

Chapter EM2: Multi-Vehicle Positioning and Telemetry

WinFrog supports wireless communications between multiple WinFrog systems. This feature, called the **WinFrog Multi-Vehicle Positioning and Telemetry (MVP&T) Extension Module**, provides the communications medium for simple multiple vehicle tracking and display by each individual vehicle and extended multiple vehicle **remote control** operations.

The WinFrog MVP&T Module has three operational modes to select from: an automatic self-monitoring token ring network, a manually controlled token ring network, and a point-to-point network. The module also supports file transfers and the transmission of DGPS RTCM corrections.

Multiple telemetry devices can be added to a WinFrog system enabling the operation of multiple radio network cells. This feature is of particular use for the **remote control** application where there is a Master system that provides the link between cells so that any vehicle, on any cell, can track any vehicle regardless of the cell on which that vehicle is operating.

This chapter describes the Multi-Vehicle Positioning & Telemetry module's capabilities and the associated simple tracking of multiple vehicles. In this mode, WinFrog is able to transmit positional information and waypoint targets between vehicles. The remote control capability is detailed in the **Remote Control** chapter.

Note: see the **GPS Calculations** chapter for a discussion about raw pseudorange calculations, differential GPS positions, and RTCM corrections.

A typical multiple vehicle telemetry configuration would consist of a primary vessel mobilized with a multiple RTCM source in addition to the standard GPS receiver, gyro, radio modem and other supporting peripherals, and several support vessels mobilized with a GPS receiver, gyro, radio modem, and other supporting peripherals. The primary vessel would use the RTCM for its own multi-station DGPS solution and re-broadcast one RTCM station over the telemetry. The support vessels would receive the RTCM corrections and use them for their single station DGPS solution. All of the vessels would, in turn, transmit their positional information which would allow the other vessels to track not only themselves, but all of the other vessels as well.

Network Functionality

The functionality of each **Network** mode is discussed here before detailing the configuration of the **Telemetry** device, because it is important to understand these concepts in order to make the decisions required for the configuration. **Note:** for all network operations, each WinFrog system must have a unique identity code (ID) within that network.

All stations in the network must be configured the same way with respect to the network settings in order for the network to perform reliably. The only exception to this is the **Master** and **Slave** settings for the **Point-to-Point** mode.

Token Ring Network

Briefly, a **Token Ring Network** is comprised of systems, or stations, that constantly pass data packets from one to the next in a specific sequence. This sequence is determined by the order that the stations are allotted space in the network. The station at the end of the list passes its packet to the station at the top of the list, thus forming a **ring**.

The data packets may contain specific network messages and/or data to be used at the receiving end for navigational purposes. Each station must transmit a data packet when it is its turn. If there are data in its transmit queue, the data are transmitted. If there are no data to be transmitted, a **token** is transmitted as a placeholder for where the data would have been, thus the **Token Ring Network**.

It is important to note that in the WinFrog application of the Token Ring Network, all stations listen and decode all data packets transmitted. If the packets contain information required by any station, regardless of that station's position in the sequence and originator of the transmission, the packet is decoded and the information used. For example, the positional information for any vessel is only transmitted by that vessel (the exception is the Remote Control feature). Therefore, any other vessel that is to track that vessel must decode the data packet and extract the positional information contained in it.

The list of stations in the network is critical to its performance. This list can be created in two ways.

Automatic Mode

In **Automatic** Mode, the network itself maintains the list of those stations in the network.

An integrity message is broadcast by one station. This message contains information about the station itself. As each successive WinFrog station on the network receives the message, the station ID number is added to the message. This continues until all stations have included their ID numbers to the original integrity message. When the integrity message has successfully passed around the network twice, with no changes, the network is considered stable. In this way, the network is periodically checked for stations that have been added or dropped out of the network.

Though all stations may originate the integrity message, each station resets its timer controlling the transmission of an integrity message when a successive integrity cycle has been completed, regardless of the originator of the cycle.

This operational mode is very flexible and permits a dynamic network where vessels can enter and leave the work area with optimal cycle times.

A limitation of this approach is that all vehicles utilizing the telemetry system must be within radio visibility. Otherwise, as vehicles move to the extremes of the operation area or are blocked by other structures in the work area, they may not be able to receive the station preceding them in the token ring. As a result, they can lose their spot in the network. Since they will continue to transmit in an attempt to re-establish a spot in the network, radio collisions can occur, negatively affecting the operation of the telemetry network.

Manual Mode

In **Manual Mode**, the operator manually enters the IDs of the stations that are to operate in the network. No integrity messages are used and the maintenance of the network members is performed by the operator.

The advantage of this operational mode is that the token ring is artificially maintained and the requirement of all vehicles remaining in the work area within range of the telemetry system's radios is eliminated.

This is at the cost of flexibility, as the telemetry network is now unable to add and remove vehicles automatically. A change in the vehicles operating in the network necessitates a change to the telemetry configuration on all vehicles.

If you are changing from manual mode to automatic mode, first remove the IDs closing with OK, and then with the Manual mode still selected, close the Configure Telemetry dialog with OK. This is to clear these ID. Then reopen the Configure Telemetry dialog, select the Automatic mode and close with OK.

Point-to-Point Network

A point-to-point network, also referred to as a point-to-multipoint network when there are more than two stations, involves a **Master** station specifically communicating with one **Slave** station at a time. When there are multiple **Slave** stations, each one is communicated with in a continuous cycle.

