



Twin Link

Wireless Point-to-Point System

- › **Input Node (P2P-I)**
2x universal isolated inputs
- › **Output Node (P2P-O)**
2x 4-20mA isolated analog outputs
- › **Flexible IO on Input & Output Nodes**
4x digital inputs, 2x digital outputs, and 2x relay outputs
- › **Up to 15x Repeater Nodes (P2P-R)**
To extend the system's range



General Description

The Define Instruments Twin Link is capable of transferring signals wirelessly over distances of up to 0.9mi (1.5km) line of sight, providing sophisticated remote control without the need for expensive cabling.

The **Input** node has two universal isolated input channels, and accepts a range of inputs, including: TC and RTD, mA and V, NPN/PNP, Potentiometer, and AC current sensors. The **Output** node provides two 4-20mA isolated analog outputs for retransmission to PLCs and SCADA systems.

Both **Input** and **Output** Nodes also offer four digital IO's, and are easily programmable for mimicking, alarms, and sophisticated remote control of other equipment.



Setting up your Twin Link Point-to-Point system is fast and easy with Define ToolBox. The software provides simple but flexible drop-down selections, with all input ranges pre-calibrated for your convenience.

All functions and features are explained expertly in the dynamic sidebar help - perfect for the novice starting out, or the expert who wants to save commissioning time.

The Twin Link has been designed for harsh industrial environments, and has been extensively tested for noise effects to and beyond CE requirements.

1.1 - Quick start

p9

1 Set up using ToolBox



2 Output Node



3 Input Node



4 Check Link



5 Add Repeaters



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SAFETY NOTICES

For your safety and the prevention of damage to your P2P-I, P2P-O or P2P-R, as well as other equipment connected to these units, **please read and carefully observe all safety regulations and instructions**. Use of these instruments in a manner not specified by the manufacturer may compromise the protection provided by the instruments.

Define Instruments has not approved any change or modification to these devices by users. Any modification or change could void users' authority to operate this equipment. Please refer to CFR 47, Section 15.21.

These instruments should not be used to directly drive valves, motors, or other actuators, unless equipped with appropriate safeguards. It is the responsibility of the user to identify potential hazards that may arise in the event of a fault to unit, and implement safeguards for the prevention of harm to persons or equipment.



CAUTION

Risk of electric shock



CAUTION

Risk of danger

For your safety, please read complete instructions prior to installation and operation of a P2P node. In particular, consult this manual in all cases where hazard symbols are marked on your P2P-I, P2P-O or P2P-R units, in order to understand and avoid potential hazards. The safety of any system incorporating these units is the responsibility of the assembler of the system.



CAUTION

Observe minimum safe distance

Define Instruments P2P units comply with CFR 47, Section 1.1307(b)(1). For your safety, please observe a minimum safe distance of 8" (20cm).

1

SPECIFICATIONS

1.1 - Ordering Codes

P2P Nodes

P2P-TWIN-LINK	Point-to-Point paired I/O units (P2P-I + P2P-O)
P2P-R	Point-to-Point Repeater Node (up to 15/network)
P2P-I	Point-to-Point Universal Input Node* (1/network)
P2P-O	Point-to-Point Output Node* (1/network)

* Not sold separately, unless for replacement.

Accessories

WG-3DBI	Included	3DBi Monopole antenna (Range= 0.9mi [1.5km] LOS)
WG-8DBI*	Sold Separately	8DBi Monopole antenna (Range= 1.7mi [2.7km] LOS)
WG-AEC*	Sold Separately	Antenna extension cable, 0.98ft (30cm)
WG-PSU*	Sold Separately	Power adaptor for 9–36V DC supply
BRIDGE-KEY*	Sold Separately	USB Bridge Key for software programming

* Starred accessories are not FCC approved.

1.2 - General Specifications

Power

Power supply 9–36V DC, 2.5VA max

Isolation 1500V AC between power supply and input or output channels

Transmission

RF data rate 250Kb/s

RF frequency range 2405–2475MHz

RF transmission power +20dBm (10dBm selectable in software for regions with transmission power restrictions)

Transmission range Up to 0.9mi (1.5km) LOS with supplied antenna. All nodes must be set to full power [+20dBm] for max range.

RF receiver sensitivity -110dBm

Number of RF channels 15

Number of wireless nodes Up to 17 nodes per mesh (1x P2P-I, 1x P2P-O, 15x P2P-R)

Spreading method Direct sequence

Modulation O-QPSK

USB programming

Simple software programming

Connect using the Bridge Key (sold separately). Program using Define ToolBox.

Protocols Modbus RTU

Serial data rate 9600 baud, 8-N-1

Construction

DIN 35 rail mount casing

IP20 rated - Install in a protective enclosure (see 4.3). Installation Category II; Pollution Degree 2; Flame resistant

Dimensions (H x W x D)

3.98 x 0.91 x 4.72" (101 x 23 x 120mm)

Dimensions (H x W x D, with included antenna)

5.91 x 0.91 x 5.75" (150 x 23 x 146mm)

Single unit weight (with included antenna and plugs) P2P-I= 5.4oz (154g); P2P-O= 5.3oz (150g); P2P-R= 4.0oz (113g)

Environmental conditions

Operating temp -4 to 131°F (-20 to 55°C)

Storage temp -4 to 149°F (-20 to 65°C)

Operating humidity 0–85% non-condensing

Altitude 1.24mi (2,000m)

Compliances

IP20 enclosure rating

FCC ID: 2ACTT-1409

47 Code of Federal Regulations; Part 15 - Radio Frequency Devices; Subpart C - Intentional Radiators, including Section 15.247 - Operation in the band 2400–2483.5MHz

AS/ANS 4268:2012

Radio equipment and systems - Short range devices - Limits and methods of measurement

ETSI EN 300 440-2, V1.4.1, 2010

Electromagnetic compatibility and Radio spectrum matters (ERM); Short Range Devices (SRD); Radio equipment to be used in the 1GHz to 40GHz frequency range; Part 2: Harmonised EN under article 3.23 of the R&TTE Directive

EN 301 489-3, V1.6.1, 2013

Electromagnetic compatibility and Radio spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short Range Devices (SRD) operating on frequencies between 9kHz and 40GHz

1.3 - Input Node (P2P-I)

Inputs

2x Universal inputs See 9.3 for full input specifications and wiring

Digital IO's

4x Digital inputs Max rate 1Hz. Selectable sink/source. Suitable for clean contacts, NPN, PNP and voltage inputs (low input <1.4V DC, high input 1.4–30V DC)

Max continuous input 20V DC

Not isolated to power supply common

2x Digital outputs Open drain (1A, 30V DC max)

Relay Outputs

2x Relay outputs Form A relays (5A 250V AC / 5A 30V DC)

Isolation to sensor and user input commons 2,300Vrms for 1min. Working voltage 250V AC

Life expectancy 100K cycles min at full load rating

1.4 - Output Node (P2P-O)

Analog Outputs

2x Analog outputs Isolated 4–20mA or 20–4mA DC

Power supply Loop powered

Resolution 15 bits, 16000 steps

Loop drop 10V max

Linearity & repeatability 0.1% FSO max

Accuracy 0.1% FSO max

Ambient drift 50ppm/°C FSO max

Isolation to Digital IO GND 1,400Vrms for 1min. Working voltage 125V DC

Digital IO's

4x Digital inputs Max rate 1Hz. Selectable sink/source. Suitable for clean contacts, NPN, PNP and voltage inputs (low input <1.4V DC, high input 1.4–30V DC)

Max continuous input 20V DC

Not isolated to power supply common

2x Digital outputs Open drain (1A, 30V DC max)

Relay Outputs

2x Relay outputs Form A relays (5A 250V AC / 5A 30V DC)

