



AdvanceGuard

Hardware Installation Guide

Document version 1.2e

Contents

2 Welcome

- 2 Essential items
- 3 Parts

4 Creating an installation

- 4 Mounting a radar sensor
- 4 Mounting the enclosure and power supply
- 5 Levelling a sensor
- 7 Connecting a radar sensor
- 8 Connecting other items
- 8 Connecting cameras
- 9 Connecting trigger inputs and alarm outputs

10 Confirming sensor operation

- 10 Preparing your computer
- 10 Connecting your computer
- 11 Testing a sensor

15 Appendices

- 15 Appendix 1 - FAQ
- 16 Appendix 2 - Radio frequency energy statement

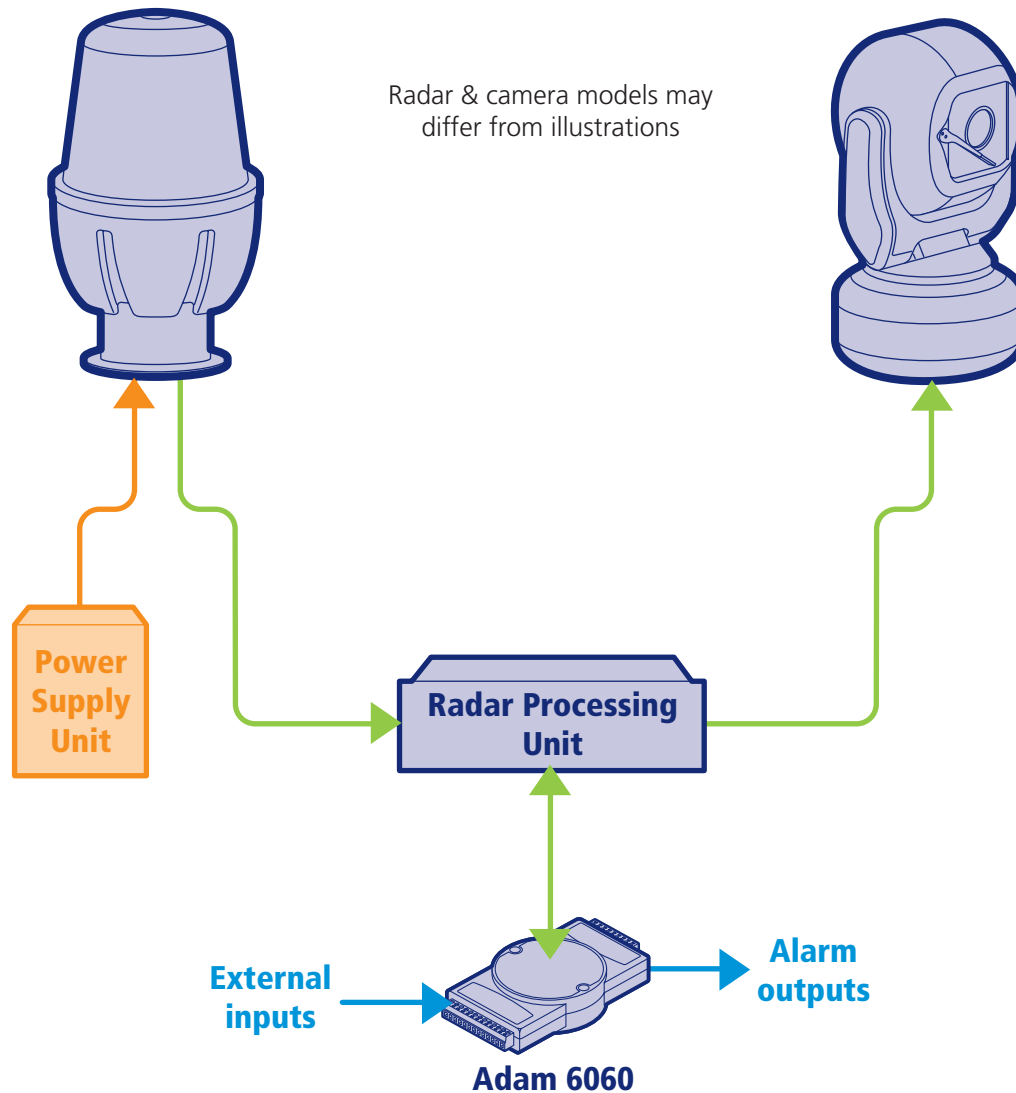
Welcome

The Navtech Radar AdvanceGuard system provides high integrity detection, tracking and intelligent alarm generation for wide area intrusion detection systems. This guide concentrates on installing the key hardware components: Radar sensors; cameras and external inputs/outputs. As part of the installation process this guide also covers how to test the radar sensor output and adjust its positioning for optimum performance. For details about the witness application group, please refer to the companion **Witness Commissioning Guide**.

Essential items

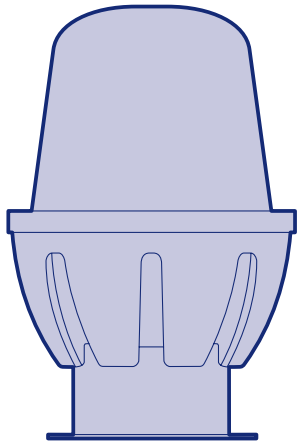
The following are the essential additional items that you will need to install a radar sensor:

- Laptop computer running Radar View software,
- Shielded Cat5E patch lead,
- Digital level,
- 25m² radar target and tripod, 2 off,
- 10mm spanner,
- Pair of 2 way radios,
- An assistant.

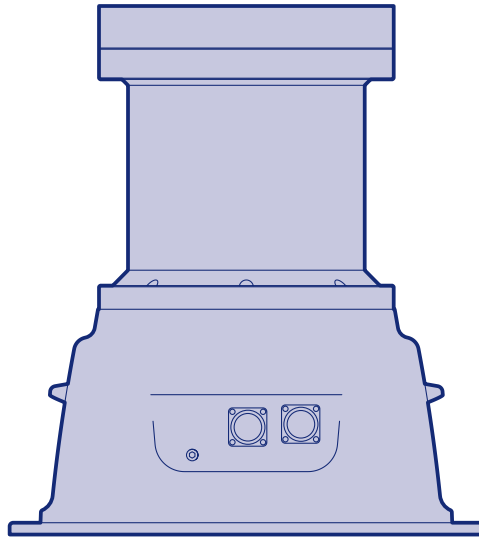


Parts

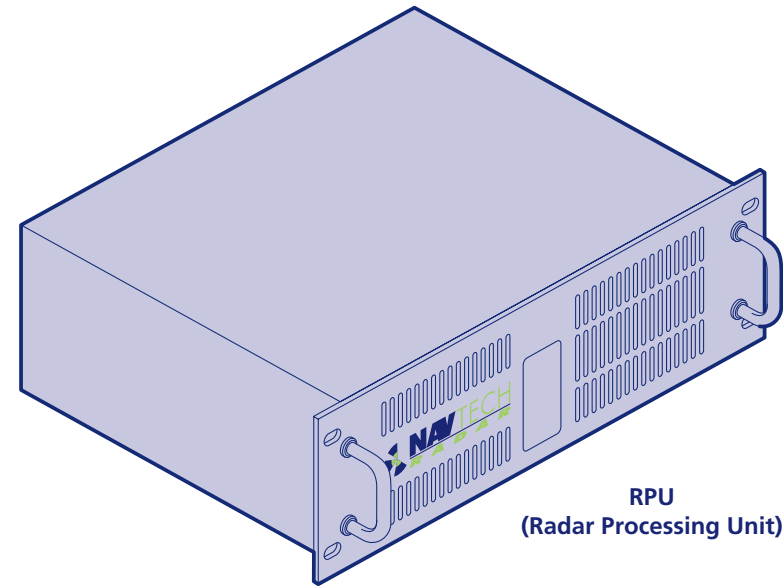
This page lists the main parts that are commonly used in most radar installations (mount poles are not shown). Note that these images are for illustrative purposes only, as items/casing shapes are subject to change.