The **Slave** stations have no knowledge of other **Slave** stations, the **Master** is the only station with knowledge of all stations in the network. At the **Master** station, you enter the IDs of the **Slave** stations with which to communicate. No entry of IDs is required at the **Slave** stations, other than the ID for that specific station.

As a result, although the detection of stations in the work area and the maintenance of the network station list can not be automatic, it is a very easy network mode to manage. The only changes required are made at the **Master** station. These take affect immediately.

The **Master** specifically sets the ID of the intended receiver of the data packet in the packets header and transmits a data packet. If there are data in the transmit queue, the data are transmitted. Otherwise, a **token** is transmitted. The intended **Slave** responds in the same manner, that is, if there are data in its transmit queue, the data are sent. If not, it responds with a token.

As was the case in the **Token Ring Network**, in **Point-to-Point** mode all stations listen and decode all data packets that are transmitted. If the packets contain information required by any station, regardless of that station's position in the sequence and originator of the transmission, the packet is decoded and the information used. For example, the positional information for any vessel is only transmitted by that vessel (the exception is the **Remote Control** feature). Therefore, any other vessel that is to track that vessel must decode the data packet and extract the positional information contained in it.

Data Packet Types

There are several data packets that are used by the telemetry device. These are summarized

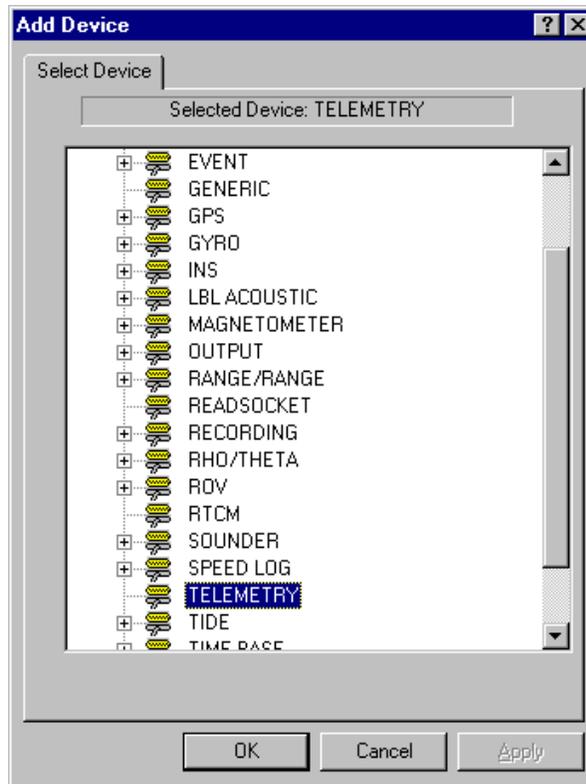
here.

Token Message	This message contains the ID of the transmitting and destination station. It is used to maintain the communications from one station to the next in the Token Ring Network and between the Master and a Slave in the Point-to-Point Network.
Integrity Message	This message is passed around a Token Ring network to determine what stations are present and to update the station list at all stations.
Link Message	This message contains the contents of the file being transmitted between stations. Note: this does include the file transfer initiated from within the Remote Control window (see the Remote Control chapter).
Link Ack Message	This message is sent by the receiving station to the station transmitting a file to acknowledge the reception of the last Link Message.
Broadcast Message	This message contains navigational data. This may be Position data, Target data, RTCM data or in the case of the Remote Control operation, general ASCII data (see the Remote Control chapter).

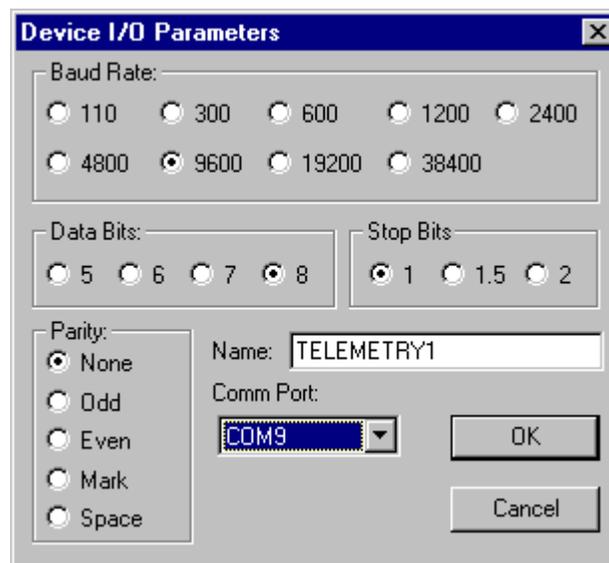
Telemetry Setup

To Add the Telemetry Device

- 1 Connect the radio modem to a WinFrog com port or Digiboard port.
- 2 Select **Configure > I/O Devices... Add** or from within the **I/O Devices** window, right-click and choose **Add Device** from the pop-up menu.



- 3 From the **Devices** list, select **TELEMETRY**.
- 4 Click **OK**.



