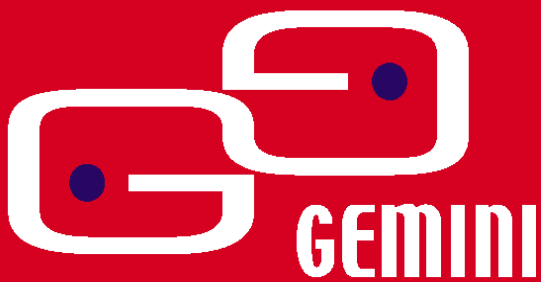# Orthogon Systems

GEMINI

and then there's
Orthogon Systems

There's non-line-of-sight...

There's line-of-sight...

Orthogon Systems

Orthogon Systems

Gemini System User Manual

February 24th, 2004

Ref: PHN-0630-01.01

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Compliance

Changes or modifications not expressly approved by Orthogon Systems could void the user's authority to operate the system.

NOTE: This system has been tested and found to comply with the limits for a Class B digital device[1], pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the Outdoor Unit (ODU).
- Increase the separation between the equipment and ODU.
- Connect the equipment into a power outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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[1] Class B Digital Device, A digital device that is marketed for use in a residential environment notwithstanding use in commercial, business and industrial environments.

Disclaimer

The parameters quoted in this document must be specifically confirmed in writing before they become applicable to any particular order or contract. The company reserves the right to make alterations or amendments to the detail specification at its discretion. The publication of information in this document does not imply freedom from patent or other rights of Orthogon Systems or others.

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1 Getting Started

1.1 For Your Safety

Caution Users and installers should note that the mains power supply is the primary disconnect device.

Warning Use extreme care when installing antennas near power lines.

Warning Use extreme care when working at heights.

Caution When the system is operational, avoid standing directly in front of the antenna. Strong RF fields are present when the transmitter is on. The Outdoor Unit (ODU) must not be deployed in a location where it is possible for people to stand or walk inadvertently in front of the antenna.

Warning The OS-Gemini Outdoor unit must be properly grounded to protect against lightning. It is the user's responsibility to install the equipment in accordance with Section 810 of the National Electric Code, ANSI/NFPA No.70-1984 or Section 54 of the Canadian Electrical Code. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. It is recommended that installation of the outdoor unit be contracted to a professional installer.

Caution Safety will be compromised if external quality cables are not used for connections that will be exposed to the weather.

Caution Safety will be compromised if a different power supply is used than the one supplied by Orthogon as part of the system.

1.2 Welcome

Congratulations on the purchase of the OS-Gemini systems from Orthogon Systems. The OS-Gemini is the latest innovation in high-speed wireless networking that lets you deploy wireless networks in areas previously unattainable.

1.2.1 About This Guide

This guide covers the installation, commissioning, operation and fault finding of the OS-Gemini system.

1.2.2   Who Should Use This Guide

The guide is for use by the system installer and the end user IT professional. The system installer will require expertise in the following areas:

- Outdoor radio equipment installation
- Network configuration
- Use of web browser for system configuration, monitoring and fault finding

1.2.3   Contact Information

Postal Address:	Orthogon Systems, Unit A1, Linhay Business Park, Eastern Road, Ashburton, Devon. TQ13 7UP United Kingdom
Telephone Enquiries:	+44 (0) 1364 655500
Fax Enquiries:	+44 (0) 1364 654625
Web Site:	http://www.orthogonsystems.com/
Sales Enquires:	mailto:sales@orthogonsystems.com
North American:	mailto:usainfo@orthogonsystems.com
International:	mailto:globalinfo@orthogonsystems.com
Web Support:	http://www.orthogonsystems.com/
Email Support:	mailto:support@orthogonsystems.com

Table 1 Contact Information

Comments or suggestions concerning this user manual may be emailed to the support team.

1.2.4   Repair and Service

For unit repair or service, contact your service provider or an authorised Orthogon Systems distributor for authorisation and shipping instructions.

1.3   Product Description

This User Manual is specifically written for the OS-Gemini platform and the 5820 software load for North America.

The OS-Gemini has been developed to provide Point-to-Point data connectivity via a 5.8 GHz wireless Ethernet bridge operating at broadband data rates. The OS-Gemini is aimed at enterprises that have a requirement to connect together the Local Area Network (LAN) of two or more buildings. Figure 1 illustrates such a deployment.

The OS-Gemini offers true non-Line-Of-Sight (NLOS) operation by using a combination of Orthogonal Frequency Division Multiplex (OFDM) modulation and Multi-Beam Space Time Coding (STC) techniques. These technologies enable the OS-Gemini to drive through foliage and around buildings to such an extent that almost universal coverage can be expected at short range.

The OS-Gemini consists of a pair of identical devices that are deployed one at each end of the link. At install time the user sets up one unit as the Master and the other as the Slave. Either unit can be configured as master or slave.

Each end of the link consists of:

- An integrated outdoor transceiver unit containing all the radio and networking electronics hereafter referred to as the Outdoor Unit (ODU).
- An indoor passive connection box containing status indicators, DC power connection and network connection. Hereafter referred to as the Indoor Unit (IDU).
- A 'mains' power adaptor
- Units will normally be supplied pre-configured as a link.
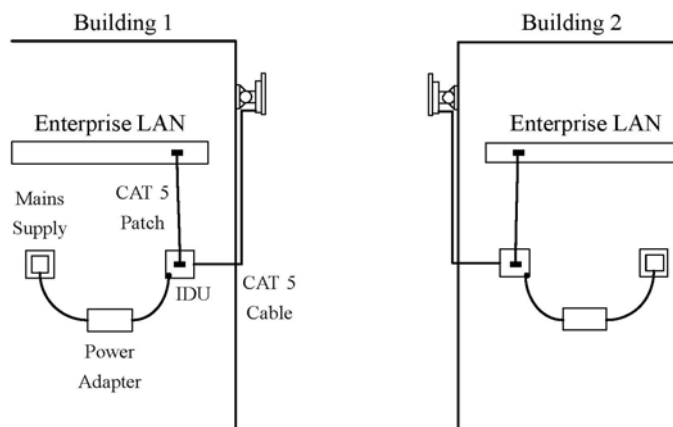
Figure 1 Typical OS-Gemini Deployment

Power is fed into the IDU from the mains power adaptor via a standard low voltage DC connector. The network connection is presented to the user at the IDU via an RJ45 socket. Connection between the ODU and IDU is made using standard CAT 5 UV resistant cable. The spare twisted pairs of the cable are used to feed power from the IDU to the ODU.

1.3.1 The Outdoor Unit (ODU)

The ODU (Figure 2) is a self-contained unit. It houses both radio and networking electronics. A single CAT 5 cable feeds the unit. Power is fed to the unit via the brown/brown white pair connected to pins 7 and 8 of the RJ45 plugs and sockets employed. It should be noted that this powering arrangement is not standard Power Over Ethernet (POE). The OS-Gemini ODU should only be deployed using the supplied OS-Gemini Indoor Unit (IDU).

Figure 2 OS-Gemini Outdoor Unit (ODU)

1.3.2 The Indoor Unit (IDU)

The OS-Gemini IDU is a passive device used to inject the DC supply voltage into the cable connecting the IDU to the ODU. The IDU also houses status indicators driven from the ODU over the blue/blue white pair connected to pins 4 and 5 of the RJ45 plugs and sockets employed.

Figure 3 OS-Gemini Indoor Unit (IDU)

The front panel contains indicators showing the status of the power and Ethernet connections.

The power indicator is illuminated when the IDU is receiving 48 volts from the power adaptor.

The Ethernet indicator normally illuminates when the Ethernet link is working; it flashes when there is Ethernet activity; the fact that it lights also indicates that the ODU is powered. See Section 7 for further fault finding information.

The bottom of the IDU houses the Ethernet connection via RJ-45 socket, the power connection, an entry point for IDU/ODU cabling and the reset button.

Figure 4 OS-Gemini Reset Switch Depressed

The reset switch is used for various purposes identified in Table 2.

Reset Button Depression	Action
More than 20 seconds, whilst the unit is already powered up.	This resets the configuration to factory defaults.
While connecting power for more than 40 seconds after power is applied	This resets to factory defaults and erases any user loaded software images leaving the factory loaded image intact.
None	Power cycle by switching off at the mains. All settings remain the same.

Table 2 Reset Actions

1.3.3 Mains Power Adaptor

The mains power adaptor is an inline power supply which provides a 48 Volt DC output to supply power to the IDU / ODU.

Figure 5 OS-Gemini Power Adaptor

Caution Safety may be compromised if a different power supply is used instead of the one supplied as part of the system.

1.3.4 Cables and Connectors

The cable used to connect the IDU to the ODU can be any standard CAT 5 type provided that it is suitable for outdoor deployment. Orthogon Systems recommends that cables to the specification below be used.

NEC/CEC: CMR (ETL) C (ETL) 75C SUN RES OIL RES II

Failure to use the recommended (or equivalent) standard of cable may invalidate the system's safety certification.

The IDU/ODU cable may be unscreened (UTP) or screened (STP). However, unscreened cables reduce the system's ability to cope with nearby lightning strikes. If lightning activity is common in the area of deployment, the use of screened cable is highly recommended. See Section 9 "Lightning Protection".

The connection between the IDU and user's equipment can be made using any standard CAT5 patch cable. The RJ45 Ethernet connection is presented as a piece of network equipment. However as automatic MDI/MDI-X sensing and pair swapping is employed a crossed or no crossed Ethernet patch cable can be used for connection to another piece of networking equipment or directly to end user equipment.

It should be noted that the IDU provides continuity between the screen on the ODU-IDU cable and screen on the IDU-User equipment cable. If continuity of the screening is desired from the ODU-IDU to the user's equipment, CAT 5 STP cable and connectors should be used for the latter connection. CAT5 STP cable between the IDU and the user's equipment will provide additional protection against surges induced on the Ethernet connections.

1.3.5 Surge Arrestor

The IDU does not provide lightning or surge suppression. Should lightning or surge suppression be required a separate Ethernet surge suppressor should be used and appropriately earthed. Suitable surge suppressors can be sourced from your Orthogon Systems distributor or reseller. The ODU is protected by built-in surge suppression as standard.