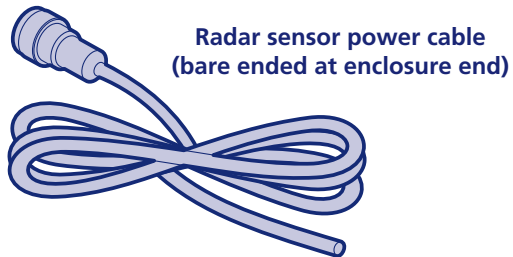
W- Series radar sensor



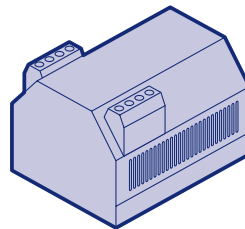
I-Series radar sensor



RPU
(Radar Processing Unit)



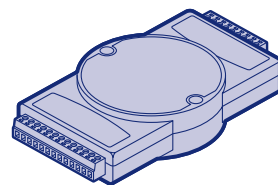
Radar sensor power cable
(bare ended at enclosure end)



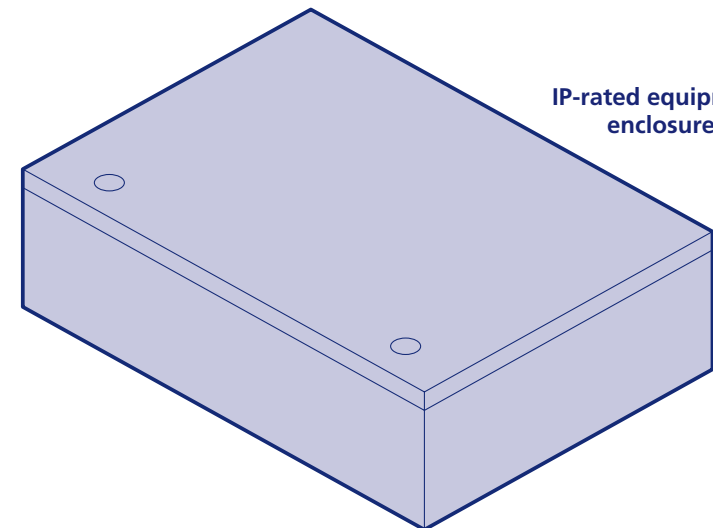
Radar sensor power supply



Mil spec shroud for radar
sensor data connection



Adam 6060 input/output unit



IP-rated equipment
enclosure

Creating an installation

Mounting a radar sensor

Navtech Radar Limited supply a range of radar sensors and mounting posts to suit various installation sites.

The two most common posts are:

- Standard mount post which provides a height adjustment of between 1.35m to 1.89m (measured beam height for a W200/500/AGS800/1600 sensor) and can optionally be fitted with a CCTV camera arm.
- Telescopic mount post which can extend to 4 metres in height and is suitable for the X variant sensor.

For the standard mount posts you should aim to initially position the sensor so that its metal collar is at roughly 1.5 metres above ground level so that the post is at the middle of its vertical adjustment range. During commissioning it may be necessary to raise or lower the sensor to clear obstacles or allow for the local terrain.

Note: If you are creating your own mount post, you are recommended to include at least 50 centimetres of vertical adjustment built into the post to allow for local topography.

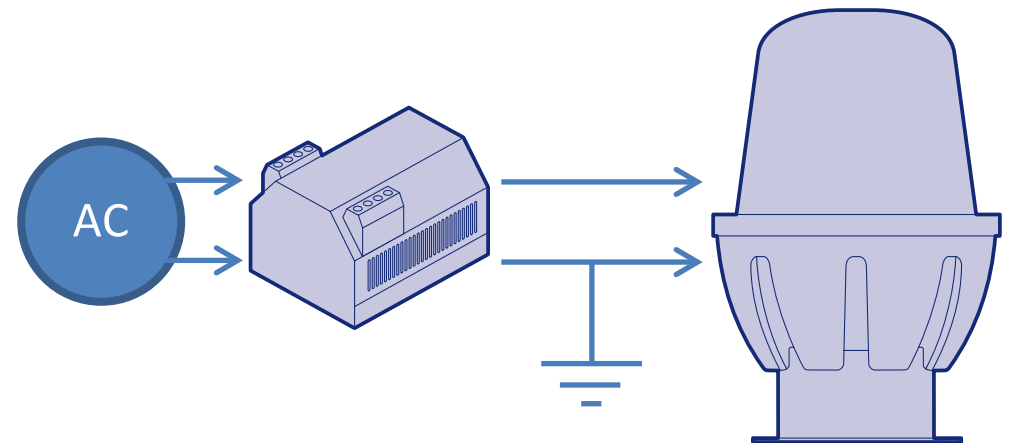
Mounting the enclosure and power supply

The IP-rated equipment enclosure is normally mounted at the base of the radar post and is used to house the radar power supply unit, however, other items may also need to be housed within the enclosure:

- If the radar is mounted more than 70 metres from the RPU server then it is recommended that a fibre optic ethernet link is used. In this case a media converter would also need to be housed within the enclosure.
- If there is a camera option on the post then the camera power supply unit and a possibly a video encoder will also need to be housed.

IMPORTANT: To prevent floating voltage levels on the low output of the radar sensor power supply unit, link the 0v output to earth.

IMPORTANT: Note that each radar is supplied with a pressure plug, which is left loose during freight. This plug should be reinserted at install time such that the radar is kept pressurised and maintains its ingress protection. Failure to insert the pressure plug could invalidate the warranty in the event of damage.

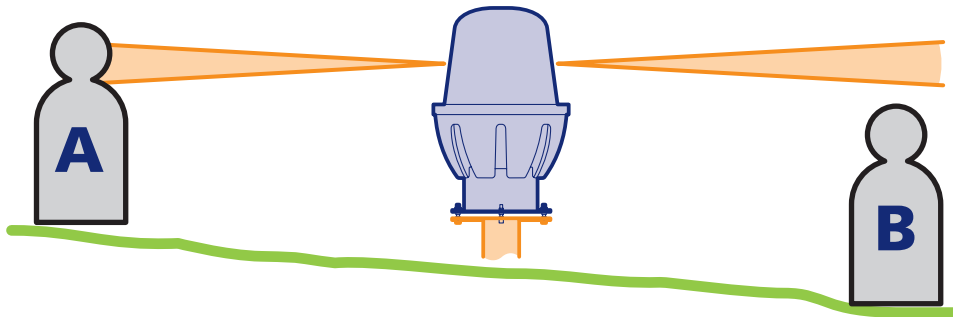


Simplified wiring diagram

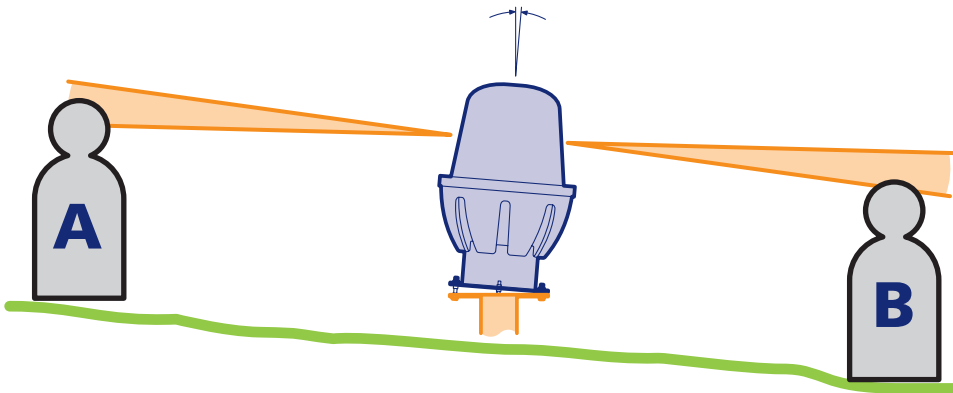
Levelling a sensor

Due to the very narrow beams (1 or 2 degrees) used by most radar sensors, it is important that each sensor is level in relation to the area that it surveys. Level in this sense may not mean absolutely horizontal. For instance, if the site has a continual slope it may prove beneficial to incline the sensor in line with the slope to ensure that targets are correctly tracked.

