

# Q48 Point to Point System

## User Guide

Q48 Point to Point System

Version 1.9



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## Revision Details

1.3	March 2019	First Issue new document format
1.4	April 2019	Addition of information on communication failure modes and retries
1.5	Sept 2019	Troubleshooting clarification, removal of Advanced Config section
1.6	Jan 2020	Reformatted as User Guide, added 1W radio specifications
1.7	May 2021	Clarified mechanical specifications
1.8	March 2022	Clarified comms fail behaviour
1.9	June 2023	Update antenna requirements and warnings for use with 1W radios

## Introduction

The Q48 Point to Point (Q48-P2P) system can be used to link electrical devices together in situations where the physical separation or terrain between them would make direct wiring uneconomic or impractical. Each Q48-P2P system comprises two Q48-P2P modules that are pre-programmed with a unique common communication address, allowing multiple Q48-P2P systems to be used within the same general location.

Each Q48-P2P module has 8 Digital Inputs, 8 Digital Outputs, 2 Analogue Inputs, and 2 Analogue Outputs. The modules have high speed digital radios which they use to communicate their input state to the other module. The time delay between when an input changes state and the corresponding output changes is normally less than 500ms. The digital radios have a maximum range of up to 4km with optional high gain antenna.

This system can be considered as a multicore cable replacement option, without the expense and hassle of trenching and installation. Configuration is not required for most applications.

“Failsafe” options during communication link failures can be configured by QTech prior to supply.

## Overview



Figure 1: Q48-P2P module

### Features

- 8 Digital Inputs, 8 Digital Outputs, 2 Analogue Inputs, 2 Analogue Outputs.
- Simple set up, no programming or configuration required.
- Digital radio using 900MHz Digital Modulation technology.
- Line of sight operational ranges up to 2km with whip antenna, and up to 4km with Yagi or high gain whip antenna.
- Low power consumption, ideal for solar or battery installations.

### Supply options

Each Q48-P2P System (P/N PD8630-P2P) is supplied with the following:  
Qty 2 Q48-P2P modules



**Note - Power supplies and antennas are all ordered separately.**

## Getting Started

### Antenna

The Q48-P2P system is designed specifically for operation in New Zealand and Australia.

All radio systems work most reliably when the path between the radios is clear “line of sight”. This needs to be considered when planning longer range systems.

**Do not apply power to the Q48-P2P before connecting the antenna.**

**The Q48-P2P must be connected to PD9241 900MHz 3dBi Whip Antenna at a minimum.**

For best performance mount the antenna vertically, as high as possible and away from large objects.

Optional higher gain, long range antennas are available. Please contact QTech for details and advice.

**⚠ Warning – Do not operate the device without an antenna attached. Do not substitute antennas; use only those antennas recommended by your equipment supplier. Failing to comply with these requirements can damage the module.**

**Never operate the devices in violation of RSM conditions. AS/NZS 4268:2008 specifies a maximum EIRP of 1 watt.**

Communications range can be increased using one of the externally mounted antenna options below.

Antenna Type	QTech Part Number	Maximum Range	Radio Tx Power
3dBi Whip	PD9241	~3km	260mW
6dBi Yagi	PD9225	~4km	100mW
6dBi Whip	PD9242	~4km	100mW

Communications range is dependent on the installation and local factors, so these figures are indicative only.

**⚠ Note - Do not cut or join the coax cable, this will increase signal losses and impact reliability.**

### Power Supply

The Q48-P2P must be powered from a 12-24V DC supply. QTech recommends the QTech plug pack P/N PD5412 which supplies 13.8V DC.

Connect the power supply positive wire to the terminal labelled ‘+V’. Connect the negative wire to the terminal labelled ‘GND’.

The third terminal at the right end of the connector is not used.

Current consumption is ~85mA (no inputs on) to ~120mA (all inputs on) at 13.8V DC.

**⚠ Warning – Do NOT use Switch Mode Power Supplies (SMPS) with this product. The DC power supply used for this product MUST have a grounded negative or be a “linear” transformer-based plug pack. The reason is because the antenna, programming port and external connections can provide exposed earth points and a SMPS can impose high AC voltage on the DC supply, which can lead to damage.**

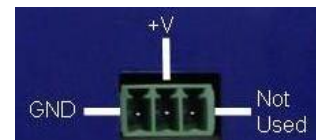


Figure 2

The following power supplies from QTech are suitable and cost effective:

Part Number	Description
PD5412	Plug pack – 230V AC input
PD5414	230V AC Input rewirable power pack
PD5413	110V AC Input rewirable power pack

### Internal Fuse

Each Q48-P2P module is protected by a 20mm x 5mm 2A fast blow fuse located on the internal circuit board.