1.3.6 Mounting Brackets

The OS-Gemini is supplied with a mounting bracket suitable for mounting the ODU to a pole of 50mm to 75mm in diameter or to a flat surface. For more details on mounting, see section 5 "Installation".

The bracket allows for adjustment in both azimuth and elevation. The bracket may be mounted to the pole or wall prior to installation. This allows the installer to take the weight of the unit on a single mounting bolt while fitting the retaining nut and washers.

The IDU can either be desk or wall mounted. The preference is wall mounted with the cables dressed to a cable channel. Wall mounting is achieved by screwing through the mounting lugs on either side of the unit. Remember to leave space for access to the reset button. See section 5.7.7.

1.3.7 Configuration and Management

Configuration and Management of the OS-Gemini is implemented using an inbuilt web server hosting a number of Configuration and Management web pages. This approach allows Configuration and Management to be carried out on any standard web browsing technology. The OS-Gemini can also be managed remotely using the SNMP management protocol. Connection to the OS-Gemini is via the Ethernet connection carrying the bridge network traffic. Connection to the unit is via a preset IP address. This address can be changed via the Network Interface Configuration web page. A full explanation of the available web pages and their use can be found in section 6 "Web Page Reference".

1.4 Warranty

Orthogon Systems has agreed a product warranty with their distributors. The Orthogon Systems warranty for hardware and software is for 12 and 6 months respectively from the date of delivery of the relevant system by a distributor to the installer.

IN NO EVENT SHALL ORTHOGON SYSTEMS BE LIABLE TO YOU OR ANY OTHER PARTY FOR ANY DIRECT, INDIRECT, GENERAL, SPECIAL, INCIDENTAL, CONSEQUENTIAL, EXEMPLARY OR OTHER DAMAGE RISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION OR ANY OTHER PECUNIARY LOSS, OR FROM ANY BREACH OF WARRANTY, EVEN IF ORTHOGON SYSTEMS LTD. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. (Some States do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you.) IN NO CASE SHALL ORTHOGON SYSTEMS' LIABILITY EXCEED THE AMOUNT YOU PAID FOR THE PRODUCT.

2 Product Architecture

The OS-Gemini consists of an identical pair of units deployed one at each end of the link. The radio link operates on a single frequency channel using Time Division Duplex (TDD). One unit is deployed as a master and the other as a slave. The master unit takes responsibility for controlling the link in both directions.

The non-Line-of-Sight (NLOS) aspects of the product are provided by multi-beam space time coding, coupled with Orthogonal Frequency Division Multiplex (OFDM) modulation with a dispersion capability of 10 microseconds in both directions.

The OS-Gemini has been developed to operate within license exempt frequency bands, for example the ETSI 5.8 GHz C band (5.725–5.850 GHz) and the USA 5 GHz ISM band (5.725-5.850 GHz). The OS-Gemini has been designed to coexist with other users of the band in an optimal fashion using a combination of Transmit Power Control (TPC), Dynamic Frequency Selection (DFS) and Antenna beam shape.

In order to maintain link availability, the product employs adaptive modulation techniques that dynamically reduce the data rate in severe or adverse conditions. To the data network the OS-Gemini is implemented as a learning bridge. A learning bridge builds up a picture of which addresses are connected to which port. This means that it will not bridge a packet if it knows that the destination address is connected to the same port on which the bridge saw the packet. Figure 6 illustrates the OS-Gemini layer diagram.
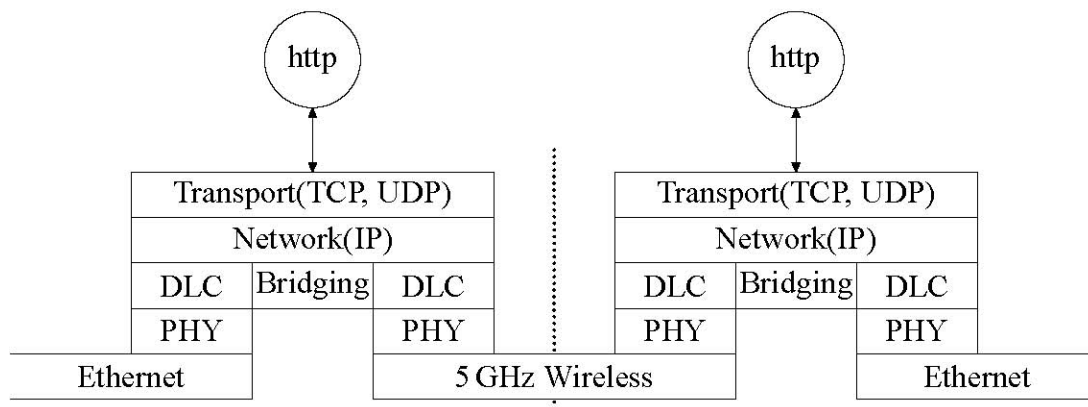
Figure 6 OS-Gemini Layer Diagram

The OS-Gemini functionality has been extended to encompass the IEEE 802.1q sub specification IEEE 802.1p. IEEE 802.1p allows the Ethernet packets to be extended by 4 bytes to include the IEEE 802.1q VLAN Tag and VLAN Priority/ID with VLAN ID set to 0 and the packet priority set to 0-7. The OS-Gemini will forward all VLAN tagged packets regardless of

the VLAN ID value. Packets with a value of Priority greater than 0 will be given priority over other packets.

Each unit in the link is manageable through an IP connection. Standard IP protocols are utilised for all management functions e.g. HTTP, SNMP, etc.

The OS-Gemini is fully software upgradeable. New software images are first download from the Orthogon Systems website http://www.orthogonsystems.com to a convenient computer. The image is then uploaded to the ODU via the web management page described in section 6.3.4 "Software Upgrade". The compressed image is first loaded into RAM and check-summed. If the compressed image transfer has completed successfully the image is decompressed and written to Flash memory. On completion of this process the unit can be rebooted to use the newly uploaded image. Should this process fail the unit will revert to a protected compressed image installed during manufacturing to allow the unit to be recovered.

3 General Considerations

3.1 Frequency Planning

The OS-Gemini operates over the frequency range 5.725 to 5.850 GHz (defined as the USA ISM band and the ETSI 5 GHz C band), utilising a 11 MHz wide channel. Setting of the operating frequency channel is automatic and is carried out by the built in Dynamic Frequency Selection (DFS) functionality.

The user can configure the OS-Gemini to avoid using certain frequencies to prevent interference to other users of the band and prevent operation in parts of the band containing interference. The use of this functionality is described in detail in section 6.3.5 "DFS Pages".

3.2 Distance

The OS-Gemini will operate at ranges from 100 m to 130 km, this within 3 modes 0-5km, 0-40km and 0-130km. Operation of the system will depend on obstacles in the path between the units. Operation at 40 km or above will require a near Line-of-Sight path. Operation at 100m could be achieved with one unit totally obscured from the other unit, but with the penalty of transmitting at higher power in a non-optimal direction, thereby increasing interference in the band. This subject is covered in more detail in section   "Path Loss Considerations".

3.3 Networking Information

The OS-Gemini operates as a transparent Ethernet bridge. Each unit requires an IP address. This IP address is for management purposes only and it plays no part in the operation of the system. IP addresses are assigned during initial configuration as described in section 5.2 "Installation Procedure".

3.4 Lightning Protection

The amount of lightning protection is dependent on regulatory requirements and the end user requirements. The standard OS-Gemini ODU is fitted with surge limiting circuits and other features to minimize the risk of damage due to nearby lightning strikes. These standard features may require some additional equipment to be configured as part of the system installation to be fully effective. Orthogon Systems recommends the use of screened cable and surge arrestor to protect connected equipment from nearby strikes.

Note: The OS-Gemini is not designed to survive direct lightning strikes. For this reason the unit should not be installed as the highest point in a localised area, unless specific precautions are taken. See section 9 "Lightning Protection".

3.5   Electrical Requirements

The OS-Gemini is supplied with a variable input voltage inline power supply unit. The OS-Gemini requires one mains supply outlet at each end of the link.

4 Site Planning

4.1 Site Selection Criteria

The following are guidelines for selecting the installation location of the OS-Gemini ODU and IDU.

4.1.1 ODU Site Selection

When selecting a site for the ODU the following should be taken into consideration:

- That it is not possible for people to stand or walk inadvertently in front of the antenna.

- Height and location to achieve the best radio path

- Height in relation to other objects with regard to lightning strikes

- Protection from the weather

- Aesthetics and planning permission issues

- Distance from IDU and connected equipment (Maximum cable run ODU to connected equipment is 100m)

- Distance from the IDU to the ODU (Maximum cable run IDU to ODU is 60m)

4.1.2 IDU Site Selection

When selecting a site for the IDU the following should be taken into consideration:

- Availability of a mains electricity supply

- Accessibility for viewing status indicators and pressing reset switch (See section 1.3.2 "The Indoor Unit (IDU)" and section 7 "Fault Finding"

- Distance from ODU and connected equipment (Maximum cable run ODU to connected equipment is 100m)

- Distance from the ODU to the IDU (Maximum cable run ODU to IDU is 60m)

4.1.3 Path Loss Considerations

The path loss is the amount of attenuation the radio signal undergoes between the two ends of the link. The path loss is the sum of the attenuation of the path if there were no obstacles in the way (Free Space Path Loss), the attenuation caused by obstacles (Excess Path Loss) and a margin to allow for possible fading of the radio signal (Fade Margin).

$$L_{free\_space} + L_{excess} + L_{fade} + L_{season} < L_{capability}$$

Where

L_{free_space}

L_{excess}

L_{fade}

$L_{seasonal}$

Where

L_{free_space}

L_{excess}

L_{fade}

$L_{seasonal}$

Equation 1 Path Loss

4.1.4 Aggregate Ethernet throughput rate v maximum link loss

The equipment capability is given in Table 3. It gives the Ethernet throughput rate vs link loss for OS-Gemini in both modes. Adaptive modulation will ensure that the highest throughput that can be achieved instantaneously will be obtained taking account of propagation and interference. The calculation of Equation 1 needs to be performed to judge whether a particular link can be installed. When the link has been installed web pages provide information about the link loss currently measured by the equipment both instantaneously and averaged. The averaged value will require maximum seasonal fading to be added and then the radio reliability of the link can be computed.

