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**

1. **Set up using ToolBox**
2. **Output Node**
3. **Input Node**
4. **Check Link**
5. **Add Repeaters**
## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contents</td>
<td>2</td>
</tr>
<tr>
<td>Safety Notices</td>
<td>3</td>
</tr>
<tr>
<td>1 - Specifications</td>
<td>4</td>
</tr>
<tr>
<td>1.1 - Ordering Codes</td>
<td>4</td>
</tr>
<tr>
<td>1.2 - General Specifications</td>
<td>4</td>
</tr>
<tr>
<td>1.3 - Input Node (P2P-I)</td>
<td>5</td>
</tr>
<tr>
<td>1.4 - Output Node (P2P-O)</td>
<td>6</td>
</tr>
<tr>
<td>2 - Front Panel &amp; LED’s</td>
<td>7</td>
</tr>
<tr>
<td>2.1 - Front Panel</td>
<td>7</td>
</tr>
<tr>
<td>2.2 - Network Status LED’s</td>
<td>7</td>
</tr>
<tr>
<td>2.3 - Wireless Link Quality LED’s</td>
<td>8</td>
</tr>
<tr>
<td>2.4 - Restart Button</td>
<td>8</td>
</tr>
<tr>
<td>3 - Quick Start</td>
<td>9</td>
</tr>
<tr>
<td>4 - Hardware Installation</td>
<td>11</td>
</tr>
<tr>
<td>4.1 - Case Diagram</td>
<td>11</td>
</tr>
<tr>
<td>4.2 - Installation Environment</td>
<td>11</td>
</tr>
<tr>
<td>4.3 - Installation Instructions</td>
<td>12</td>
</tr>
<tr>
<td>4.4 - EMC Installation Guidelines</td>
<td>13</td>
</tr>
<tr>
<td>5 - Software Installation</td>
<td>14</td>
</tr>
<tr>
<td>6 - Software Configuration Using ToolBox</td>
<td>16</td>
</tr>
<tr>
<td>6.1 - Before You Start</td>
<td>16</td>
</tr>
<tr>
<td>6.2 - Bridge Key</td>
<td>16</td>
</tr>
<tr>
<td>6.3 - Using ToolBox</td>
<td>17</td>
</tr>
<tr>
<td>6.4 - ToolBox Interface Overview</td>
<td>18</td>
</tr>
<tr>
<td>6.5 - Mesh ID, Wireless Transmit Power</td>
<td>19</td>
</tr>
<tr>
<td>7 - Wiring Guidelines</td>
<td>20</td>
</tr>
<tr>
<td>8 - Output Wiring</td>
<td>20</td>
</tr>
<tr>
<td>8.1 - P2P-O Bottom View</td>
<td>20</td>
</tr>
<tr>
<td>8.2 - Power Supply</td>
<td>21</td>
</tr>
<tr>
<td>8.3 - Analog Output</td>
<td>21</td>
</tr>
<tr>
<td>9 - Input Wiring</td>
<td>22</td>
</tr>
<tr>
<td>9.1 - P2P-I Bottom View</td>
<td>22</td>
</tr>
<tr>
<td>9.2 - Power Supply</td>
<td>22</td>
</tr>
<tr>
<td>9.3 - Input</td>
<td>22</td>
</tr>
<tr>
<td>9.3A - Thermocouple Input</td>
<td>23</td>
</tr>
<tr>
<td>9.3B - RTD Input</td>
<td>23</td>
</tr>
<tr>
<td>9.3C - Current Input</td>
<td>24</td>
</tr>
<tr>
<td>9.3D - Voltage Input</td>
<td>25</td>
</tr>
<tr>
<td>9.3E - Digital Pulse</td>
<td>26</td>
</tr>
<tr>
<td>9.3F - Potentiometer Input</td>
<td>26</td>
</tr>
<tr>
<td>9.3G - AC Current Sensor</td>
<td>27</td>
</tr>
<tr>
<td>10 - Digital I/O’s &amp; Relays</td>
<td>28</td>
</tr>
<tr>
<td>10.1 - Overview</td>
<td>28</td>
</tr>
<tr>
<td>10.2 - P2P-I &amp; P2P-O Top View</td>
<td>28</td>
</tr>
<tr>
<td>10.3 - Relay Outputs</td>
<td>29</td>
</tr>
<tr>
<td>10.4 - Digital Outputs</td>
<td>29</td>
</tr>
<tr>
<td>10.5 - Digital Inputs</td>
<td>29</td>
</tr>
<tr>
<td>11 - Repeater Node</td>
<td>30</td>
</tr>
<tr>
<td>11.1 - Overview</td>
<td>30</td>
</tr>
<tr>
<td>11.2 - Supply Power</td>
<td>30</td>
</tr>
<tr>
<td>11.3 - Check the Mesh ID</td>
<td>30</td>
</tr>
<tr>
<td>12 - Maintenance</td>
<td>31</td>
</tr>
<tr>
<td>12.1 - Calibration</td>
<td>31</td>
</tr>
<tr>
<td>12.2 - Troubleshooting</td>
<td>31</td>
</tr>
<tr>
<td>Appendix A - EMC Test Results</td>
<td>32</td>
</tr>
<tr>
<td>Appendix B - Warranty</td>
<td>33</td>
</tr>
</tbody>
</table>
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).
1.1 - Ordering Codes