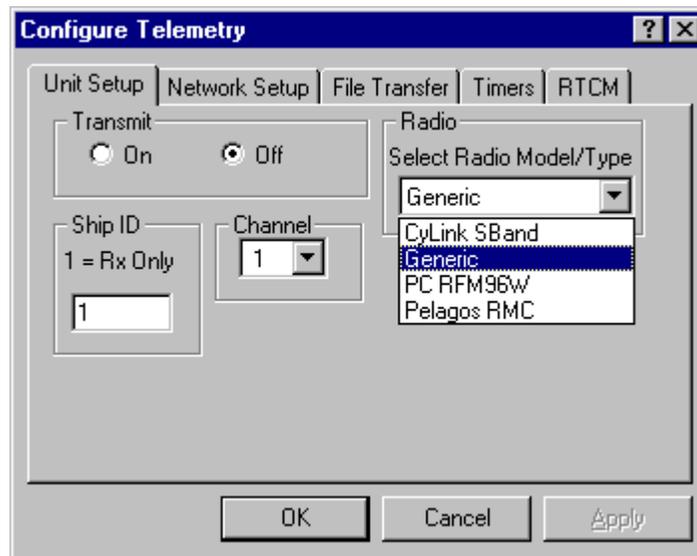
- 5 Enter a name for the device in the **Name:** field.
- 6 Set all of the communication parameters to match those of the radio modem.
- 7 Click **OK**.

At this point the device has been added to WinFrog.

To Configure the Telemetry Device

The configuration of the telemetry device, unlike many devices, requires comprehensive configuration at the device level. The following details only those configurations required for the Telemetry device to operate, specifically Unit Setup, Network Setup and Timers. Other configuration issues, specifically File Transfer and RTCM transmission, will be covered separately.

- 1 Select **Configure > I/O Devices... > Configuration** and then select the **Telemetry** device and click **OK**. Or from within the **I/O Devices** window, select the **Telemetry** device, right-click and choose **Configure Device** from the pop-up menu.
- 2 The next step is to configure the **Unit Setup**. You select the specific radio modem and configure how this WinFrog will be seen by other WinFrog systems in the telemetry network. Click on the **Unit Setup** tab.



Transmit

On/Off radio buttons

Turns the Telemetry device on and off.

Radio

Select Radio Model/Type

Different radio modems support different interfacing methods. To support this, WinFrog provides you the choice of several specific radios.

Cylink Sband
Generic

A point to multi-point radio modem system.
Provides connection support for most radio modems utilizing the RTS/CTS lines to control radio transmissions.

PC RFM96W

Pacific Crest blue bricks. These do not utilize the RTS/CTS lines.

Pelagos RMC

In house Radio Modem Controllers used to perform the necessary RTS/CTS line controls of radios. These were used when the **Telemetry**

feature was first implemented are generally not required now.

Ship ID

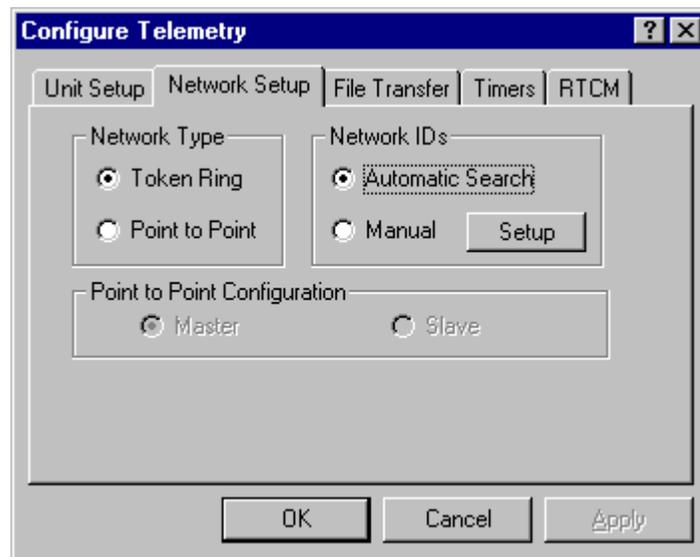
Each WinFrog system in a given telemetry network requires a unique identifier, as well as a unique identifier for each vehicle whose position is to be transmitted. Each WinFrog station can transmit up to 5 vehicle's positions. This can be a number from 1 to 32. The ID of 1 is special in that it sets that WinFrog system to be a "listener" only. The ID selected here must also be assigned to one (and only one) of the vehicles whose position is to be broadcast. (See Transmitting/Receiving Positions.) In the **Remote Control** mode, this ID provides the address of the remote WinFrog system to which the controller is to communicate.

Channel

If a radio modem supports multiple channels (frequencies), use this dropdown list to select the channel that WinFrog will instruct the radio to use.

The next step is to configure the Telemetry Network Setup. The actual operation of the network as configured here is covered more fully later in this section.

- 3 Click on the **Network Setup** tab.



Network Type

The telemetry network can support several operation modes.