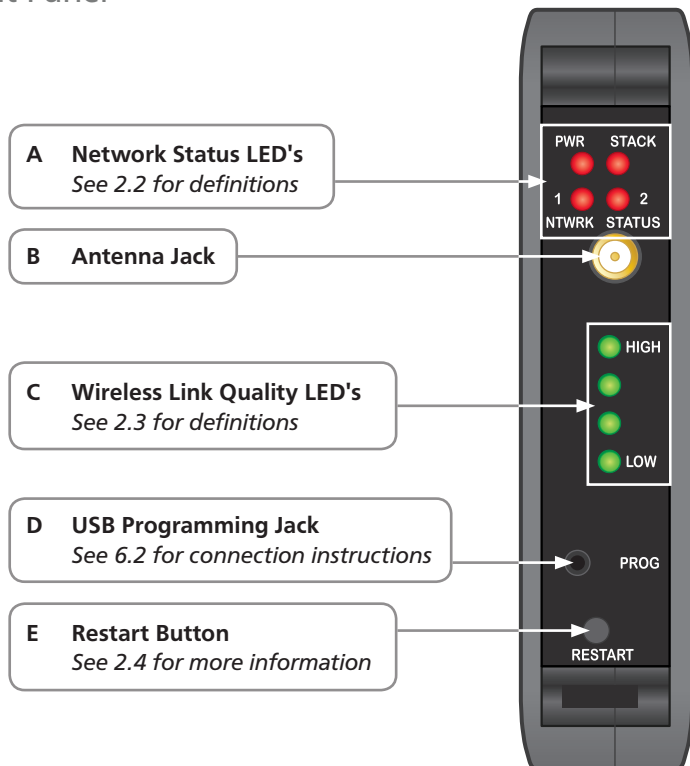
Isolation to sensor and user input commons 2,300Vrms for 1min. Working voltage 250V AC

Life expectancy 100K cycles min at full load rating

2

FRONT PANEL & LED'S

2.1 - Front Panel



2.2 - Network Status LED's

LED	State	Definition
PWR	On	Power supplied
STACK	Flashing	Node is transmitting or receiving
NTWRK STATUS 1	On	Output node is booting
	Flashing	Output node is searching for a network
NTWRK STATUS 2	On	Input node is booting
	Flashing	Input node is searching for a network

LED	State	Definition
NTWRK STATUS 1&2	Both On	Units not paired. Check that all P2P nodes are powered on and in range, and that line-of-sight is uninterrupted. (See 12.2 for Troubleshooting.)
	Both Flashing	P2P-I & P2P-R: Cannot connect to the network P2P-O: Max available nodes has been reached
	Toggling	Wireless network successfully established - ready to transmit or receive

2.3 - Wireless Link Quality LED's

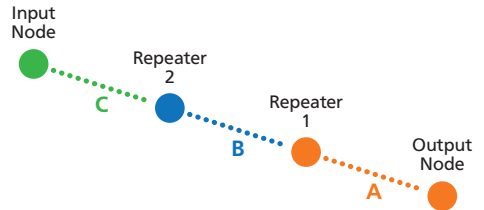
The green **Wireless Link Quality** LED's are used to indicate the quality of the wireless connection between nodes.

HIGH indicates 100% link quality, while **LOW** indicates approximately 80% link quality (i.e. 80% of the receiving packet intact.) For the most stable and reliable wireless connection, the link quality should be at **HIGH**, or as close to it as possible.

In a network with one or more **Repeaters**, each node indicates the link quality between itself, and the nearest node that it can reach in the direction of the **Output** node.

For example, in the network below:

- > **The Input node** indicates quality of link C
- > **Repeater 2** indicates the quality of link B
- > **Repeater 1** indicates the quality of link A
- > **The Output node** indicates the quality of link A



2.4 - Restart Button

The **Restart** button can be used to reboot the node in the event of a malfunction. (This action is the same as turning the power on and off again - all user settings will be retained.)

To prevent accidental use, the **Restart** button is inset and can only be pressed with a fine-tipped, blunt instrument, such as a pen or small screwdriver.

3

QUICK START



1 - Configure your system using ToolBox

The Twin Link is dispatched from the factory with the default input type of 4–20mA, and all Setpoints set to Transparent Mode (see 10.1). If you wish to keep the defaults, you can skip to Step 2 now. To change your input type, output scaling or setpoint configuration:

- A Install Define ToolBox (see Section 5).
- B Connect the **Input** node (P2P-I) to your computer using the USB Bridge Key (see 6.2). Then launch ToolBox and click the 'Connect' button (see 6.3).
- C Configure your system as required, referring to 6.3–6.5 in this manual, and also the Help Panel in the software. You may like to wire your **Input** and **Output** nodes now, using the diagrams in the Help Panel as a guide.
- D When you are finished configuring your system, click 'Disconnect' in ToolBox, and then disconnect the **Input** node from your PC.

Note that it is usually not necessary to connect the **Output** node or the **Repeater** to your PC, unless the Wireless Transmit Power or Mesh ID needs to be adjusted (see 6.5).

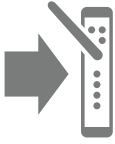


2 - Install Output node

If possible, your **Output** node (P2P-O) should be powered up first when setting up your Point-to-Point system.

- A Install the **Output** node (P2P-O) in an enclosure at the output location (see 4.3).
- B Supply power to the node (see 8.2).
- C Wait until the **NTWRK STATUS 1** and **NTWRK STATUS 2** LED's (2.1A) start toggling. This indicates that the network has been successfully created, and the unit is ready to connect to other nodes.
- D Wire your analog outputs (see 8.3). You may also wire your digital IO's and relays now, if desired (see Section 10).

The analog outputs will briefly output 3mA when the node is powered up or restarted. They will then output a 3.6mA fault signal until a successful link with an **Input** node (P2P-I) is established.



3 - Install Input node

- A Install the **Input** node (P2P-I) in an enclosure at the input location (see 4.3).
- B Supply power to the node (see 9.2).
- C Referring to 9.3A–9.3G, wire the two input channels as required for your application. You may also wire your digital IO's and relays now, if desired (see Section 10).

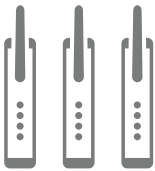


4 - Check connectivity

- A Please wait at least 2 minutes after powering up the **Input** node for the wireless connection to be made. When a link has been successfully established, the **NTWRK STATUS 1** and **NTWRK STATUS 2** LED's (2.1A) on the **Input** node will start toggling.

If the **NTWRK STATUS** LED's do not change from flashing to toggling, then a connection cannot be established, and one or more **Repeater** nodes may be needed (see Step 5, below).

- B Check the 4 green **Wireless Signal LED's** on the **Input** node (P2P-I), to establish link quality (see 2.3). If the link quality is low, then one or more **Repeater** nodes may be needed (see Step 5, below).



5 - Add Repeaters

If a successful link cannot be established between the Input and Output nodes, or the link quality is low, then one or more Repeater nodes can be added.

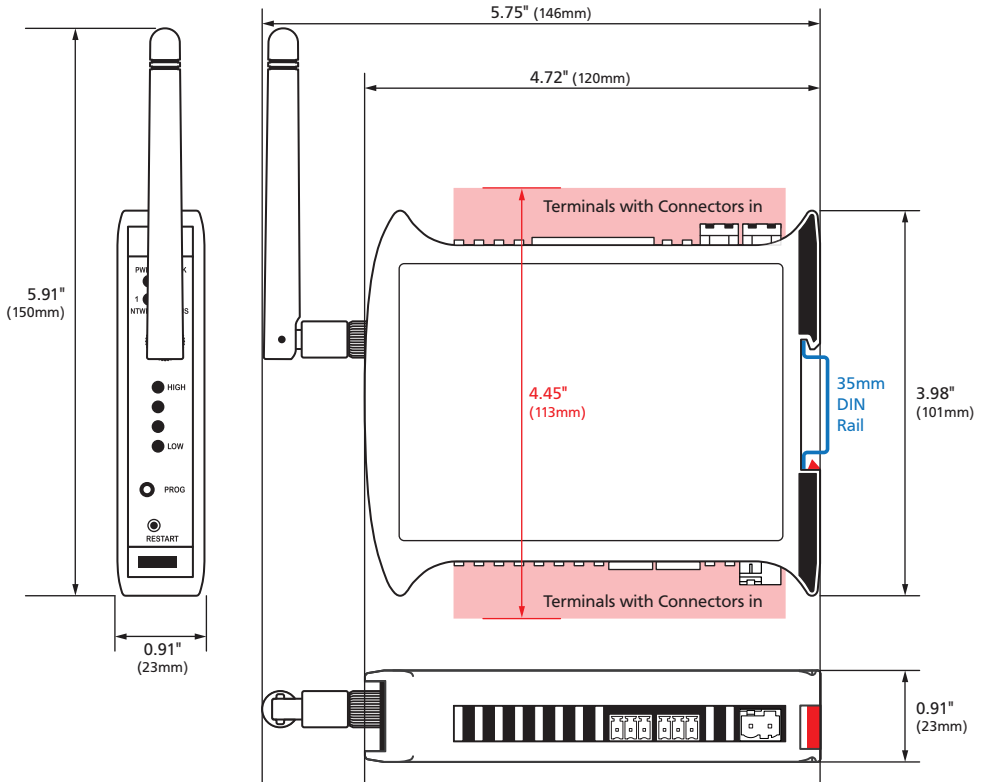
Note that for a successful wireless connection (using the included 3DBi antenna), all nodes must be within a range of 0.9mi (1.5km) LOS. If line of sight is impeded by buildings or topography, the transmission distance must be reduced until a strong signal can be obtained.