Aggregate Ethernet Throughput Rate (Mbps)[2]			Maximum path budget[3] (dB)
0-5km Mode	0-40km Mode	0-130km Mode	
33.61	31.46	27.02	138.1
28.81	26.97	23.16	142.8
25.61	23.97	20.58	144.7
19.21	17.98	15.44	150.1
12.81	11.99	10.29	154.6
8.54	7.99	6.86	159.2
6.40	5.99	5.15	161.3
3.20	3.00	2.57	166.5

Table 3 Aggregate Ethernet throughput rate v maximum link loss

The full calculation is relatively complicated and thus Orthogon Systems have supplied a link estimator that calculates the radio propagation and reliability of NLOS links using the OS-Gemini equipment.

---

[2] Throughput based on 1518 Byte Ethernet Packets on a symmetrical link.

[3] AMOD link margin of 1.5 dB applied.

5 Installation

Orthogon Systems recommends that only qualified personnel undertake the installation of an OS-Gemini system.

5.1 Preparation

Before proceeding with the installation you should:

- Check the contents of all packages against the parts lists shown in the packing list.
- Ensure that you have the correct tools for the job.
- Ensure that you are qualified to undertake the work.
- Ensure that you have taken the correct safety precautions.
- Have completed the site planning as described in section 4 "Site Planning".

5.2 Installation Procedure

The OS-Gemini installation procedure consists of the following steps:

- Mounting the ODUs, section 5.6
- Connecting up, section 5.7
- Mounting the IDUs, section 5.7.7
- Powering Up, section 5.7.8
- Aligning the ODUs, section 5.7.9

5.3 Tools Required

The following specific tools are required to install the OS-Gemini in addition to general tools:

- Two 13mm Spanners
- RJ45 Crimp Tool
- IBM Compatible Personal Computer (PC) running Windows 98 or later with 10 or 100baseT Ethernet (Ability to change IP settings easily is recommended)
- Either Internet Explorer version 6 or higher, or Netscape Navigator 7.01 or higher are recommended.
- 2 x short Ethernet patch cables
- 6mm general purpose crimp tool for the grounding lug (optional for lightning Protection)

Systems

5.4 Installation Support

Online installation support and contact details for your regional support can be found at http://www.orthogonsystems.com/

A Frequently Asked Questions (FAQ) section can be found in section 11.

5.5 Legal Disclaimer

IN NO EVENT SHALL ORTHOGON SYSTEMS BE LIABLE FOR ANY INJURY TO ANY PERSONS OR ANY DAMAGE CAUSED DURING THE INSTALLATION OF THE ORTHOGON SYSTEMS OS-Gemini PRODUCT.

5.6 Mounting the ODUs

The ODU mounting bracket is designed to ease installation by fixing the bracket to a wall or pole and then bringing the ODU into position using a single bolt fixing. The ODU should be mounted using the following steps ensuring that the cable entry is at the bottom:

5.6.1 Pole Mounting

Step 1: Mount the bracket to the pole.   Step 2: Mate the unit to the bracket together and tighten the nut and bolt.

5.6.2 Wall Mounting

Select and use high quality wall fixings. Note that wind loading can be very high (many times the weight of the unit) depending upon the location chosen. Also ensure that the wall can withstand these high forces.

Step 1: Mount one half of the bracket to the wall.

Step 2: Mate the two halves of the bracket together and tighten the nut and bolt.

5.7   Connecting Up

5.7.1   Preparing The Cable — RJ45 connections

Cable can be purchased from your reseller or distributor in lengths up to 60m. (Note that the maximum length between the IDU and ODU is 60m.) Those wishing to source their own cables and connectors (see section 1.3.4 "Cables and Connectors" above) should follow the following instructions along with the cable and connector suppliers instructions:

Step 1: Assemble gland Step on cable as shown
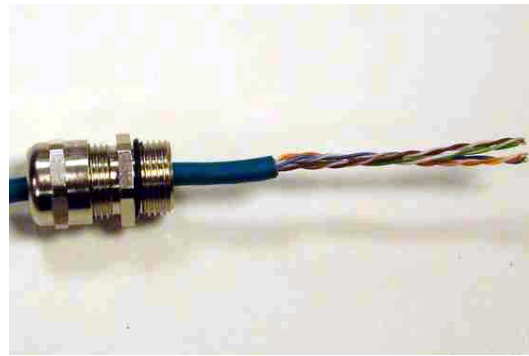
Step 2: Strip the outer insulation

Step 3: Arrange conductors as shown in Figure 8 and cut to length
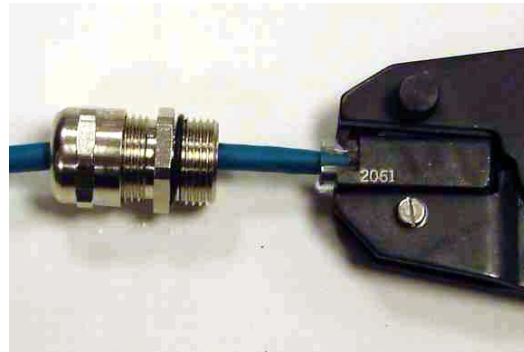
Step 4: Insert conductors and crimp

Figure 7 Completed ODU connector

Both ends of the ODU cable are terminated in the same way. The above procedure should be repeated for the IDU end of the cable when the cable routing process is complete.

Note: The IDU end of the cable does not employ a cable gland.

White/Orange	Pin 1
Orange	Pin 2
White/Green	Pin 3
Blue	Pin 4
White/Blue	Pin 5
Green	Pin 6
White/Brown	Pin 7
Brown	Pin 8

Lock tab underneath
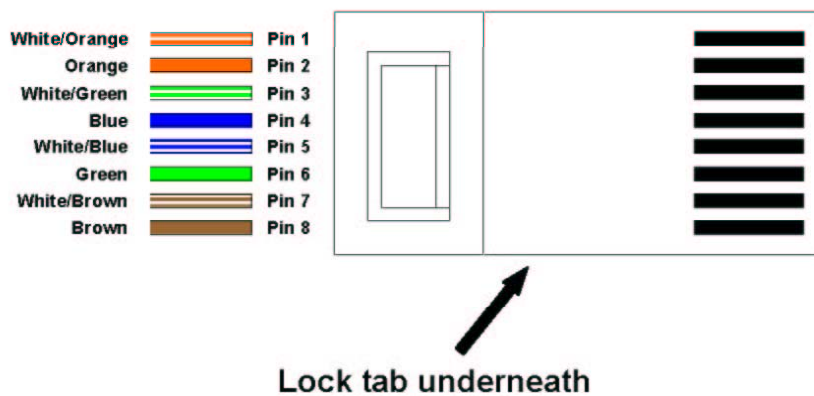
Figure 8 RJ45 Pin Connection

5.7.2   Making the Connection At The ODU

The following procedure describes how connection is made at the ODU. It is often easier to carry out this procedure on the ground or a suitable surface prior to mounting the ODU.

Ensure no power is connected to the IDU or present on the cable before connecting the ODU.

Step 1: Assemble the cable as described in 5.7.1 above

Step 2: Insert the RJ45 connector making sure that the locking tab snaps home

Step 3: Screw in the body of the weather proofing gland and tighten

Step 4: Screw on the clamping nut and tighten

Should it be necessary to disconnect the IDU to ODU cable at the ODU this can be achieved by removing the weather proofing gland and depressing the RJ45 locking tab with a small screwdriver as shown below:

Figure 9 Disconnecting the ODU

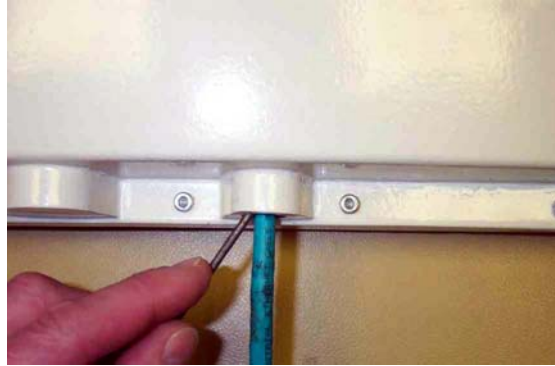Warning: Ensure that power is removed from the system at the IDU to prevent damage to the ODU whilst making or breaking the connection.

5.7.3 Routing the Cable

After connecting the cable to the ODU it can be routed and secured using standard cable routing and securing techniques. When the cable is in place it can then be cut to the desired length at the IDU prior to connection to the IDU.

5.7.4 Fitting A Surge Arrestor

If you have opted to fit a Surge Arrestor, this should be installed by following the manufacturers instruction. For recommended types see Section 9 "Lightning Protection"

5.7.5 Grounding The Installation

The OS-Gemini Outdoor unit must be properly grounded to protect against power surges. It is the user's responsibility to install the equipment in accordance with Section 810 of the National Electric Code, ANSI/NFPA No.70-1984 or Section 54 of the Canadian Electrical Code. These codes describe correct installation procedures for grounding the outdoor unit, mast, lead-in wire and discharge unit, size of grounding conductors and connection requirements for grounding electrodes. It is recommended that installation of the outdoor unit be contracted to a professional installer. See Section 9 "Lightning Protection" for recommended grounding kits.

5.7.6   Making the Connection At The IDU

The ODU is connected to the IDU by means of a concealed RJ45 connector. The RJ45 connection has been placed inside the IDU to prevent the user inadvertently plugging other equipment into the ODU RJ45 socket.

Warning: Plugging other equipment into the ODU RJ45 socket may damage the equipment due to the non-standard Power-over-Ethernet techniques employed. Plugging the ODU into other equipment may damage the ODU and/or the other equipment.

Step 1: Remove the cover by removing the four cover fixing screws.

Step 2: Plug in the ODU to IDU Cable ensuring that it snaps home

Step 3: Replace the cover

5.7.7   Mounting The IDU

This step is optional. Orthogon Systems recommends that you mount the IDU on a wall or other suitable mounting surface. This prevents the unit from being knocked or kicked and can help maintain link availability. Ensure that the reset switch can be accessed when mounting the unit.