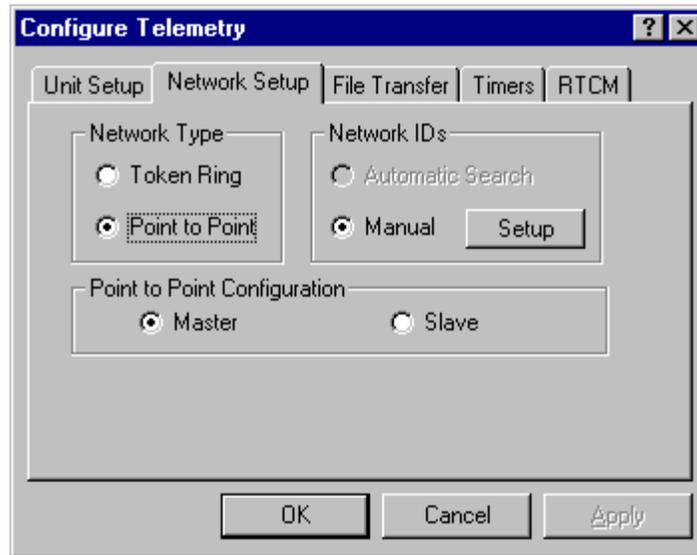
Token Ring

WinFrog maintains a network by passing a data packet between vehicles in a specific sequence, resulting in, essentially, a "ring" of communications. This packet contains data if there are any in the transmit queue. If no data are

in the queue, a token maintains its place in the network.

Point-to-Point

WinFrog maintains a **Master** system and **Slave** systems. The **Master** repeatedly, sequentially interrogates the **Slaves**, transmitting data to all **Slaves** in the process. Only certain options are available in this mode as indicated by the following figure.



Network IDs

There are two methods of determining the identities of the WinFrog systems in a given network.

Automatic Search

WinFrog operates a self-monitoring token ring network. No previous knowledge of the identities of other WinFrogs that will operate in the network is required. As vessels enter the network area, their presence is detected and they are added to the ring. As vessels leave the network area, their departure is detected and they are removed from the ring.

Manual

WinFrog uses an operator-entered list of the identities of the vessels that will operate in the network.

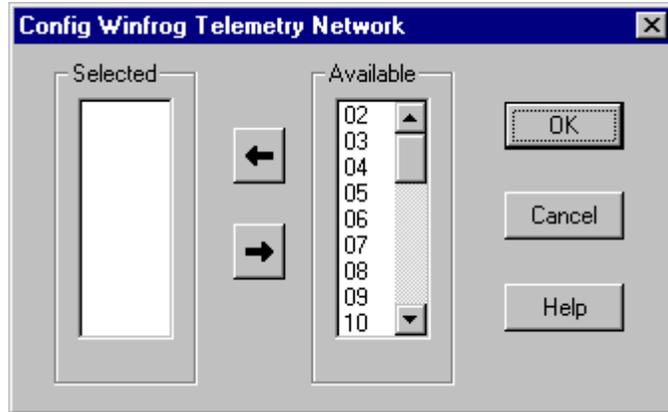
In the case of a **Token Ring** network, the identities of all of the WinFrog systems that are to be part of the network, including the identity of the WinFrog being configured here, are entered. The network does not automatically monitor and maintain its own list of vessels in the network in this mode.

In the case of **Point-to-Point**, at the **Master** WinFrog, you enter the identities of the **Slave**

systems that are to be interrogated. Editing of this list at the **Master** enables full control of the network. At the **Slaves**, no knowledge of other systems in the network is required, thus, no identities of other vessels are entered.

Setup

Click this button to access the **Config WinFrog Telemetry Network** dialog, which enables you to add and remove the identities of the vessels in the network, as described above.



Add to Network

Select an identity from the **Available** list and click the **left** arrow.

Remove from Network

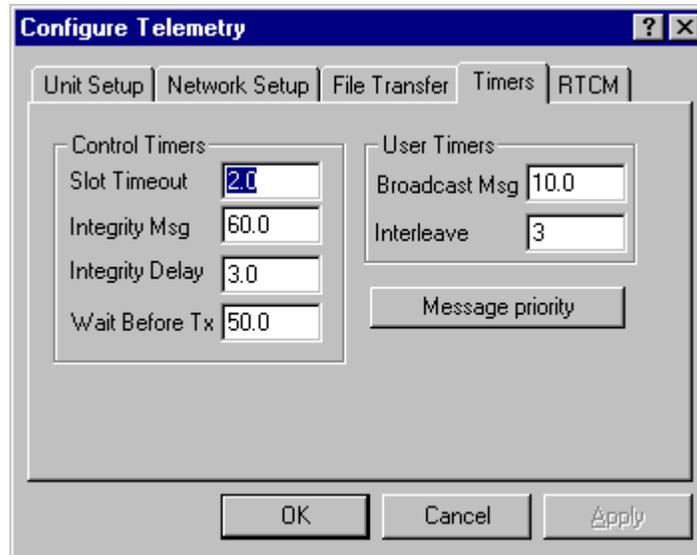
Select an identity from the **Selected** list and click the **right** arrow.

Point-to-Point Configuration

Master/Slave buttons

The **Point-to-Point** mode requires that there be one (and only one) **Master** system. All the remaining systems in the network are **Slaves**. It is recommended that the central WinFrog system be set to be the **Master**, such as the WinFrog on a rig and the work tugs are set to be the **Slaves**.

- 4 The next step is to configure the **Timers**. Click on the **Timers** tab.



Control Timers

Slot Timeout

In a **Token Ring** network, this is the length of time in seconds that a WinFrog system will wait for the preceding system in the ring to transmit its message before proceeding with its own transmission. This value needs to be smaller than the Integrity Delay by at least 200ms.

In the case of a **Point-to-Point** network, this is the length of time a **Master** will wait for a **Slave** to respond before moving to the next **Slave** in the list. As in the case of the **Broadcast Message**, this interval must not be set to a value shorter than what the telemetry system can support. **Note:** for 9600 baud radio modems, 1 second is reasonable.