- A Install each **Repeater** (P2P-R) in an enclosure at a location that is in line of sight from any nodes it will communicate with (see 4.3).
- B Supply power to the node (see 11.2).
- C Provided the Mesh ID of the **Repeater** is a match to the **Input** and **Output** nodes, the **Repeater** will be automatically detected and included into the network. (See 11.3 for more about the Mesh ID).

4

HARDWARE INSTALLATION

4.1 - Case Diagram



4.2 - Installation Environment

Twin Link nodes should be installed in locations that do not exceed the maximum operating temperature, and at a safe distance from other devices that generate excessive heat. The installation environment should provide good air circulation to the unit.

The plastic casing and product label may be cleaned, if required, using a soft, damp cloth and neutral soap product.

Caution should be exercised when cleaning the unit to avoid water to dripping inside, as this will damage the internal circuits.

4.3 - Installation Instructions

Define Instruments P2P nodes are rated IP20. Nodes should be mounted in protective enclosures, to protect them from weather conditions and dust.

For a successful wireless link to be made, each P2P node must be located at a distance of no more than 0.9mi (1.5km) LOS from other nodes that it will communicate with. If using the WG-8DBI antenna, this distance may be increased to 4km (2.5mi) LOS.

A - Plastic Enclosure (Fig 1)

Prepare the **Plastic Enclosure** (not supplied) as illustrated by mounting a **DIN 35 rail**, cable glands, and any other required components. The antenna may be mounted directly on the P2P unit (inside the **Plastic Enclosure**).

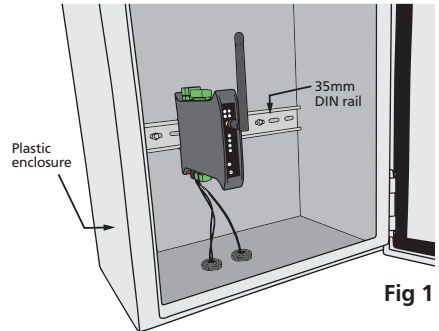


Fig 1

B - Metal Enclosure (Fig 2)

Prepare the **Metal Enclosure** (not supplied) as illustrated by mounting a **DIN 35 rail**, cable glands, and any other required components. *This enclosure type should be earthed.*

A **Metal Enclosure** will impede wireless signal strength if the antenna is mounted internally. In this case, the antenna must be installed on the outside of the enclosure, using the **WG-AEC Antenna Extension Cable** (sold separately).

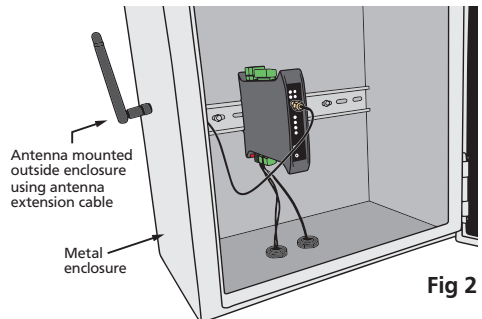


Fig 2

C - DIN Rail Mounting (Fig 3)

To clip the unit onto the DIN rail:

- (1) Hook the upper part of the unit onto the rail, and then
- (2) Press down towards the rail until the red hook clicks into place.

Leave at least 0.8" (2cm) clear on either side of the unit, and at least 2" (5cm) clear above and below the unit, to allow room for airflow and wiring.

D - Wiring

Refer to Sections 7–11 in this manual.

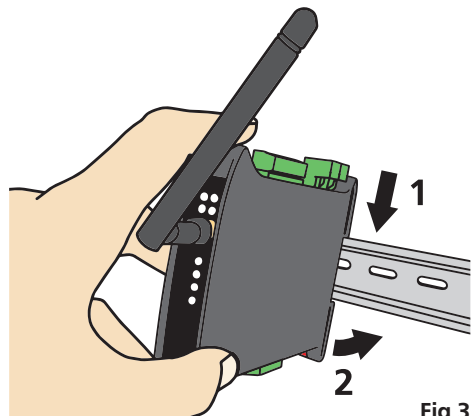


Fig 3

E - Removal from DIN Rail (Fig 4)

The unit may be unclipped from the DIN rail if required by inserting a small screwdriver into the slot on the red hook (just visible when the unit is mounted), and levering the red hook down.

This will release the hook, allowing the unit to be detached from the **DIN rail**.

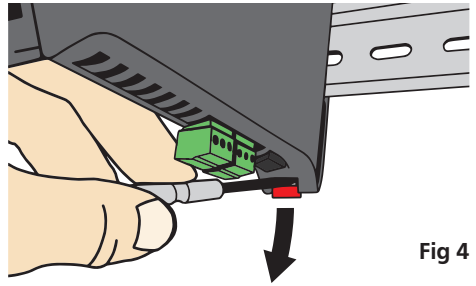


Fig 4

4.4 - EMC Installation Guidelines

All products in the P2P series have been designed to cope with large EMC disturbances. This has been achieved by continual testing and improvement of filtering and layout techniques over many years.

P2P nodes meet CE noise requirements, and even surpass them in many tests. (For full details and test results, see Appendix A.) However in some applications with less than optimum installations and large power switching, the EMC performance of a P2P node can be further improved, by:

- A** Installing the node in an earthed **Metal Enclosure** (see 4.3B). This is particularly useful if the control box is mounted close to large power switching devices like contactors. Every switching cycle there is a possibility of generating a large amount of near field radiated noise. The **Metal Enclosure**, acting as a faraday cage, will shunt this radiation to ground and away from the P2P node.
Further improvements can be made with this type of noise by increasing the physical distance from the power devices. For example, increasing the control box distance from 6" to 12" from the noise source will reduce the noise seen by the control box by a factor of 4. Probably the cheapest and best results in this

situation could be obtained by adding RC snubbers to the contactors or power switches.

- B** Using shielded cable on sensitive input and control signal lines. Good results can be obtained by grounding the shields to the metal enclosure close to the entry point. All cables act as aerials and pick up unwanted R.F. radiated signals and noise; the earthed shield acts as a faraday cage around the cables, shunting the unwanted energy to ground.
Shields can also help with capacitively coupled noise typically found in circumstances when signal cable is laid on top of noisy switching power cables. Of course in this case you are better off to keep separate signal and power lines.
- C** Laying cable on earthed cable trays can also help reduce noise seen by the P2P node. This is particularly useful if there are long cable runs, or the unit is close to radiating sources such as two way radios.
- D** The relay outputs of the P2P-I and P2P-O nodes have built in MOV's to help reduce EMI when switching inductive loads. EMI can further be reduced at the load by adding snubbers for AC signals or a flyback diode for DC coils.

5

SOFTWARE INSTALLATION

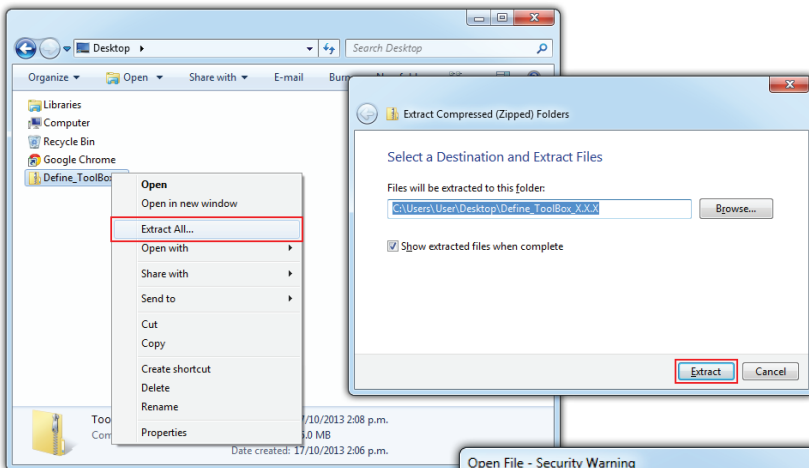
ToolBox offers a smart, no-fuss setup experience for your Twin Link Point-to-Point system, and has been designed to simplify and speed up configuration.