The exaggerated examples below show how a sensor with an incorrect incline could miss targets which are lower down the slope:



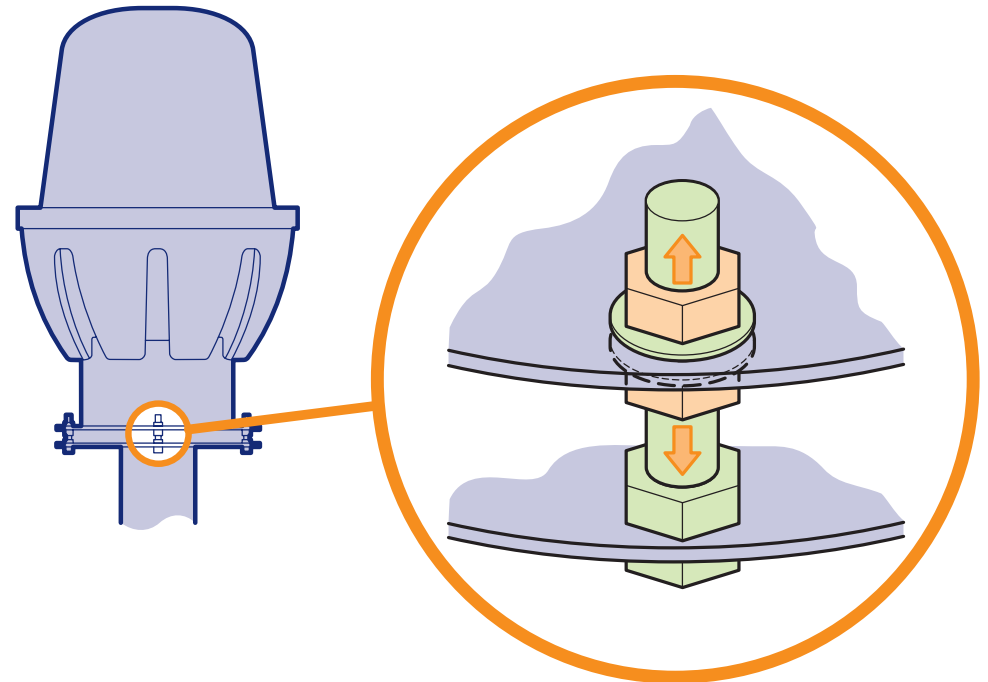
The horizontal radar sensor misses target B.



The inclined radar sensor locates both targets.

To make sensor levelling adjustments

The sensor mounting plate allows for a simple yet effective method to fine tune the incline of the sensor. For each of the mounting holes, the bolt is fed from underneath and locked onto the mounting plate with a nut. Two more nuts and washers are then used above and below the sensor plate so that the sensor can be positioned anywhere up or down the bolt thread, as necessary.

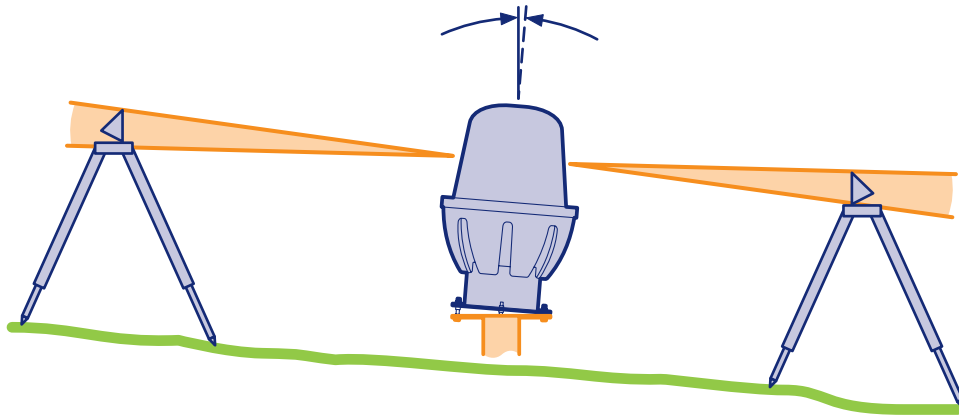


We recommend that you begin with the sensor completely horizontal and then carefully adjust it to suit the conditions using the method described next.

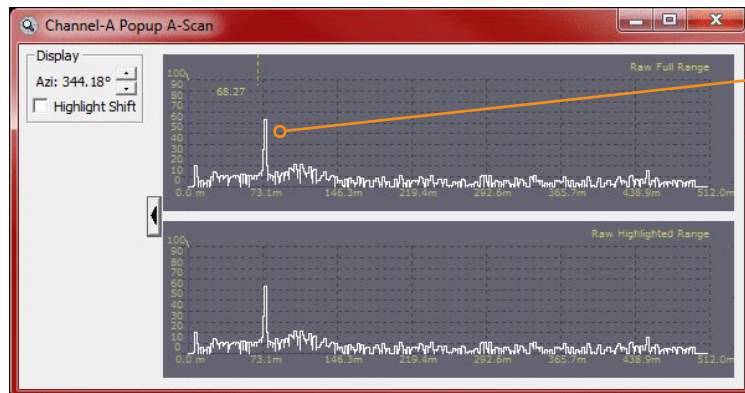
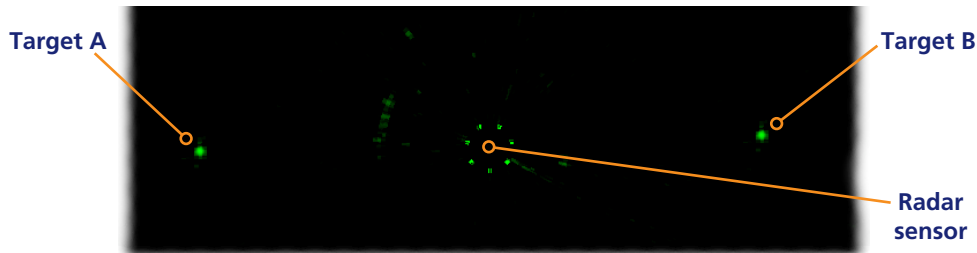
To adjust the sensor level

The recommended procedure to check for the optimum incline is to use two radar targets mounted on tripods.

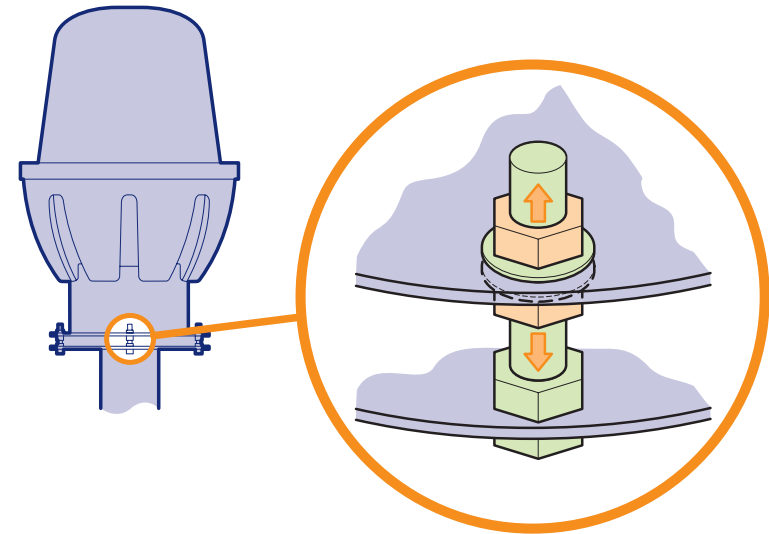
- 1 Adjust each target to a height of 1.3 metres above ground level and locate them on opposites sides of the sensor at suitable distances (e.g. 30m or further).



- 2 Connect a portable computer to the radar sensor and then use the procedure [To use SPx RadarView](#) (within the section [Testing a sensor](#)) to view the resulting scan:



Your aim is to ensure that both targets can be clearly seen by the radar sensor. If necessary, carefully adjust the incline of the sensor until they produce similar traces. It may be necessary at this point to raise or lower the radar in addition to changing the incline.