To access the fuse, disconnect the power supply and then remove the power supply connection. **Carefully** remove the top cover by prising it off its retaining dimples.

Only replace the fuse with an identical type, do not use alternatives.

## Inputs and Outputs

### Digital Inputs

The Digital Inputs are a ‘normally open’ type, which can be connected to mechanical switches, contacts, or other closure devices. A Digital Input is turned ON by closing the connected switch to Ground. It is turned OFF by opening the switch.

The Digital Input LEDs will light up when the corresponding input is ON.

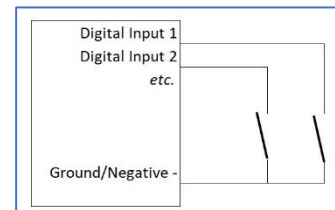


Figure 3

**⚠ Warning – Only mechanical switches or mechanical closure devices should be connected to the inputs. No external voltage or other electrical source is to be connected to the inputs.**

### Digital Outputs

The Digital Outputs are solid state devices designed to interface to a low power relay. The module turns a Digital Output on by switching the terminal to the power supply Ground.

The Digital Output LED will light up when the Digital Output is ON.

The Digital Output can switch up to 1A at up to 26.5V DC. However, the maximum current available to drive all eight interface relays is 1.5A. Output voltages are clamped to 65V during inductive switching. The voltage into a Digital Output channel when the channel is OFF is also clamped to 65V, which eliminates the need for reversed biased diodes across inductive loads.

To use a Digital Output with a relay, wire as shown in the diagram to the right. Relays with a coil current of ~50mA are recommended.

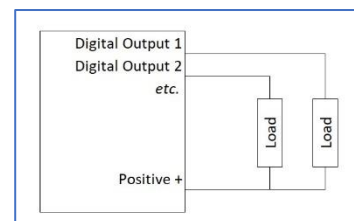


Figure 4

### Analogue Inputs

Each Q48-P2P module has two Analogue Inputs configured for 4-20mA operation. The Analogue Inputs can optionally be configured as 0-10V (to order).

The Analogue Inputs are labelled: Analog I/O 1 and 2 on the connector and ANL-1 and 2 on the status LEDs.



### 4-20mA Devices

The Analogue Inputs can be connected to any self-powered 4-20mA transducer. Loop-powered transducers are not suitable for use with the Q48-P2P. If the transducer has a separate power supply from that of the Q48-P2P it is important that the Grounds of both power supplies are connected together. Typical wiring is shown to the right.

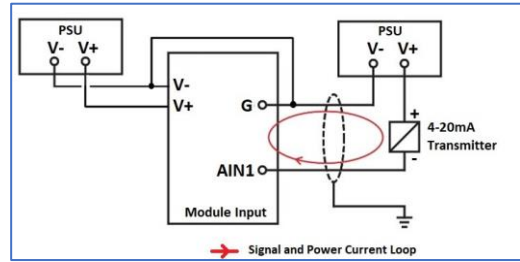


Figure 5

The Analogue Input LED will be off when the input signal is less than 4mA.

The LED lights up when the signal is within the measuring range.

### 0-10V Devices (Optional)

If the Q48-P2P is configured for 0-10V operation, the transducer signal wires should be connected between the Input and Ground terminals, as shown to the right.

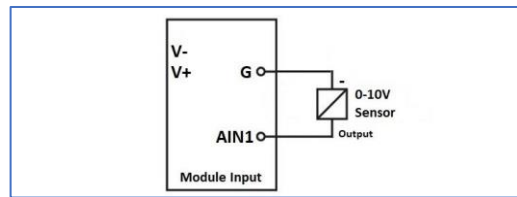


Figure 6

### Analogue Outputs

Each Q48-P2P module has two Analogue Outputs configured for 4-20mA operation. The Analogue Outputs can optionally be configured for 0-10V (to order).

The Analogue Outputs are labelled: Analog I/O 3 and 4 on the connector and ANL-3 and 4 on the and status LEDs.

### USB Port

The Type B USB port is used for limited configuration and firmware upgrades by qualified technicians under direction of QTech.

## Operation

The Q48-P2P System operates by copying the state of the input terminals from one device to the output terminals on the other device. The Q48-P2P modules operate in a peer-to-peer manner meaning they communicate in the same way. The high-speed digital radio technology allows up to 5 changes per second.