You must install ToolBox before connecting the Twin Link to your computer. If you have already connected your Input node using the Bridge Key, **please disconnect before continuing.**

- A** Download the latest version of ToolBox from **www.defineinstruments.com/toolbox**

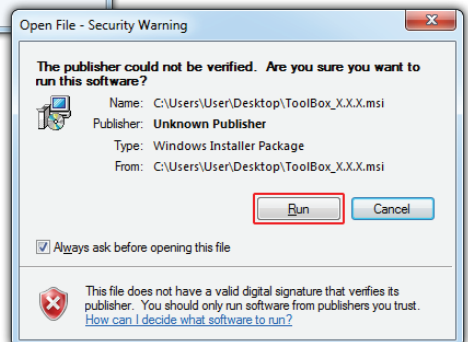
For ease of access, we recommend saving the install file on your desktop. If you cannot locate the install file, check whether your browser has saved it in your Downloads folder.

- B** Extract the install file from the zip folder. Right-click on the zip folder and choose 'Extract All', (or extract the file using another extraction utility of your choice).



- C** Double-click on the extracted .msi install file. This will launch the ToolBox installer.

Depending on your security settings, a 'Security Warning' dialogue may appear. If you see the security message, click 'Run'.

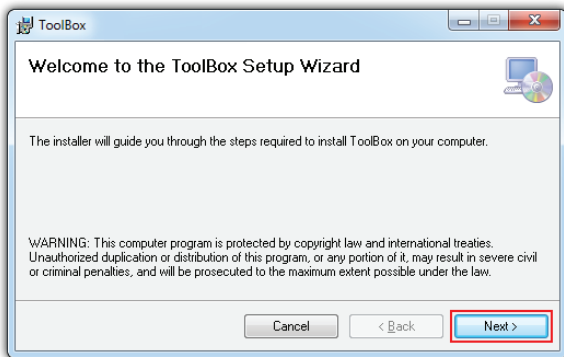


- D The ToolBox setup wizard will launch.

Click **'Next'** to get started.

- E The wizard will also ask for confirmation that you wish to begin the installation.

Click **'Next'** to continue.



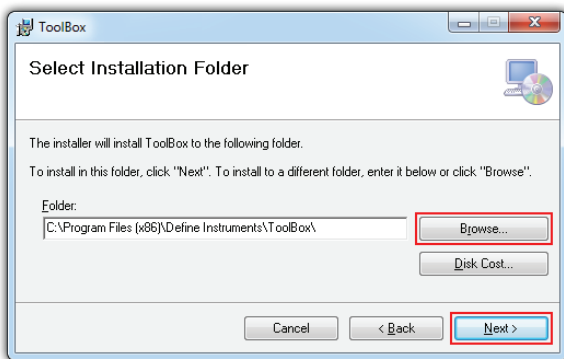
- F The wizard will prompt you to select an installation folder.

You may accept the default installation folder, or select an alternative location by clicking **'Browse'**.

Click **'Next'** to continue.

- G The install wizard will now install ToolBox.

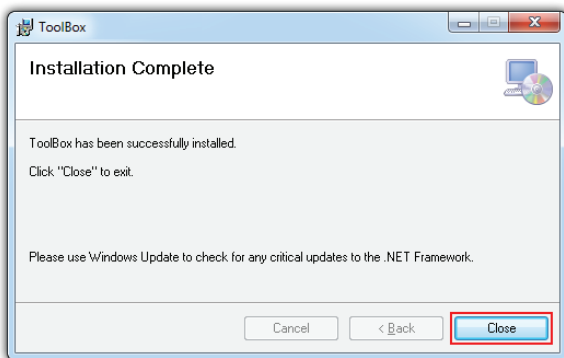
Please wait. This process usually takes 2-3 minutes, but may take longer in some situations.



- H When the installation has successfully completed, the following dialogue will appear. Click **'Close'** to exit.

The installer will place an icon on your desktop for easy access to ToolBox.

The downloaded **.zip** and **.msi** installer files are no longer needed, and may be deleted if desired.



6

SOFTWARE CONFIGURATION USING TOOLBOX

6.1 - Before You Start

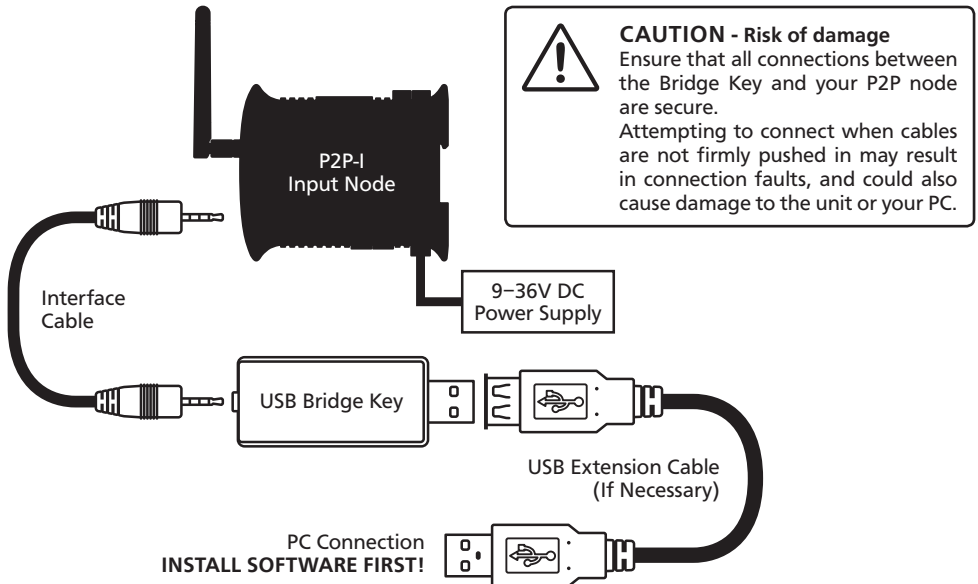
Software setup of your Twin Link network is facilitated through the **Input** node (P2P-I), and there is usually no need to connect your **Output** (P2P-O) or **Repeater** (P2P-R) to your computer:

Node to Connect to ToolBox		Configurable Options
Input Node	P2P-I	All input, output and setpoint settings Mesh ID & Wireless Transmit Power (see 6.5)
Output Node	P2P-O	Wireless Transmit Power ONLY (see 6.5)
Repeater Node	P2P-R	Mesh ID & Wireless Transmit Power ONLY (see 6.5)

Install the ToolBox software (see Section 5) before connecting the Input Node to your PC.

6.2 - Bridge Key

Connect the **Input Node** (P2P-I) to your computer's USB port using the Bridge Key, and supply power to the unit. The interface cable connects to the USB programming jack on the unit's front panel (see 2.1D). A USB extension cable is supplied for your use if required - this is often used for convenience in accessing USB ports located at the back of the computer.



6.3 - Using ToolBox

Define ToolBox enables full configuration of your Twin Link system. To set up your Point-to-Point network, **you only need to plug in the P2P-I**. Other nodes generally do not require software configuration (see 6.1).

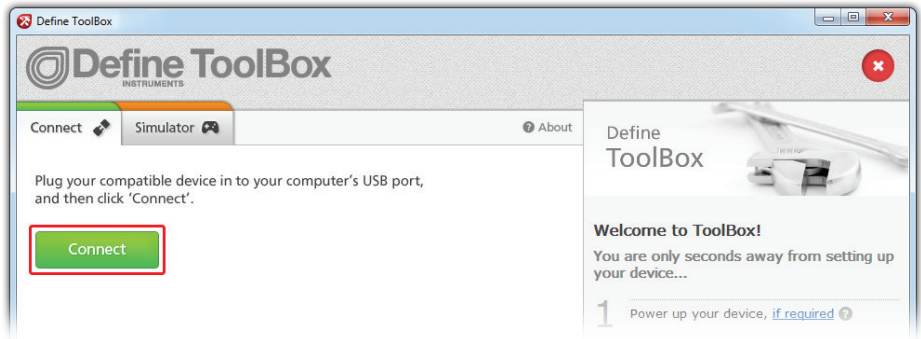


ToolBox features a **comprehensive help panel** that will guide you through the setup of your Twin Link. Helpful hints and explanations will appear when you adjust a setting using the ToolBox controls.