Step 1: Fix the IDU to the wall using the lugs provided.

Step 2: Connect the DC power and LAN connection

5.7.8   Powering Up

Prior to powering up the OS-Gemini, a computer with web browsing capabilities should be configured with an IP address of 10.10.10.n and subnet mask of 255.0.0.0 where n is any value between 1 and 254 but excluding 10 or 11. If the default address of the unit 10.10.10.10/11 clashes with an address you are already using on your LAN, or you are not sure, you should set up an isolated LAN. As the LAN connection presented at the IDU has a default configuration as a hub/switch (and auto-sensing MDI/MDIX cross over is employed) connection can be made directly to the computer using a standard CAT 5 patch cable.

The Gemini system is supplied as a pair of matched Master/Slave units. The Master unit to be configured can now be powered up and accessed using the default URL http://10.10.10.10/; the Slave unit can be accessed using http://10.10.10.11/.

Before physical installation takes place the units to be installed should be set up as described in the section 6.3.3. This process will give the installer the opportunity to set the units IP address to one that is in the desired address range and set each unit up with the MAC address of its peer unit ready to establish a radio link. It is recommended that this procedure be carried out on the bench before physical installation commences. Providing it is safe to do so the installer should take the process to the point where a radio link is established before proceeding to the installation site.

5.7.9 Aligning the ODUs

The following is a description of the steps taken to establish a radio link between the two units forming the bridge and align the units for the best signal strength.

OS-Gemini uses audible tones during installation to assist the installer with alignment. The tones and their meanings are as follows:

State Name	Tone Description	State Description	Pitch Indication (Higher pitch = higher power)
Band Scan	Regular beep	Executing band scan	N/A
Scanning	Slow broken tone	Not demodulating the wanted signal	Rx Power
Synchronised	Fast broken tone	Demodulating the wanted signal	Rx Power
Registered	Solid tone	Both Master and Slave units exchanging Radio layer MAC management messages	Rx Power

Table 4 Audio indications from the ODU

The term 'wanted signal' refers to that of the peer unit being installed.

In each of the states detailed above the unit should be aligned to give the highest pitch tone. It should be noted that if, when in the Synchronised or Registered state the tone varies wildly, you may be suffering from interference or a fast fading link. Installing in this situation may not give a reliable link. The cause of the problem should be investigated.

For the ease of alignment both Master and Slave units use the install tones in the same way but with some small behavioural differences. This allows the installer to install the Slave unit first and carry out the initial alignment with the Master unit if desired. However due to the Behavioural differences of Master and Slave units it is recommended that the Master unit is installed first and the initial alignment carried out at the Slave unit.

The following behaviour should be noted:

When first started up and from time to time the Master unit will carry out a band scan to determine which channels are not in use. During this time, between 10 and 15 seconds, the Master unit will not transmit and as a consequence of this neither will the Slave unit. During this time the installation tone on the master unit will drop back to the band scan state and the Slave unit will drop back to Scanning state with the pitch of the tone set be the background noise level. Alignment of the unit should cease during this time.

The master unit can take between 10 seconds in 0-5km mode to 60 seconds in 0-130km mode to determine the range of the link being installed. The Master unit will remain in the Scanning state until the range of the link has been established. The Master unit will only move to the Synchronized state when the range of the link has been established.

If at the end of the ranging period the Registered state is not achieved due to interference or other reasons, the Master unit will retry twice more on the same channel before moving to another available channel. Should this occur it might take a number of minutes to establish a link in the Registered state.

The Slave unit does not have a ranging process. The slave unit will change to the Synchronized state as soon as the wanted signal is demodulated.

When the alignment process is complete the installer MUST REMEMBER TO DISARM BOTH UNITS in the link as described in section 6.3.3. This is necessary for the following:

- Turn off audible alignment aid.
- Enable Adaptive Modulation
- Fully enable Dynamic Frequency Selection
- Clear unwanted installation information from the various systems statistics
- Store the link range for fast link acquisition on link drop

6 Web Page Reference

The web user interface has three main sections. The home page presents to the operator a high level summary of the OS-Gemini wireless link. The status page presents a more detailed set of system parameters describing the performance of the wireless link together with other key system performance metrics. The final section is the system administrator section. This section is password protected and allows the OS-Gemini administrator to perform all the day-to-day administrative procedures, e.g. Software Upgrade and perform configuration changes.

The following subsections give a detailed usage guide for all the web user interfaces. All the web pages are best viewed using a screen resolution of at least 1024 x 768 pixels on a PC using Microsoft Internet Explorer Version 6 or Netscape Navigator version 7 or later.

The navigation bar on the left hand side of the web page is used to move between the various management pages. The currently selected page is always highlighted with a dark blue background. The menu is hierarchical selecting any menu item which has associated submenu options will automatically display all sub options. An example webpage with the navigation menu is shown in Figure 10 when the 'Home' Link is highlighted as the current page.

6.1 Home Page

The OS-Gemini home page has been designed to display a high level summary of the status of the wireless link and associated equipment. The home page (Figure 10) normally displays four key system attributes:

Wireless Link Status The Wireless Link Status attribute as the name suggests displays the current status of the OS-Gemini wireless link. A state of 'Up' on a green background indicates that a Point-to-Point link is established. A state of 'Down' on a red background indicates that the wireless link is not established. If the link is down for an unknown reason the system administrator should first consult the status web page for a more detailed summary of up to date system diagnostics.

Link Name The link name attribute is a name and/or handle allocated by the system administrator to aid the identification of the unit of the network or building.
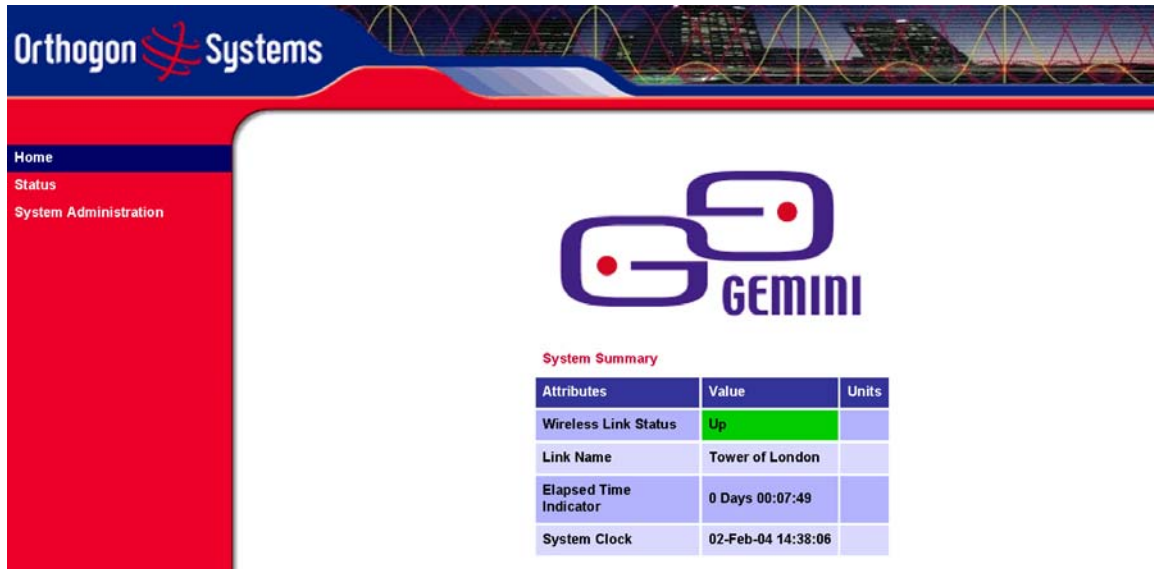
Figure 10 OS-Gemini Home Page

Elapsed Time Indicator The elapsed time indicator attribute presents the total time in days, hours, minutes and seconds since the last system restart. The system can restart for several reasons, e.g. commanded reset from the system reset webpage, or a power cycle of the equipment.

System Clock If the SNTP (Simple Network Time Protocol) (see section 6.3.6.3) is enabled a system clock attribute is displayed giving the date and time of the last page refresh. If SNTP is disabled then the system clock attribute is not displayed on the home page.

6.1.1 Home Page Alarm Display

The home page is also used to display all outstanding major system alarms. The following major system alarms are defined:

Unit Calibration The unit calibration alarm is raised if the OS-Gemini unit fails to detect a valid set of calibration data in the unit's non-volatile memory.

Install Status If any errors are detected during the installation process, the unit will automatically raise an audible alarm. The install status alarm will be raised with an appropriate reason code, e.g. the alarm will be raised if an incorrect target MAC address is specified for the peer OS-Gemini wireless unit.

ARQ Is Not Configured ARQ must be enabled on both ends of the Point-to-Point link. This error message is generated if there is a mismatch in the ARQ settings between both ends of the link.

6.2   Systems Status Page

The status page has been designed to give the system administrator a detailed view of the operation of the OS-Gemini system from both the wireless and network perspectives.

The page is subdivided into three main categories Equipment, Wireless and Ethernet/Internet. The 'Equipment' section contains all the unit's inventory and identification information. The 'Wireless' section presents all the key wireless metrics displayed as a series of measurements and histograms. The 'Ethernet/Internet' section describes the unit's network identity and connectivity.

