

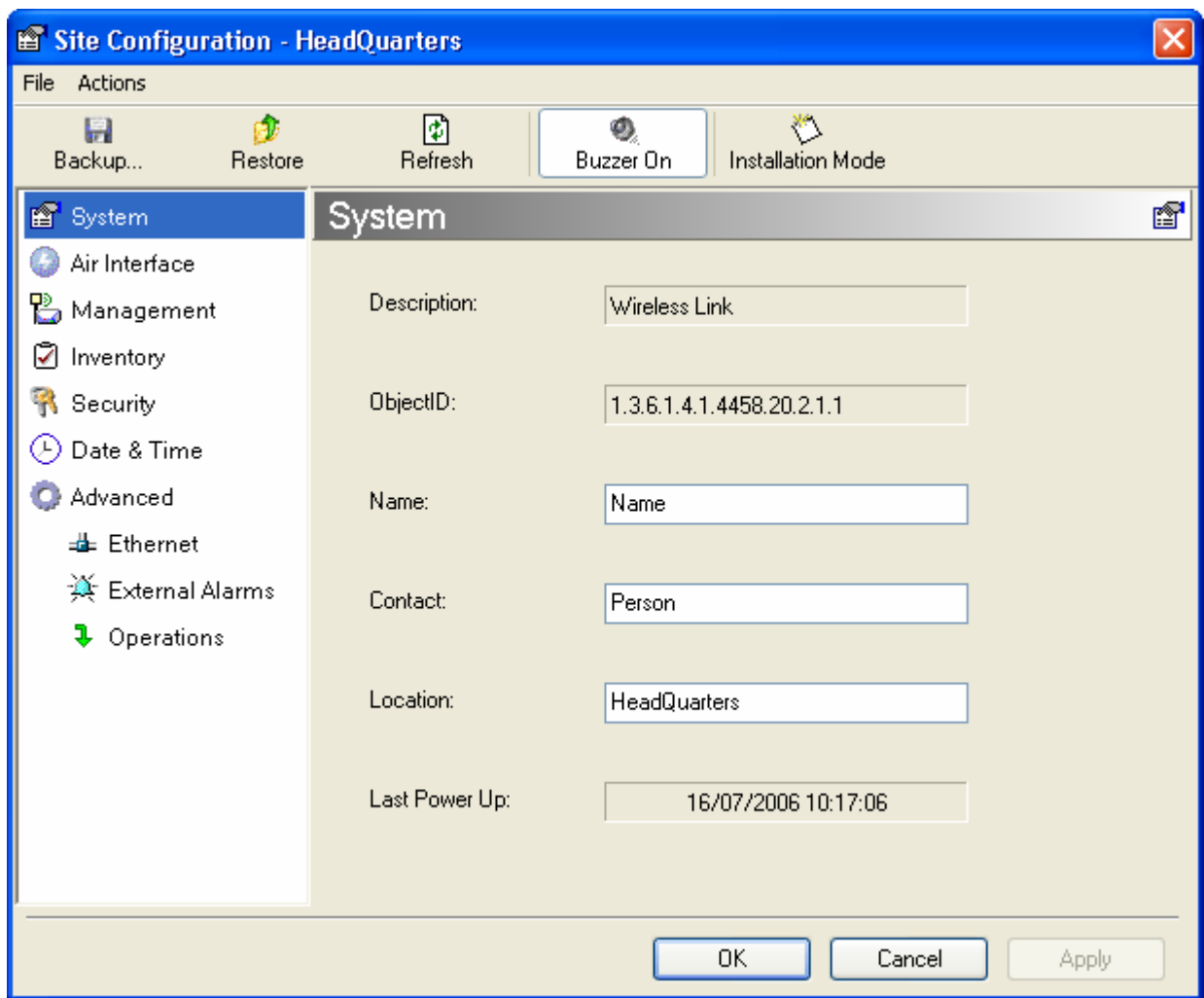


Figure 4-8. Configuration Dialog Box

3. Select the appropriate item in the left hand list to open a dialog box.
4. Click **Apply** to save the changes.

4.5 Setting the Clock Configuration

The TDM clock feature is enabled in all carrier class IDU's in addition to new hardware IDU's. A TDM dialog box will appear where IDU supports the clocking configuration feature (see [Figure 4-9](#) and [Figure 4-10](#)).

A new master clock configuration option is available in the Link Configuration Wizard. The automatic mode selects the clock from the first trunk that is working in normal mode (or is configured to loop-back maintenance). If a specific trunk is selected, this trunk shall be

used as the system master regardless of the trunks state. The current master clock trunk is also displayed.

Link Configuration Wizard

TDM Parameters
Configure the TDM Parameters below.

TX Clock

HB32	"OR" Tower
☒ Transparent	Transparent
☐ Loop Timed	Recovered
☐ Recovered	Loop Timed
☐ Internal	Recovered
☐ Recovered	Internal

Master Clock

Current	Mode
1st Trunk	Automatic

< Back Next > Cancel

Monitor Link

Radio Interface	HB32	"OR" Tower
RSS [dBm]	-44	-47
ETBE	sec min hour day month year	sec min hour day month year

Figure 4-9. TDM clock dialog box for T1 IDU

Link Configuration Wizard

TDM Parameters
Configure the TDM Parameters below.

TX Clock

	5.4	5.2
☒ Transparent	Transparent	Transparent
☐ Loop Timed		Recovered
☐ Recovered		Loop Timed
☐ Internal		Recovered
☐ Recovered		Internal

Master Clock

Current	Mode
1st Trunk	Automatic

< Back Next > Cancel

Monitor Link

Radio Interface	5.4	5.2
RSS [dBm]	-36	-38
ETBE	sec min hour day month year	sec min hour day month year

Figure 4-10. TDM clock dialog box for E1 IDU

If TDM services are selected then the TDM parameters dialog box appears.

The TDM Parameters dialog box contains five working modes; select the appropriate clock mode according to your application. Choosing one of these modes sets the TDM clock behavior on both sides of the link. The user equipment must be configured as described [Table 4-1](#).

Table 4-1. TDM Clock Modes

	Unit clock mode		User equipment side	
	Local Unit	Remote Unit	HQ side	Branch side
1	Transparent	Transparent	Internal/Recover	Internal/Recover
2	Loop Time	Recover	Internal	Recover
3	Recover	Loop Time	Recover	Internal

	Unit clock mode		User equipment side	
	Local Unit	Remote Unit	HQ side	Branch side
4	Internal	Recover	Recover	Recover
5	Recover	Internal	Recover	Recover

Transparent/Transparent

WinLink1000 transparently regenerates the clock from line clock side to Tx clock on the opposite side of the link.

Loop time/Recover

The local unit receive clock is the transmit clock on both sides of the link.

Recover/Loop time

The remote unit receive clock is the transmit clock on both sides.

Internal/Recover

The local unit internal oscillator generates the clock while the remote unit recovers this clock.

Recover/Internal

The remote unit internal oscillator generates the clock while the local unit recovers this clock.

Note

The Line code option is used with T1 Systems.

a summary of the link configuration (see [Figure 4-12](#)).

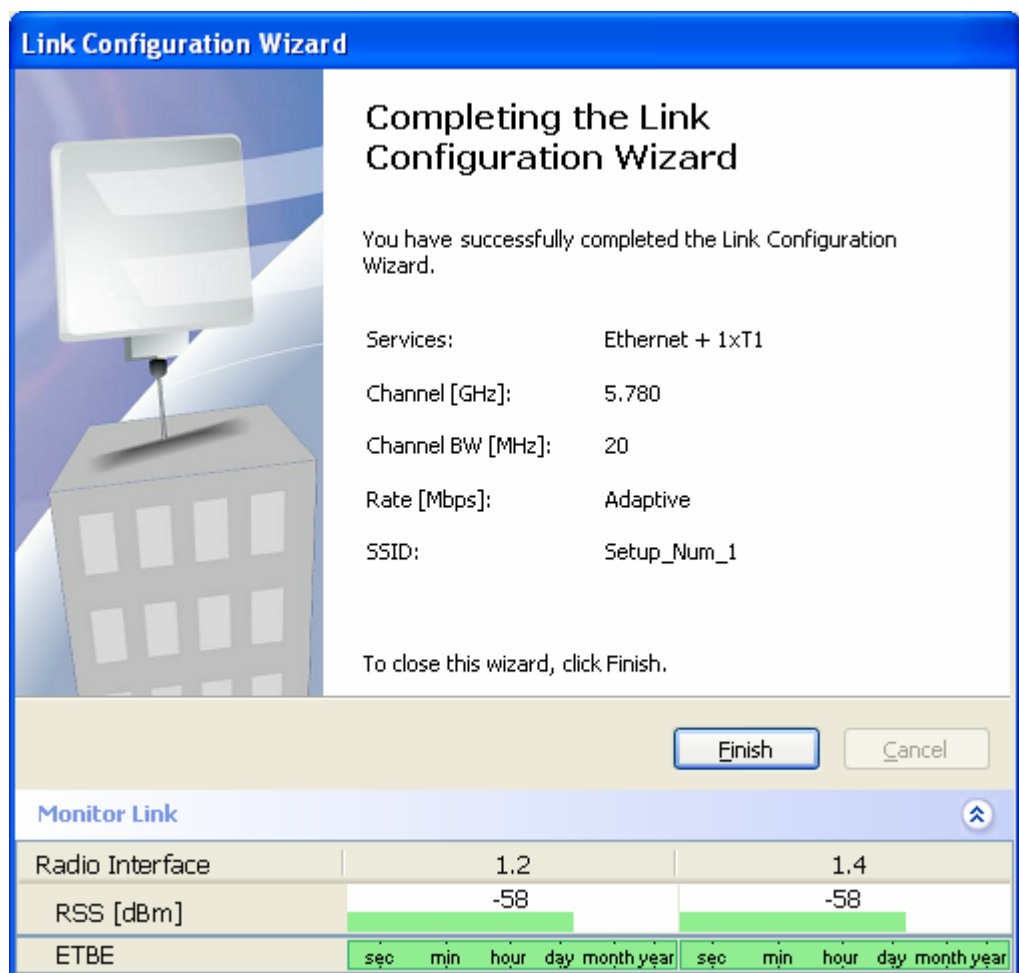


Figure 4-12. Configuration Link, Finish screen

5. Click **Finish** to complete the configuration wizard.

The Main screen is displayed.

4.7 Changing the Transmit Power

Each site can have a different transmit power level.

✱ **To change the Transmit Power:**

1. Click **Configuration** from the main menu.
2. Select which site to configure.
The Configuration dialog box opens.
3. Select Air Interface. (See *Figure 4-13*)
4. Select the required Transmit Power Level. Table 4-2 shows the available power limits for each WinLink1000 system.

5. Click Apply to save the changes.

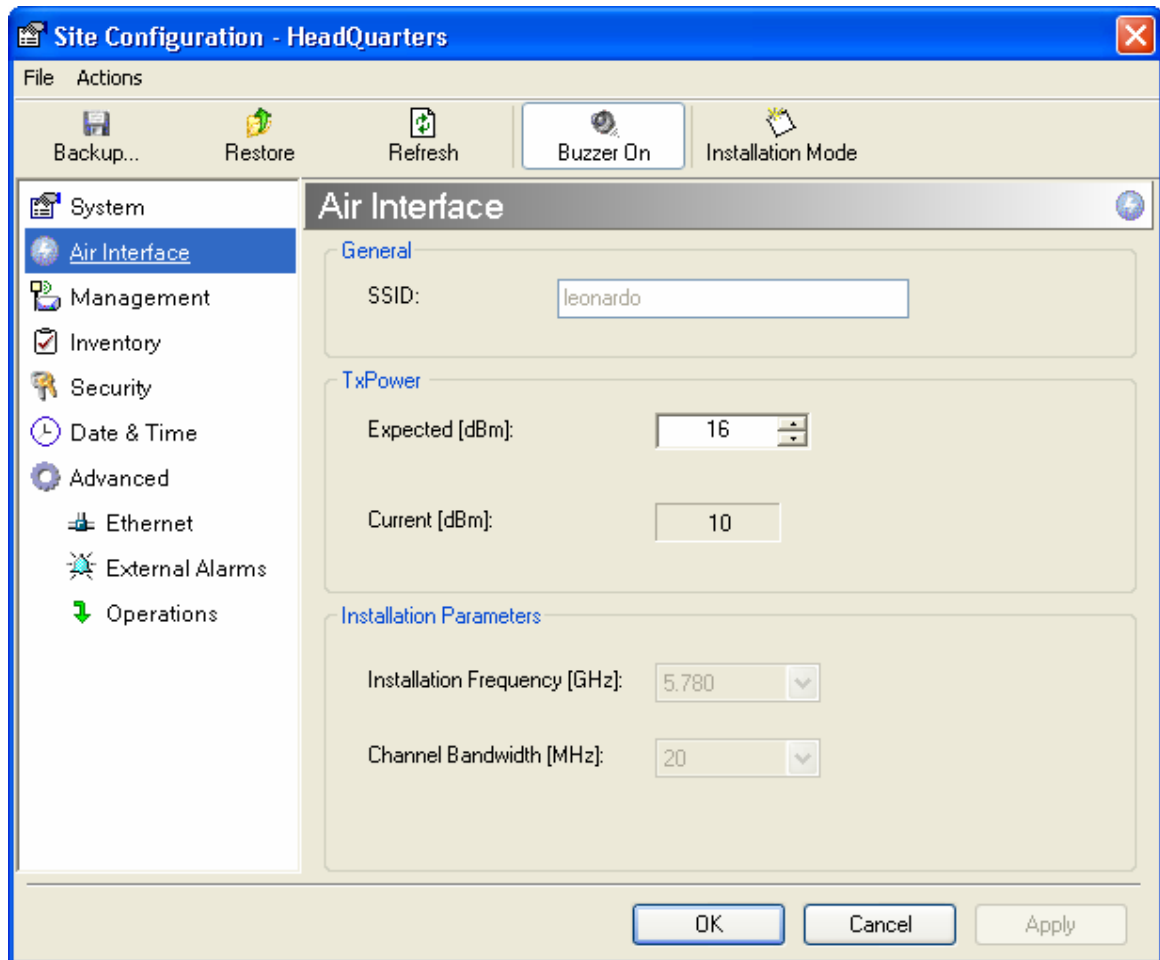


Figure 4-13. Changing the Transmit Power

Table 4-2. Typical Transmit Power Limits

Regulation	Version	Min Tx [dB]	Max Tx [dB]	MaxTx at 36 Mbps [dB]	MaxTx at 48 Mbps [dB]	Power Control
FCC	F58	4	16	14	10	Yes
	F58/EXT	4	16	14	10	Yes
	F49	14	15	15	14	No
	F53	-3	8	8	8	Yes
	F53/EXT	3	3	3	3	No
	F24	18	18	18	18	No
	F53HP	10	16	14	10	Yes
India	F58CN	-1	10	10	10	Yes
China	F24/EXT/ET SI	-4	-4	-4	-4	No
ETSI	F54	2	8	8	8	Yes
	F54/ETSI	2	8	8	8	Yes
	F54- HG/EXT	-3	3	3	3	Yes

4.8 Defining the Management Addresses

Each site must be configured separately, first site A then site B.