When any of the Digital Inputs change state or any of the Analogue Input values change by more than 5% of full scale (0.8mA), the Q48-P2P will send a 'change of state' message to the other module. Each time a Q48 hears one of these messages it will update its outputs to be the same as the inputs on the other module.

The Q48-P2P also sends a 'background poll' message every 5 minutes (configurable), which is used to check that the communications link is OK without needing to wait for an input value to change. The background poll also improves the resolution of the Analogue Outputs by ensuring that the values are up to date, even if they haven't changed by more than 5%.

Each time the Q48-P2P sends a message it expects to hear an acknowledgement (ACK) back from the other module. If it hears an ACK from the other module that means the communications link is OK. While the link is OK the Coms Status LED will be on. If the module doesn't hear an ACK after retrying several times, it will indicate that the link is down by turning the Coms Status LED off. While the link is down each module will try to re-establish the link by sending a message every 30 seconds.

## Status Indicators

The Status LEDs on the Q48-P2P module are used to indicate information to assist with installation, commissioning, and maintenance. The operation of the Input and Output LEDs is described in the Inputs and Outputs section above.

Status LED	Colour	Meaning
<b>PWR</b>	Blue	On while the module is powered.
<b>OK</b>	Green	Blinks to indicate the module is active.
<b>ERR</b>	Red	Blinks to indicate certain error conditions (See below).
<b>COMS</b>	Orange	On while the communications link is OK, off if the link is down (comms fail).
<b>RXD</b>	Orange	Flashes each time the module receives a message.
<b>TXD</b>	Orange	Flashes each time the module sends a message.

## Input and Output Indicators

The IN, OUT and ANL indicators represent the input, output, and analogue input states, respectively. The indicator is illuminated (on) if the corresponding signal is asserted.

## Communications

By default, the communication link between the Q48-P2P modules is checked every 5 minutes by either unit sending a message which is acknowledged by the other end. The orange Coms Status LED will be on when the modules are communicating normally.

### Communication Failures

Failure to acknowledge the message after the configured retries (attempts) causes the modules to enter comms fail mode. The Coms Status LED is turned off showing the link is down.

However, for some applications 5 minutes is too long to determine a comms fail state, therefore both the polling interval and the number of attempted retries to establish communications is configurable by QTech.

To avoid radio data message collisions each module attempts to re-establish communications using a pseudo random retry interval. Once all retry attempts have been made and no acknowledgment from the corresponding device is received, then the unit enters comms failure mode.

If each end successfully receives a message acknowledgment from the other, communication is re-established and normal operation resumed. Messages are generated using either the background poll or when a change of state on an input occurs. Devices may indicate that the communication link is down but they continue to attempt to re-establish communications. The device does not enter a halted state but may condition the outputs into a safe mode when the link is down (see Failsafe settings).

### Communication Retries

The number of retries and the poll rate affects the total time to determine if there is a communication link failure.

The more retries that are defined the longer it takes to determine the link is down. This needs to be considered when designing the Q48-P2P into your particular application.

For example, a device is configured to poll every 15s with 4 retry attempts. This will take 15s **plus** between about 5,000ms and 10,000ms (5-10 seconds) of retries (total time of 25s) before comms failure mode is declared.

This graph shows the expected time range (between the black lines of the graph) for a given number of retries.



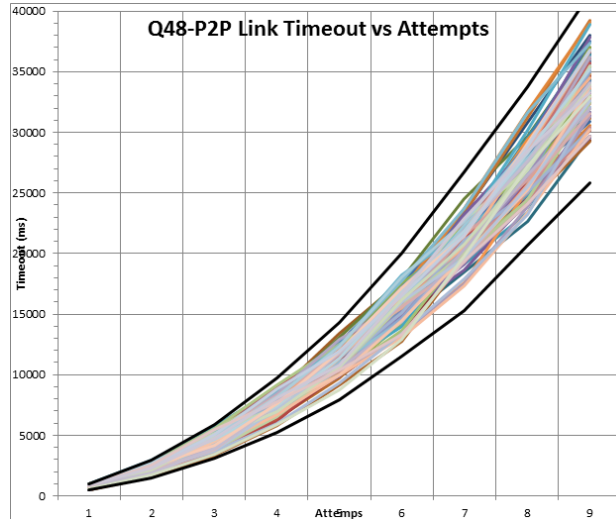


Figure 7 Link timeout delay

### Output Failsafe Settings

Using the default configuration, the Q48-P2P outputs remain in their last known state during a comms fail.

For example, if a Digital Output was on before the comms fail occurred, it will remain on during the comms fail.