Integrity Msg

The number of seconds between transmitted integrity messages. This is only applicable in a **Token Ring** network, configured for **Automatic** mode. It is recommended that the station that is expected to remain in the work area for the longest duration of time have this parameter set to an interval several magnitudes smaller than the other stations. In this way, it can be expected that this station would always be the originator of the **Integrity Message** and thus act as a network manager. **Note:** it is recommended that this setting for the manager be 60 seconds, and all other stations be set to 600 seconds. However when joining a network, setting this message back to 60 seconds should speed up the connection.

Integrity Delay

The time, in seconds, that is to elapse after receiving any message **before** transmitting an

Wait Before Tx

Integrity Message. This value needs to be greater than the Slot Timeout by at least 200ms. The delay in milliseconds between the WinFrog initiating a transmission by the radio and the message actually being sent to the radio. This permits the stabilization of the radio's transmission frequency and is therefore radio-dependent. For example, the Rnet 9600 radios require a 50ms delay, whereas the Teledesign radios require a 0ms delay. This is not applicable to the Pacific Crest RFM96W radios.

User Timers

Broadcast Msg

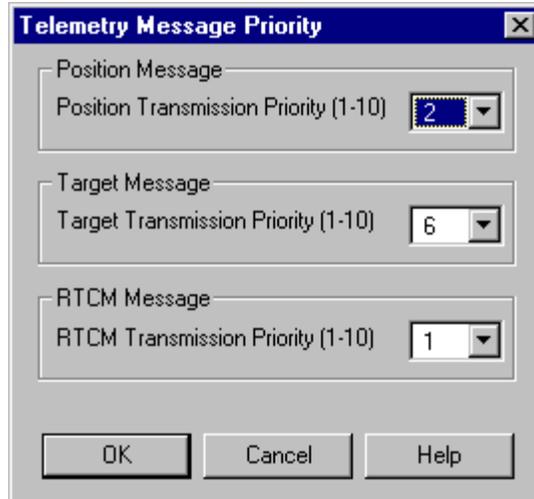
This is the time interval, in seconds, at which **Broadcast Messages** are to be transmitted. This directly controls the fastest possible position update rate of the vessels in the network as tracked by other vessels. It is important that this setting not be shorter than the telemetry system can support and may have to be adjusted in order to achieve the optimum performance. This setting should be the same on all vessels in the network. **Note:** for a 9600 baud radio modem, a setting between 1 and 5 is reasonable. For example, for the Pacific Crest RFM96W a setting of 1 second provides for a fast, robust telemetry network.

Interleave

The number of **Link Messages** that will be sent before the **File Transfer Link** may be interrupted to allow the transmitting station to send out a **Broadcast Message**. This is to ensure that other stations in the network continue to receive broadcast data from the transmitting station throughout a long file transfer. If the interleave is set to **0**, broadcast messages are sent out as soon as they are generated. This setting is only used by the station transmitting the file.

Message Priority

This button opens the **Telemetry Message Priority** dialog box, allowing you to set the priority of the broadcast messages to be transmitted. A setting of **1** is the highest priority and **10** the lowest. These values default to the recommended settings.



The different messages to be transmitted are generated by different WinFrog functions. As each is generated, it is sent to a queue. The priority of a message determines when it is actually sent. When it is time for a WinFrog system to transmit a message, the queue is checked and the message with the highest priority is sent. The default settings give the RTCM corrections top priority because without them, the receiving vehicles would be unable to position and navigate to the required accuracy.

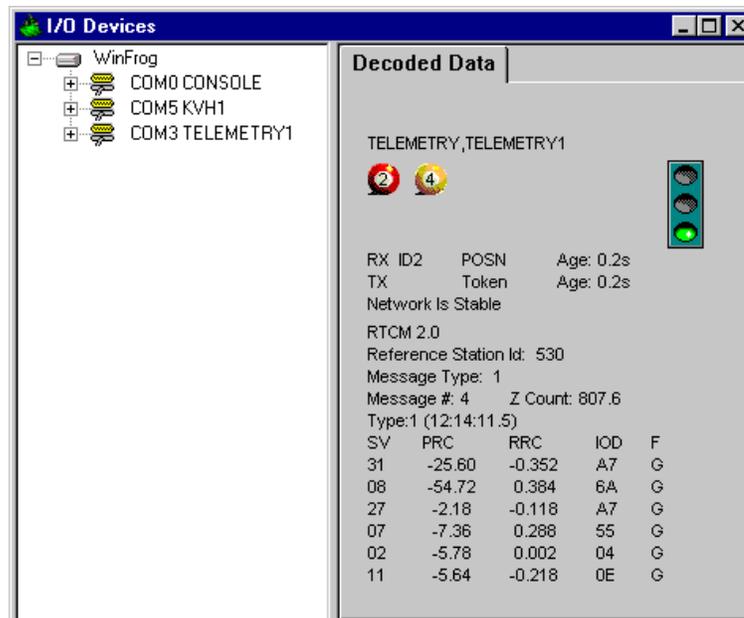
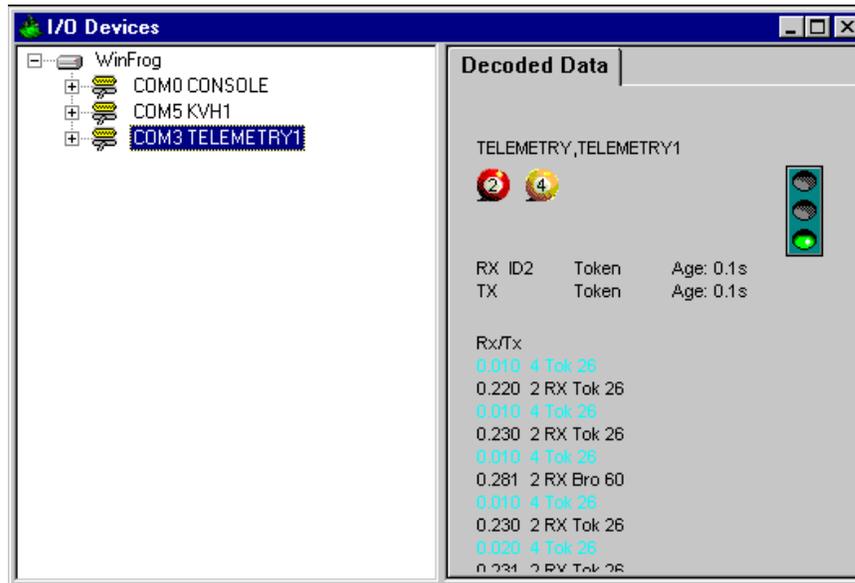
Note: the priority for the messages used for the **Remote Control** feature are not operator-configurable. However, they are impacted by the settings here if that operational mode is to be mixed with another telemetry feature, specifically the transmission of the RTCM corrections.