- 3 Reposition the targets in new locations and repeat the adjustment procedure until targets in various positions can be seen by the radar sensor.

Connecting a radar sensor

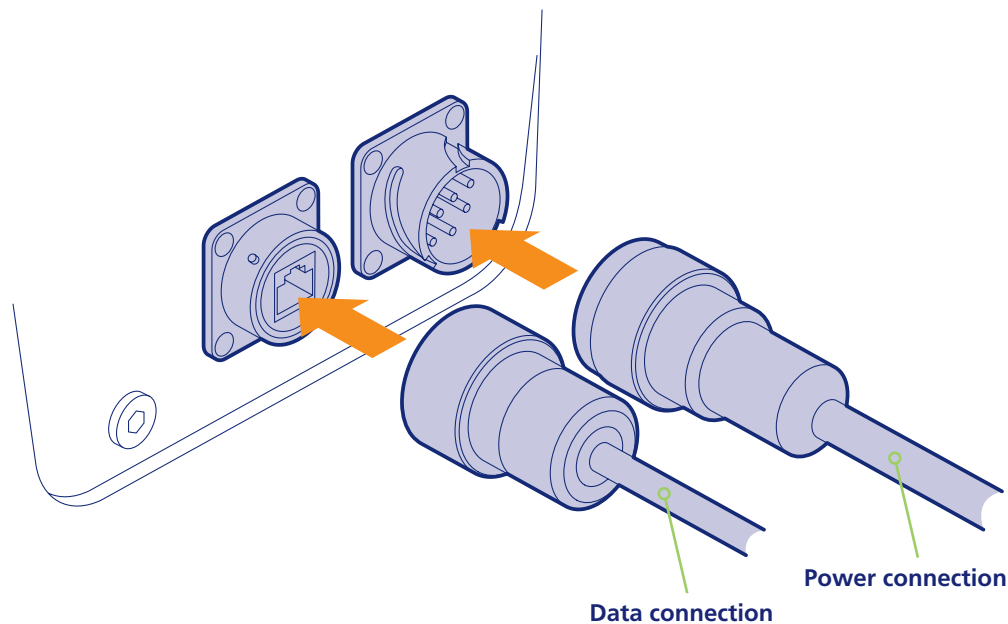
Each radar sensor requires a power and a data connection. Both are made using military specification connectors to ensure link integrity in the harshest environmental conditions. In the majority of cases, the power and data connections run from the sensor to the enclosure at the base of the mounting pole where the power supply is situated.

Supplied with each radar sensor is a power cable with a mil-spec connector for the sensor connection and a bare end at the enclosure connection. A mil spec shroud is also supplied for use with a suitable environmentally protected Ethernet network cable. It is essential that the supplied shroud is correctly used to ensure that the data connection is water tight.

IMPORTANT: Failure to correctly fit the shroud can invalidate the warranty on sensors that have been caused to fail through water ingress.

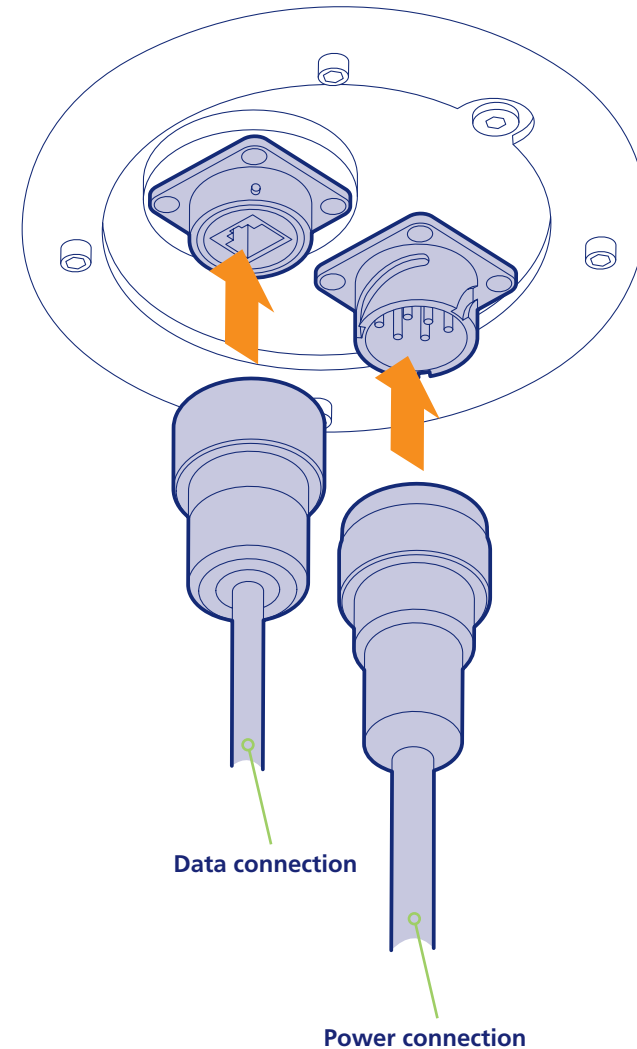
Connections to I-Series radars

On radar sensors with I-Series enclosures, the connections are made on the side panel:



Connections to W and AGS-Series radars

On radar sensors with W and AGS-Series enclosures, the connections are made underneath:



Connecting other items

The modular nature of the AdvanceGuard system offers considerable opportunity for customisation to suit a wide range of installations. This section discusses the broad approach for connecting third party devices to the AdvanceGuard system.

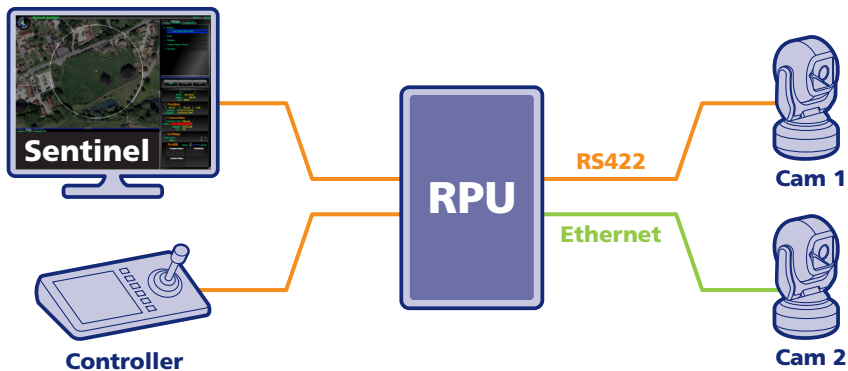
Connecting cameras

The AdvanceGuard system communicates with cameras using either direct Ethernet, RS422 serial or VipX (a proprietary Ethernet-based standard), as required. All cameras within an installation are linked to a server system called an RPU (Radar Processing Unit), which is a high specification industrial computer. In certain cases a single RPU will control several radar sensors as well as the cameras. In larger installations there may be separate RPU systems for the radar sensors and cameras. A software component called Cyclops is used on the RPU for the purpose of controlling all of the cameras.

Depending on the nature of your installation, there are numerous ways to connect cameras to an RPU.

Basic Ethernet or serial links

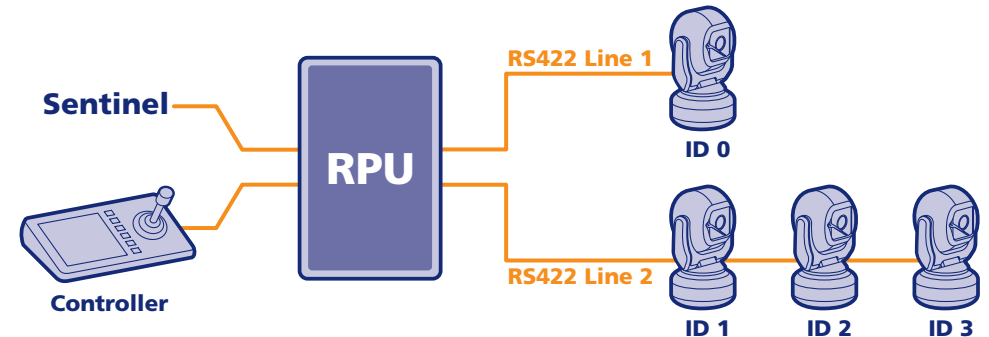
The diagram shows two cameras connected by their own Ethernet and/or serial links (different connection types can easily be mixed on the same RPU). The operator is provided with the AdvanceGuard Sentinel display which allows manual control of cameras where necessary. Additionally, a standard CCTV camera controller can also be provided and would be fed via the RPU, where its actions are interpreted by the AdvanceGuard system before being directed to the cameras.