**P2P Nodes**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2P-TWIN-LINK</td>
<td>Point-to-Point paired I/O units (P2P-I + P2P-O)</td>
</tr>
<tr>
<td>P2P-R</td>
<td>Point-to-Point Repeater Node (up to 15/network)</td>
</tr>
<tr>
<td>P2P-I</td>
<td>Point-to-Point Universal Input Node* (1/network)</td>
</tr>
<tr>
<td>P2P-O</td>
<td>Point-to-Point Output Node* (1/network)</td>
</tr>
</tbody>
</table>

*Not sold separately, unless for replacement.*

**Accessories**

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

*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)

Complies

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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2x Analog outputs</strong></td>
<td>Isolated 4–20mA or 20–4mA DC</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>Loop powered</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>15 bits, 16000 steps</td>
</tr>
<tr>
<td><strong>Loop drop</strong></td>
<td>10V max</td>
</tr>
<tr>
<td><strong>Linearity &amp; repeatability</strong></td>
<td>0.1% FSO max</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>0.1% FSO max</td>
</tr>
<tr>
<td><strong>Ambient drift</strong></td>
<td>50ppm/°C FSO max</td>
</tr>
<tr>
<td><strong>Isolation to Digital IO GND</strong></td>
<td>1,400Vrms for 1min. Working voltage 125V DC</td>
</tr>
</tbody>
</table>

## Digital IO's

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4x Digital inputs</strong></td>
<td>Max rate 1Hz. Selectable sink/source. Suitable for clean contacts, NPN, PNP and voltage inputs (low input &lt;1.4V DC, high input 1.4–30V DC)</td>
</tr>
<tr>
<td><strong>Max continuous input</strong></td>
<td>20V DC</td>
</tr>
<tr>
<td><strong>Not isolated to power supply common</strong></td>
<td></td>
</tr>
<tr>
<td><strong>2x Digital outputs</strong></td>
<td>Open drain (1A, 30V DC max)</td>
</tr>
</tbody>
</table>

## Relay Outputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2x Relay outputs</strong></td>
<td>Form A relays (5A 250V AC / 5A 30V DC)</td>
</tr>
<tr>
<td><strong>Isolation to sensor and user input commons</strong></td>
<td>2,300Vrms for 1min. Working voltage 250V AC</td>
</tr>
<tr>
<td><strong>Life expectancy</strong></td>
<td>100K cycles min at full load rating</td>
</tr>
</tbody>
</table>
2.1 - Front Panel