I/O Devices Dialog Box

The performance of the telemetry system can be monitored from the **I/O Devices** window. The information displayed can be toggled between the standard telemetry information and the RTCM data being received.

The Telemetry device does not support the terminal tab portion in the I/O device window. Raw data will not be displayed there.

The following details the information displayed. The first figure illustrates the display of the standard telemetry information and the second shows the display of the RTCM data.



To Toggle Between Standard Telemetry and RTCM Displays

- 1 Move the cursor to the data information portion of the **I/O Devices** window.
- 2 Click the right mouse button. The pop-up menu allows the selection of either **Telemetry** or **RTCM Data**. Select the item you wish to display.

Colored Light

A colored light is displayed for the local station and for each remote WinFrog station that is detected transmitting information via telemetry. The number at the center of the light shows the Ship ID that the light represents. The color of the light indicates the status of the station.

The following are status options:

Blue	inactive
Red	transmitting
Yellow	receiving
none	telemetry is turned off

“Traffic Light”

A traffic light style display shows the current status of the network. The light color of the display indicates the following:

Red	Telemetry network problem
Yellow	Searching for other WinFrog Stations transmitting via Telemetry
Green	Telemetry network stable Note: that in Manual Mode this is always the status of this indicator.
Black	Telemetry network turned off at local station

Status Line

A status line for each the receive and transmit state is displayed for the local station.

These lines includes the following information from left to right:

TX/RX	TX is a transmit message, used to represent the local station. An RX is a received message followed by a Ship ID number, identifying the originating transmitting station.
	The type of message that was last received or transmitted:
Token	Token ring message
Link	Link message
Link Ack	Link Acknowledgment message
Integrity	Telemetry Network integrity message
RTCM	RTCM correction information message
POSN	Position information message

TRGT	Target information message
ASCII	Remote Control message
Elapsed time	The elapsed time (in seconds) since the last Tx or Rx message

Note: If the telemetry device is configured for Token Ring/Manual mode, the traffic light icon in the device window stays green regardless of the connection status. This is as designed because the network never goes into search mode. Instead the telemetry status should be monitored by the use of the colored lights, TX/RX lines and the scrolling display.

Network Messages

The general network status is indicated in a line displaying either the type of message (only those pertinent to the monitoring of the network) that is being transmitted or the actual state as determined by the last sequence of relevant messages. The following messages for normal network operation may be displayed along this line:

Originate Integ Msg	Indicates that the local station has originated an integrity message.
Confirmation Integ Sent	Indicates that the local station has sent an integrity message.
Additional Integ Sent	Indicates that the local station sent an integrity message and that, due to changes detected in the returned integrity message, an additional integrity message has been sent.
Network Updated	Indicates that an integrity message was sent and that the network has been updated.
Network Is Stable	Indicates that an integrity message was sent and received successfully and that the network is stable.
ID Added To Message	Indicates that an integrity message has been received and that the local station's ID has been added to the message and the message forwarded.
Network Unchanged	Indicates that the second pass of the integrity message has been received and that the network is unchanged.
IDs Dropped From Net	Indicates that the IDs for one or more stations have been dropped from the network.
New Station Is Found	Indicates that a new station has been detected by the network.
ID Added on Further Pass	Indicates that the integrity message has gone once around and that a Ship ID number has been added to the integrity message on a subsequent pass.

In addition to these messages, other messages may be displayed when receiving or sending a file via telemetry. These messages are discussed in the **File Transfer** section.

Scrolling Display

A scrolling display, similar to the TX/RX status line, is shown. The difference is that the time shown is the elapsed time since the previous message, regardless of whether it was a receive or transmit type message. The size of the packet is also listed and if the packet type is a Broadcast (indicated by the term Bro) and the data is compressed, the size of the packet as compressed is given in brackets. Each station is displayed in a different color.