Note: For simplicity in these examples, the Sentinel display and CCTV controller are shown connecting directly into the RPU. In reality they would not be connected in this manner. For security reasons, these controls would be connected to their own computer system which would indirectly link them to the RPU via an Ethernet connection.

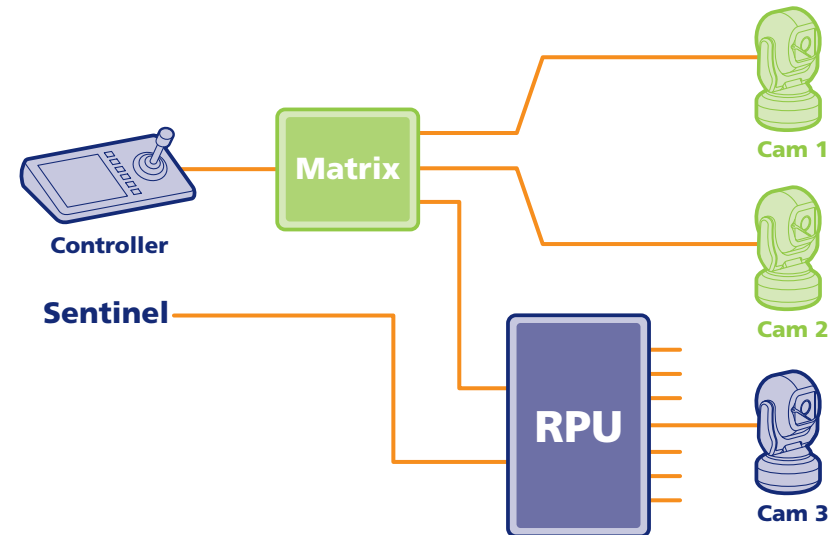
Multiple serial links

This diagram indicates the two ways to link serial cameras to the RPU. As required, cameras can either use their own dedicated links to the RPU. It is important that each camera is given a unique ID number.



Adapting existing larger installations

When AdvanceGuard is integrated into an existing large installation, it is likely that a matrix will be employed to link multiple cameras to a single CCTV controller. It is also possible that the AdvanceGuard system is not required to control all of the existing cameras. In such situations it is important that the RPU is linked at the correct point.

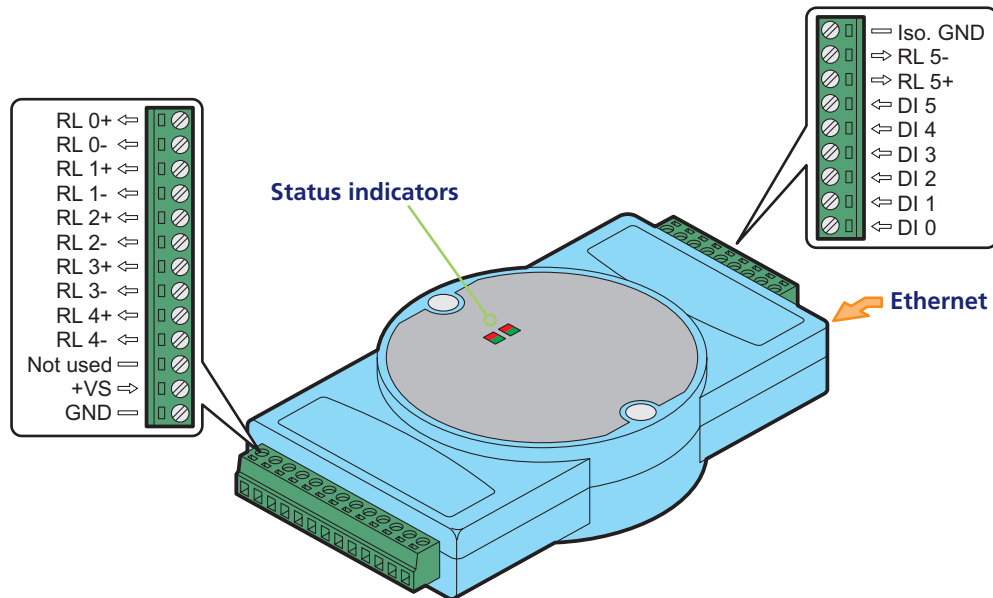


In the diagram only Cam 3 is required to be controlled by AdvanceGuard. The RPU is linked to the existing output for Cam 3 from the matrix and interprets the control signals before sending them to the camera. In this way the CCTV controller can service both the AdvanceGuard and non-AdvanceGuard sections of the installation.

Connecting trigger inputs and alarm outputs

In addition to radars and cameras, the AdvanceGuard system can be integrated with other sensors, such as simple PIR units, and also linked to external alarms. Connections of this type are handled by one or more Advantech Adam 6060 industrial I/O devices which are attached, via Ethernet, to the RPU (Radar Processing Unit) system.

Each Adam 6060 unit provides six opto-isolated inputs (labelled DI0 to DI5) and six relay switched dry-contact outputs. Input and output connections are made using the green blocks at each end, as shown below:



The Adam 6060 unit requires a power input of 10 to 30VDC which is applied between connections +VS and GND. At 24VDC supply level the unit consumes a maximum of 2W.

Status indicators

There are four status indicators on the top panel. Their functions are as follows:

- **Status** (red) - Flashes when the module is powered on.
- **Link** (green) - On when Ethernet connection is valid.
- **Speed** (red) - On when the Ethernet connection 100Mbps.
- **COM** (green) - Flashes when the Ethernet link is communicating.

Addressing

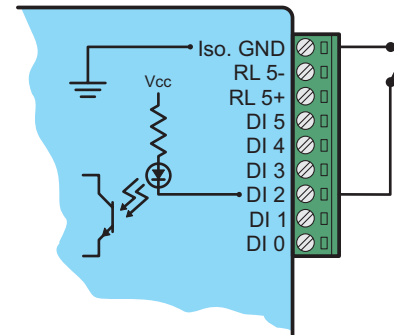
Each Adam 6060 unit must use a unique IP address that is within the same subnet as the RPU.

Connecting inputs

The Adam 6060 unit can accept inputs in either of two ways between the Iso GND and the opto-isolated inputs DI0 to DI5:

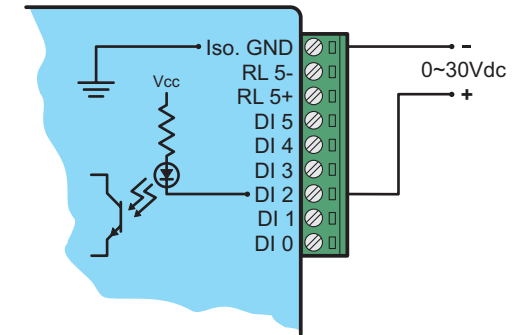
Dry contact inputs

Also called 'zero-volt' switching, where the input line is shorted by an external switch to the Isolated GND terminal to signal a change of state.



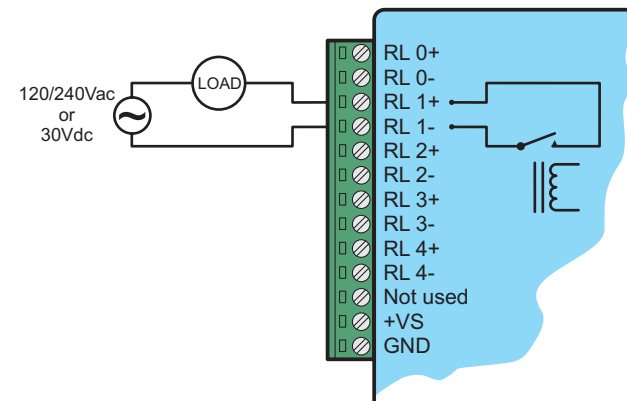
Wet contact inputs

Each input can also accept a DC voltage to represent a logic state. An input of 0 to 3VDC is taken to represent a logic zero, while a logic 1 is triggered when the input level rises above 10VDC. The input can accept voltages up to 30VDC.