* To define the Management Addresses:

1. Click **Configuration** from the main menu.
2. Select which site to configure.
The Configuration dialog box opens.
3. Select Management (see *Figure 4-14*).
4. Enter the IP address of the ODU in the IP address field.

Note *If performing configuration from the WinLink manager, the IP address is entered in the login screen (Figure 2-4)*

5. Enter the Subnet Mask.
6. Enter the Default Gateway.
7. Enter the Trap Destination. This is the IP address of the PC running the management application. The event log will be stored at this address.
8. Click Apply to save the changes.

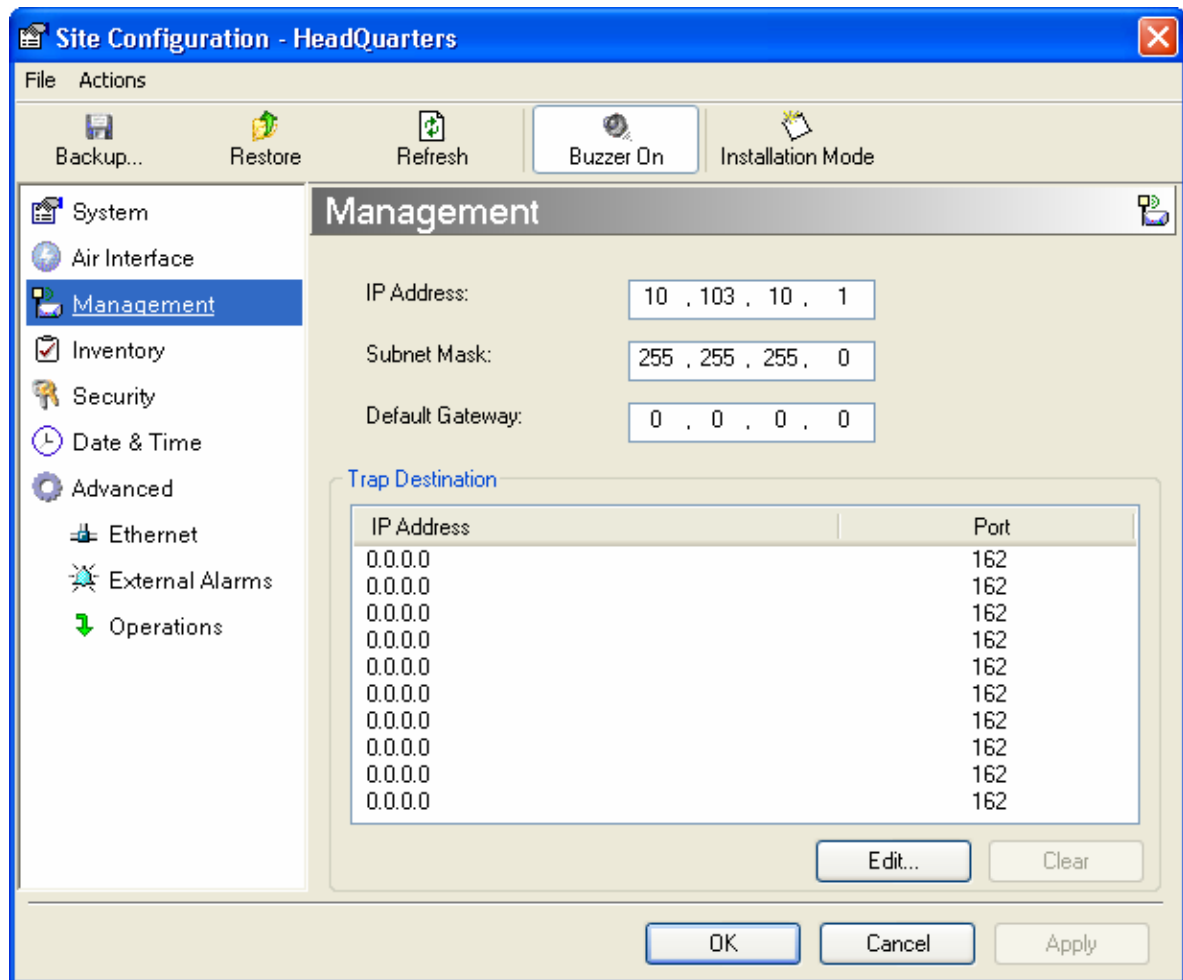


Figure 4-14. Configuration, Management

Notes The Installation mode button opens the Link Installation wizard to reinstall the link.
The Backup and Restore buttons are for saving and restoring the configuration files.

4.9 Setting the Date and Time

* To set Date and time

The ODU maintains a date and time value. The date and time value should be synchronized with any Network Time Protocol (NTP) version 3 compatible server¹. On power-up the ODU configures the initial date and time using an NTP server. If the server IP is not configured or is not reachable, a default time is set. When configuring the NTP server IP, you should also configure the offset from the Universal Coordinated Time (UTC). If there is no server available, you can either set the date and time, or you can set the manager workstation time. Note that manual setting is not recommended since reset, power up, or synchronization with an NTP server will override the setting.

Note

- *The NTP uses UDP port 123. If a firewall is configured between the ODU and the NTP server this port must be opened².*
 - *It can take up to 8 minutes for the NTP to synchronize the ODU date and time.*
-

1. Click **Configuration** from the main menu.
2. Select which site to configure.
The Configuration dialog box opens.
3. Select Date & Time (see [Figure 4-15](#)).

¹ Windows XP is configured by default as a server.

² Windows XP command w32tm /stripchart /computer:<server IP> can be use to check the NTP server connectivity

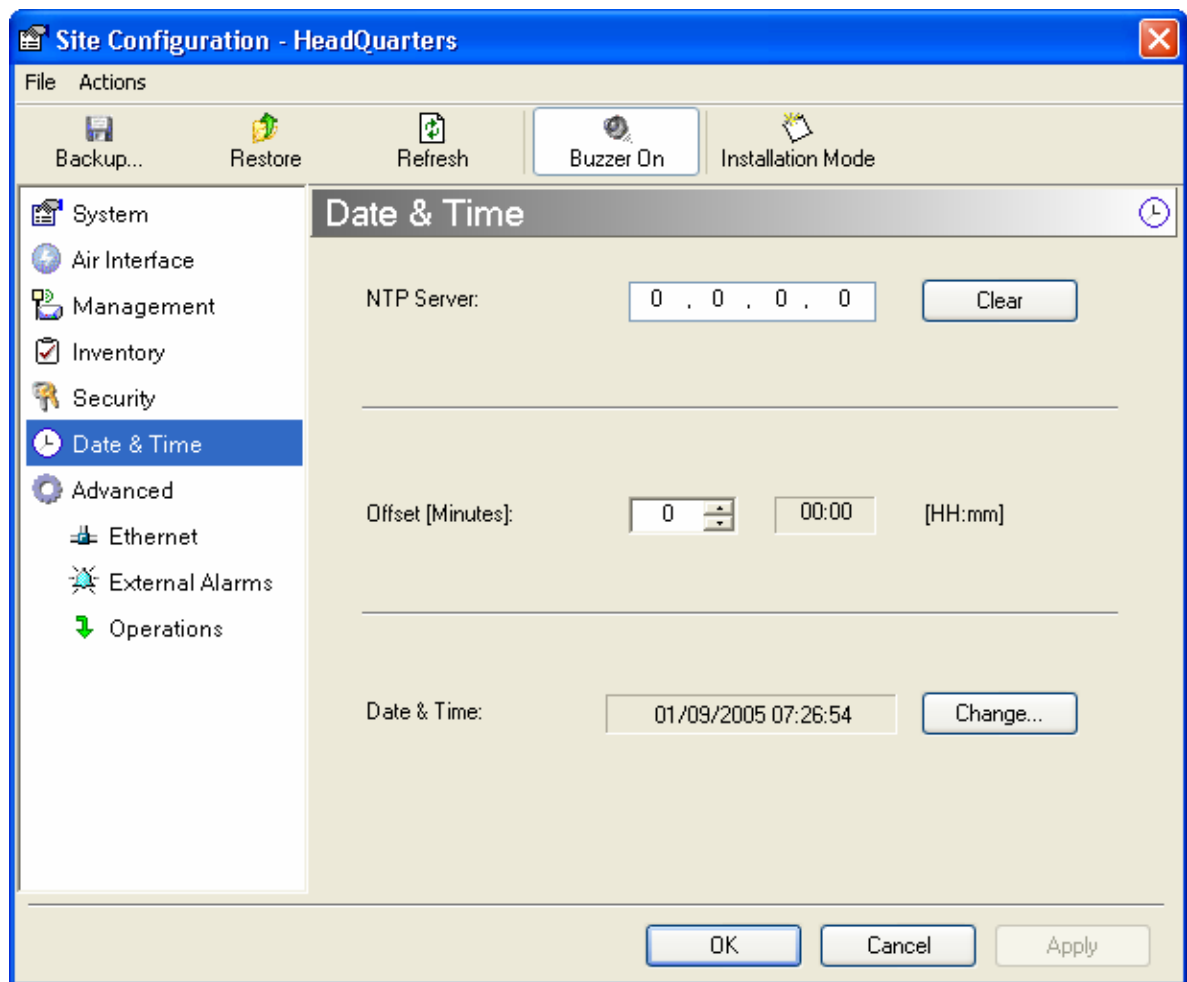


Figure 4-15. Date & Time configuration

4. If entering an address for the NTP Server, click Clear, and then enter the new address.
5. Set the Offset value.
6. To manually set the date and time, click Change ([Figure 4-16](#)) and edit the new values.

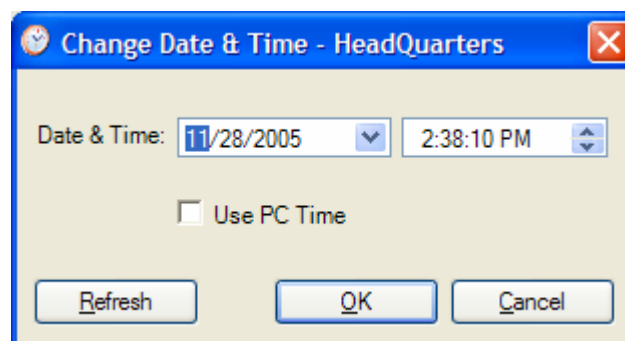


Figure 4-16. Manually changing date and time

4.10 Configuring the Bridge

Bridge configuration is required in various network topologies, such as protection (1+1) and ring application. The bridge configuration parameters are located under the Advanced tab of the Configuration dialog box (*Figure 4-17*). There are three parameters to configure:

- ODU bridge mode
- IDU Aging time
- Ethernet mode

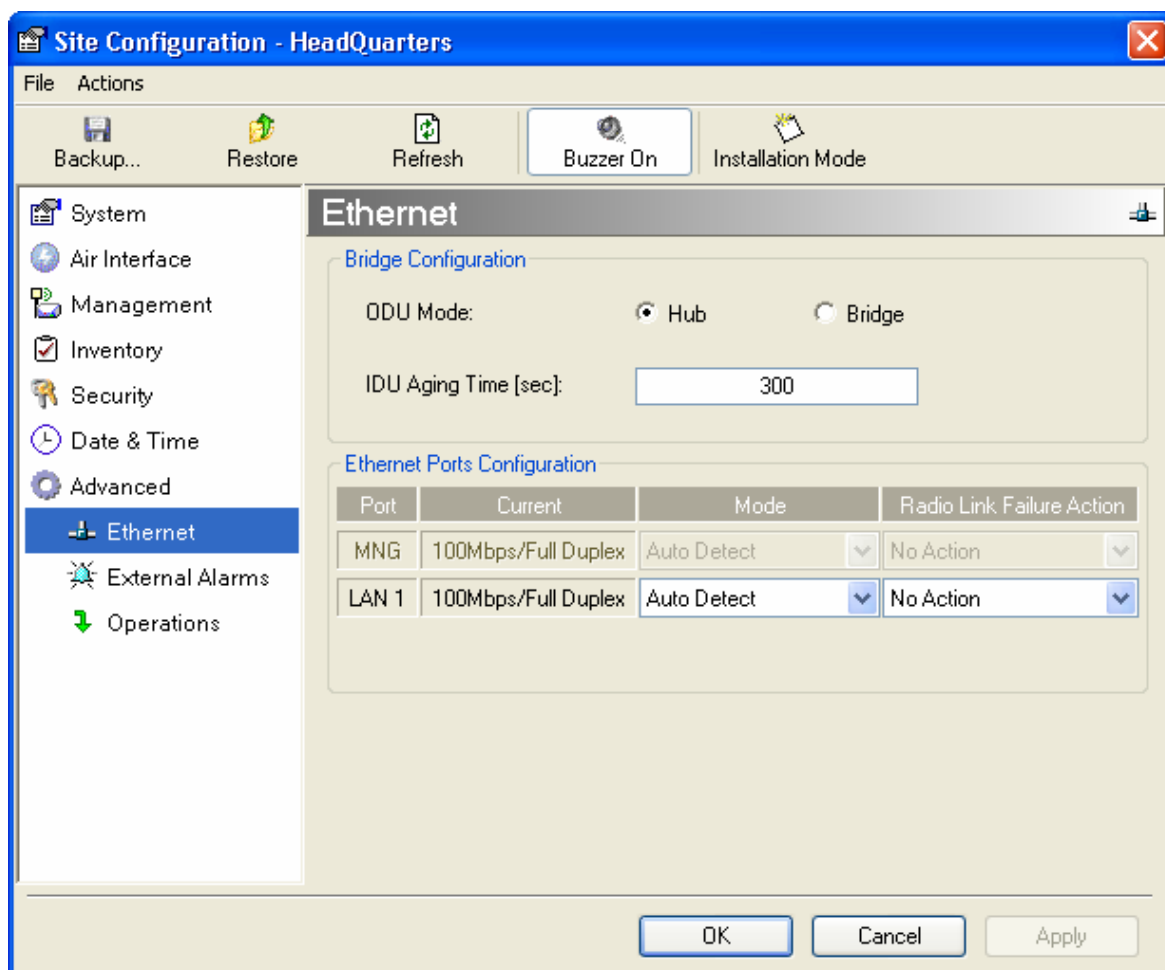


Figure 4-17. Advanced Configuration–Ethernet

ODU Bridge Mode

This parameter controls the ODU mode with two optional values,

- Hub Mode – in Hub mode the ODU transparently forwards the all the packets over the wireless link.

- Bridge Mode – In Bridge mode the ODU performs both learning and aging, the aging time of the ODU is fixed at 300 seconds.

Note *Changing these modes requires system reset.*

IDU Aging time

This parameter controls the IDU aging time.

The IDU has a 2047 MAC address–learning table. The aging time parameter controls the time each MAC address is dropped from the table.

Default value is 300 seconds.

Notes *Any change to these parameters is effective immediately.
Each side of the link can be configured separately.*

The following list details common configurations; both sides are must be configured with the same parameter.

- Standard (Default) Configuration for Ethernet Applications
Set IDU aging to 300 seconds, ODU set to Bridge mode, [Figure 4–17](#).
- Fast aging mode – for rapid network topology changes
Set IDU aging to one second, ODU set to Hub mode.
- Hub Mode
The ODU is set to HUB mode. IDU aging is not applicable.
- Ethernet Bridge
The ODU is set to Bridge mode. The IDU aging is not applicable.

4.11 Configuring Ethernet Mode

The Ethernet mode is configurable for line speed (10/100BaseT) and duplex mode (half or full duplex). WinLink1000 provides an Auto detect feature where the line speed and duplex mode are detected automatically using autonegotiation. Use the manual configuration when external equipment does not support autonegotiation. The default setting is Auto Detect. (See [Figure 4–17](#))

Note *It is not recommended to configure the port that is used for the management connection, since a wrong configuration can cause management disconnection or Ethernet services interruption.*

✱ **To configure the Ethernet Mode:**

1. From the **Configuration** menu, select the site to reconfigure.
The Configuration dialog box opens.
2. In the Ethernet Ports Configuration pane, use the drop-down menu to select the LAN configuration.
3. Click **Apply** to save the changes.

Note *It is possible to close the Ethernet service by disconnecting the Ethernet port. The user should be aware that it is possible to close the port and not have any access to the device. If this should occur the workaround is as follows:*

- *Connect the system from the remote site*
 - *Connect via other Ethernet port (IDU-C)*
 - *Power down the equipment and connect immediately after the power up (the fastest way is to enter install mode).*
-

4.12 Changing Community Values

The ODU communicates with the management application using SNMPv1 protocol. The protocol defines three types of communities:

- Read-Only for retrieving information from the ODU
- Read-Write to configure and control the ODU
- Trap used by the ODU to issue traps.

The community string must be entered at login. The user must know the password and the correct community string in order to gain access to the system. A user may have read-only privileges.

It is not possible to manage the ODU if the read-write or the read community values are forgotten. A new community value may be obtained from technical support for the purpose of setting new community; the serial number or the MAC address of the ODU must be supplied.

Note *The manager application and the ODU use the community strings **public-bru1** for the local unit and **public-bru4097** for the remote unit. These are the factory defaults, but can only be used one time on the first installation.*

A new community string must be set when entering the system for the first time. The read-write community and read-only community have a minimum of five alphanumeric characters. (Bru1 and bru4097 are not permitted). Changing the trap community is optional by clicking the check box.

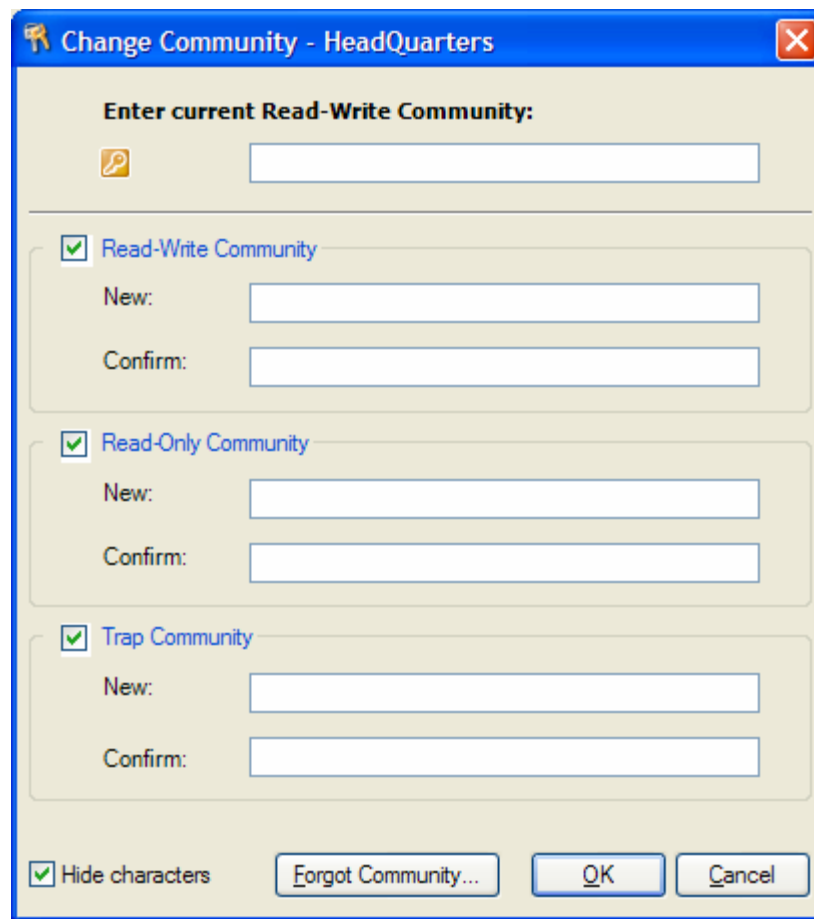
Editing Community Strings

The community change dialog box is available from the **Configuration > Security** tab. Both read-write and read-only communities must be defined.

On entering for the first time, use **netman** as the current community. The community string must be changed when entering the system for the first time, and the community string **netman** cannot be used again.

*** To change a community:**

1. From the **Configuration** dialog box, select the **Security** tab
2. Type the current read-write community (default is **netman**).
3. Select the communities to be changed by clicking the check box.
4. Type the new community and re-type to confirm.
5. Click OK to save.



The image shows a Windows-style dialog box titled "Change Community - HeadQuarters". It has a blue title bar with a yellow key icon on the left and a red close button on the right. The main area is light beige. At the top, it says "Enter current Read-Write Community:" followed by a text input field and a yellow key icon. Below this, there are three sections, each with a checked checkbox and a label: "Read-Write Community", "Read-Only Community", and "Trap Community". Each section contains "New:" and "Confirm:" text labels followed by text input fields. At the bottom left, there is a checked checkbox labeled "Hide characters". To the right of this are three buttons: "Forgot Community...", "OK", and "Cancel".

Figure 4-18. Changing the Community String

Forgotten Community string

If the read-write community string is unknown, an alternative community key can be used. The alternative community key is unique per ODU and can be used only in order to change the community strings. The alternative community key is supplied with the product, and it is recommended to keep it safe.

If both the read-write community and the alternative community key are unavailable, then an alternative community key can be obtained from customer support using the ODU serial number or MAC address. The serial number is located on the product, and the MAC address is displayed in the manager inventory tab.

When you have the alternative community key, click on the Forgot Community button and enter the Alternative Community (*Figure 4-19*). Then reconfigure the read-write community string.

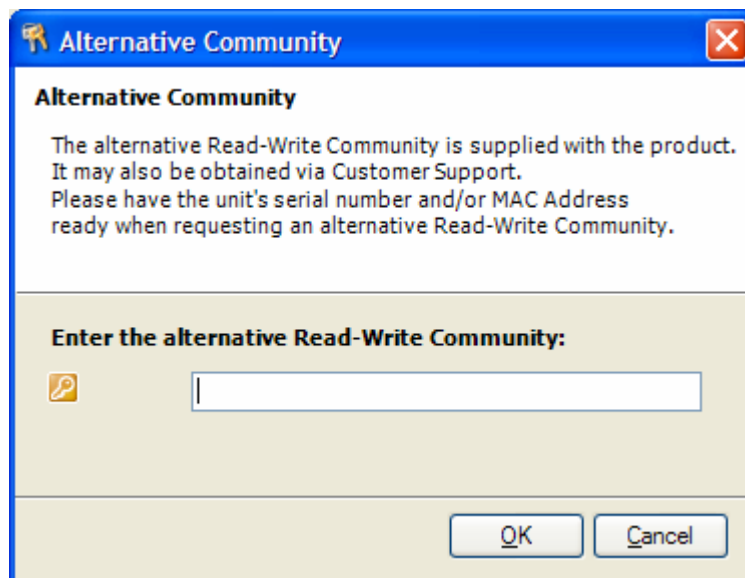


Figure 4-19. Alternative Community Dialog box

4.13 Changing Passwords

There are two passwords necessary to use the WinLink1000 system. The first is encountered when running the management software, the second, the link Password is used for encryption purposes and is found when installing or configuring the link.

Changing the Management Password

- * **To change the management password**

1. From the Tools menu, select Change Password
2. The Change Password dialog box appears.
3. Enter current password, and new password.
4. Click **Ok** to confirm.

Changing the Link Password

WinLink1000 Radio Link is encrypted using Advanced Encryption System (AES) using a 128 bit dynamic key. During the installation process a Link Password must be set. An Initial encryption key is generated. Each time a link is established the Encryption key is validated. If the validation failed the link is established but no service or configuration is allowed. In this state the user can change the link password of each of the sites.

- * **To change the Link Password:**

1. From the **Configuration** dialog box, select the **Security** tab
2. Click **Change** next to the Link Password field box.
The Change Link Password dialog box appears.
3. Enter the current link password.
4. Enter the new password.
5. Enter the new password again in the Confirm box.

Forgotten the Link Password

In case of a forgotten link password, the user may enter the key password supplied with the product. The key password may be obtained from customer support after validation of the device serial number or MAC address. The user may change the link password of both sides of the link at any time using the Link Configuration Wizard.

✱ **To enter the key password:**

1. From the **Configuration** dialog box, select the **Security** tab.
2. Click **Change** next to the Link Password field box.
The Change Link Password dialog box appears.
3. Click the Forgot Link Password button.
The Key Link Password dialog box appears.
4. Type the key link password.
5. A new link password may now be set.

4.14 Muting the Beeper

The ODU beeper starts beeping as soon as power is supplied, and continues until the ODUs are aligned and the link established.

It is possible to mute the beeper until the alignment procedure is to be performed.

✱ **To mute the beeper:**

1. Click on **Configuration** in the Menu bar and select the relevant site.
The Configuration dialog box opens.
2. In the Configuration dialog box, click the Buzzer button. The button toggles between on and off.
3. The Beeper will stop.

✱ **To restore the beeper:**

1. Click on Configuration in the Menu bar and select the relevant site.
The Configuration dialog box opens.
2. In the Configuration dialog box, click the Buzzer button. The button toggles between on and off.
3. The Beeper will start.

4.15 Setting External Alarm Inputs

The IDU-C has two external alarm inputs in the form of dry-contact relays. The Alarm interface is located on the front panel of the IDU-C and is a 9-pin D-type female connector, see [Appendix A](#) for the pinout. The user enables or disables each of the alarms and can configure the text that appears in the alarm trap. The ODU sends the alarm within less than a second from actual alarm trigger.