The status page can be configured to refresh itself at an operator defined rate. The refresh this page field defaults to is 3600 seconds but can easily be changed to refresh at any period between 2 seconds and 1 hour. Pressing the 'update page refresh period' button causes a new page refresh period to be adopted by the system. The page refresh mechanism uses a HTML Meta refresh command. Therefore the refresh is always initiated by the local browser and not by the OS-Gemini system at this interval.
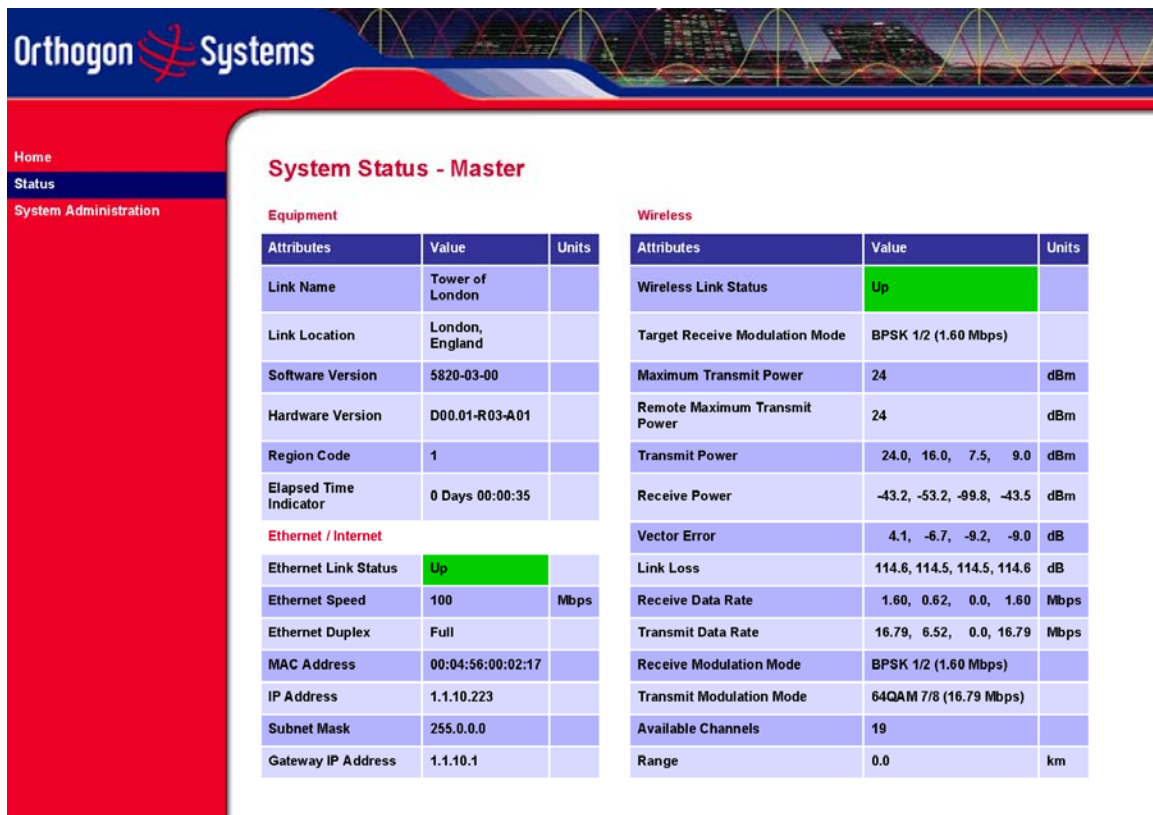

System Status - Master

Equipment

Attributes	Value	Units
Link Name	Tower of London	
Link Location	London, England	
Software Version	5820-03-00	
Hardware Version	D00.01-R03-A01	
Region Code	1	
Elapsed Time Indicator	0 Days 00:00:35	

Ethernet / Internet

Attributes	Value	Units
Ethernet Link Status	Up	
Ethernet Speed	100	Mbps
Ethernet Duplex	Full	
MAC Address	00:04:56:00:02:17	
IP Address	1.1.10.223	
Subnet Mask	255.0.0.0	
Gateway IP Address	1.1.10.1	

Wireless

Attributes	Value	Units
Wireless Link Status	Up	
Target Receive Modulation Mode	BPSK 1/2 (1.60 Mbps)	
Maximum Transmit Power	24	dBm
Remote Maximum Transmit Power	24	dBm
Transmit Power	24.0, 16.0, 7.5, 9.0	dBm
Receive Power	-43.2, -53.2, -99.8, -43.5	dBm
Vector Error	4.1, -6.7, -9.2, -9.0	dB
Link Loss	114.6, 114.5, 114.5, 114.6	dB
Receive Data Rate	1.60, 0.62, 0.0, 1.60	Mbps
Transmit Data Rate	16.79, 6.52, 0.0, 16.79	Mbps
Receive Modulation Mode	BPSK 1/2 (1.60 Mbps)	
Transmit Modulation Mode	64QAM 7/8 (16.79 Mbps)	
Available Channels	19	
Range	0.0	km

Figure 11 Status Page

The following section details all the attributes displayed on the status page.

Link Name The link name is allocated by the system administrator and is used to identify the equipment of the network. The link name attribute is to a maximum size 63 of ASCII characters.

Link Location The link location is allocated by the system administrator and can be used as a generic scratch pad to describe the location of the equipment of any other equipment related notes. The link location attribute is limited to a maximum size of 63 ASCII characters.

Software Version The attribute describes the version of software installed on the equipment. The format of the attributes is *PPPP-XX-YY* where *PPPP* is the product variant, *XX* is the major release version and *YY* is the minor release version.

Hardware Version The hardware version attribute contains all the combined hardware version information. The attribute is formatted as D*XX.XX*-R*YY*-A*ZZ* where D*XX.XX* contain the version of the digital card, R*YY* contains the version of the RF (radio frequency) card and A*ZZ* describes the antenna type.

Region Code The region code is used by the system to constrain the wireless to operate within the 5.8 GHz regulatory regime of the particular country. The region code is encoded in the product licence key. If the operator wishes to change region code, a new licence key must be obtained from Orthogon Systems or the local distributor / system integrator.

Elapsed Time Indicator The elapsed time indicator attribute presents the total time in days, hours, minutes and seconds since the last system restart. The system can restart for several reasons, e.g. commanded reset from the system reset webpage, or a power cycle of the equipment.

Ethernet Link Status Current status of the Ethernet link. A state of 'Up' with a green background indicates that an Ethernet link is established. A state of 'Down' with a red background indicates that the Ethernet link is not established.

Ethernet Speed The negotiated speed of the Ethernet interface specified in Mbps.

Ethernet Duplex The negotiated duplex of the Ethernet interface.

Full Duplex Full Duplex data transmission means that data can be transmitted in both directions on a signal carrier at the same time. For example, on a local area network with a technology that has full duplex transmission, one workstation can be sending data on the line while another workstation is receiving data.

Half Duplex Half Duplex data transmission means that data can be transmitted in both directions on a signal carrier, but not at the same time. For example, on a local area network using a technology that has half duplex transmission, one workstation can send data on the line and then immediately receive data on the line from the same direction in which data was just transmitted.

MAC Address The Medium Access Control Layer (MAC) address is used to uniquely identify the equipment on an Ethernet network.

IP Address Internet Protocol (IP) address. This address is used by the family of Internet protocols to uniquely this identify the unit on a network

Subnet Mask A subnet allows the flow of network traffic between hosts to be segregated based on a network configuration. By organizing hosts into logical groups, subnetting can improve network security and performance.

Gateway IP Address The IP address of a computer on the current network that acts as a gateway. A gateway acts as an entrance / exit to packets from / to other networks.

Wireless Link Status As the attribute name suggests displays the current status of the OS-Gemini wireless link. A state of 'Up' on a green background indicates that a Point-to-Point link is established. A state of 'Down' on a red background indicates that the wireless link is not established. If the link is down for an unknown reason the system administrator should first consult the status webpage for a more detailed summary of the prevailing system diagnostics.

Target Modulation Mode The target modulation mode is used by the wireless subsystem to control the adaptive modulation algorithm.

Remote Transmit Maximum Power The maximum transmit power the remote wireless unit is permitted to use to sustain a link.

Transmit Power Transmit power histogram is expressed in dBm and presented as: max, mean, min, and latest.

The histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time.

Receive Power Receive power histogram is expressed in dBm and presented as: max, mean, min, and latest.

The histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time.

Vector Error The vector error measurement compares the received signal's In phase / Quadrature (IQ) modulation characteristics to an ideal signal to determine the composite error vector magnitude. The results are stored in a histogram and expressed in dB and presented as: max, mean, min and latest. The histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time. The expected range for Vector Error would be approximately 0dB (NLOS link operating at sensitivity limit on BPSK ½) to –29dB (short LOS link running 64QAM 7/8).

Link Loss The link loss is the total attenuation of the wireless signal between the two Point-to-Point units.

$$P_{ll} = P_{T_x} - P_{R_x} + 2 \cdot (g_{T_x} + g_{R_x})$$

Where

P_{ll}	Link Loss (dB)
P_{T_x}	Transmit power of the remote wireless unit (dBm)
P_{R_x}	Received signal power at the local unit (dBm)
g_{T_x}, g_{R_x}	Antenna gain at the remote and local units respectively (dBi). The antenna gain of the OS-Gemini is 23.5 dBi.

Equation 2 Link Loss

Receive Data Rate The data rate in the receive direction, expressed in Mbps and presented as: max, mean, min, and latest histogram format.

The histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time.

Transmit Data Rate The data rate in the transmit direction, expressed in Mbps and presented as: max, mean, min, and latest histogram format.

The histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time.

Receive Modulation Mode The modulation mode currently being used on the receive channel. The number in brackets after the modulation mode and coding rate string is the effective data rate available to all MAC layer protocols.

Transmit Modulation Mode The modulation mode currently being used on the transmit channel. The number in brackets after the modulation mode and coding rate string is the effective data rate available to all MAC layer protocols.

Available Channel The available channels attribute describes the number of usable channels that have been measured by the Dynamic Frequency Selection (DFS) algorithm.

Range The range (in km) between the peer OS-Gemini units.

Refresh Page Period The Status page refreshes automatically according to the setting entered here (in seconds).

6.3 System Administration Pages

The following menu options are available for the system administrator and can be password protected. Figure 12 shows the system administration login page. By default a system admin password is not set. Simply click the login button to access the system administration features.