Connecting outputs

Each of the six outputs are relay driven with an internal contact being made between the + and - terminal pairs of the channels RL0 to RL5. The relay contacts can handle up to 0.5A at 120/240VAC or up to 1A at 30VDC.



Confirming sensor operation

In order to test the output of the radar sensor, you will require:

- A portable computer running Windows XP, Vista, Windows 7 or later,
- The SPx RadarView application, which can be obtained from the 'tools' folder on the supplied RPU.
- A CAT 5, 5e or 6 network cable (straight or crossover wiring).

Preparing your computer

IMPORTANT: Ensure that your computer has its IP address set to operate within the same subnet as the radar sensor:

- The IP address (e.g. 192.168.0.1) of the radar sensor is preset before leaving Navtech Radar Limited according to client specifications and will be declared on a label attached to the outer casing.
- The subnet mask of the radar sensor is often preset to 255.255.255.0 but could also be set wider (such as 255.255.0.0) if requested.
- Thus, if the sensor IP address is 192.168.0.1 and the mask is 255.255.255.0, then your computer must use an IP address in the range: 192.168.0.2 to 192.168.0.254.

Note: If you are connecting to the radar via an Ethernet switch rather than making a direct link, it is important that no other radar client software is already connected before using radar view.

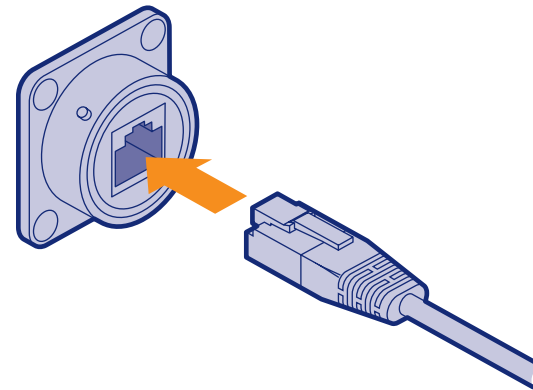
Connecting your computer

You can connect your computer at any point along the signal link from the radar sensor, either directly into the sensor mounted socket; at the pole mounted enclosure (if the signal link is joined there) or at the far end of the link where it will join the RPU (Radar Processing Unit) system. *Note: The sensor can be powered on or off while connecting and disconnecting the network link.*

The network controller within the radar sensor is autosensing so that you can use either straight through or crossover cables and it will adjust its operation accordingly.

To connect your computer

- 1 Connect a link cable between your computer and the network port, either on the sensor or elsewhere along the signal path.



- 2 Ensure that the radar sensor is powered on and is rotating - you can faintly hear the rotor when it is running.

Testing a sensor

Once your computer is connected to a sensor, there are four main tests that you can carry out on the radar sensor:

- Ping the sensor to check for a basic network response.
- Telnet to the sensor to view fundamental configuration settings.
- [Run a base level diagnostic test.](#)
- [Use SPx RadarView to view the radar output.](#)

To ping a sensor

- 1 Open the Windows command prompt window (Start > Accessories > Command Prompt).
- 2 In the window, type **ping a.b.c.d**
where **a.b.c.d** is the IP address of the radar sensor.

After a short while you should see several responses from the sensor:

```
C:\ Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\>ping 10.0.3.102

Pinging 10.0.3.102 with 32 bytes of data:

Reply from 10.0.3.102: bytes=32 time=1ms TTL=32
Reply from 10.0.3.102: bytes=32 time<1ms TTL=32
Reply from 10.0.3.102: bytes=32 time<1ms TTL=32
Reply from 10.0.3.102: bytes=32 time<1ms TTL=32

Ping statistics for 10.0.3.102:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

This shows that the network interface of the sensor is functioning (and confirms connectivity of any intermediate switching equipment).

If you do not receive a response:

- Check the power supply to the sensor.
- Listen for the rotor spinning.
- Double check the network link to the sensor.
- Confirm that you can ping intermediate switching equipment.
- Check that your computer is configured with an IP address that is within the same subnet as the sensor.

To telnet to a sensor

- 1 Open the Windows Command Prompt window (Start > Accessories > Command Prompt).
- 2 In the window, type **telnet a.b.c.d**
where **a.b.c.d** is the IP address of the radar sensor.

After a short while you should see a response from the sensor:

```
C:\ Telnet 10.0.3.102

***** NavTech Radar *****

RMB Version      02.38 13/07/09
$Rev:: 1515      $:
$OF Version      1ms 16/04/08
v1.3c Analogue Board v1.1 Digital Board
MAX_RANGE_TX    800m
FFT              8k
ADC              8k

Ip Address       = 10.0.3.102
Ip Port         = 700
Subnet          = 255.255.0.0
GateWay         = 10.0.0.254
Mac Add         = 00-50-c2-69-80-85

IP-Connected
TCPIP Client Address 10.0.3.103
Telnet Client Address 10.0.3.103

Radar Serial Number = 8105
Digital SN          = AD0085
Analogue SN         = AA0193
Front End SN        = 72902
Build Date          = 9-10-08
Last Service Date   = 29-03-10
Radar Mode          = 2
Radar Type          = 500m
Encoder             = 4000
Encoder Offset      = 3130
Exponent Offset     = 50
UCO Off T           = 80
UCO Off rev/s       = 0.5
```

The response should show details about various modules within the sensor.

To run the diagnostic test

- 1 Open the Windows Command Prompt window and telnet to the sensor as discussed in the previous section.
- 2 Whilst still within the telnet session, type **diag 1**

After ten seconds, results from the diagnostic will begin to be displayed:

```
ca> Telnet 10.0.3.102
diag1
diag 1
Diag Mode Changed to 1
Time   T   Min Max   Revs   Pkts   Kbits   Idle   VCO   TCP/IP
1388   30  19  30   1.0   908   14597  16366  A-On  IP-Connected
1394   30  19  30   1.0   909   14600  16314  A-On  IP-Connected
1404   30  19  30   1.0   908   14597  16343  A-On  IP-Connected
1414   30  19  30   1.1   909   14600  16351  A-On  IP-Connected
1424   30  19  30   1.0   908   14597  16344  A-On  IP-Connected
1434   30  19  30   1.0   908   14597  16347  A-On  IP-Connected
1444   30  19  30   1.0   909   14600  16342  A-On  IP-Connected
```

Note: The radar sensor will report incorrect temperature readings for the first 100 seconds of its operation after first being powered on.

The results will be appended every ten seconds. The various fields are as follows:

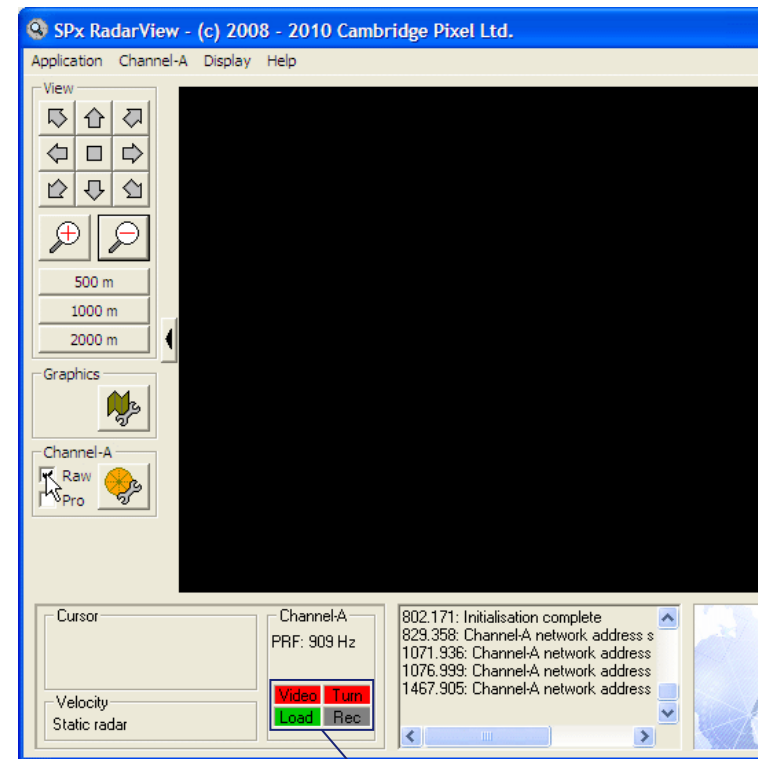
- **Time** - Shows the time when the diagnostic test was run.
- **T** - Shows the current temperature reading within the sensor housing.
- **Min/Max** - Shows the recorded minimum and maximum temperatures.
- **Revs** - Shows the rotor revolutions per second. Should be **1.0***
- **Pkts** - Shows the number of packets of IP data sent in the last ten seconds*
- **Kbits** - Shows the size of IP data sent in the last ten seconds.
- **Idle** - N/A.
- **VCO** - Shows the setting of the Voltage Controlled Oscillator - should be **A-On**.
- **TCP/IP** - Shows the status of the IP connection.

*These will only be non zero if a client is connected to the radar (RadarView or witness)

To use SPx RadarView

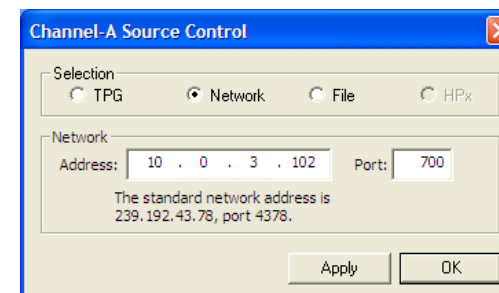
The SPx RadarView application consists of two files which must be located in the same folder (any folder) on your computer: *SPXRadarView.exe* and *SPXRadarView.rpi*.

- 1 Run **SPXRadarView.exe**. You should see a blank main screen:



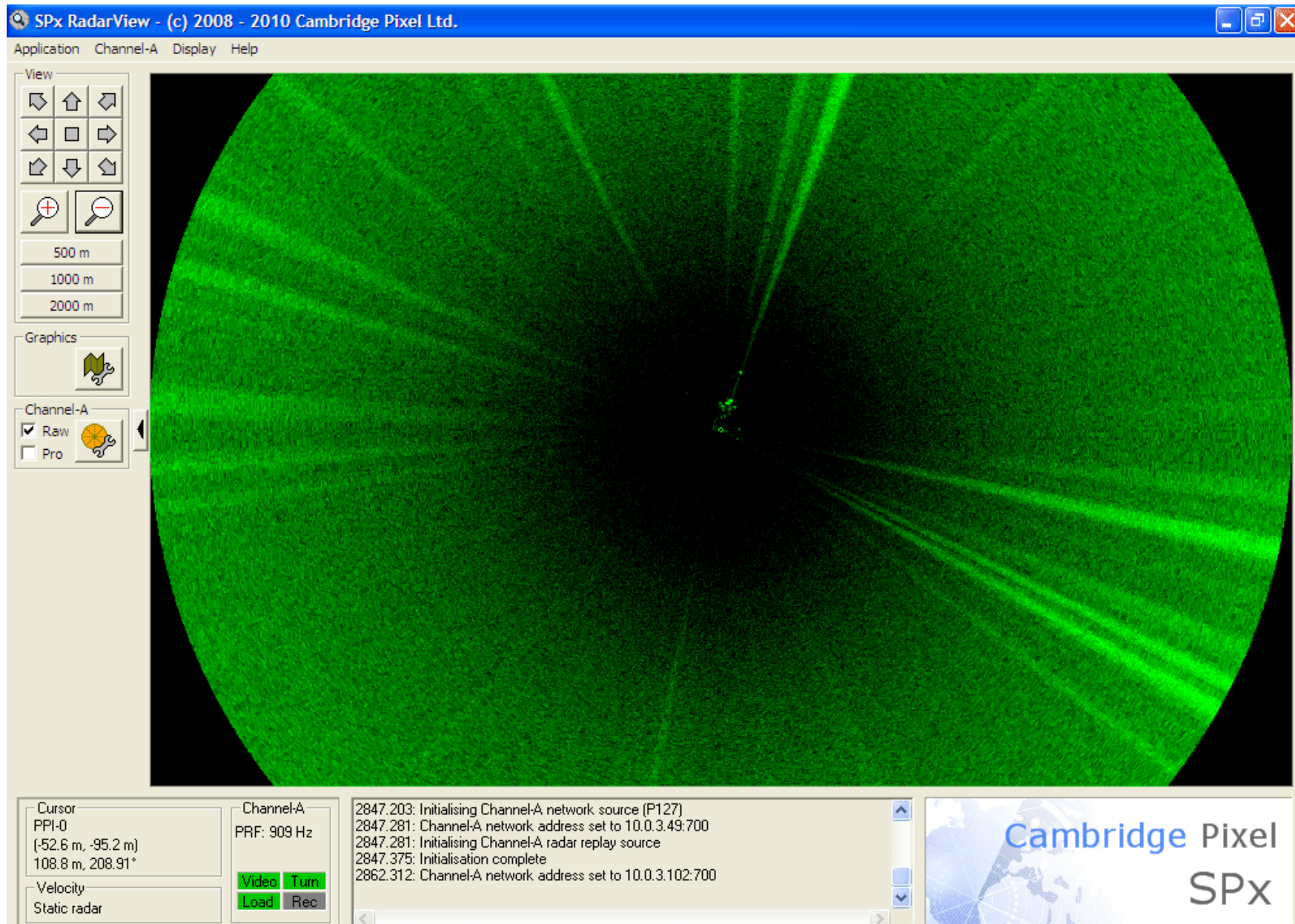
Note: In the lower panel, the Video and Turn indicators will be red to indicate that there is no communication with the sensor.


- 2 Click the *Channel-A* menu and select the **Source...** option.

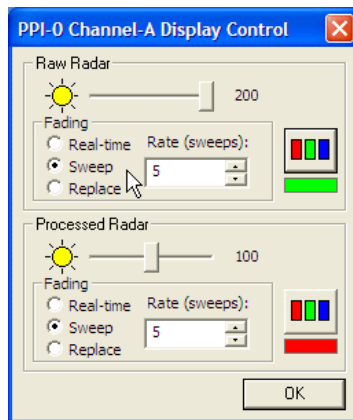



- 3 Ensure that the *Selection* option is set to **Network** and in the section below, enter the IP **Address** of the sensor. The **Port** must be set to **700**. Click **OK**.

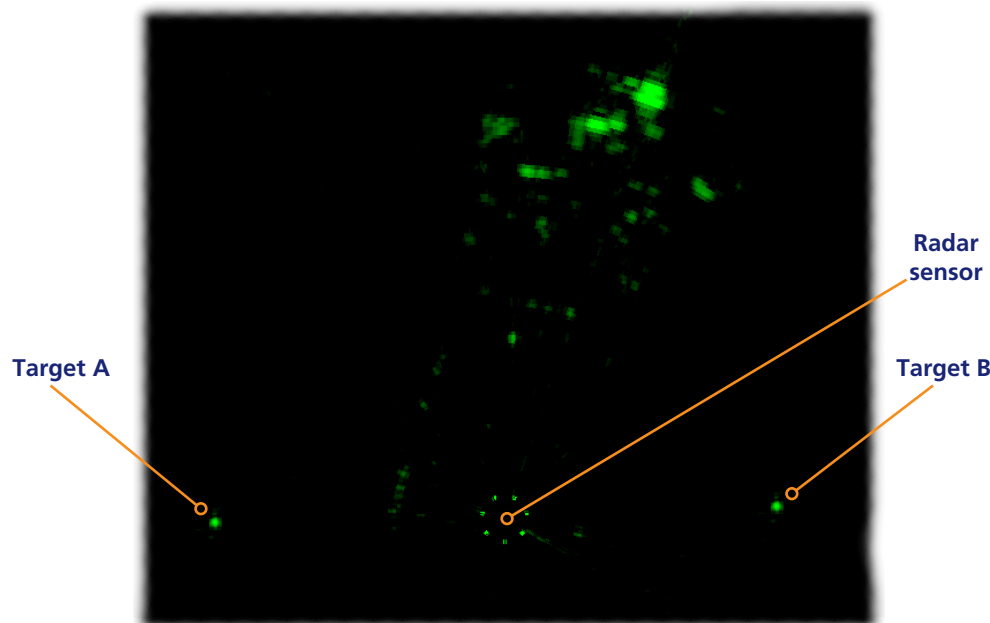
- 4 Once the IP address and port are correctly set and the application makes contact with the sensor, the *Video* and *Turn* indicators should turn green. Shortly after, you should begin to see radar scan information within the main window:



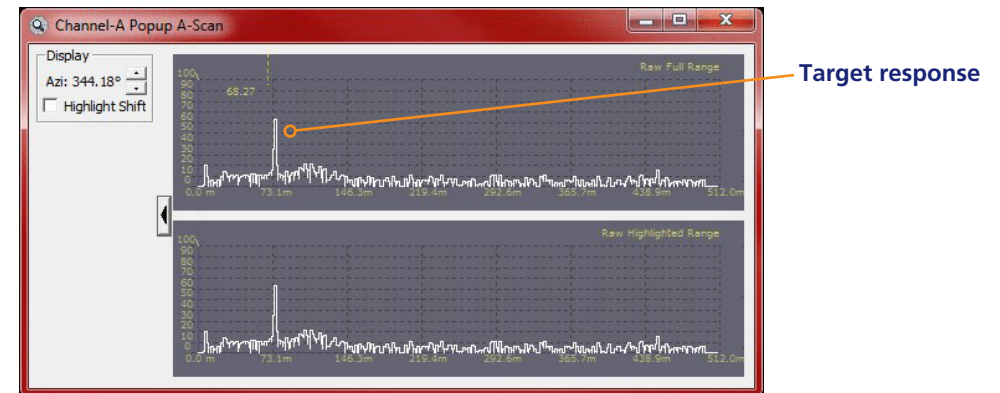
- On the left side of the screen, ensure that the **Raw** option is ticked.
- Click the  button to show the *Display Control* dialog box:



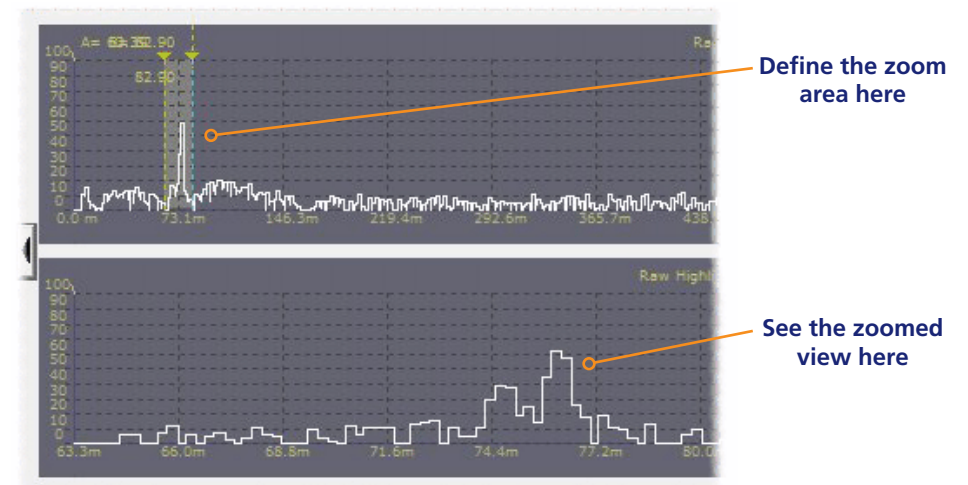
- Ensure that in the *Raw Radar* section, the *Fading* option is set to **Sweep** and the *Rate (sweeps)* is set to **5**. Click **OK**.
- Click the  button to zoom into the radar view so that you can clearly see the both of your test targets:



- Right click the mouse pointer on the exact middle point of one of the targets to display a popup options box. Click the option 'Popup Channel-A AScan...' to display a scan window:



- The scan window provides live signal strength data concentrating only on the angular direction of the chosen target from the radar sensor. In each of the two graph plots, the x-axis shows the distance from the sensor while the y-axis indicates the returned signal strength. You should see a spike representing your target at the relevant distance.
- On the top graph, left click on both sides of the spike to create a zoomed view on the lower graph. This will allow you to see small changes in the returned signal strength on the lower graph when levelling the sensor:



- Repeat steps 9 and 10 for the other target so that you can view both on screen at the same time.
