unassigned
n	Programmable input, set to *on* †
f	Programmable input, set to *off* †
t	Programmable input, set to *latch* †
h	Programmable input, set to *toggling latch* †
d	Programmable input, set to *time delay* †
D	Time delay input endpoint ‡
0	Output endpoint, initially off
1	Output endpoint, initially on
P	Pulsing output endpoint
R	Power control output
M	Time delay setpoint input ‡
S	Failsafe alarm input ‡
A	Failsafe alarm output, initially off ‡
B	Failsafe alarm output, initially on ‡
U	Unassigned
Z	*Cancels endpoint entry process*
† Code used for reporting programmed mode only. To set an endpoint as programmable, always use code ***G***	

The following input and output channel operating modes are possible with Switcher products:

An *On input endpoint* generates an On message when the input switches on. It is selected using the letter ***N***.

An *Off input endpoint* generates an Off message when the input switches on. It is selected using the letter ***F***.

A *Programmable input endpoint* allows the message it sends to be programmed after binding (Table 5). This is the factory setting for all Switcher Tx inputs, and is selected using the letter ***G***.

A *Toggling input endpoint* generates a Toggle message when the input switches on. A toggle message tells the output to enter the opposite state to the one it is in already. It is selected using the letter ***T***.

A *Latching input endpoint* does not need to be programmed after binding. It generates a Toggle message when the input turns on when the input turns off. It is selected using the letter ***L***.

A *Toggling latch input endpoint* does not need to be programmed after binding. It generates an On message when the input turns on and an Off message when the input turns off. It is selected using the letter ***H***.

A *Time delay input endpoint* implements a timed switch. When the input switches on, it generates an *On* message immediately and an *Off* message after a preset time delay. It is selected using the letter ***D***.

The time delay is defined by the Switcher Tx Timer preset control (refer to table 6 and figure 1). If the pushbutton is pressed for again before the countdown is complete, the countdown starts from the beginning again. For the preset timer to operate correctly, you must, specify a *time delay setpoint input* (letter ***M***) on channel 5 and a power control output (letter ***R***) on channel 6 – see the example at the end of this section.

For battery powered devices, a wakeup timer must be configured for the time delay to work. If a programmable input endpoint is set to timer and the wakeup timer is set to off, its will be temporarily set to a wakeup period of 15 seconds while the timer is operating.

An *output endpoint, initially off* is intended to be connected to a load controller such as a relay. It responds to messages from input endpoints and can be in an *Off* state (output low) or an *On* state (output high). At power-up, it reverts to the *Off* state. It is selected using the digit ***0***.

An *output endpoint, initially on* is intended to be connected to a load controller such as a triac or relay. It responds to messages from input endpoints and can be in an *Off* state (output low) or an *On* state (output high). At power-up, it reverts to the *On* state. It is selected using the digit ***1***.

A *pulsing output endpoint* will automatically revert to the *Off* state between 20ms to 40ms after it receives a message to turn *On*. It is selected using the letter ***P***.

With a *failsafe alarm* input and output pair, the output turns on if any of the following events occurs:

- When the Tx input is turned on
- If regular contact with the Tx is lost
- If the supply voltage on the Tx is low

When the switch is not activated, the Tx still sends regular messages to the Rx to confirm that it is still in contact. If radio communication fails for any reason, for example if the transmitter is vandalized or stolen or the battery is run down, the alarm is raised.

The *failsafe alarm input endpoint* is specified using the letter ***S*** and generates an *On* message when the input turns on and an *Off* message when the input turns off. It re-transmits the state of the input immediately after rejoining a network and every *retransmit period*, even if it hasn't changed. Normally it would be connected to a 'Failsafe Test' or 'Alarm' button or left unconnected. If it is to be left unconnected, you can even use any of channels 5 to 8 as the input. Refer to the *Set failsafe & low battery alarm settings* command for details of how to set failsafe time periods and voltage levels.

A *failsafe alarm output endpoint* is similar to a normal *output endpoint*. It responds to messages from input endpoints and can be in an *Off* state (output low) or an *On* state (output high). In addition, if it does not receive any messages for a pre-specified *quiet period*, it will automatically revert to the *On* state. Typically it would be connected to a 'Fault' light or buzzer. Refer to the *Set failsafe & low battery alarm settings* command for details of how to set failsafe time periods. The letter ***A*** is used to specify a false alarm output if the output is initially off until the first message is received, or the letter ***B*** if the output is initially on until the first message is received.