There are four main navigation pages/tabs:

- › **Overview:** General info about the connected node, Mesh ID and regional settings
- › **Input/Output:** Input mode/range, Scaling/offset, Retransmission scaling
- › **Setpoints:** Setpoint mode for digital IO's, including activation points and smart modes
- › **Advanced:** Load/save configuration, Create configuration certificate

- A** Connect the P2P-I to your computer using the Bridge Key as shown in 6.2.
Supply power to your P2P-I node as shown in 9.2.
- B** Double-click the ToolBox icon on your desktop to launch the ToolBox program.
- C** Click the green '**Connect**' button. This will scan your computer's Com ports and automatically connect to your device.



Connection problems?

ToolBox will auto-detect and connect to any connected P2P node when you click the '**Connect**' button. If you have problems establishing a connection, please check the following:

- › Ensure that all connections between the device and your computer are secure.
- › Ensure that 9–36V DC is being supplied to the connected node.
- › Try disconnecting and reconnecting the USB, or using a different USB port on your PC.
- › Disconnect any additional compatible devices. The software's auto-detect feature will not work if multiple compatible devices are connected to your computer at the same time.

6.4 - ToolBox Interface Overview

Main Navigation Tabs

Overview, Input/Output, Setpoints, and Advanced configuration pages.

Control Area

Main control area for configuring your system. Any changes made in this area will bring up the **Apply Bar** (see below)

Connection Panel

Disconnect button
Connection status

The screenshot shows the Define ToolBox interface with the following elements:

- Header:** Define ToolBox INSTRUMENTS logo and navigation tabs: Overview, Input/Output, Setpoints, Advanced, About.
- Left Panel:** A list of relays (R1, R2, DO3, DO4) with R1 selected.
- Control Area (Relay 1):**
 - Data Source: Input Channel 1
 - Mode: Control
 - Function: On/Off - Energised Below
 - On Value: 0.0
 - Off Value: 0.0
- Control Mode (Example) Diagram:**

A diagram illustrating the control mode. A Water Level Sensor is connected to a Universal Input Node. This node is connected to an Output Node, which controls a Switch Pump On & Off. A 'mimic' icon (two linked relays) indicates that the output node mimics the input node's state.
- Help Panel (Control Mode):**

Control Mode
In **Control Mode**, the four setpoints on the **Output Node** mimic (i.e. exactly copy) the four setpoints on the **Input Node**.

Setpoint mimicking is a powerful tool which easily enables control from a remote location. For example, a pump can be automatically controlled from the level measurement at a different site.

The two analogue input channels control the setpoints on the **Input Node**, which are then mimicked to the setpoints on the **Output Node**:

Analogue Input	Controls Input Node	Mimicked to Output Node
Analogue Input 1	Relay 1	Relay 1
Analogue Input 2	Relay 2	Relay 2
Analogue Input 3	Digital Output 3	Digital Output 3
Analogue Input 4	Digital Output 4	Digital Output 4

The **Digital Inputs** on the **Output Node** are disabled, and have no function.

Note that some **Control** modes require the use of two setpoints.
When two setpoints are being used together, the icon will appear between the two linked **Relays** or **Digital Outputs** in the setpoint selection menu.
- Apply Bar:** A green bar at the bottom of the control area with the text "Your configuration has unapplied changes" and an "Apply" button.
- Connection Panel:** Located in the top right, showing "Connected: COM3" with a green checkmark and a "Disconnect" button.

Apply Bar

Appears if you have made any changes in the **Control Area**. ToolBox will not allow you to browse to a new tab in the **Main Navigation** with unapplied changes to your configuration.

Help Panel

Diagrams, explanations, and helpful tips will automatically appear in this panel as you configure your unit.

6.5 - Mesh ID, Wireless Transmit Power

Mesh ID and **Wireless Transmit Power** are the only two settings that must be configured individually for each P2P node. Because of this, they are also the only settings that require you to connect to your **Output** node (P2P-O) or your **Repeater** (P2P-R) using the ToolBox software. (All other settings are configured by connecting the **Input** node [P2P-I].)

Mesh ID

Each P2P node has a **Mesh ID** code, which is printed on the product label. This 16-digit code is used to link the node to other nodes in the network.

The **Mesh ID** of the **Output** node is considered the 'parent' ID of the network, and cannot be edited.

The **Mesh ID** of the **Input** node is matched to the **Output** node by the manufacturer, prior to dispatch. In the event of a fault requiring replacement of one of the **Twin Link** nodes, the **Mesh ID** of the **Input** node may be edited. This can be done on the 'Overview' page in Define ToolBox.

The **Mesh ID** of any **Repeater** node(s) used must also match that of your **Twin Link**. Any **Repeater** nodes that you order with your **Twin Link** will be **Mesh ID** matched by your distributor, so there is usually no need to configure this setting.

If additional **Repeater** nodes are added at a later stage, then you may need to set them to match the **Mesh ID** of the **Twin Link** pair (see 11.3 for instructions).

A **Repeater** that has a clear line of sight to other in-range nodes, with a matched **Mesh ID**, will be automatically incorporated into the network.

Wireless Transmit Power

The **Wireless Transmit Power** setting offers a selectable list of regions. Selecting the region in which the P2P network will be used, will set the transmission power of the node to comply with local regulations.

Note that **each node in the system must be individually set for the correct region**, by connecting the node to Define ToolBox, selecting the region, and then clicking 'Apply'.

Region	Transmission Power	Complies With
New Zealand & Australia	+20dBm (100mW)	AS/NZS 4268:2012
USA	+20dBm (100mW)	FCC Part 15.247
South Africa	+10dBm (10mW)	ETSI EN 300 440-2
Europe	+10dBm (10mW)	ETSI EN 300 440-2



IMPORTANT

Regional regulations may have changed since manufacture of this product or publication of this manual. It is the responsibility of the assembler of the system to ensure that the system fully complies with all local codes and requirements.

7

WIRING GUIDELINES

Electrical connections are made via plug in terminal blocks on the top and bottom of P2P nodes. All conductors must conform to the unit's voltage and current ratings, and be suitably rated for the expected temperature range to be incurred.

When wiring your P2P nodes, check all connections against the terminal numbers printed on the label, and the appropriate wiring diagrams in this manual (Sections 8–11) or the Define ToolBox software.

Strip the wire, leaving around 0.25" (6mm) of bare lead exposed. If you are using stranded wire, this should be tinned with solder. Insert the lead into the correct plug in the correct position, and tighten until the wire is secure. Verify tightness by pulling on the wire.

Follow all local codes and regulations when wiring and installing your P2P node.

3.5mm Terminals

See 8.1B–C, 9.1B–C & 10.2E–F



The smaller 3.5mm terminals, (used for the channel inputs, analog output and Digital IO), are rated to accept one wire from #14 AWG (2.5mm) to #28 AWG. However it is possible to accept up to four #28 AWG wires.

5mm Terminals

See 8.1A, 9.1A, 10.2D & 11.2

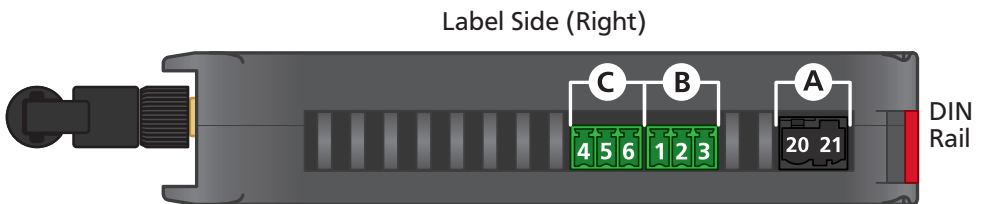


The larger 5mm terminals, (used for the power and relay outputs), are rated to accept one wire from #14 AWG (2.5mm) to #20 AWG. However it is also possible to accept two #18 AWG wires, or up to four #20 AWG wires.

8

OUTPUT WIRING

8.1 - P2P-O Bottom View



A Power supply
(9–36V DC)
(See 8.2, Pins 20–21)

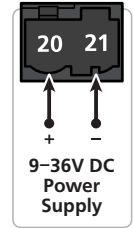
B Analog output
CH 1 (4–20mA)
(See 8.3, Pins 1–3)

C Analog output
CH 2 (4–20mA)
(See 8.3, Pins 4–6)

8.2 - Power Supply

See 8.1A, Pins 20–21

Supply 9–36V DC to the **Output** node (P2P-O) as shown (right).