RTCM Corrections

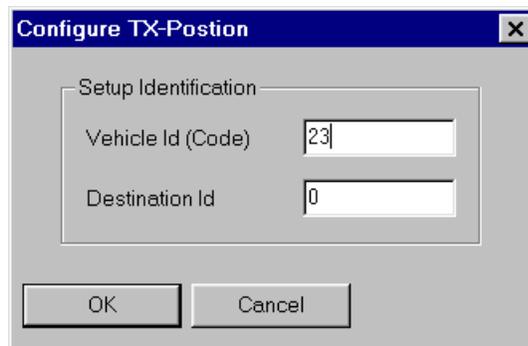
If the telemetry is being used to transmit or receive RTCM corrections, the RTCM corrections for each station transmitted are displayed.

Transmitting/Receiving Positions

A WinFrog station can be configured to broadcast the position of up to 5 vehicles being directly positioned at the WinFrog station. This position information includes the vehicle identification, latitude, longitude, speed, elevation, and heading. This information is then available to all other WinFrog stations on the telemetry network. The position is received and associated with the vehicle having the same identification. This allows a WinFrog station to track multiple remote WinFrog vehicles in real-time, several of which may be coming from one “source” WinFrog.

To Configure WinFrog to Transmit Position Information

- 1 Access the **Configure Vehicle-Devices** dialog for the appropriate vehicle
- 2 Click the **Add** button.
- 3 Select the **TELEMETRY, *, TX-POSITION** data item from the Available Data Items list.
- 4 Click **OK**.
- 5 Select the same device within the devices list of the **Configure Vehicle-Devices** dialog box.
- 6 Click the **Edit** button. The **Configure TX-Position** dialog box opens.



Vehicle Id (Code)

For one and only one vehicle, the Vehicle Id (Code) must match the Ship ID for this Telemetry device. Each and every vehicle in the

entire network must have a unique ID. If only one vehicle's position is to be broadcast then it must be assigned the Ship ID value. See the section **To Configure the Telemetry Device** (Unit Setup tab) earlier in this chapter.

Destination Id

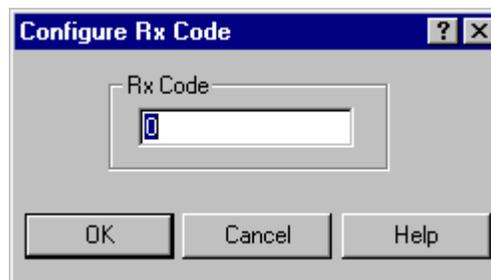
This is currently not used. Leave at 0.

WinFrog starts broadcasting the vehicle's ID, longitude, latitude, elevation, North component of the horizontal velocity, East component of the horizontal velocity, and heading. Other WinFrog stations on the telemetry network can then use this information.

Since the ID numbers are unique, any receiving WinFrog can distinguish between each vehicle. The IDs are assigned as described below.

To Configure WinFrog to Receive a Position

- 1 Access the **Configure Vehicle-Devices** dialog for the appropriate vehicle
- 2 Click the **Add** button.
- 3 Select the **TELEMETRY, *, RX-POSITION** data type from the **Available Data Items** list.
- 4 Click **OK**.
- 5 Select the same device within the devices list of the **Configure Vehicle-Devices** dialog box.
- 6 Click the **Edit** button. The **Configure Rx Code** dialog box opens.



- 7 In the **Rx Code** entry field enter the vehicle Id number as set in the **TX-POSITION** data item for the WinFrog station transmitting the desired vehicle position.
- 8 Click **OK**. The vehicle is updated with the received position.

Note: if the computer clocks are not synchronized to GPS on the transmitting and receiving WinFrog computers, the position displayed in the **Vehicle Text** window may indicate an old position even though the data are current and valid. This is due to the apparent age of the data due to difference in the clocks exceeding tolerances.

Transmitting/Receiving Targets

A WinFrog Station can be configured to broadcast a specific target for a specified vehicle. This Target information includes the target name, latitude, and longitude. The receiving vehicle

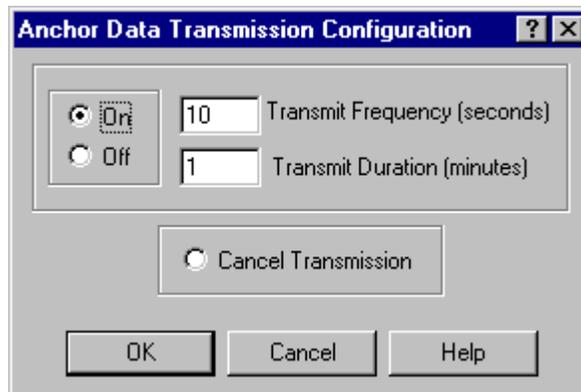
automatically assigns this target as its active waypoint, drawing it in the Graphics window (if waypoints are checked in the Graphics configuration) as a bulls eye with 3 m rings.

Note: there are two things to consider when attaching a **RX-TARGET** and/or a **TX-TARGET** data type to a vehicle:

- 1 The **TX-TARGET** data type is added to a vehicle on the WinFrog station controlling the target data. It is added to the vehicle on that station that is to ultimately receive and use the target data. For example, on a barge-based WinFrog system configured to track anchor tug(s) using the telemetry, the **TX-TARGET** data type is added to the vehicle(s) assigned as the anchor tug(s) on the barge WinFrog system.
- 2 The **RX-TARGET** data type is added to any vehicle that is to receive and use target messages on any system that it is desired to monitor the waypoint tracking status of that vehicle. For example, in the aforementioned situation, the **RX-TARGET** data type is added to the vehicle(s) assigned as anchor tug(s) on the anchor tug(s) WinFrog system(s). In addition, it can also be added to the anchor tug(s) vehicle(s) on the barge WinFrog system. This configuration enables the WinFrog systems on all of the vessels included in the telemetry network to monitor the target data being sent to and used by any tug.