Once the password has been set using the 'Change Password' menu item the system administration pages will only be available after the user has entered the correct password.
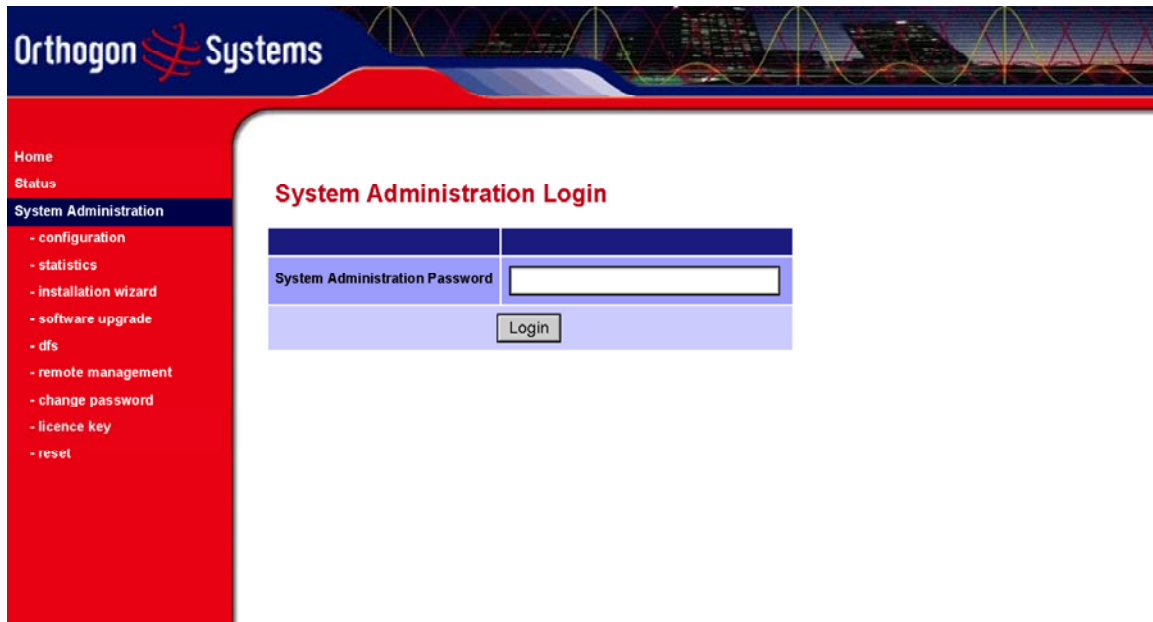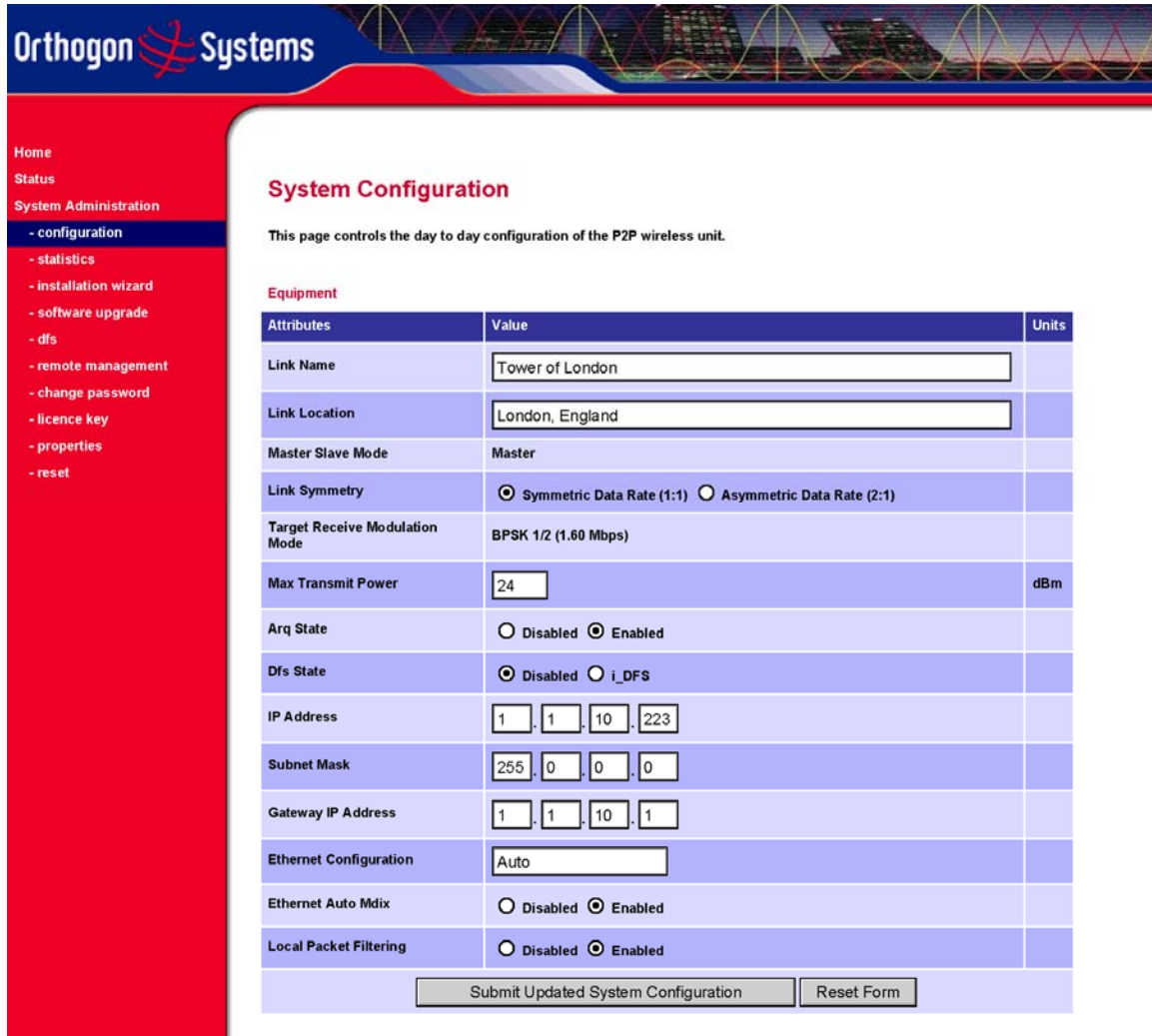
Figure 12 System Administration Login Page

The features that are only available to the system administrator are:

- Configuration
- System Statistics
- The Installation Wizard
- Software Upgrade
- DFS (Dynamic Frequency Selection)
- Remote management
- Password Management
- Licence Key Management
- System Reset

6.3.1 System Configuration Page

The configuration page (Figure 13) is used by the system administrator to configure the OS-Gemini unit.

Figure 13 Configuration Page

Whilst the majority of the system configuration is entered during installation and should never require changing, this page offers the system administrator the ability to change the basic system parameters for both the wireless and Ethernet components.

Link Name User defined identity for the unit (max 63 characters).

Link Location Can be used as a generic scratch pad to describe the location of the equipment or any other equipment related notes (max 63 characters).

Link Symmetry By default Link Symmetry of a Point-to-Point link is 'Symmetrical Data Rate (1:1)' in this configuration the ratio of time the wireless link spends transmitting and receiving is equal. When Link Symmetry is configured to Asymmetric Data Rate (2:1) the wireless link Master will spend twice as long transmitting as receiving. It should be noted that data rate available to the end users might not follow these ratios exactly. The exact data rates will be dependant on the prevailing modulation modes.

Target Receive Modulation Mode This is the maximum mode the unit will use as its adaptive modulation. The modulation modes available are:

- BPSK 1 / 2
- QPSK 1 / 2
- QPSK 2 / 3
- 16QAM 1 / 2
- 16QAM 3 / 4
- 64QAM 2 / 3
- 64QAM 3 / 4
- 64QAM 7 / 8

By default the Target Receive Modulation Mode is 64QAM 7/8.

Maximum Transmit Power This specifies the maximum transmit power in dBm of the system, it is country dependent and although the user can change this it will be limited to that country's regulations.

ARQ State Automatic Repeat reQuest (ARQ) is a mechanism where packets lost due to transmission errors over the wireless link are retransmitted rapidly. The retransmission helps to prevent TCP congestion mechanisms from inadvertently interpreting intermittent pack loss as network congestion. ARQ must be enabled on both end of the Point-to-Point link for it to function.

Dynamic Frequency Selection (DFS) The user can enable or disable the DFS functionality, by default it is enabled. Note that this attribute will be greyed out when the installation agent is armed. Disarming installation will return this attribute to its normal state.

IP Address Internet protocol (IP) address. This address is used by the family of Internet protocols to uniquely identify this unit on a network.

Subnet Mask A subnet allows the flow of network traffic between hosts to be segregated based on a network configuration. By organizing hosts into logical groups, subnetting can improve network security and performance.

Gateway IP Address The IP address of a computer / router on the current network that acts as a gateway. A gateway acts as an entrance / exit to packets from / to other networks.

Ethernet Configuration This enables the Ethernet configuration to be forced rather than auto negotiated. The configuration should only be forced if you are having problems with auto negotiation. You must ensure that you configure both this unit and the Ethernet port to which it is connected identically. If you force a fixed Ethernet Configuration on the OS-Gemini unit then you MUST also force the same fixed configuration on the equipment to which it is connected. If you fail to force the configuration of the connected equipment, its automatic configuration mechanisms will normally cause a duplex mismatch, and you will receive greatly reduced throughput!

Ethernet Auto Mdix This enables/disables the Auto Medium Dependent Interface (MDI)/Medium Dependent Interface Crossover (MDIX) capability.

All the above attributes are non-volatile, once set they will be used by the unit even after a power on reset. A number of attributes, such as IP Address, Subnet Mask and Gateway IP Address will require a reset before they are used. If any of these attributes are changed a reset screen appears asking the user to verify the reset. (see Figure 14)

Figure 14 Configuration Reset Page

Note: At this point you will lose connection to the unit. If you have just changed the IP Address you now have to reconnect to the unit using the address just set.