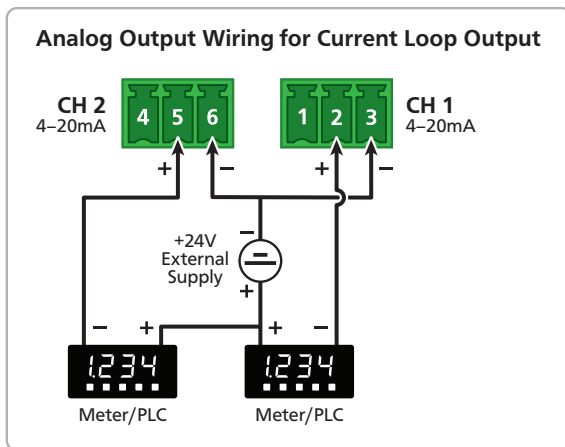
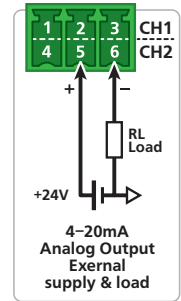
8.3 - Analog Output

See 8.1B, Pins 1–3 (CH1), and 8.1C, Pins 4–6 (CH2)

Wire your two analog output channels, referring to the diagrams in this section and the terminal numbers for each channel, as printed on the product label. (The diagram below gives a more detailed example of how to wire the two analog outputs for current loop output.)

The analog outputs will briefly output 3mA when the **Output** node (P2P-O) is powered up or restarted.

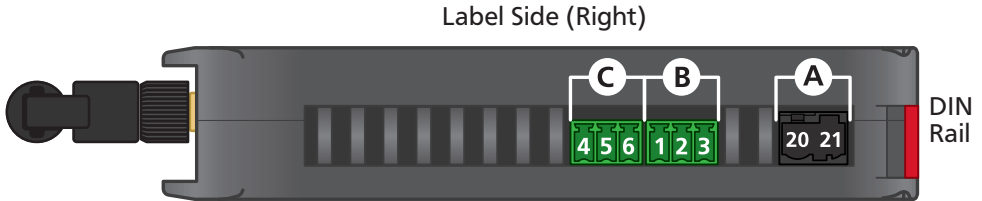
They will then output a 3.6mA fault signal until a successful link with an **Input** node (P2P-I) is established. The analog outputs can be scaled to suit your application using the ToolBox software connected to the **Input** node (P2P-I, see Section 6).



9

INPUT WIRING

9.1 - P2P-I Bottom View



A Power supply
(9–36V DC)
(See 9.2, Pins 20–21)

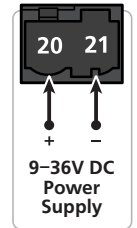
B Input CH 1
(See 9.3, Pins 1–3)

C Input CH 2
(See 9.3, Pins 4–6)

9.2 - Power Supply

See 9.1A, Pins 20–21

Supply 9–36V DC to the **Input** node (P2P-I) as shown (right).



9.3 - Input

See 9.1B, Pins 1–3 (CH1), and 9.1C, Pins 4–6 (CH2)

The P2P-I has two universal input channels which accept a wide range of input types. Input specifications and wiring for all available P2P-I input types can be found below (9.3A–9.3G).

**CAUTION**

Risk of electric shock. Dangerous and lethal voltages may be present on the terminals of the unit. Please take appropriate precautions to ensure safety.

**CAUTION**

Risk of danger. The sensor input can potentially float to dangerous and unexpected voltages depending on what external circuit it is connected to. Appropriate considerations must be given to the potential of the sensor input with respect to earth common.

9.3A - Thermocouple Input

Thermocouple types

B, E, J, K, N, R, S, T

Input impedance >500K Ω min

TC lead resistance 100 Ω max

Cold junction comp. -10 to 60°C

CJC drift <0.02°C/C typical for all inputs

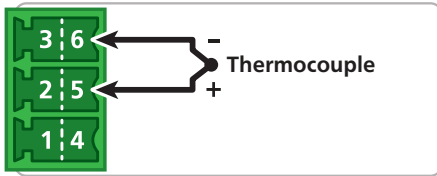
Sensor open Upscale

Accuracy 0.1% of FSO \pm 1°C typical

Temperature (thermocouple)

The thermocouple is one of the most common temperature sensors used in industry. It relies on the Seebeck coefficient between dissimilar metals.

The thermocouple type is selected with reference to the application temperature range and environment. The most common thermocouple types for general purpose applications are J and K type.



Supported thermocouple types/ranges

K	-328 to 2300°F	(-200 to 1260°C)
B	752 to 3272°F	(400 to 1800°C)
E	-328 to 1292°F	(-200 to 700°C)
J	-328 to 1832°F	(-200 to 1000°C)
R	32 to 3092°F	(0 to 1700°C)
S	32 to 3092°F	(0 to 1700°C)
T	-328 to 752°F	(-200 to 400°C)
N	-328 to 2372°F	(-200 to 1300°C)

9.3B - RTD Input

RTD types

Pt100 (3-wire RTD DIN 43760:1980) or Pt1000 (3-wire RTD standard)

Resolution for each calibrated range

-328–572°F (-200–300°C) = 0.02°F (0.01°C)

-328–1472°F (-200–800°C) = 0.1°F (0.1°C)

Sensor current 0.6mA continuous

Lead resistance 10 Ω /lead max recommended

Sensor fail Upscale

Accuracy

-328–572°F (-200–300°C) = \pm 0.1°C

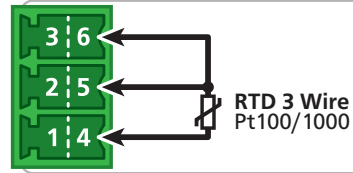
-328–1472°F (-200–800°C) = \pm 0.3°C

Ambient drift 0.003°C/C typical

Temperature (RTD)

The RTD (standing for Resistance Temperature Device) is highly stable and accurate, and is fast becoming the most popular temperature sensor in industry.

Often referred to as Pt100 and Pt1000, the Pt represents platinum (the dominant metal in its construction), and 100/1000 is the resistance in ohms at 0°C.



Supported RTD types/ranges

Pt100/	-328 to 572°F	(-200 to 300°C)
Pt1000	-328 to 1472°F	(-200 to 800°C)

9.3C - Current Input

Range 0/4–20mA

Input resistance 45Ω

Max over-range Protected by PTC to 24V DC

Linearity & repeatability 0.1% FSO max

Accuracy 0.1% FSO max

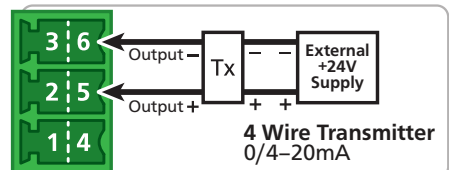
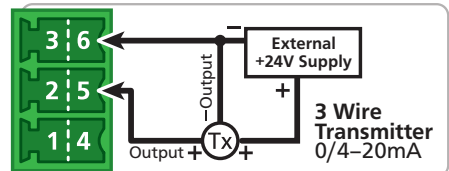
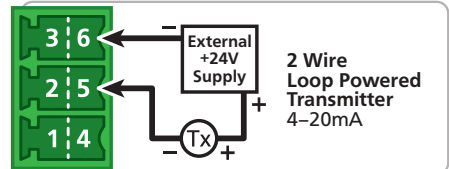
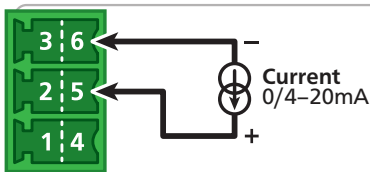
Channel separation 0.001% max

Ambient drift <50ppm/°C of FS input

Response 100msec

0/4–20mA DC

0/4–20mA DC is the most commonly used analog signal in industry, and is universally accepted. As a current loop, it is unaffected by voltage drops in cables, and can be transmitted over long distances without signal degradation.



9.3D - Voltage Input

Ranges $\pm 200\text{mV}$, -200mV to 1V ,
 $0-10\text{V}$, $0-18\text{V}$

Input impedance $>500\text{k}\Omega$ on all ranges

Maximum over-voltage 24V DC

Accuracy 0.1% FSO max

Linearity and repeatability

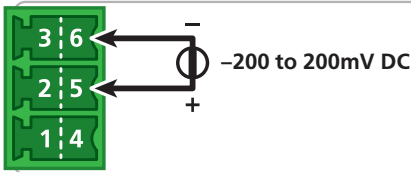
0.05% FSO max

Channel separation 0.001% max

Ambient drift $0.003\%/^{\circ}\text{C}$

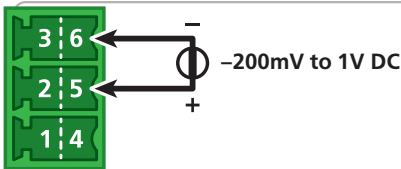
$\pm 200\text{mV DC}$

For low signal applications the P2P-I supports a $\pm 200\text{mV DC}$ range. Typical applications include measuring large DC currents using external current shunts.