A Network Status LED's  
See 2.2 for definitions

B Antenna Jack

C Wireless Link Quality LED's  
See 2.3 for definitions

D USB Programming Jack  
See 6.2 for connection instructions

E Restart Button  
See 2.4 for more information

2.2 - Network Status LED's

<table>
<thead>
<tr>
<th>LED</th>
<th>State</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR</td>
<td>On</td>
<td>Power supplied</td>
</tr>
<tr>
<td>STACK</td>
<td>Flashing</td>
<td>Node is transmitting or receiving</td>
</tr>
<tr>
<td>NTWRK STATUS 1</td>
<td>On</td>
<td>Output node is booting</td>
</tr>
<tr>
<td></td>
<td>Flashing</td>
<td>Output node is searching for a network</td>
</tr>
<tr>
<td>NTWRK STATUS 2</td>
<td>On</td>
<td>Input node is booting</td>
</tr>
<tr>
<td></td>
<td>Flashing</td>
<td>Input node is searching for a network</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>LED</th>
<th>State</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>NTWRK STATUS 1&amp;2</td>
<td>Both On</td>
<td>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.)</td>
</tr>
<tr>
<td></td>
<td>Both Flashing</td>
<td>P2P-I &amp; P2P-R: Cannot connect to the network. P2P-O: Max available nodes has been reached</td>
</tr>
<tr>
<td></td>
<td>Toggling</td>
<td>Wireless network successfully established - ready to transmit or receive</td>
</tr>
</tbody>
</table>

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).
4.1 - 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).

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).

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.
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.

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
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.
6.1 - 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:

<table>
<thead>
<tr>
<th>Node to Connect to ToolBox</th>
<th>Configurable Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Node P2P-I</td>
<td>All input, output and setpoint settings</td>
</tr>
<tr>
<td></td>
<td>Mesh ID &amp; Wireless Transmit Power (see 6.5)</td>
</tr>
<tr>
<td>Output Node P2P-O</td>
<td>Wireless Transmit Power ONLY (see 6.5)</td>
</tr>
<tr>
<td>Repeater Node P2P-R</td>
<td>Mesh ID &amp; Wireless Transmit Power ONLY (see 6.5)</td>
</tr>
</tbody>
</table>

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.

**CAUTION - Risk of damage**

Ensure that all connections between the Bridge Key and your P2P node are secure. Attempting to connect when cables are not firmly pushed in may result in connection faults, and could also cause damage to the unit or your PC.
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

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.

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.

<table>
<thead>
<tr>
<th>Region</th>
<th>Transmission Power</th>
<th>Complies With</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Zealand &amp; Australia</td>
<td>+20dBm (100mW)</td>
<td>AS/NZS 4268:2012</td>
</tr>
<tr>
<td>USA</td>
<td>+20dBm (100mW)</td>
<td>FCC Part 15.247</td>
</tr>
<tr>
<td>South Africa</td>
<td>+10dBm (10mW)</td>
<td>ETSI EN 300 440-2</td>
</tr>
<tr>
<td>Europe</td>
<td>+10dBm (10mW)</td>
<td>ETSI EN 300 440-2</td>
</tr>
</tbody>
</table>

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'.

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.
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

Label Side (Right)

<table>
<thead>
<tr>
<th>A</th>
<th>Power supply (9–36V DC)</th>
<th>B</th>
<th>Analog output CH 1 (4–20mA)</th>
<th>C</th>
<th>Analog output CH 2 (4–20mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(See 8.2, Pins 20–21)</td>
<td></td>
<td>(See 8.3, Pins 1–3)</td>
<td></td>
<td>(See 8.3, Pins 4–6)</td>
</tr>
</tbody>
</table>
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

Label Side (Right)

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** >500KΩ min

**TC lead resistance** 100Ω 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±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

<table>
<thead>
<tr>
<th>Type</th>
<th>Range (°F)</th>
<th>Range (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>-328 to 2300°F (-200 to 1260°C)</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>752 to 3272°F (400 to 1800°C)</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>-328 to 1292°F (-200 to 700°C)</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>-328 to 1832°F (-200 to 1000°C)</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>32 to 3092°F (0 to 1700°C)</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>32 to 3092°F (0 to 1700°C)</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>-328 to 752°F (-200 to 400°C)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>-328 to 2372°F (-200 to 1300°C)</td>
<td></td>
</tr>
</tbody>
</table>