6.3.2   Statistics Page

The OS-Gemini statistics page is designed to display some key statistics of the Ethernet Bridge and the underlying wireless performance.
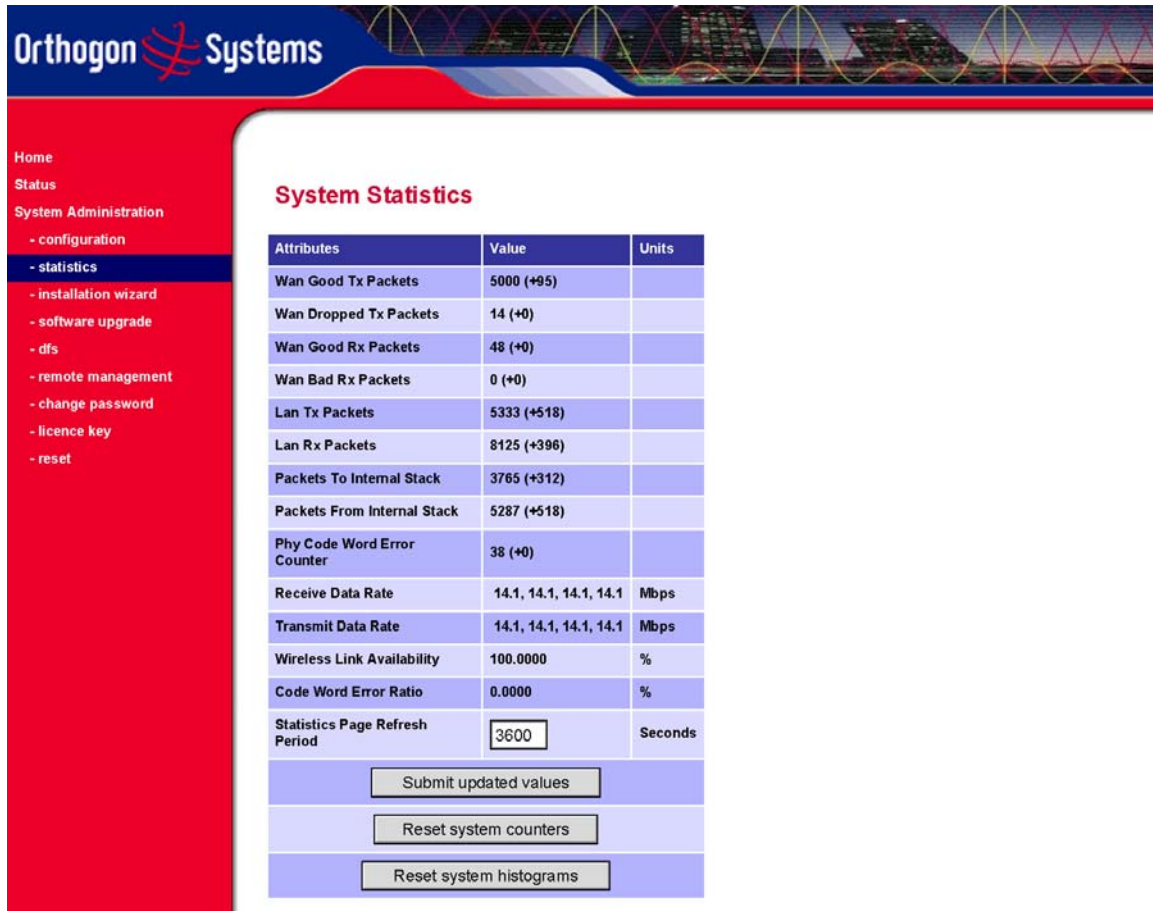

Figure 15 Statistics

Wan Good Tx Packets This displays the total number of good packets the bridge has sent for transmission by the wireless interface. The number in (+nn) displays the number of packets transmitted since the last page refresh.

Wan Dropped Tx Packets This displays the total number of packets that the local unit could not bridge to the remote unit because either the wireless link was down or because Ethernet packets are being received faster than they can be transmitted over the wireless link. The number in (+nn) displays the number of packets dropped since the last page refresh.

Wan Good Rx Packets This displays the total number of good packets the bridge has received from the wireless interface. The number in (+nn) displays the number of packets received since the last page refresh.

Wan Bad Rx Packets This displays the total number of corrupt packets the bridge has received from the wireless interface. The number in (+nn) displays the number of corrupt packets received since the last page refresh.

Lan Tx Packets This displays the total number of good packets the bridge has sent for transmission by the local Ethernet interface. The number in (+nn) displays the number of packets transmitted since the last page refresh.

Lan Rx Packets This displays the total number of good packets the bridge has received from the local Ethernet interface. The number in (+nn) displays the number of packets received since the last page refresh.

Packets To Internal Stack This displays the total number of good packets the bridge has transmitted to the internal stack (e.g. ARP requests, PING requests, HTTP requests). The number in (+nn) displays the number of packets transmitted since the last page refresh.

Packets From Internal Stack.This displays the total number of good packets the bridge has received from the internal stack (e.g. ARP responses, PING replies, HTTP responses). The number in (+nn) displays the number of packets received since the last page refresh.

PHY Code Word Error Counter The wireless link uses error correction techniques to enable reconstruction of packets where there is a certain level of data corruption. This counter displays the total number of packets that were so badly corrupted that they could not be reconstructed. The number in (+nn) displays the number of packets received since the last page refresh

Receive Data Rate The data rate in the receive direction, expressed in Mbps and presented as: max, mean, min, and latest histogram format.

The histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time.

Transmit Data Rate The data rate in the transmit direction, expressed in Mbps and presented as: max, mean, min, and latest histogram format.

The histogram is calculated over a one hour period. If the equipment has been running for less than one hour then the histogram is calculated over the current elapsed time.

Wireless Link Availability Expresses the link availability as a percentage of time since the first successful registration after a system restart. Expressed as a percentage to four decimal places.

Code Word Error Ratio The ratio of detected codeword errors to the total number of codewords since the last system reset.

Statistics Page Refresh Period The statistics page refreshes automatically according to the setting entered here (in seconds).

Reset System Counters By pressing this button all counters in the system are reset to zero. This not only affects this page for example the Elapsed Time Indicator is also reset.

Reset System Histograms All histograms are reset, and the calculation period is restarted.

6.3.3   Install Pages

These pages are used during system installation. There follows a description of the install pages along with their use during the installation configuration process. The actual installation process is described in section 5.7.9 "Aligning the ODUs" above.

All wireless links are shipped as paired units. They are pre-configured at the factory so that they can be installed without any user supplying any configuration. Each wireless link is shipped with a quick start guide. Attached to the quick start guide is a summary of the pre-configured configuration data. Table 5 shows an example link configuration. The values highlighted have been committed to the wireless units non-volatile storage.

Example OS-Gemini Configuration Data	
For your convenience these two units have been pre-configured as a link	
Units:	
ODU serial number	ODU serial number
0167800002BE	0167800002BF
Ethernet MAC address	Ethernet MAC address
00:04:56:00:02:BE	00:04:56:00:02:BF
Configured as:	
Master	Slave
Target MAC address	Target MAC address
00:04:56:00:02:BF	00:04:56:00:02:BE
Licence Key	Licence Key
A471-FE88-428D-E1F3	534F-4F54-D1B0-E2DA
IP Address	IP Address
10.10.10.11	10.10.10.10

Table 5 OS-Gemini Factory Configuration Values

The factory default configuration is written to the 'semi-permanent' configuration bank. The semi permanent bank is used to hold all non-default values and allows the system administrator to return the unit back to 'factory defaults'.

6.3.3.1 Manually Configuring The Wireless Units

If the installer / system administrator wishes, they may modify the default installation configuration. If only the IP addresses are incorrect it is recommended that the values are changed via the configuration menu (Section 6.3.1). If any other parameters require modification then it is recommended that the system administrator use the Installation Wizard.

A detailed description of the Installation Wizard follows:

The OS-Gemini operational software requires a licence key to enable the wireless bridging capability and programs region code specific parameters in to the unit.
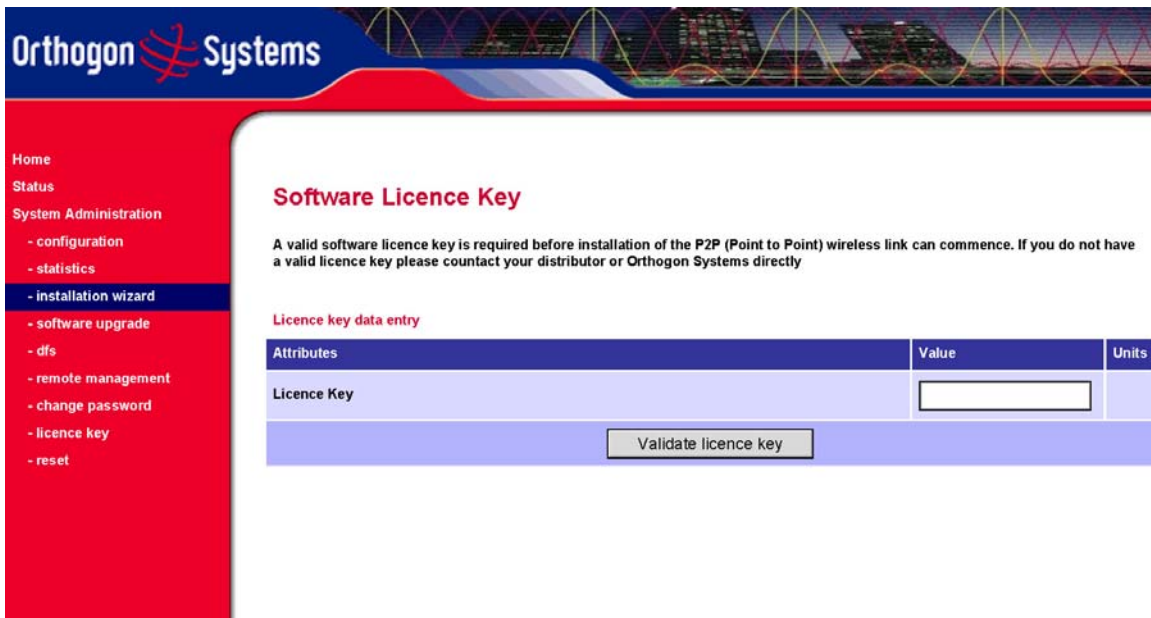
Figure 16 Licence Key Data Entry
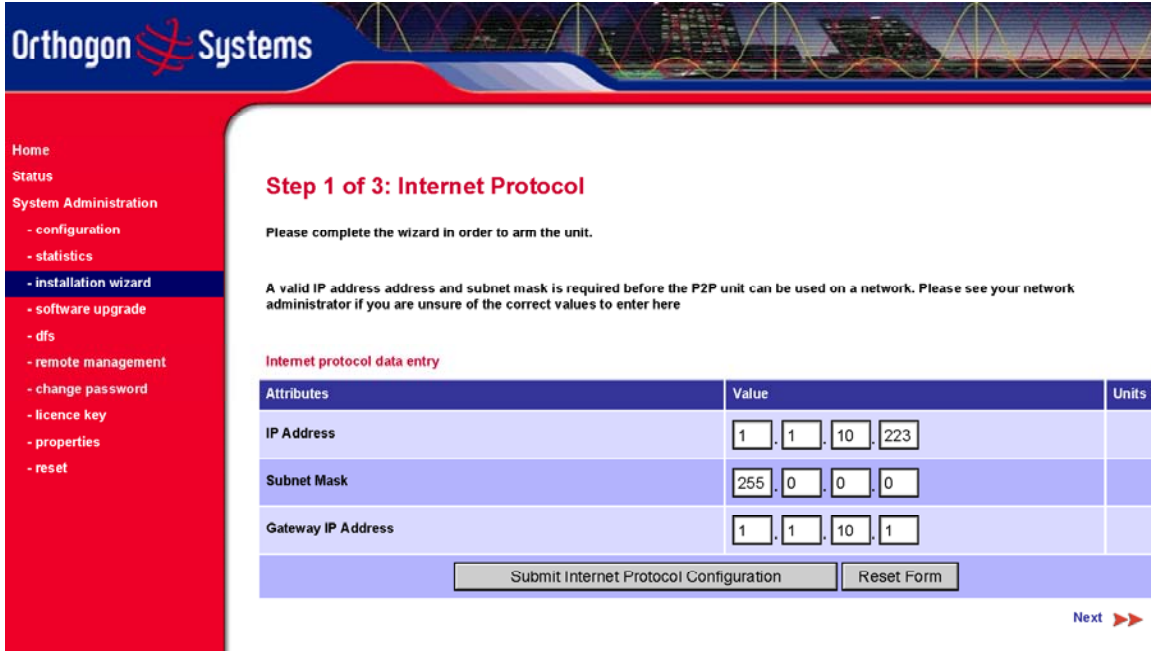
A licence key is supplied programmed into each unit and can be found written on the Configuration Data Summary Label which is attached to the Quick Install Guide. If subsequently the licence key has been mislaid, replacement keys can be applied for online.