✱ **To set the external alarm inputs:**

1. Open the Site Configuration Alarms configuration by clicking **Configuration > Advanced**.

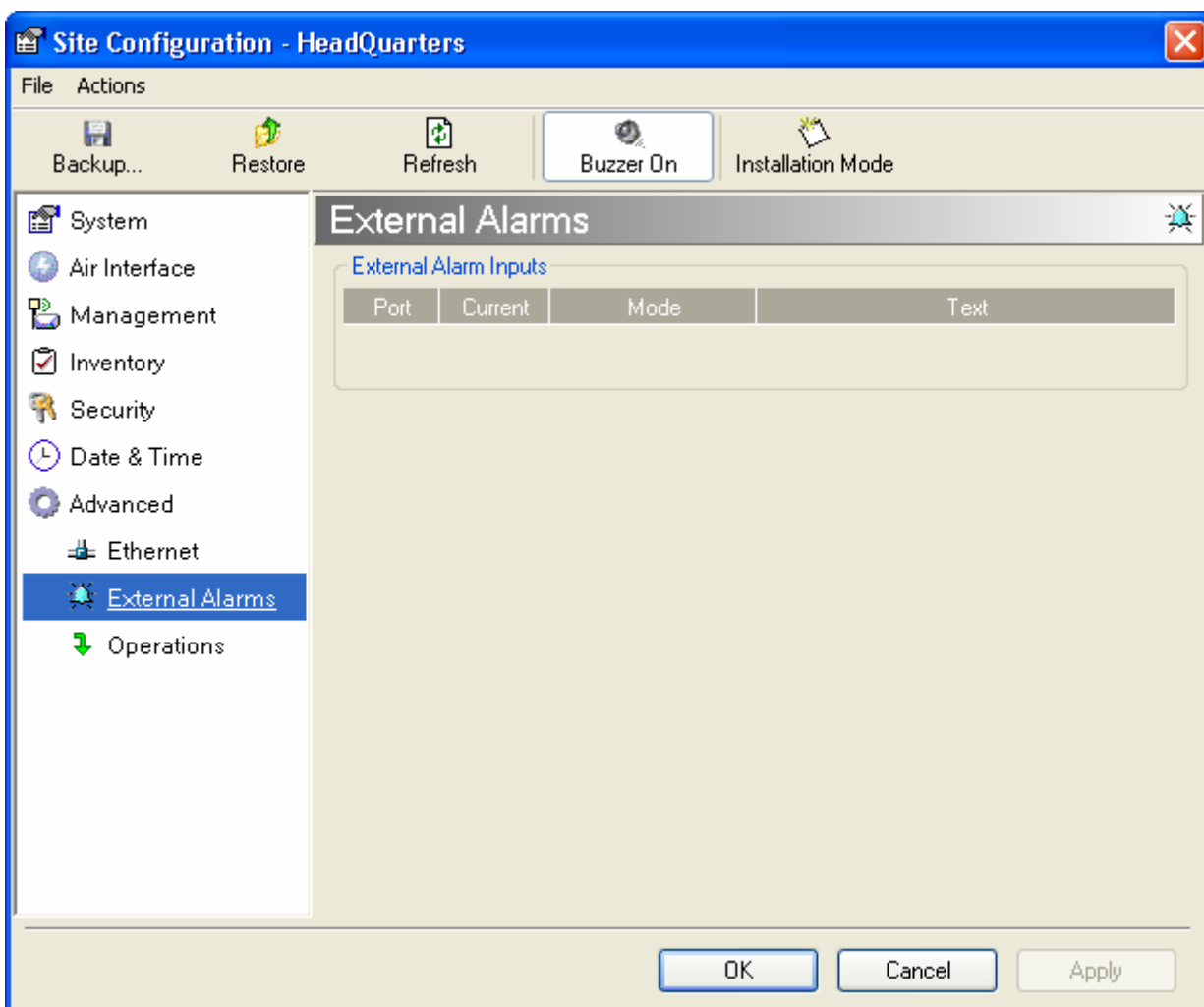


Figure 4-20. External Alarm Configuration

2. Enter a description of the alarms in the fields.
3. Click **Apply** to save.

4.16 Managing Configuration Files

Saving WinLink1000 Configuration in a File

WinLink1000 management software allows you to save configuration parameters of the local and remote units on the management station as an INI file. Each site is saved in a separate INI file.

✱ **To save the configuration in a file:**

1. Click **Configuration** from the main menu.
2. Select which site to backup.
The configuration dialog box opens.
3. Click **Backup**.
4. In the Save As dialog box, indicate in which folder and under what name configuration file is to be saved, and click **Save**.

Restoring a Configuration File

Configuration files (*.ini) can be uploaded from the management station. Verified configuration files can be distributed to other units that use the same configuration.

✱ **To restore a configuration file:**

1. From the **Configuration** menu, select the site to reconfigure.
The Configuration dialog box opens.
2. Click Restore.
3. From the Open dialog box select *.ini file to upload and click **Ok**.

4.17 Reinstalling the Link

It may be necessary to reinstall the link if the ODUs should need to be realigned.

Note

Reinstalling the link causes both sites to go into install mode.

✱ **To reinstall the link:**

4. Click on **Configuration** in the Menu bar and select any one of the sites.

The Configuration dialog box opens.

5. Click the Install Mode button in the Configuration dialog box.

A message box asking if you want to enter install mode appears.

6. Click Yes to continue.

WinLink1000 enters install mode and the beeper starts beeping.

7. Realign the ODUs and complete the Installation wizard (see *Chapter2*).

4.18 Resetting WinLink1000

Note

Resetting the link causes service disconnection.

In order to maintain the link configuration, reset the remote WinLink1000 first.

*** To reset WinLink1000:**

1. From **Maintenance**, reset the remote WinLink1000.
2. From **Maintenance**, reset the local WinLink1000.

*** To reset to Factory Defaults**

1. Click on **Configuration** in the Menu bar and select any one of the sites.

The Configuration dialog box opens.

2. Select **Operations** in the Configuration dialog box.
3. Click the Restore Defaults button

A message box asking if you want to restore factory default appears.

4. Click the check box if you want to keep the current IP settings.
5. Click Yes to continue.

4.19 Displaying the Inventory

*** To view the inventory data**

1. Click **configuration** from the main menu.

2. Select which site to configure.

The configuration dialog box opens.

3. Select Inventory (*Figure 4-21*).

Note *This screen is for viewing purposes only.*

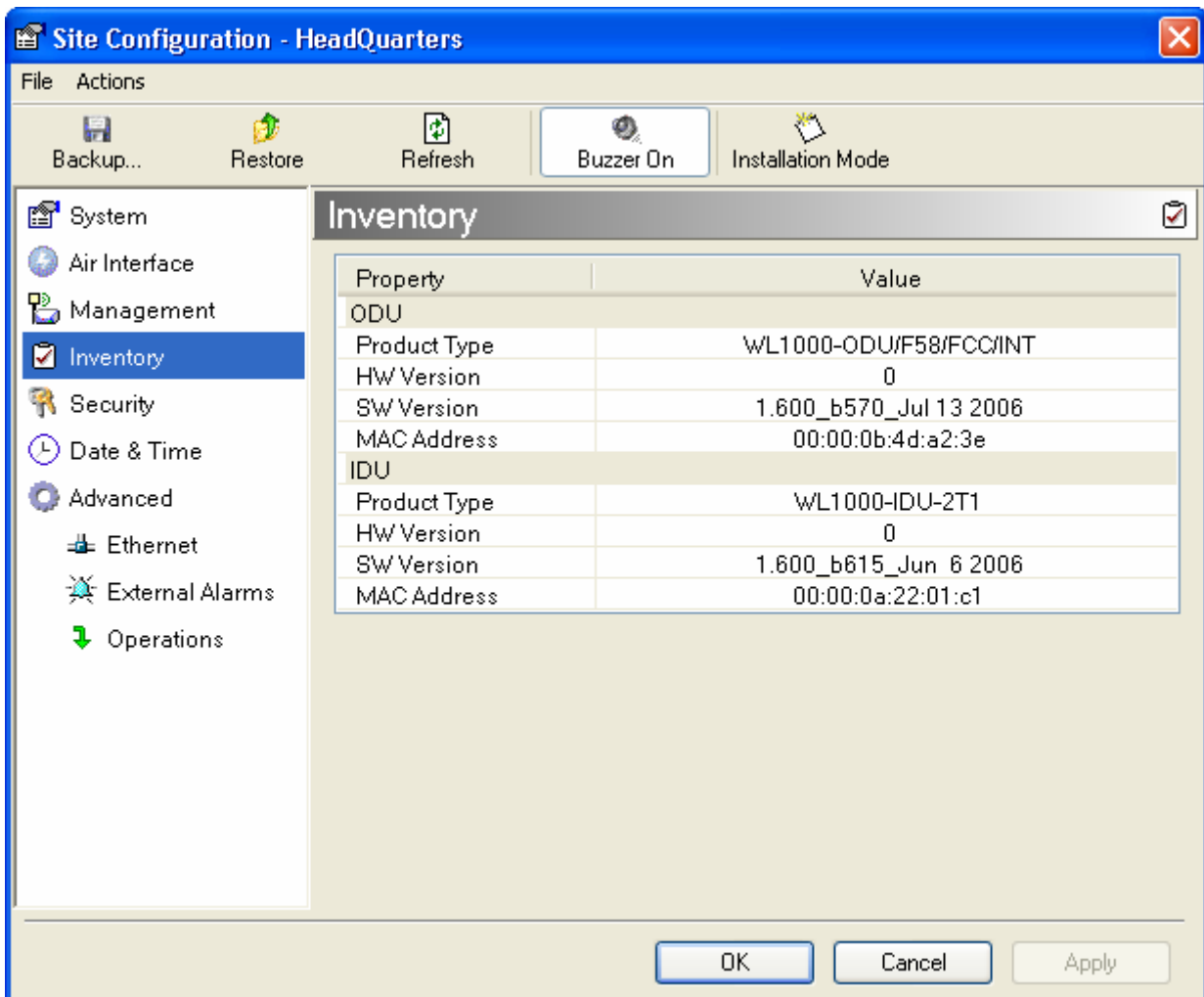


Figure 4-21. Inventory Screen

Chapter 5

Diagnostics and Troubleshooting

This chapter describes the WinLink1000 diagnostic functions, which include:

- Monitoring Performance
- Error detection and alarms
- Diagnostic tests (local and remote loopbacks on E1 or T1 link)
- Troubleshooting
- Frequently asked questions.

5.1 Monitoring Performance

WinLink1000 constantly monitors traffic over the radio link and collects the following statistics data:

- Site 1 /Site 2 received traffic rate (in kbps)
- Site 1 /Site 2 received frames rate (in fps)
- Radio signal strength (in dBm)
- Error (Blocks).

The statistics (monitor) log and event log can be saved as TXT files. New alarms are automatically added to the text file, as they enter the event log.

Saving the Monitor Log

* To save the monitor log:

1. From the Tools menu, choose **Preferences**.

The Preferences dialog box appears (see [Figure 5-1](#)).

2. Click the Monitor Tab.
3. Select the file to save.
4. Click the check box to open the file for saving.
5. Click the  button and in the Select File dialog box indicate in which folder and under what name the alarm log file is to be saved.
6. Set the time interval for adding data to the file.
7. Click **Ok** to save the file

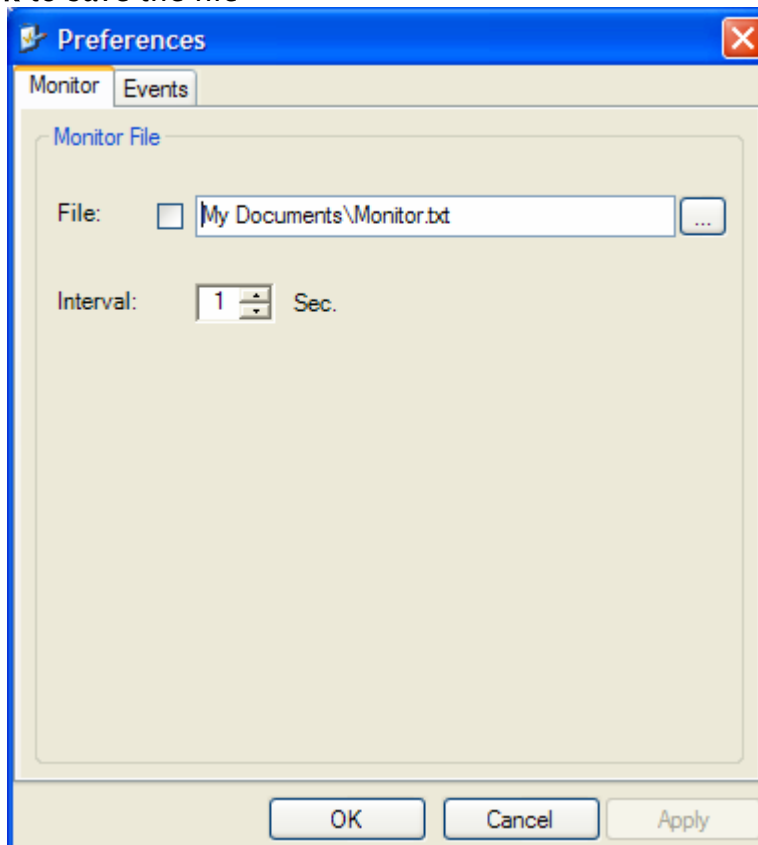


Figure 5-1. Preferences Dialog Box, Monitor Tab

Setting the Events Preferences

You can define a color that the traps are displayed in the monitor pane, according to severity of the event. The severity is predefined.

✱ **To set the trap color:**

1. From the Tools menu, choose **Preferences**.
The Preferences dialog box appears).
2. Click the Events Tab (see [Figure 5-2](#)).

3. Select the Event priority type and click on the  button.

A color chart opens.

4. Select the desired color.
5. Repeat for all the trap types.

* **To set the trap background color:**

- Click **Background Color** to change the text background.

* **To reset the trap colors:**

- Click **Reset Settings** to return to the default color settings.

Saving the Events Log

* **To save the event log:**

1. From the Tools menu, choose **Preferences**.

The Preferences dialog box appears (see [Figure 5-2](#)).