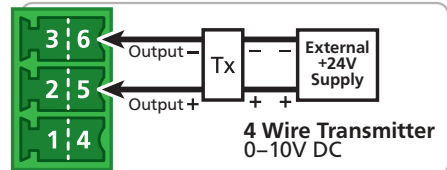
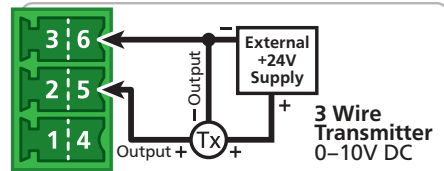
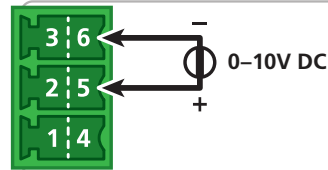
-200mV to 1V DC

A -200mV to 1V range is provided for interfacing to sensors and other electronic apparatus that provide this output.



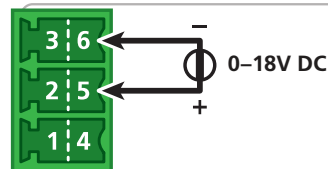
$0-10\text{V DC}$

$0-10\text{V DC}$ is a common process signal generated by transmitters, meters and PLCs. It would normally be scaled into engineering units by the P2P-I.



$0-18\text{V DC}$

This is a general purpose voltage measuring range, typically used to measure battery voltages, power supply outputs etc.



9.3E - Digital Pulse

Frequency range 0–2500Hz

Sensors Open collector (NPN, PNP)

Frequency resolution 0.1Hz

Software modes General frequency, Flow rate, or RPM

Accuracy $\pm 0.5\%$

General frequency mode

General Frequency mode allows an NPN or PNP input (up to 2.5KHz) to be measured and scaled to any engineering unit.

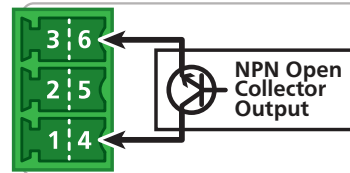
Flow rate mode

Flow Rate mode enables an input from an NPN or PNP paddle type flow meter to be converted to a flow rate. The input signal (up to 2.5KHz) is converted into a flow rate by programming the unit with the sensor manufacturer's K-factor value.

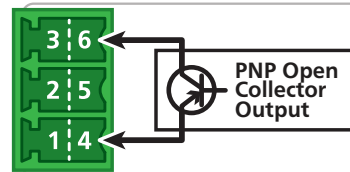
RPM mode

ToolBox RPM mode enables an input from an NPN or PNP proximity sensor to be converted to an RPM (Revs Per Minute) value. The input signal (up to 2.5KHz) is converted into RPM by programming the unit with the pulses per revolution value.

NPN open collector output



PNP open collector output



9.3F - Potentiometer Input

Potentiometer input 3-wire

Potentiometer resistance
Low range (<2K Ω) or High range (>2k Ω)

Excitation voltage Variable

Field programmable zero 0–90% of span

Field programmable span 0.1–100%

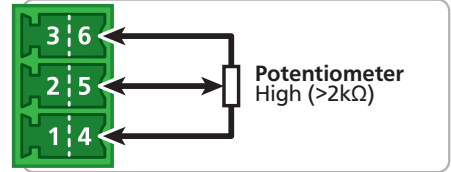
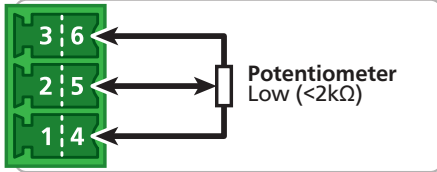
Linearity and repeatability
< $\pm 0.05\%$ FSO typical

Response time 100msec

Temperature drift <50ppm/ $^{\circ}\text{C}$

3 wire potentiometer

A 3 wire potentiometer is typically used to measure position. The low or high potentiometer range can be programmed to your unit using the ToolBox software. These ranges must be calibrated using the two point calibration method.



9.3G - AC Current Sensor

Sensor type Current transformer
ACCS-420, ACCS-420-L and ACCS-010

Header selectable amperage range
ACCS-420/010 = 100/150/200A
ACCS-420-L = 10/20/50A

Overload (continuous)
ACCS-420/010 = 175/300/400A respectively
ACCS-420-L = 80/120/200A respectively

Isolation voltage 2,000V

Accuracy 1% of full scale

Output (Representing 0–100% of full scale input range)

ACCS-420(-L) = 4–20mA DC loop powered
ACCS-010 = 0–10V DC

Power supply

ACCS-420(-L) = Loop powered, 15–36V DC
ACCS-010 = Self powered

Response time 250ms (10–90%)

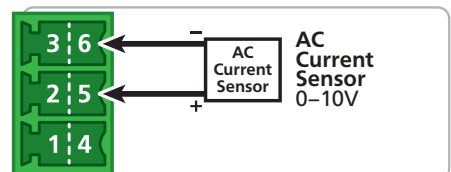
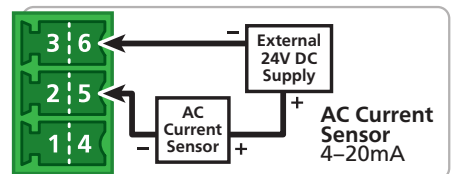
Frequency 50–60Hz

AC current sensors

The unit accepts input from a Define Instruments AC current sensor. Set the jumper on the top of the sensor to the desired current range, as shown (below).

ACCS Jump Ranges

010/420:	0–100A	0–150A	0–200A
420-L:	0–10A	0–20A	0–50A



10

DIGITAL I/O'S & RELAYS

10.1 - Overview

Each digital IO and relay output is mapped to a corresponding channel on the **opposite point**, depending on the **Setpoint Mode** selected during initial setup using Define ToolBox. There are three software modes that may be selected:

Transparent Mode

In **Transparent Mode**, each relay or digital output on the **Output** node is controlled by its corresponding digital input on the **Input** node, and vice versa.

This is ideal for the transfer of slow pulses through the air to PLC's and SCADA systems, or for manual remote control of appliances and machines.

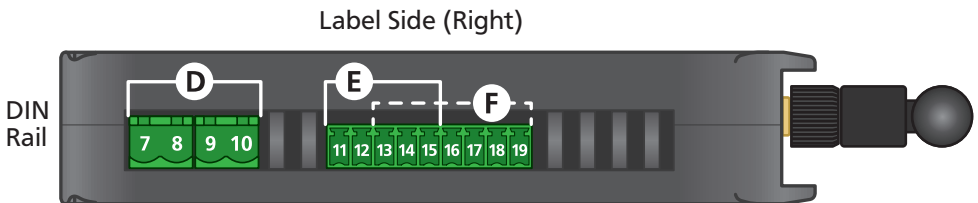
Alarm or Control Mode

Alarm Mode is ideal for tripping alarms or for alerting an operator to key system conditions. **Control Mode** is designed to control other equipment (such as turning pumps and heating units on and off).

In both **Alarm & Control** modes, the input channels control the relays and digital outputs on both the **Input** and the **Output** nodes.

It is recommended that you configure your setpoints in Define ToolBox (see Section 6) before continuing with wiring your digital IO's and relays. Once software setup is complete and you have decided exactly how each setpoint will be used, wire them as shown below, referring to the terminal numbers printed on the product label.

10.2 - P2P-I & P2P-O Top View



D Relay Outputs
(See 10.3, Pins 7–10)

E Digital Outputs
(See 10.4, Pins 11–12, 15)

F Digital Inputs
(See 10.5, Pins 13–19)

10.3 - Relay Outputs

See 10.2D, Pins 7–10

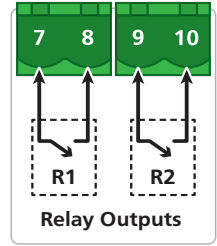
Wire your two relay output channels as shown (right), referring to the terminal numbers for each channel as printed on the product label.

In Transparent Mode:

- › R1 is controlled by DI1 of the opposite node.
- › R2 is controlled by DI2 of the opposite node.

In Alarm or Control Mode:

- › R1 and R2 are controlled by Input CH1, and mimicked from the Input node to the Output node.