If a valid licence key is not detected in the unit's non-volatile memory then the user is prompted to enter a valid key. It should be noted that OS-Gemini units are now shipped as link pairs and as such valid licence keys are entered during the production process. Hence the user should never see the Software Licence Key screen (Figure 16).

To enter a licence key simply type or paste the licence key into the data entry box and click the 'validate licence key' button.

6.3.3.2   Internet Protocol Configuration

Step 1 of the installation wizard requires the installer to enter the Internet Protocol (IP) configuration.

Figure 17 Installation Wizard Internet Protocol Configuration

Once complete click the 'Submit Internet Protocol Configuration' button or the 'Next' link.

6.3.3.3   Wireless Configuration

Step 2 of the installation wizard requires the installer to enter the wireless configuration parameters.

Figure 18 Installation Wizard Wireless Configuration

Target MAC Address The MAC Address of the peer unit that will be at the other end of the wireless link. This is used by the system to ensure the unit establishes a wireless link to the correct peer.

The MAC Address can be found embedded within the serial number of the unit. The last six characters of the serial number are the last three bytes of the unit's MAC address.

(Note: The OS-Gemini system is shipped as a pair of units with pre-loaded correct MAC addresses. MAC addresses will only need to be entered if an existing unit has to be replaced in the field or the units configuration has been erased).

Master Slave Mode At this point it is necessary to decide which end will designated a Master. The Master unit is the controlling unit with respect to the Point-to-Point link and its maintenance. Master transmits until the link is made, whilst the Slave listens for its peer and only transmits when the peer has been identified.

Link Symmetry By default Link Symmetry of a Point-to-Point link is 'Symmetrical Data Rate (1:1)' in this configuration the ratio of time the wireless link spends transmitting and receiving is equal. When Link Symmetry is configured to Asymmetric Data Rate (2:1) the wireless link Master will spend twice as long transmitting as receiving. It should be noted that data rate available to the end users might not follow these ratios exactly. The exact data rates will be dependant on the prevailing modulation.

ARQ State Automatic Repeat reQuest (ARQ) is a mechanism where packets lost due to transmission errors over the wireless link are retransmitted rapidly. The retransmission helps to prevent TCP congestion mechanisms from inadvertently interpreting intermittent pack loss as network congestion. ARQ must be enabled on both end of the Point-to-Point link for it to function.
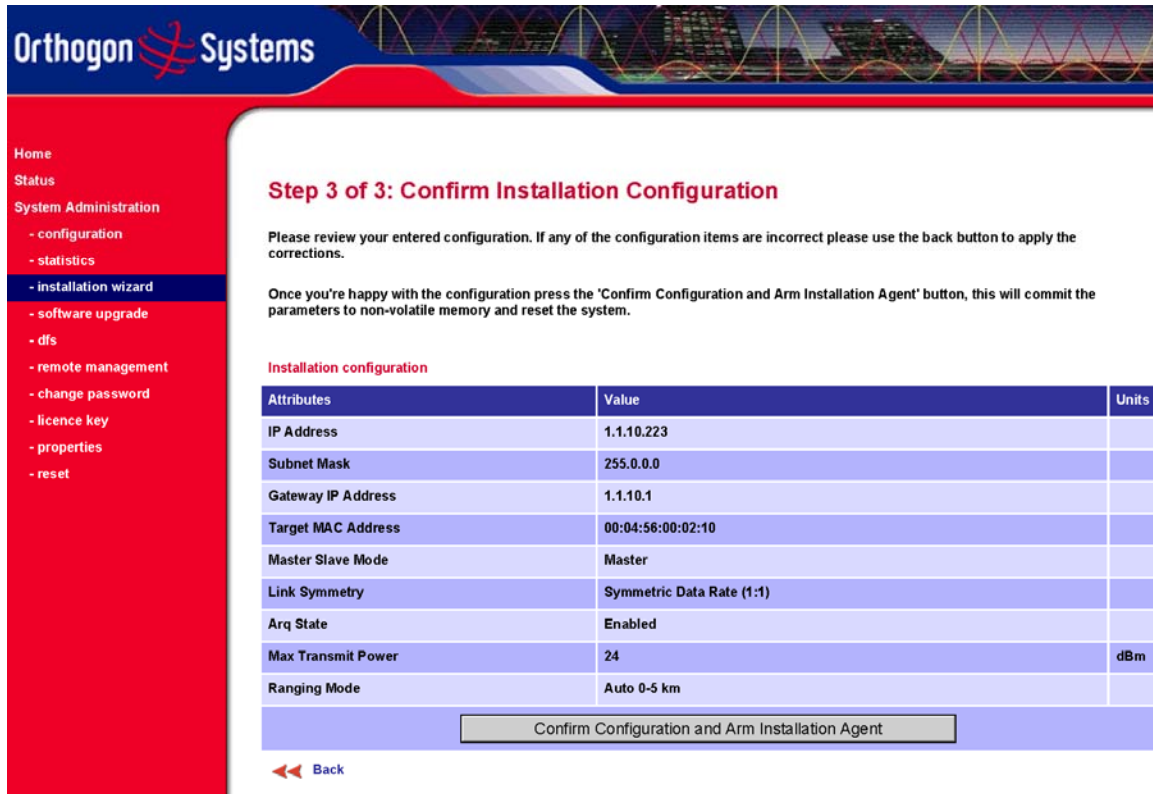
Max Transmit Power This attribute controls the maximum transmit power the unit is permitted to use when installing and executing the wireless link.

Ranging Mode During installation the wireless units perform automatic ranging. The ranging mode allows the installer to control the behaviour of the systems automatic ranging algorithms. The default value is 0 to 40 km. If the installer is required to install a link of greater than 40 km then the ranging mode attribute MUST be configured to 0 to 130 km mode. Likewise selecting the 0 to 5 km mode for links under 5 km will give you optimal performance. Installers that know the range between the two wireless units to within $\pm$ 1 km can use the target range mode. The main advantage of the target range mode is that it reduces the time taken by the units to range. To use the target range mode the installer MUST select the Target as the ranging mode and enter the approximate range in km in the Target range data entry field.

Once the installer is satisfied with the wireless configuration options then the 'Submit Wireless Configuration' button or the 'Next' link should be clicked.

6.3.3.4 Confirm Configuration

Step 3 of the installation wizard allows the installer to review and confirm the installation information before committing the information to non-volatile memory (Figure 19)

Figure 19 Installation Wizard Confirm Configuration

If all the settings are correct and appropriate click the "Confirm Configuration and Reset Unit" button. All the attributes are committed to non-volatile memory. Immediately following the write to non-volatile memory the unit is reset.

Note: If you have changed the Ethernet parameters you must reconnect using the correct network and address settings.

6.3.3.5   Disarm

Step 5 of the installation wizard is the disarm phase.

Disarm Installation

The installation agent is armed. If you wish to disarm installation then use the 'Disarm Installation Agent' button. If you wish to reconfigure the installation agent then use the wizards 'back' button

Installation configuration

Attributes	Value	Units
IP Address	1.1.10.223	
Subnet Mask	255.0.0.0	
Gateway IP Address	1.1.10.1	
Target MAC Address	00:04:56:00:02:10	
Master Slave Mode	Master	
Link Symmetry	Symmetric Data Rate (1:1)	
Arq State	Enabled	
Max Transmit Power	24	dBm
Ranging Mode	Auto 0-5 km	

Disarm Installation Agent

◄◄ Back

Figure 20 Disarm Installation

Once section 5.7.9 "Aligning the ODUs" is complete pressing the "Disarm Installation Agent" button completes the installation process and the audible installation tone will be switched off. If the installer wishes to modify the installation configuration then the 'Back' link can be used to access the installation wizard steps described above.