Each device can be configured to place its outputs into a known condition if there is a communications failure.

QTech can be requested to set the outputs to “Failsafe mode”, which will turn the Digital Outputs off (open) and set the Analogue Outputs to the minimum allowable value for the duration of the communication failure.

If required, please discuss this with us prior to purchase of the Q48-P2P system.



**Note – The failsafe behaviour of the Q48-P2P is different to the QTech WP2P system.**

## Troubleshooting

Symptom	Possible Cause	Solution
The PWR LED does not light up when power is applied.	Blown fuse	Check power supply voltage is not greater than 30V DC and replace the internal fuse. Only use 2 Amp quick blow type. To access the fuse, disconnect the power supply connector and then carefully remove the top cover by prising it off its retaining dimples. Care must be taken with respect to the connection between the LED PCB in the cover and the motherboard.
	Insufficient power supply voltage	Check supply voltage is at least 12V DC and provide suitable power supply.
The ERR LED is blinking.	1 Blink	Contact QTech and report this.
	2 Blinks	
	3 Blinks	
The Coms LED is off.	The other Q48-P2P is not operating	Check that the other module is powered on and the OK LED is blinking.
	Insufficient radio signal strength	Install an antenna with more gain at one or both Q48-P2P modules.
A Digital Input LED does not turn on when the Input is activated.	Faulty relay contacts	Check that the device connected to the Digital Input makes a short between the input terminal and Ground when it activates.
	Input wiring fault	
A Digital Output does not turn on when it should.	Comms fault	Check that the Coms LED is on and resolve comms fault if needed.
	Digital Input fault at the other Q48-P2P	Check the Digital Input LED state is correct on the other Q48-P2P.
A Digital Output LED is on but the connected relay doesn't activate.	Output wiring fault	
	Relay coil fault	

## Technical Specifications

**Note.** Specifications are subject to change without notice.

### Q48-P2P Specification

Item	Parameter	Specification
<b>General</b>		
	Dimensions	Approx. 186 x 120 x 40 mm 4 x M4 fixing holes at 177 x 84mm centres
	Weight	650g
<b>Enclosure</b>		
	Material	Case: 1.5 mm mild steel
	Finish	Powder coated with front panel decal
<b>Environmental</b>		
	Temperature	Operating: 0-65 degrees C Storage 0-65 degrees C
	Humidity	0-90% non-condensing
	Ingress Protection	IP20, Water contact must be avoided
<b>Electrical</b>		
	Power	Input voltage: 12-24V DC +/- 5%, 30 V DC Max. Current: nominally 85mA @12V DC, 250mA Max (when specifying external PSU) 3 pin screw terminal Short circuit and reverse polarity protection
	Clock	Internal, battery-backed
	Storage	1MB – non-volatile event storage 8 kB – non-volatile configuration data
	Display	1 LED per digital and analogue input and output to indicate status 6 device and communications status LEDs
<b>Radio</b>		
	Regulatory	ISM Band, AS/NZS 4268:2008
	Antenna	Detachable SMA
	Operating Frequency	915 – 928 MHz
	Output power	1W (30 dBm) Max.
	Modulation	GFSK
<b>Interfaces</b>		
	Digital Inputs	8 signals, normally open close to activate, common ground Only mechanical switches should be connected to the inputs. No external voltage or other electrical source is to be connected. Max input frequency 2.5 Hz
	Digital Outputs	8 signals, solid state, active low output Can be connected to common +V rail Max load 26.5V DC, 1A per individual output 1.5A Max. total for multiple switched outputs
	Analogue Inputs	2 signals 4-20 mA current input style Optional 0-10V voltage style
	Analogue Outputs	2 signals 4-20 mA current output style Optional 0-10V voltage style
<b>Communications</b>		
	USB 2.00	Device management and configuration via QTech Workbench software

## Warranty

The hardware and software for this product is covered by the QTech Limited Warranty Agreement and software End User License Agreement, respectively.

Please refer to the QTech Limited Product Warranty Agreement, which may be downloaded from the QTech website: [www.qtech.co.nz](http://www.qtech.co.nz)

QTech Data Systems Limited does not warrant the suitability of this product for any particular application as the conditions in which it is used are beyond our control. This is not withstanding warranty of merchantability.

## Additional Information and Support

If you have problems try the following:

- Visit the QTech web site for application notes and guides
- Refer to the troubleshooting section if one is present in this document
- Contact the support desk at [support@qtech.co.nz](mailto:support@qtech.co.nz)
- Phone the support desk, contact details at beginning of this document



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