2. Click the Events Tab.
3. Select the file to save.
4. Click the check box to open the file for saving.
5. Click the  button and in the Select File dialog box indicate in which folder and under what name the alarm log file is to be saved, and click **OK**.

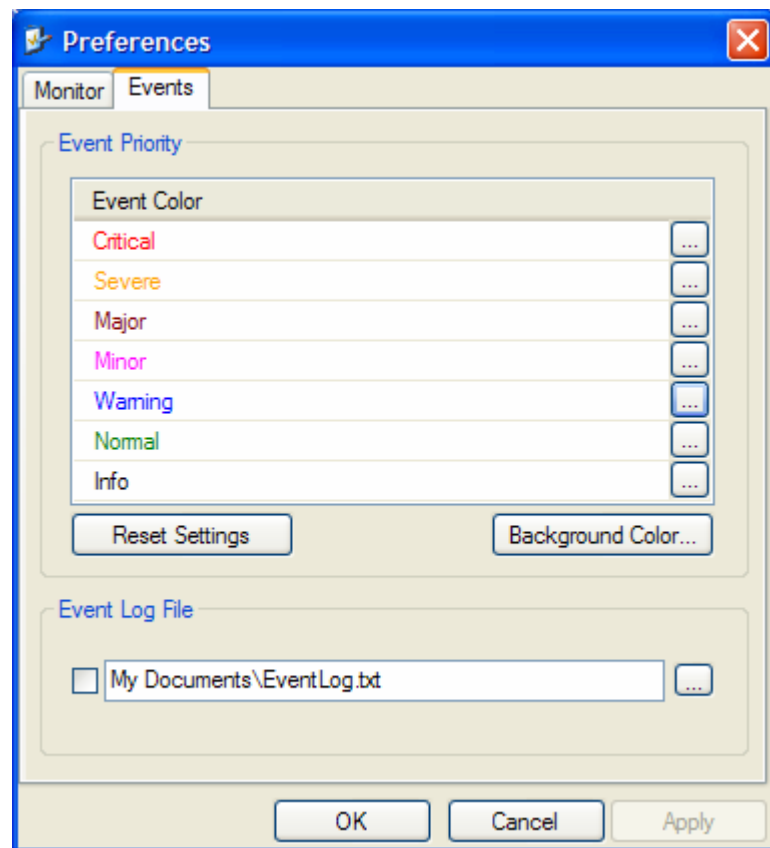


Figure 5-2. Preferences Dialog Box, Event Log Tab

5.2 Automatic Link Data collection

The Get Link Information feature collects all the link and Manager information which can be used for diagnostics.

In the event of needing to contact technical support please send this file so as to speed up the assistance.

* **To get link information**

1. Click **Help** on the menu bar, select **Link Information**.

The Get Link Information dialog box appears. See [Figure 5-3](#).

2. Click **File Path** to get to the directory to save the file in.
3. Click **Start** to save the information.

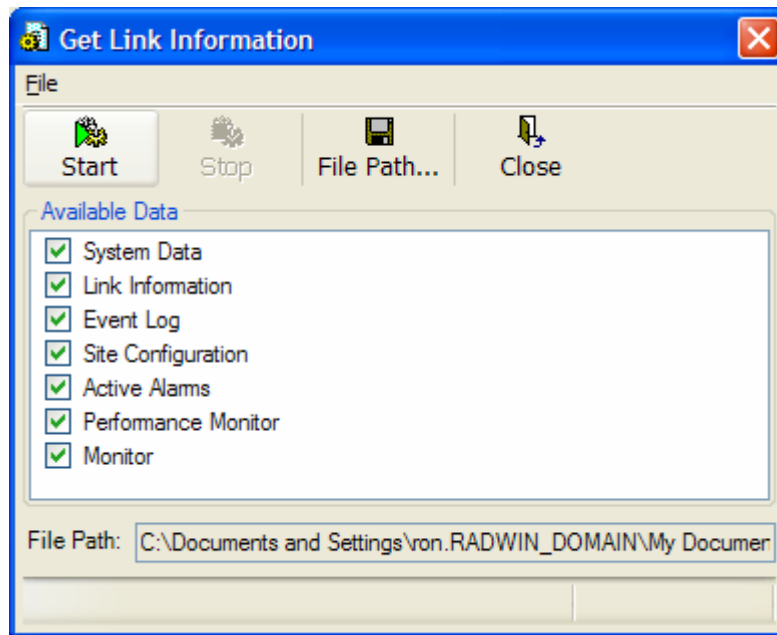


Figure 5-3. Get Link Information

5.3 Viewing Performance Reports

The Performance Monitor Report opens a window (*Figure 5-4*) displaying performance views of each of the interfaces¹. Several performance data are collected for each of the interfaces (ES, SES, and UAS), as well as Specific data per Interface type (e.g., TX and RX bytes for Ethernet). For the Air Interface, user defined thresholds data are collected. Refer to *Table 5-1* and *Table 5-2*.

Data is collected and selectively displayed based on three time intervals as selected by the **Interval** radio buttons:

- Current (t=0)
- 15 minutes Intervals
- Daily.

In...	Date & Time	Min RSL	Max RSL	RSL Thr...	RSL Thr...	Min TSL	Max TSL	TSL Thre...	BBER Thr...	UAS	Raw ES	SES	BBE
✓	11/28/2005 5:00:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 4:45:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 4:30:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 4:15:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 4:00:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 3:45:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 3:30:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 3:15:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 3:00:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 2:45:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 2:30:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 2:15:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 2:00:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 1:45:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 1:30:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 1:15:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 1:00:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 12:45:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 12:30:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 12:15:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 12:00:00 PM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 11:45:00 AM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 11:30:00 AM	-53	-53	0	0	16	16	0	0	0	0	0	0
✓	11/28/2005 11:15:00 AM	-53	-53	0	0	16	16	0	0	0	0	0	0

Figure 5-4. Performance Monitoring Report window

¹ Ethernet performance is not collected in PoE systems.

Table 5-1. Explanation of performance data

Data type	Reported value	Explanation
Generic PM Data	UAS – Unavailable Seconds	Seconds in which the interface was out of service.
	ES – Error Second	The number of seconds in which there was at least an error block. Note that notation of an error block is different per interface.
	SES – Severe Error Second	The number of seconds in which the service quality is low (the actual BBER ratio varies per interface).
	BBE – Background Block Error	The number of error block in an interval.
	Integrity	A flag indicating that the data is valid. Note that the PM data is not valid if not all the values were stored ² .
Air Interface PM Data	Max RSL	The maximum of the receive signal level (measured in dBm).
	Min RSL	The minimum of the receive signal level (measured in dBm).
	Max TSL	The maximum of the transmit signal level (measured in dBm) ³ .

² Possible reasons are: Clock changes within the interval and Power up reset

³ The transmit power is fixed. The value can be changed only by user configuration

Data type	Reported value	Explanation
	Min TSL	The minimum of the transmit signal level (measured in dBm).
	RSL Threshold 1	This parameter counts the number of seconds in which the RSL is below the specified threshold.
	RSL Threshold 2	This parameter counts the number of seconds in which the RSL is below the specified threshold.
	TSL Threshold 1	This parameter counts the number of seconds in which the RSL is above the specified threshold.
	BBER Threshold	The BBER Threshold value counts the number of seconds in which the Background Block Error Ratio (BBER) exceeds the specified threshold. Note, that the system is design for excellent quality of service with BBER of less then 1%. (at 1% BBER expected TDM BER is less than 1E-6.
Ethernet Interface PM Data	Received Bytes	The number of Mega bytes received in the specified port within the interval

Data type	Reported value	Explanation
	Transmitted Bytes	The number of Mega bytes received in the specified port within the interval.

Table 5–2. Action of the tool bar button commands

Button	Action
Get Data	Uploads the selected report from the ODU.
Save	Saves the data in a CSV or Text format for additional analysis.
Clear	Removes the current data from the window.
Selection pane	Selects the site, interface, and interval to be displayed.
Threshold	Opens the threshold configuration dialog box (Figure 5–5) to set the Air Interface thresholds. Note that threshold change is effected immediately, but it does not change any historical data.
Close	Closes the Performance Monitor Report window.

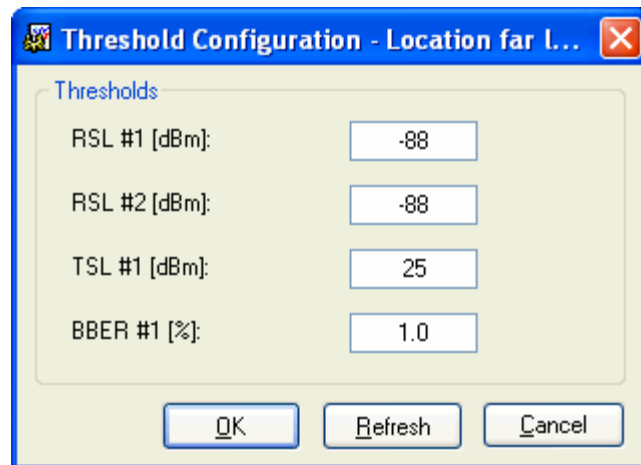


Figure 5–5. Threshold configuration dialog box

5.4 Error Detection and Alarms

WinLink1000 detects fault conditions of the radio and user links and initiates alarms to alert the user.

Note *To store the event log, first define the IP address, subnet mask, default gateway and trap address of the management PC, see [Chapter 4](#) for details.*

Alarms (traps) are displayed in the Event Log in the lower panel of the Main Menu screen. The alarm log is saved as a TXT file.

The event log includes the following fields:

- Sequential number (ID)
- Date and time stamp
- Message
- Trap source
- IP address of the ODU that initiated alarm.

Table 5-3. WinLink1000 Alarms and Information Messages

Message	Description
Radio Link – Sync	Radio link is synchronized
Radio Link – Out Of Sync	Radio link lost synchronization
Link Has Been Reset	ODU was reset due to internal problem
TDM Interface – Normal	TDM interface is operating properly
TDM Interface – LOS	Loss of Synchronization is reported by TDM interface
TDM Interface – LOS	Loss of Signal is reported by TDM interface
TDM Interface – AIS	Alarm Indication Signal is reported by TDM interface
TDM Interface – Loopback	A loopback is active on TDM interface
Link Resetting	Wireless link reset from the management station. This alarm is caused by automatic reset after link configuration.
Local ODU Resetting	The local ODU reset from the management station.
Monitor was stopped since no connection to the link	No ODU-to-IDU traffic was detected during the last 20 minutes.
TDM Service – Normal	TDM service is operating properly
TDM Service – Alarm	Error has been detected on a TDM line
Configuration problem detected	The link needs to be reinstalled
Channel Scanning in progress	The ODU is scanning the channels for the remote ODU
Transmitting on <frequency> GHz	The ODU is transmitting on the frequency channel listed
Radar activity was detected in <site>, on channel <frequency> GHz	For DFS versions only. Radar is detected; the channel is prohibited for 30 minutes.
Monitoring for Radar activity on channel <frequency> GHz	For DFS versions only. ODU is looking for Radar activity.
Bit Failed indication	Indicates ODU hardware problem. Send error code to Technical Support.

✱ **To view summary of saved alarms**

- From the Tools menu, choose **Active Alarm Summary**.

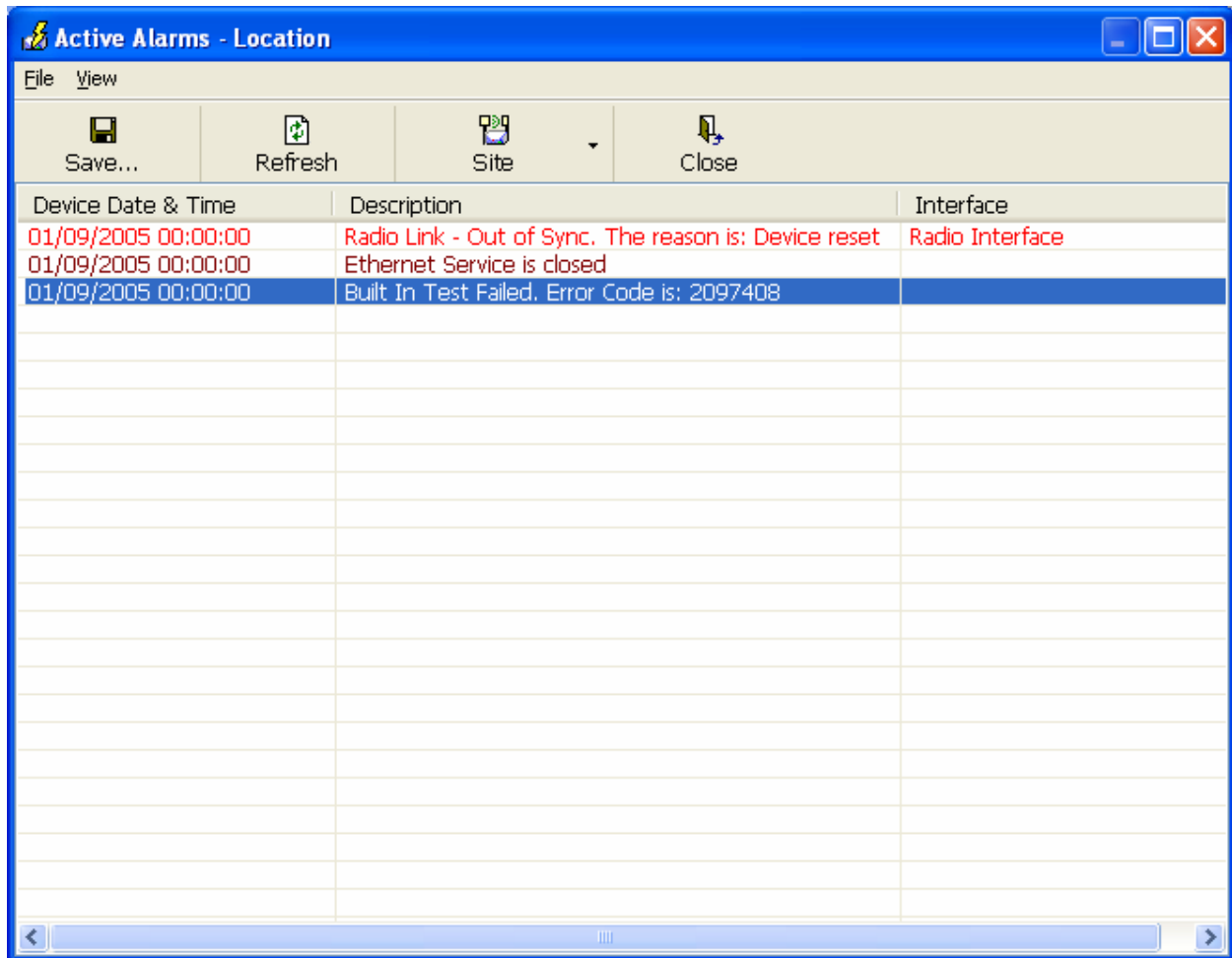


Figure 5-6. Active Alarms Summary

Table 5-4. Active Alarms command buttons

Command	Action
Save	Saves the alarms in CSV or text format for further analysis.
Refresh	Reads the alarms from the ODU, and displays the alarms.
Site	Selects site for the active alarms.
Close	Closes the active alarm window.