10.4 - Digital Outputs

See 10.2E, Pins 11–12 & 15

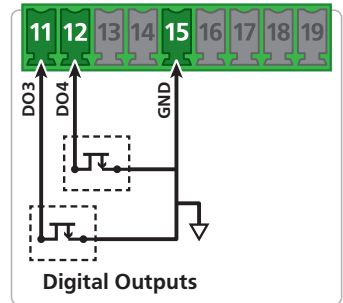
Wire your two digital output channels as shown (right), referring to the terminal numbers for each channel as printed on the product label.

In Transparent Mode:

- › DO3 is controlled by DI3 of the opposite node.
- › DO4 is controlled by DI4 of the opposite node.

In Alarm or Control Mode:

- › DO3 and DO4 are controlled by Input CH2, and mimicked from the Input node to the Output node.



10.5 - Digital Inputs

See 10.2F, Pins 13–19

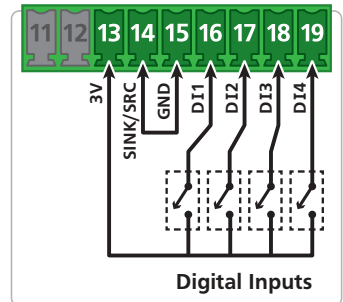
Wire your two digital output channels as shown (right), referring to the terminal numbers for each channel as printed on the product label.

In Transparent Mode:

- › DI1 controls R1 of the opposite node.
- › DI2 controls R2 of the opposite node.
- › DI3 controls DO3 of the opposite node.
- › DI4 controls DO3 of the opposite node.

In Alarm or Control Mode:

- › DI1–DI4 may be programmed for various other functions using ToolBox, but are not linked to any of the outputs.



11

REPEATER NODE

11.1 - Overview

The Point-to-Point **Repeater** is the perfect addition to a **Twin Link** system where the **Input** and **Output** nodes are out of range, or a line of sight connection is interrupted by buildings or hilly terrain. It works by retransmitting incoming signals from other nodes in the network, enabling you to boost your range and navigate around obstacles.

A **Repeater** will extend the range of your **Twin Link** by up to 0.9mi (1.5km) LOS using the supplied antenna. Add up to 15 repeaters in a single Point-to-Point system, and that's a wireless transmission distance of up to 14.9mi (24km).

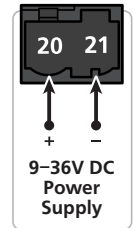
11.2 - Supply Power

Pins 20–21

Supply 9–36V DC to the **Repeater** node (P2P-R) as shown (right). The power terminal is located on the underside of the P2P-R, and is the only wiring terminal on the unit.

Wait up to two minutes, and then check the **NTWRK STATUS** LED's on the front of the **Repeater** unit. If the LED's start toggling, then the **Repeater** has successfully integrated with your **Twin Link**, and no further setup is required.

If the **NTWRK STATUS** LED's do not start toggling after waiting a few minutes, and you are sure that all P2P units are in range and line of sight, please see 11.3.



11.3 - Check the Mesh ID

Connections between P2P nodes are established using a **Mesh ID** code (see 6.5). If you ordered your **Repeater** with a **Twin Link**, then all of the **Mesh ID**'s should have been matched by your distributor, and it is not necessary to continue with 11.3.

If the **Mesh ID**'s are not yet matched, or you are having difficulty pairing a **Repeater** and would like to check the **Mesh ID**:

- A** Supply power to your **Repeater** (P2P-R), and then connect the node to your computer using the Bridge Key (see 6.2).
- B** Launch Define ToolBox and click 'Connect'.
- C** ToolBox will display the 'Overview' panel. Check the **Mesh ID** number against the number printed on your **Twin Link**. If required, edit the **Mesh ID** number and then click 'Apply'.
- D** Disconnect from ToolBox.
- E** Once the **Mesh ID**'s are matched, and all units in the system are in range and line of sight, the new node will be automatically included in the network.

12

MAINTENANCE

12.1 - Calibration

Your P2P units have been fully calibrated at the factory, and can be recalibrated in software using Define ToolBox (see 6.3 to connect). Scaling to convert the input signal to a desired display value is also done using ToolBox.

If your P2P unit appears to be behaving incorrectly or inaccurately, refer to troubleshooting before attempting to calibrate it. When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment.

Calibration does not change any user programmed parameters. However, it may affect the accuracy of the input signal values previously stored.

12.2 - Troubleshooting

Issue	Resolution
Input & Output nodes are not pairing	<p>Check that both nodes are powered up, in range, and line of sight.</p> <p>Check that the Mesh ID's printed on the labels are identical. If they are different, set the Mesh ID of the Input node to match the Output node, referring to 6.5.</p>
Repeater node(s) are not pairing	<p>Check that all nodes in the network are powered up, in range, and line of sight.</p> <p>If this is not the issue, then the Mesh ID of the Repeater needs to be set. Please see 11.3.</p>
Output node outputs 3mA continuously	<p>This is a fault signal, which indicates that the units are not paired. Check that all units are powered up, in range, and line of sight. You may need to add a Repeater node to achieve a wireless link (see 11.1).</p>
Output node outputs 3.6mA continuously	<p>This is a fault signal, which indicates that the network link has been broken. Check the power to the Input node, and check that the RF surrounding has not changed. If the quality of the wireless link is low (see 2.3), you may need to add a Repeater, use to a higher power antenna, or reposition your node(s).</p>

For further assistance, please contact technical support using the contact details listed at the end of this document.

A

APPENDIX A - EMC TEST RESULTS

Statement of compliance

The Define Instruments Point 2 Point (P2P) Remote Monitoring Transceiver complies with EN 301 489-3 V1.6.1–2013 when tested in accordance with EN 301 489-1 V1.9.2 2011 as a base station.

Results summary

The results from testing carried out in August 2014 are summarized in the following table.

Phenomena	Application	Results
Radiated emissions	Enclosure	Not applicable
Conducted emission	DC Power input/output ports	Complies
Conducted emission	AC Mains input/output ports	Not applicable <i>DC supply cable will not exceed 3 metres in length</i>
Harmonic current emissions	AC Mains input/output ports	Not applicable <i>DC powered device</i>
Voltage fluctuations & flicker	AC Mains input port	Not applicable <i>DC powered device</i>
Conducted emissions	Telecom port	Not applicable <i>Device does not have a telecom port</i>
RF Electromagnetic field 80–2700MHz	Enclosure	Complies
Electrostatic discharge	Enclosure	Complies
Fast transients, common mode	Signal, telecom & control ports, DC & AC power ports	Complies
RF Common mode 0.15–80MHz	Signal, telecom & control ports, DC & AC power ports	Complies
Transients & surges	DC Power input ports	Not applicable <i>Device is not used in a vehicle</i>
Voltage dips & interruptions	AC Mains power input ports	Not applicable <i>DC powered device</i>
Surges common & differential mode	AC Mains power input & telecom ports	Not applicable <i>DC powered device with no telecom port</i>

B**APPENDIX B - WARRANTY**

Warranty

Define Instruments warrants that its products are free from defects in material and workmanship under normal use and service for a period of one year from date of shipment.

Define Instruments's obligations under this warranty are limited to replacement or repair, at its option, at its factory, of any of the products which shall, within the applicable period after shipment, be returned to Define Instruments's facility, transportation charges pre-paid, and which are, after examination, disclosed to the satisfaction of Define Instruments to be thus defective.

The warranty shall not apply to any equipment which shall have been repaired or altered, except by Define Instruments, or which shall have been subjected to misuse, negligence or accident.

In no case shall Define Instruments's liability exceed the original purchase price. The aforementioned provisions do not extend the original warranty period of any product which has been either repaired or replaced by Define Instruments.

User's Responsibility

We are pleased to offer suggestions on the use of our various products, by way of print-matter, on our website, or through direct contact with our sales/application engineering staff.

However, since we have no control over the use of our products once they are shipped, **NO WARRANTY, WHETHER OF MERCHANTABILITY, FITNESS FOR PURPOSE OR OTHERWISE** is made beyond repair, replacement, or refund of purchase price at the sole discretion of Define Instruments.

Users shall determine the suitability of the product for the intended application before

using, and the users assume all risk and liability whatsoever in connection therewith, regardless of any of our suggestions or statements as to application or construction.

In no event shall Define Instruments's liability, in law or otherwise, be in excess of the purchase price of the product.

Define Instruments cannot assume responsibility for any circuitry described. No circuit patent or software licenses are implied. Define Instruments reserves the right to change circuitry, operating software, specifications, and prices without notice at any time.



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