In normal operation, the failsafe output will be off unless contact with the failsafe input is lost. The 'Failsafe Test' button may be used to check the failsafe system has been correctly bound.

The failsafe input and output must be bound together. They are ***not*** automatically bound when other endpoints on the device are bound. One failsafe input may be bound to many outputs, but only one input should be bound to any failsafe output.

Unassigned endpoints are not used. If any of endpoints 1-3 are unassigned, they should be fitted with a pull-up jumpers avoid unintended wakeup during sleep periods.

The following example sets input 1 to *latch* and 2 to *timer*. Since a timer input is used, channels 5 and 6 are set as ***M*** and ***R*** respectively:

```
EPs:   PPPPUUUU
>LDUUMRUU
```

(Device then resets)

Factory reset (F)

If an ***F*** command is sent, a factory reset is performed. This includes resetting all USB Config Options to their initial state.

Device information (I)

If an ***I*** command is sent, information messages are generated about the switcher unit. Refer to the Pixie Switcher Message Reference to interpret these messages.

Show Messages (M)

The ***M*** command sets and indicates whether diagnostic messages are generated. These may be used for advanced diagnostics. Refer to the Pixie Switcher Message Reference for details. If not used, the messages should be turned off to conserve power.

Messages are not normally implemented in Pixie Lite products.

Press bind button (P)

If a ***P*** command is sent, it has the same effect as pressing the bind button.

Reset (R)

If an ***R*** command is sent, the device resets as if it were powered down and powered up again.

Supply voltage (V)

If a ***V*** command is sent, the voltage on Vdd is reported in hex milliVolts. Refer to table 9 for translations to decimal voltage levels

Watchdog mode (W)

Battery powered Switcher Rx devices sleep for brief periods to conserve power. The ***W*** command cycles through the watchdog wakeup modes listed in table 11.

A more frequent watchdog allows faster response but will consume more power. If woken by the watchdog but otherwise idle, the device will be active for approximately 60ms after wakeup before returning to sleep. For minimum wakeup time, specify no diagnostic messages using the ***M*** command.

On battery powered devices, failsafe and time delay inputs use the watchdog to time their operations. Their timings will only be as accurate as the wakeup period allows. For minimum power consumption with failsafe and timer operation, the wakeup period should be the largest acceptable value. If wakeup is turned off (mode 00), it will be temporarily set to mode 07 while a timer is active.

Table 11. Wakeup mode options

Mode	Function
00	No wakeup on watchdog (default)
01	Wakeup every 250ms approx
02	Wakeup every 500ms approx
03	Wakeup every second approx
04	Wakeup every 2s approx
05	Wakeup every 4s approx
06	Wakeup every 8s approx
07	Wakeup every 15s approx
08	Wakeup every 30s approx
09	Wakeup every minute approx
0A	Wakeup every 2 minutes approx
0B	Wakeup every 4 minutes approx
0C	Wakeup every 8 minutes approx
0D	Wakeup every 15 minutes approx
0E	Wakeup every 30 minutes approx
0F	Wakeup every hour approx
10	Wakeup every 2 hours approx
11	Wakeup every 3 hours approx
12	Wakeup every 6 hours approx
13	Wakeup every 12 hours approx
14	Wakeup every 24 hours approx

Erase reset (Z)

If a ***Z*** command is sent, an erase reset is performed. The device clears its joining and binding settings and assumes it is not a member of a network.

The following settings remain unchanged during this operation. Resetting them requires a factory reset.

- Endpoint type information
- Watchdog wakeup rate
- Undervolt detect level
- Failsafe periods

An erase reset is also performed if, at power-up, the Bind button is held down for five seconds.

Reference

Electrical

Supply Voltage	3V – 24V line power (unregulated) 2.1V – 3.6V battery power (not all models)
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 1.0 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	-40ºC to +85 ºC
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

Ordering Contact

The Pixie Switcher range is manufactured and distributed by:

R F Solutions Ltd
Unit 21, Cliffe Industrial Estate,
Lewes, E. Sussex, BN8 6JL, United Kingdom
email : sales@rfsolutions.co.uk
www.rfsolutions.co.uk
Tel: +44 (0)1273 898 000, Fax: +44 (0)1273 480 661

Technical Information

The Pixie Switcher range is owned and designed by:

FlexiPanel Ltd
2 Marshall St, 3rd Floor,
London W1F 9BB, United Kingdom
email: support@flexipanel.com
www.flexipanel.com

FlexiPanel