5.5 Testing WinLink1000

WinLink1000 supports activation of the internal and external loopbacks on the local and remote units.

✱ **To activate a loopback:**

1. From the Maintenance menu, choose **Set Loopbacks**.

The Loopbacks dialog box appears (see [Figure 5-7](#)).

2. From the Local or Remote drop-down box, select a loopback that you intend to run, and click **OK**.

A confirmation message appears.

3. Click **OK** to activate a loopback.

WinLink1000 activates selected loopback. A loopback status arrow in the Main menu turns green to indicate an active loopback.

✱ **To deactivate a loopback:**

- From the From the Local or Remote drop-down box of the Loopbacks dialog box, select **None** and click **OK**.

A loopback is deactivated and the corresponding status arrow in the Main menu becomes dimmed.

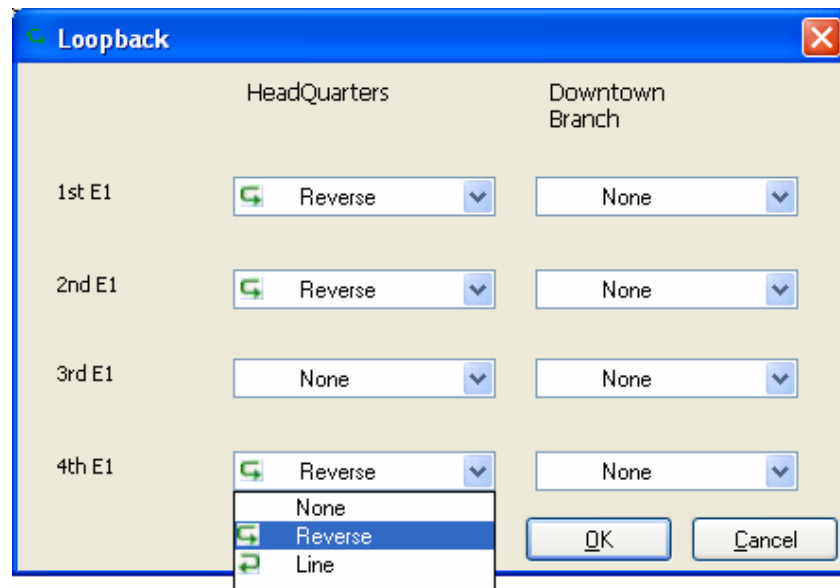


Figure 5-7. Loopbacks Dialog Box

Local External Loopback

Local WinLink1000 can be set to an external loopback to test the local E1/T1 port and its connection to the local side user equipment. In this mode, data coming from the local user equipment is looped back to it (see [Figure 5-8](#)). This loopback is initiated from a management station connected to the local unit.

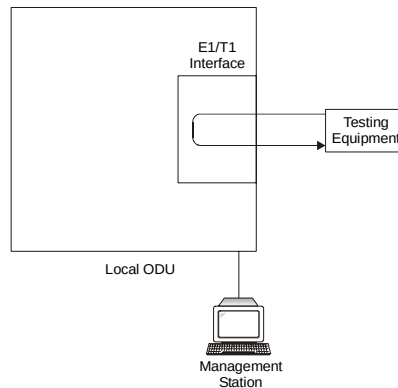


Figure 5-8. Local External Loopback

Remote Internal Loopback

Remote WinLink1000 can be set to an internal loopback to test connection between the local and remote units, the local E1/T1 port and its connection to the local side user equipment. In this mode, data coming from the local WinLink1000 is looped back to it (see [Figure 5-9](#)). This loopback is initiated from a management station connected to the local unit.

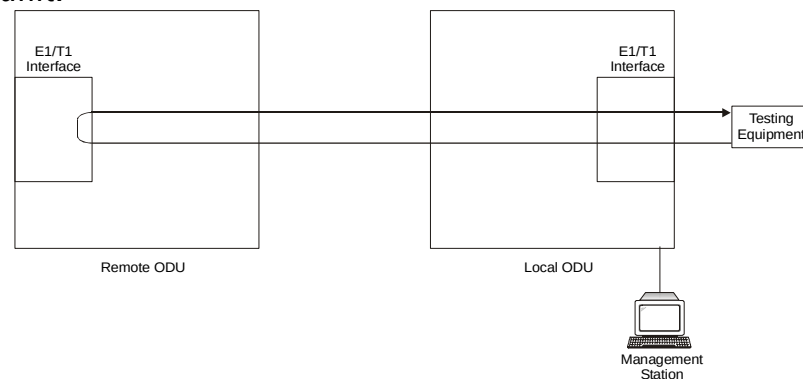


Figure 5-9. Remote Internal Loopback

Remote External Loopback

Remote WinLink1000 can be set to an external loopback to test the remote E1/T1 port and its connection to the remote side user equipment. In this mode, data coming from the remote user equipment is looped back to it (see [Figure 5-10](#)). This loopback is initiated by an

inband command sent from a management station connected to the local unit.

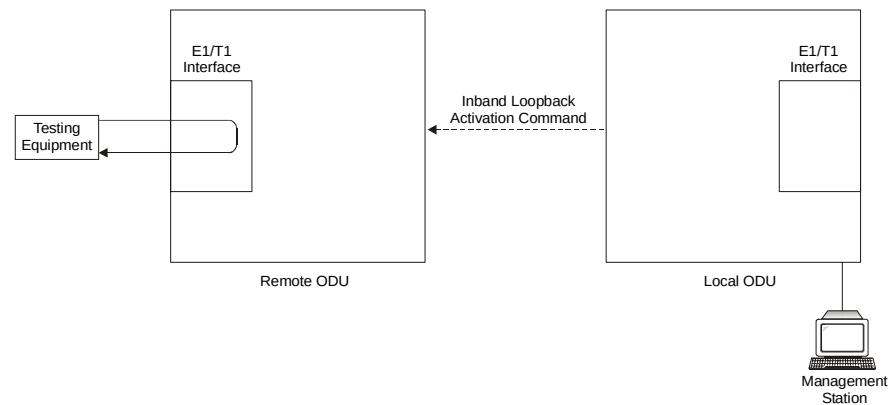


Figure 5–10. Remote External Loopback

Local Internal Loopback

Local WinLink1000 can be set to close an internal loopback to test connection between the local and remote units, remote E1 /T1 port and its connection to the remote side user equipment. In this mode, data coming from the remote user equipment is looped back to it (see [Figure 5–11](#)). This loopback is initiated by an inband command sent from a management station connected to the local unit.

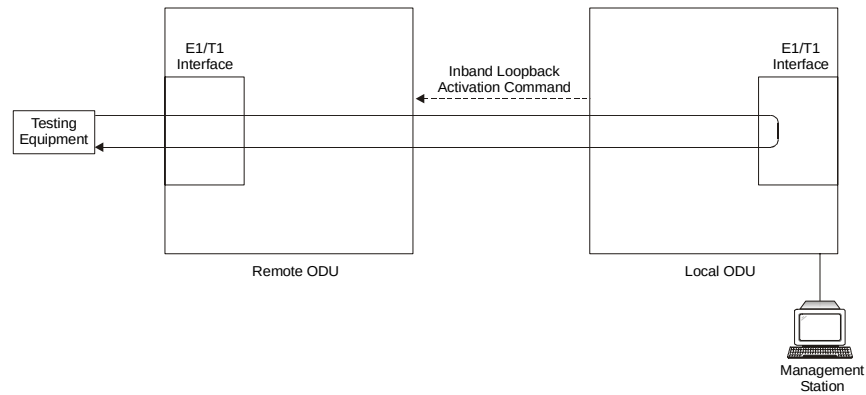


Figure 5–11. Local Internal Loopback

5.6 Troubleshooting

Use [Table 5–6](#) and [Table 5–6](#) to diagnose any faults in the system.

Table 5–5. Troubleshooting

Symptom	Remedy
No power	Verify that AC power is connected to the IDU.

	Verify that the ODU cable is properly wired and connected.
No signal	Complete the installation procedure from the management software.
	Verify the ODU alignment. Check that the radio configuration of both site A and site B units are the same (channel and SSID).
Weak signal	Verify the ODU alignment, reconfigure the link.
	Verify the beeper sounds the Best Signal sequence.

The WinLink1000 LEDs show faults in the system or the link.

Table 5–6. Troubleshooting with WinLink1000 LEDs

LED	Status	Remedy
PWR	Off	Check that AC adapter is connected to the IDU-E and the AC power outlet.
IDU	Orange	Check that the IDU/ODU cable is properly wired and connected.
ODU	Red	Check that the IDU/ODU cable is properly wired and connected.
AIR I/F	Orange	Complete the installation procedure from the management software.
	Red	Check the ODU Antenna alignment. Check that the radio configuration of both site A and site B units are the same (channel and SSID).
SERVICE	Off	Check the TDM service configuration in the NMS.
	Orange	Check that the system is not in loopback mode. Check the site B IDU ports and cables and site B external equipment.
	Red	Check the site A IDU ports, cables and external equipment.

5.7 Frequently Asked Questions

Q: What performance issues will arise due to environmental conditions?

A: WinLink1000 is not sensitive to environmental conditions. However if heavy rain or snowfall is expected ensure the performance by allowing a higher fade margin in the link budget planning calculations.

Q: When using the WinLink1000, what is the potential for interference between our system and other cellular or wireless Networks devices?

A: The WinLink1000 is a robust system. However since it operates in unlicensed band there maybe some interference. Nevertheless, the fact that we can manually set the frequency gives us the flexibility to find a clear channel. In addition each WinLink1000 link uses unique user configurable SSID code.

Q: What protocol does the WinLink1000 use, i.e. 802.11?

A: WinLink1000 uses a proprietary protocol; this protocol contains improved options that more efficiently support the clock reconstruction from the TDM services.

Q: What type of security is offered on WinLink1000?

A: WinLink1000 has three levels of security:

1. AES hardware mechanism
2. Each unit uses a unique SSID link-specific code (up to 24 alphanumeric characters)
3. Proprietary protocol protects from eavesdropping from other systems.

Q: Can we use horizontal and vertical polarization on the same frequency to double the number of wireless links?

A: Installing two WinLink1000 systems in the same band with cross polarization provides 20–25 dB separations. Nevertheless, since there are reflections, the cross polarization separation is decreased and spatial separation is recommended.

Q: Could you add the frequency of 5.735 to the manual selection in order to increase the number of 20 MHz channels to six?

A: Currently the system provides fixed channels, with one manual frequency setting. The manual setting provides flexibility of spectrum selection, including 5.735 MHz.

Q: Can we manage WinLink1000 using SNMPc other than the supplied management software that comes with the units?

A: Yes. The WinLink1000 is SNMP-based. WinLink1000 can be managed when using other SNMP software after implementing RADWIN MIB's.

Q: Can WinLink1000 be managed and configured via Telnet?

A: No. Use only the WinLink1000 software manager.

Q: Can I use WinLink1000 with any vendor's external antenna?

A: Yes. RADWIN supplies the WinLink1000 external ODU with an N-type typical connector. Any vendor's external antenna that can be cascaded to our external unit can be used without problem. Please note that dB losses in the cascading cable between the external ODU and antenna should be taken into consideration. (In the supplied cascading cable of one meter we have 1 dB loss)

Q: Do we need to add external arrestors on WinLink1000 cables?

A: The WinLink1000 ODU includes arrestors and lightning protection. Therefore there is no need to add additional arrestors.

Q: What is the actual Ethernet data rate and maximum throughput?

A: The maximum net throughput of WinLink1000 is full duplex 18 Mbps.

Note *WinLink1000 is a symmetrical system*

Q: What is the sensitivity for each rate of the WinLink1000?

A: The rate sensitivities are:

Rate [Mbps]	Sensitivity [dB]
12	-84
18	-81
36	-74

Rate [Mbps]	Sensitivity [dB]
48	-68

Q: Does WinLink1000 withhold any MAC Addresses?

A: The WinLink1000 is a layer 2 Bridge (VLAN transparent). The built-in switch contains a MAC Address table up to 2047.

Q: Can I use any category 5e cable in order to connect the IDU and ODU?

A: The cable should be suitable for outdoor use, and shielded Category 5e.

Q: What are the BER values expected in the WinLink1000 link?

A: 10⁻¹¹ (according to BER sensitivity threshold)

Q: Does WinLink1000 use DSSS technique?