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** 10Ω/lead max recommended

**Sensor fail** Upscale

**Accuracy**
-328–572°F (-200–300°C) = ±0.1°C
-328–1472°F (-200–800°C) = ±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

<table>
<thead>
<tr>
<th>RTD Type</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt100/ Pt1000</td>
<td>-328 to 572°F (-200 to 300°C)</td>
</tr>
<tr>
<td></td>
<td>-328 to 1472°F (-200 to 800°C)</td>
</tr>
</tbody>
</table>

9.3C - Current Input

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0/4–20mA</td>
</tr>
<tr>
<td>Input resistance</td>
<td>45Ω</td>
</tr>
<tr>
<td>Max over-range</td>
<td>Protected by PTC to 24V DC</td>
</tr>
<tr>
<td>Linearity &amp; repeatability</td>
<td>0.1% FSO max</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.1% FSO max</td>
</tr>
<tr>
<td>Channel separation</td>
<td>0.001% max</td>
</tr>
<tr>
<td>Ambient drift</td>
<td>&lt;50ppm/°C of FS input</td>
</tr>
<tr>
<td>Response</td>
<td>100msec</td>
</tr>
</tbody>
</table>

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 ±200mV, –200mV to 1V, 0–10V, 0–18V

Input impedance >500KΩ 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%/°C

±200mV DC

For low signal applications the P2P-I supports a ±200mV 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.

0–10V DC

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

0–18V DC

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

9.3F - Potentiometer Input

<table>
<thead>
<tr>
<th>Potentiometer input</th>
<th>3-wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potentiometer resistance</td>
<td>Low range (&lt;2KΩ) or High range (&gt;2kΩ)</td>
</tr>
<tr>
<td>Excitation voltage</td>
<td>Variable</td>
</tr>
<tr>
<td>Field programmable zero</td>
<td>0–90% of span</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field programmable span</th>
<th>0.1–100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linearity and repeatability</td>
<td>±0.05% FSO typical</td>
</tr>
<tr>
<td>Response time</td>
<td>100msec</td>
</tr>
<tr>
<td>Temperature drift</td>
<td>&lt;50ppm/°C</td>
</tr>
</tbody>
</table>
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.

![Potentiometer Example](image)

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**

<table>
<thead>
<tr>
<th>ACCS Jump Ranges</th>
<th>010/420:</th>
<th>420-L:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0–100A</td>
<td>0–10A</td>
</tr>
<tr>
<td></td>
<td>0–150A</td>
<td>0–20A</td>
</tr>
<tr>
<td></td>
<td>0–200A</td>
<td>0–50A</td>
</tr>
</tbody>
</table>

![AC Current Sensor Jumper Example](image)
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

<table>
<thead>
<tr>
<th>Label Side (Right)</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN Rail</td>
<td>Relay Outputs</td>
<td>Digital Outputs</td>
<td>Digital Inputs</td>
</tr>
<tr>
<td>(See 10.3, Pins 7–10)</td>
<td>(See 10.4, Pins 11–12, 15)</td>
<td>(See 10.5, Pins 13–19)</td>
<td></td>
</tr>
</tbody>
</table>

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)  

Copyright © 2017 Define Instruments
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.
11.1 - 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

<table>
<thead>
<tr>
<th>Issue</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input &amp; Output nodes are not pairing</td>
<td>Check that both nodes are powered up, in range, and line of sight. 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.</td>
</tr>
<tr>
<td>Repeater node(s) are not pairing</td>
<td>Check that all nodes in the network are powered up, in range, and line of sight. If this is not the issue, then the Mesh ID of the Repeater needs to be set. Please see 11.3.</td>
</tr>
<tr>
<td>Output node outputs 3mA continuously</td>
<td>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).</td>
</tr>
<tr>
<td>Output node outputs 3.6mA continuously</td>
<td>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).</td>
</tr>
</tbody>
</table>

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.

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