- Adjust the radar sensor level (see [To adjust the sensor level](#) for details) while checking the scan graphs to ensure the best (highest signal) response from both targets.

Appendices

Appendix 1 - FAQ

What is the power consumption of the radar?

- Up to 25 watts at 24VDC. Please see the data sheet for the exact figure.

What is the network bandwidth usage?

- Up to 25 megabytes per sensor. Please contact Navtech for exact figures for your chosen radar.

What connectivity does the radar support?

- Connection to the radar is via ethernet. Each radar has an RJ45 socket. We recommend cat5 cable to the radar, not to exceed 70m in length. Longer lengths should make use of switches or fibre converters.

What is the ideal mounting height?

- The ideal mounting height can vary depending on the specific site, the type of radar and if the beam is angled. The X units have been designed to be mounted at about 4m, this will give a minimum detection range of about 10m and for a man walking upright, with the maximum according to the sensor data sheet.

What is the beamwidth?

- The beamwidth varies per radar sensor. The azimuth beamwidth is either 1 or 2 degrees with the main elevation beamwidth of the radars ranging from 2 to 4 degrees. The X radar in addition has a close range infill beam of approximately 25 degrees. Please see the data sheets for clarification.

At what ambient temperatures can the radar operate?

- Please refer to the data sheet for the exact model, but most sensors will operate over -20 to +60 degrees C.

Can the radar be used on the move?

- Not as an intruder detection device, as the radar has to be static in order to be able to detect movement. It can, however, be used as an obstacle detection device to prevent large plant equipment from having collisions.

Can the radar sensor be inverted?

- Please contact Navtech Radar Ltd to discuss the application. The Industrial series may be inverted, subject to some firmware changes and additional charge.

What is the operating frequency/band width of the radar?

- All radars operate within the 76-77GHz band as per ETSI standard EN 301 091-1 V1.3.3

What output power does the radar emit?

- Maximum output power is within the limit of +55dBm EIRP as specified by ETSI standard EN 301 091-1 V1.3.3

Does the radar interfere with aviation systems?

- The radar conforms to ETSI standard EN 301 091-1 V1.3.3. Confirmation of compliance with aviation systems is the responsibility of the systems integrator/end user.

Is the radar affected by adverse weather conditions?

- The radar is unaffected by fog, rain, snow etc.

Does witness provide other interfaces?

- Witness can interface to multiple ethernet relay units, providing multiples of 6 digital inputs and 6 relay outputs. These I/O lines can be linked to various actions/events within witness.

Which cameras does Witness support?

- Witness currently supports a selection of cameras, as detailed in the applicable sales literature. Additional cameras can be added (at cost) if they support absolute positioning.

Appendix 2 - Radio frequency energy statement

FCC compliance statement (United States)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

The operation of this device is limited to a fixed position at airport locations for foreign object debris detection on runways and for monitoring aircraft as well as service vehicles on taxiways and other airport vehicle service areas that have no public vehicle access. This equipment must be mounted in a fixed location maintaining a minimum separation distance of 46cm from personnel when in general operation. This restriction of operation is specific for use in North America. For use in other regions aligned to the FCC regulations, specific country restrictions should be reviewed.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.