A: No, WinLink1000 uses the advanced OFDM technique.

Q: What are the main advantages of the WinLink1000 solution (e.g., wireline, wireless, etc.) over other possible alternatives?

A:

- Easy and intuitive installation using audio indication.
- Easy configuration using the management software of overall link site-to-site, there is no need to travel between the two sites in order to change the configuration.
- Easy migration between transition channels site-to-site.
- Full backup option – backup and restore using ini files.
- Very light ODU (1.5 kg).
- No RF losses between IDU and ODU.
- Robust Air Interface Layer 2 ARQ insures “error-free” Ethernet service even in harsh conditions. Retransmit mechanism for TDM ensures low BER.
- Integrated up to 4 E1/T1 and Ethernet radio over one single product.

- Supports a variety of applications Voice and Data over single radio – no need for external mediation device.
- Smooth migration to VoIP applications.
- Carrier class compliant with ITU standards for E1 and T1.
- Low and constant TDM latency (8 msec).
- Extremely accurate recovered clock low cost replacement to PDH radios.

5.8 Technical Support

Technical support for this product can be obtained from the local distributor from whom it was purchased.

For further information, please contact the RADWIN distributor nearest you or one of RADWIN's offices worldwide. This information can be found at www.radwin.com.

Appendix A

Wiring Specifications

A.1 ODU-IDU Cable

The ODU-IDU cable is standard CAT-5, 4 twisted-pair 24 AWG FTP, terminated with RJ-45 connectors on both ends. It is covered by a cable gland on the ODU side for hermetic sealing.

Table A-1 shows the connector pinout.

Table A-1. ODU-IDU Cable Connector Pinout

IDU RJ-45	Wire Color	Function	ODU RJ-45
1 twisted	White/Green	Ethernet (RxN)	1
2 pair	Green	Ethernet (RxT)	2
3 twisted	White/Orange	Ethernet (TxT)	3
6 pair	Orange	Ethernet (TxN)	6
4 twisted	Blue	Power (+)	4
5 pair	White/Blue	Power (+)	5
7 twisted	White/Brown	Power (–)	7
8 pair	Brown	Power (–)	8

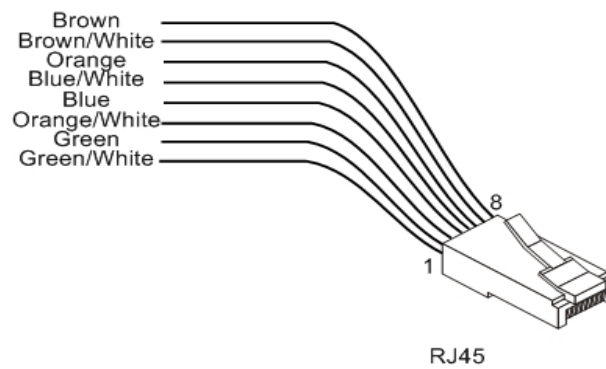


Figure A-1. RJ-45 wiring for IDU-ODU cable

A.2 User Port Connectors

The IDU includes ports for connecting E1/T1 and 10/100BaseT Ethernet user devices.

Trunk Port

The Trunk (E1/T1) interface terminates in an 8-pin RJ-45 balanced connector, wired in accordance to [Table A-2](#).

Table A-2. E1/T1 Connector Pinout

Pin	Function
4,5	Receive (input)
1,2	Transmit (output)

LAN Port

The LAN 10/100BaseT interface terminates in an 8-pin RJ-45 connector, wired in accordance to [Table A-3](#).

Table A-3. Fast Ethernet Connector Pinout

Pin	Signal	Function
1	TD (+)	Transmit Data

(positive)		
2	TD (-)	Transmit Data (negative)
3	RD (+)	Receive Data (positive)
6	RD (-)	Receive Data (negative)

A.3 IDU-C Connectors

IDU-C DC Power Terminal

Table A-4. Terminal Block 3-pin -48VDC

Pin	Connection
Right	+
Center	Chassis
Left	-

IDU-C Alarm Connector

Table A-5 lists the alarm connector pinout.

Table A-5. Alarm Connector (Dry-Contact)

Pin	Description
1	Input 1 Positive
6	Input 1 Negative
2	Input 2 Positive
7	Input 2 Negative
3	Output 1 Normally Closed
8	Output 1 Common
4	Output 1 Normally Open
9	Output 2 Common
5	Output 2 Normally Open

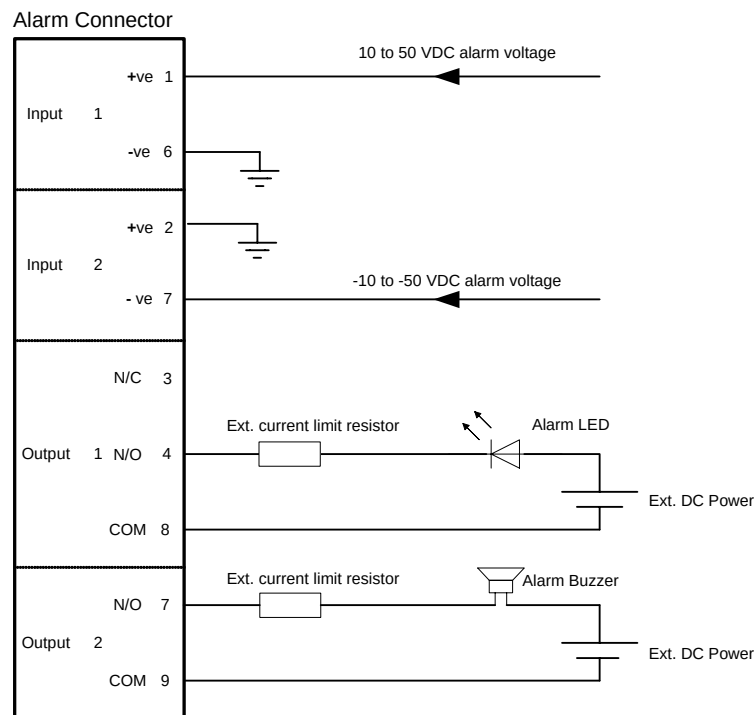


Figure A-2. Example for connecting the alarm connector

Appendix B

Mast and Wall Installation

B.1 Mounting the ODU

The ODU can be mounted on a mast or a wall.

ODU Mounting Kit Contents

The ODU mounting kit includes the following items:

- One Large Clamp (see figure B-1)
- One Small Clamp (see figure B-2)
- One Arm (see figure B-3)
- Four Screw hex head M8x40
- Two Screw hex head M8x70
- Four Washer flat M8
- Three Washer spring M8
- Two M8 Nuts

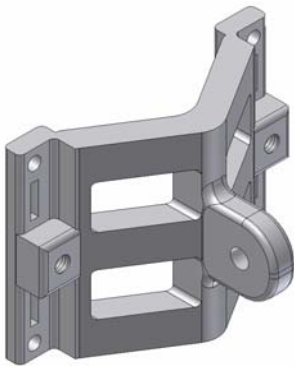


Figure B-1. Large Clamp

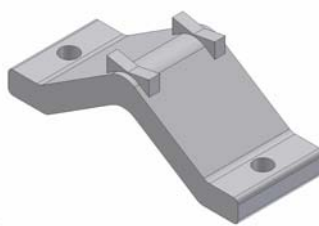
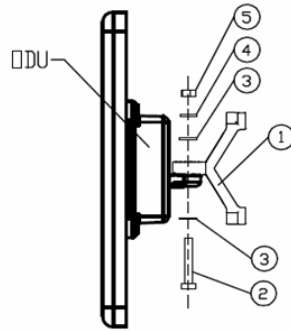


Figure B-2. Small Clamp



Figure B-3. Arm

Mounting WinLink 1000 on a Mast

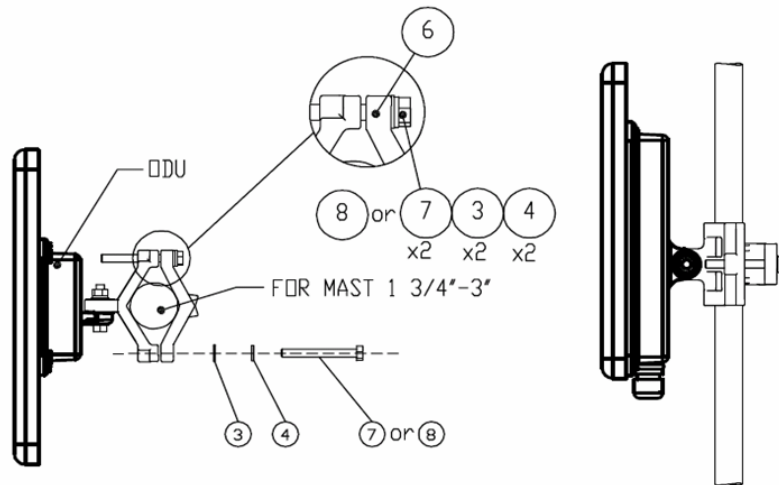


ITEM	DESCRIPTION	QTY
1	Clamp	1
2	Screw hex head M8x40	1
3	Washer flat M8	4
4	Washer spring M8	3
5	Nut M8	1
6	Clamp	1
7	Screw hex head M8x40 (for 1 3/4" dia mast)	2
8	Screw hex head M8x70 (for greater size of mast)	2



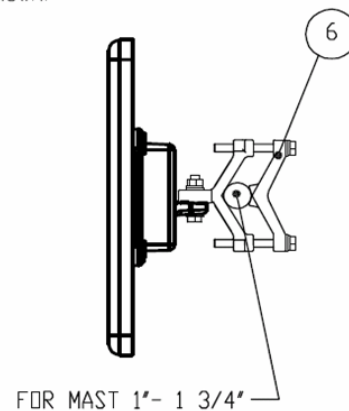
STEP 1

Attach item 1 to the base
(mate knurled surfaces)
using items 2,3,4,5 as shown
Use tightening torque of 24 N/m.

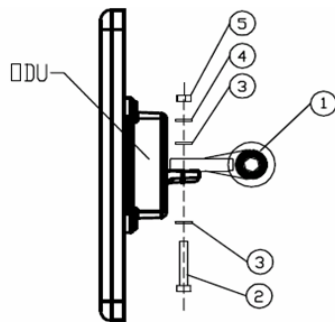


STEP 2

Tighten the antenna to the mast, using item 6,
screws, and washers items 7,3,4 as shown.
Use tightening torque of 14 N/m.



Mounting WinLink1000 on a Wall

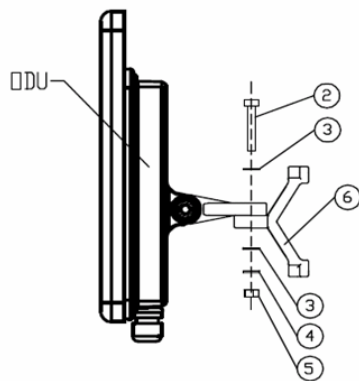
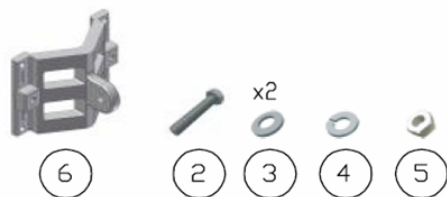


Installation Kit		
ITEM	DESCRIPTION	QTY
1	Arm	1
2	Screw hex head M8x40	2
3	Washer flat M8	4
4	Washer spring M8	2
5	Nut M8	2
6	Base wall	1



STEP 1

Attach item 1 to the base
(mate knurled surfaces)
using items 2, 3, 4, 5 as shown.
Use tightening torque of 24 N/m.

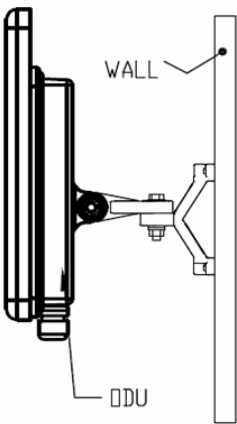


STEP 2

Attach item 6 to the arm
(mate knurled surfaces)
using items 2, 3, 4, 5 as shown.
Use tightening torque of 24 N/m.

STEP 3

Install ant. to wall
(hardware supplied by customer)



B.2 Mounting an External Antenna

The optional external antenna can be mounted on a mast.

External Antenna Mounting Kit Contents

The external antenna mounting kit includes the following items:

- Twelve flat washers
- Eight spring washers
- Eight hex nuts
- Four bolts
- One U-bracket
- One pivoting bracket
- Two metal strap clamps.

➔ **To install external antenna on the mast:**

1. Attach the U-bracket to the back of the antenna using four flat washers, four spring washers and four hex nuts.
2. Attach the pivoting bracket to the U-bracket using eight flat washers, four spring washers, four hex nuts and four bolts.
3. Pass both strap clamps through the vertical slots in the pivoting bracket.
4. Attach the antenna to the mast using the two strap clamps.
5. Adjust the required tilt using the angular scale and tighten all bolts and nuts at the required position.

Appendix C

Link Budget Calculator

C.1 Overview

The Link Budget Calculator is a utility for calculating the expected performance of the WinLink 1000 wireless link and the possible configurations for a specific link range.

The utility allows you to calculate the expected RSS of the link, and find the type of services and their effective throughput as a function of the link range and deployment conditions.

The Link Budget Calculator is supplied on the WinLink 1000 Manager CD. After installation, it may also be accessed from the menu bar of the WinLink Manager (see Figure C-1).

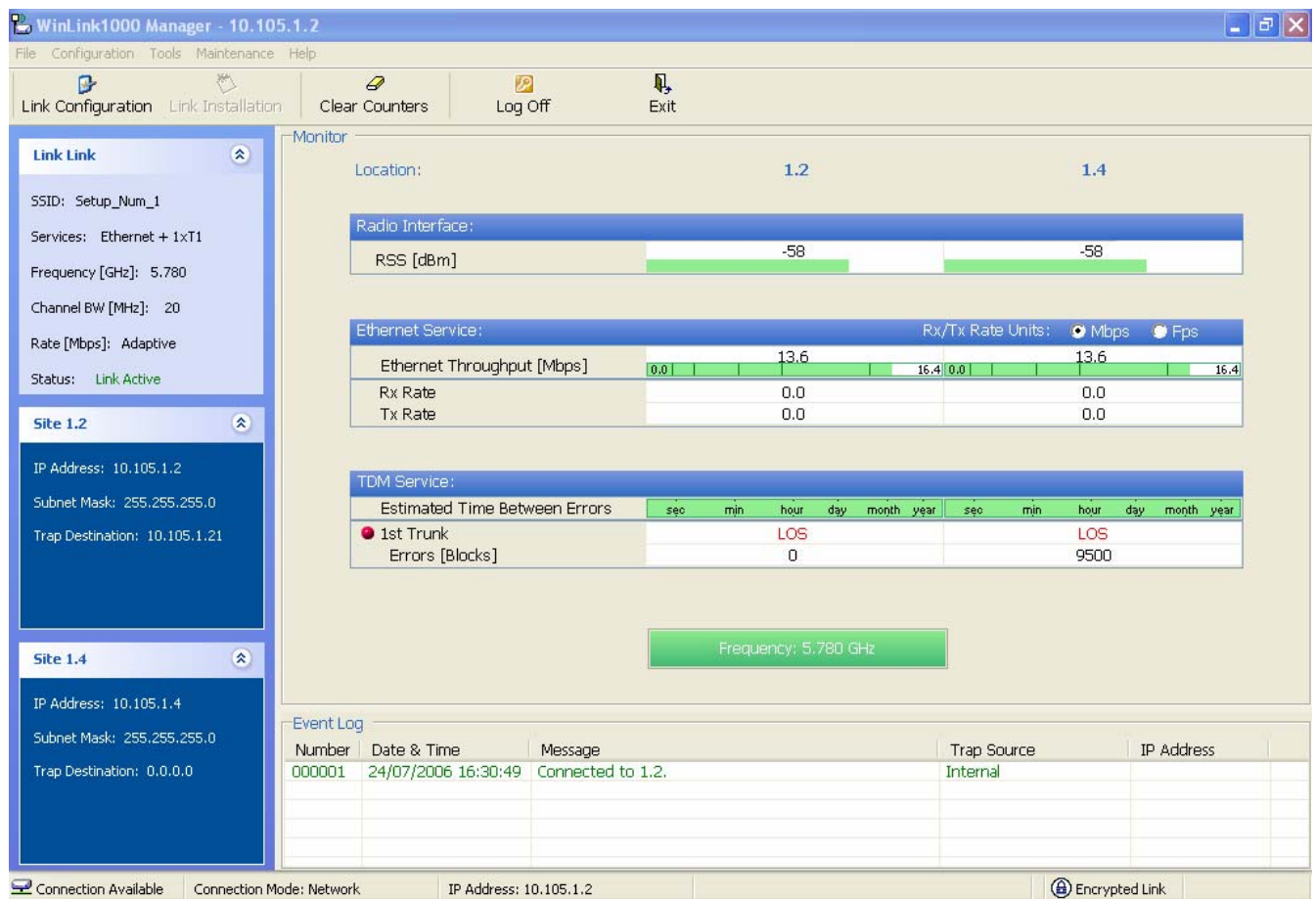


Figure C-1. Accessing the Link Budget Manager Calculator

C.2 Using the Link Budget Calculator

The Link Budget Calculator comprises of one table where all the link parameters are defined.

WinLink - Link Budget

Product	WVL1000-ODU/F58/FCC/INT	
Channel / Frequency / Duplex	20 MHz	5.8 GHz / TDD
Rate	9Mb/s	
Tx Power	16	dBm [4 - 16]
Tx Antenna Gain	22	dB
Rx Antenna Gain	22	dB
Cable Loss	0	dB
Fade Margin	6	dB
Tx Power EIRP	38 dBm / 6.3 Watt	
Min Range	0.1 Km / 0.1 Miles	
Max Range	46 Km / 28.6 Miles	
Expected Performance		
Distance/Climate	46 Km	Good (C=0.25) help
Expected RSS	-81 dBm	
Services	Ethernet Only	
Ethernet Rate (Full Duplex)	1.7 Mb/s @ Ethernet Only	
Recommended antenna height	24 Meter / 79 Feet	
Calculate		

Figure C-2. Link Budget Screen

→ To calculate the link budget

1. Select your WinLink system product from the dropdown list of products.
2. Select the rate from the dropdown list. The rate defines the air-interface rate in Mbps. The system operates in TDD mode and has overhead of the air-interface protocol and therefore the accurate actual throughput is provided in the 'Service' Row and the effective Ethernet throughput is provided in the 'Ethernet Rate'.

Note *Throughput can be decreased as a function of range due to propagation delay.*

The remaining fields are completed automatically depending on the product selected in the product field. Standard WinLink1000 system parameters are entered as default. Fields in blue boxes may be edited if non-standard antennas and cables are used.

The Fade margin is the minimum margin that is required for LOS conditions. For degraded link conditions, a larger fade margin should be taken into account.

The Tx power EIRP for the system is given in dBm and Watts.

3. Select the required link distance and units of distance, kilometers or miles.

4. Click Calculate

The Expected Performance parameters are calculated and displayed in the lower part of the table.

- Expected RSS – this is the number that the WinLink1000 Manager software shows when the WinLink1000 ODUs are best aligned.
 - Services – Maximum E1/T1 services possible whilst maintaining full duplex Ethernet throughput.
 - Ethernet Rate – Maximum throughput available with the chosen system.
5. If the expected performance is not suitable for your application, select a different data rate and re-calculate.

Appendix D

AIND Antenna Alignment Procedure

Use this procedure when using the all indoor system WinLink1000–ANID or manually aligning two WinLink1000 units.

To achieve the best benefit and link budget from the WinLink installation, the link antennas must be aligned; the two antennas should exactly face each other.

In order to achieve the best performance, the line of sight must be as clear as possible with no obstructions between the two sites.

Prior to attempting WinLink alignment, install the hardware and software in accordance with the WinLink1000 Installation and Operation Manual. *Figure D-1* shows the link setup. At least two people are needed to perform the alignment procedures.

Once the alignment is complete, you are able to evaluate the quality of the link.

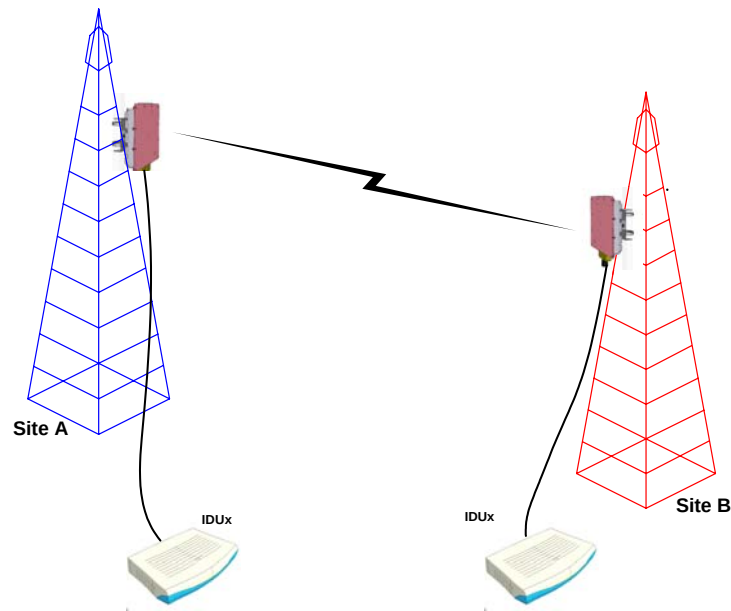


Figure D-1. WinLink1000 Link Setup

D.1 Expected Signal Level

Based on the link budget parameters of the actual WinLink sites, you need to calculate the expected signal level that will be received by the receiving site.

Use the Link Budget Calculator utility supplied on the WinLink1000 Manager Software CD-ROM to calculate the expected performance of the WinLink1000 wireless link. The utility allows you to determine the RSS of the link, and find the number of E1/T1 services available at various data rates, with the minimum and maximum distance.

D.2 Performing WinLink1000-AIND Alignment

The supervisor of the antenna alignment is situated at the receive site with the Spectrum Analyzer.

Equipment Setup

*** To set up the antenna alignment equipment:**

1. Coarsely align the two antennas. Use the compass readings taken during the Site Survey to point the antennas in the correct direction.
2. Connect the equipment as shown in *Figure D-1* but connect a spectrum analyzer in place of the remote WinLink1000-AIND.
3. Turn on the CW transmit signal from site A (from the WinLink1000 NMS).
4. At site B, tune the SA to the frequency transmitted.
5. Increase the SA sensitivity according to the expected receive signal.

Align the antennas:

Note

- *When one antenna is moved, the opposite site is passive*
 - *Move the antennas very slowly*
-
1. Slowly move the site B antenna azimuth axis (the elevation axis should be locked) until you see the best signal on the SA Lock the azimuth axis.

2. Slowly move the site A antenna azimuth axis (the elevation axis should be locked) until you see the best signal on the SA.
Lock the azimuth axis.
3. Slowly move the site B antenna elevation axis (the azimuth axis should be locked) until you see the best signal on the SA.
Lock the elevation axis.
4. Slowly move the site A antenna elevation axis (the azimuth axis should be locked) until you see the best signal on the SA.
Lock the elevation axis.
5. Repeat steps 1 to 4 until the reading on the SA is equal or as close as possible to the calculated receive signal (for Rx Power Level see *Expected Signal Level*).
When the SA reads the expected receive signal, the antennas are aligned and there is an indication of a good link between the sites.
6. Tighten the antenna azimuth axis and elevation axis.
7. Stop the CW function. The NMS will restart the system.
8. Connect WinLink1000-AIND unit to external antenna. See WinLink1000 Installation and Operation Manual for details. The operational link is shown in *Figure 2-3*.
9. Configure WinLink1000 NMS at both sites to operate at the pure channel frequency found in the RF survey. WinLink1000 is now ready for operation.

D.3 Configuring the Link

1. Run the Installation Wizard in the WinLink1000 Manager Software to set the configuration of the link. Configure the link in accordance with the parameters calculated in the Link Budget Calculator.
2. WinLink1000 has a unique identification number, the SSID. Each side of the link looks for its partner with the same SSID. Therefore both sides of the link must be configured with the same SSID.
3. The WinLink1000 link is now ready for operation.

D.4 Evaluating the Link

With the link operating at a pure channel as determined by the RF survey procedure, the recommended performance threshold of an WinLink1000 link is the following:

RSS: -84 dBm minimum

There are cases when there is no line of sight, but still the link is of an acceptable quality.

If the link is not within the acceptable limit, see [Troubleshooting](#).

D.5 Troubleshooting

If the link is not within the acceptable limit as defined in *Evaluating the Link*, check the following:

- Verify that both antennas have the same polarization (horizontal/vertical).
- Check all the WinLink1000–AIND cable connectors for faulty connections.
- Verify that there are no obstacles in the Fresnel zone of the antenna path such as large buildings, trees, etc.
- Use a spectrum analyzer with suitable sensitivity to measure the signal at the distance between the sites.

If nothing improves the receive power level, check the overall link.

- Reduce the distance of the link—move the equipment from one site closer to the other site—where it is possible to actually see the antennas with the naked eye.
- If you now get the expected receive signal level, you can assume that the equipment is operational, and the problem arises from interference between the sites.

Appendix E

Antenna Characteristics

An antenna is the radiating and receiving element from which the radio signal, in the form of RF power, is radiated to its surroundings and vice versa. The transmission range is a function of the antenna gain and transmitting power. These factors are limited by country regulations.

WinLink1000 may be operated with an integrated antenna attached to the ODU unit, or with an external antenna wired to the ODU via an N-type connector. All cables and connections must be connected correctly to reduce losses. The required antenna impedance is 50Ω.

Table E-1. Antenna Characteristics

Type		Gain [dBi]	Max Range		Beam [degrees]	Dimensions		Weight		Connector	Lightning Protection
			[km]	[miles]		[mm]	[in]	[kg]	[lb]		
5.8, 5.4, 5.3 GHz											
Integrated	Flat panel	22	40	25	9.0	305×305×58	12×12×2.3	0.5	1.1	NR	Yes
External	Flat panel	28	80	50	4.5	600×600×51	23.6×23.6×2	5.0	11.0	N-type	No
5.8 GHz only											
External	Dish	32.5	80	50	4.5	Dia 900	Dia 35.4	10	22	N-type	No
4.9 GHz											
External	Flat panel	21	24	15	9.0	305×305×58	12×12×2.3	0.5	1.1	N-type	Yes
External	Dish	27	80	50	5	Dia 600	Dia 23.6	5.0	11.0	N-type	Yes
2.4 GHz											
Integrated	Flat panel	17	40	25	20	305×305×58	12×12×2.3	0.5	1.1	NR	Yes
External	Grid	24	80	50	7.5	600×997×38	23.5×39.2×1	2.0	4.6	N-type	No
						0	5				



Parabolic Dish
Antenna

The Parabolic dish antenna is a high-gain, reflector antenna used for radio, television, and data communications. The relatively short wavelength of electromagnetic (radio) energy at these frequencies allows reasonably sized reflectors to exhibit the very desirable highly directional response for both receiving and transmitting.



Grid Antenna

Used for 2.4 GHz applications. Due to the large size, the grid design minimizes weight and windloading.

f

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