To Configure WinFrog to Transmit a Target Position

- 1 Access the **Configure Vehicle-Devices** dialog for the appropriate vehicle.
- 2 Click the **Add** button.
- 3 Select the **TELEMETRY, *, TX-TARGET** data type from the **Available Data Items** list.
- 4 Click **OK**.
- 5 Select the newly added **TX-TARGET** data type within the **Devices** list of the **Configure Vehicle-Devices** dialog box.
- 6 Click the **Edit** button.



- 7 Configure the following parameters in the **Anchor Data Transmission** Configuration dialog box:

On/Off

The transmission of the target data can be turned on or off, providing control without having to remove and add the data type for a given vehicle.

Transmit Frequency	The user enters the interval in seconds at which the target data will be put into the telemetry transmit queue.
Transmit Duration	The user enters the length of time in minutes that the target data will repeatedly be placed in the telemetry transmit queue.
Cancel Transmission	Not used.

8 Click **OK**.

The actual target transmission is done from the **Anchor Handling** window. See **Anchor Handling Window** section in **Operator Display Windows** chapter.

To Configure WinFrog to Receive a Target Position

- 1 Access the **Configure Vehicle-Devices** dialog for the appropriate vehicle.
- 2 Click the **Add** button.
- 3 Select the **TELEMETRY, *, RX-TARGET** data type from the **Available Data Items** list.
- 4 Click **OK**.

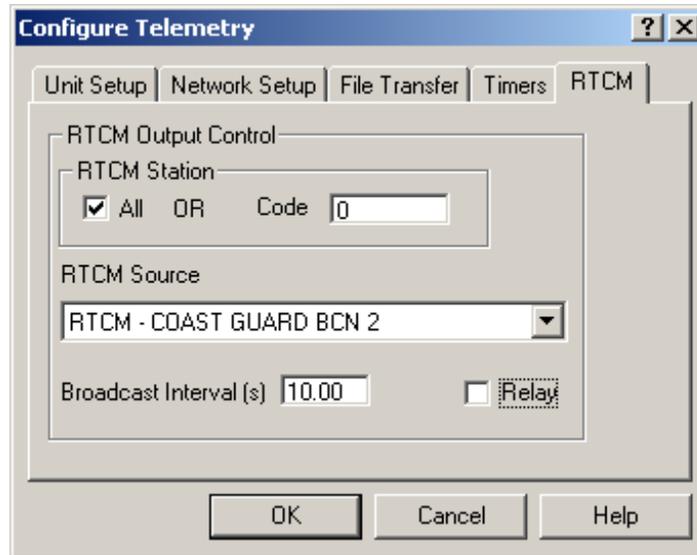
There is no configuration associated with this data type once attached to a vehicle.

Transmitting/Receiving RTCM Corrections

The WinFrog system can be configured to transmit and receive RTCM corrections over the telemetry network. Therefore, a station receiving RTCM corrections from another source can re-broadcast the corrections via the telemetry network. These corrections can then be used by all other WinFrog stations on the network.

To Configure WinFrog to Transmit RTCM Corrections

- 1 Select **Configure > I/O Devices... > Configure**, select the telemetry device, and click **OK**.
or
from within the **I/O Devices** window, select the telemetry device, right-click and choose **Configure Device** from the pop-up menu.
- 2 Click the **RTCM** tab in the configuration dialog.



- 3 Select the RTCM device from all available RTCM devices listed in the **RTCM Source** dropdown menu.
- 4 In the **RTCM Station** area, either check the **All** box or enter the ID of a specific station in the **Code** field.

Note: this can be changed at any time and the new setting is initiated immediately as you select **OK** to exit this window.

- 5 Enter a transmit interval in seconds.

WinFrog will only re-broadcast RTCM corrections after this interval has elapsed since the last RTCM re-broadcast. This permits control of the re-broadcast rate in cases where the RTCM source provides corrections at a high update rate. If the interval is too small, the telemetry will be unable to interleave position and target broadcast messages, thus eliminating this functionality.

The RTCM data broadcast is always the last received by the selected RTCM source.

- 6 The **Relay** checkbox configures this station to re-broadcast the RTCM data upon receiving it. This feature is for situations where not all vehicles in the network can hear the originating station for RTCM data. It should only be used if necessary, since it will impact the transmission of position and target data by the relay station in a similar manner as described in Step 5.
- 7 Click **OK**.

The WinFrog station starts broadcasting the RTCM corrections over the telemetry network.

It is recommended that if the RTCM device selected supports the input of multiple RTCM Reference Stations, only one be selected for re-broadcast over the telemetry. If the **All** option is selected, the telemetry will become slow with poor position update rates due to the time required for the transmission of the multiple RTCM corrections sets.

To Configure a WinFrog Station to Receive and Apply RTCM Corrections

- 1 Any WinFrog station on the network automatically receives the RTCM corrections. These corrections can then be applied to other stations on the telemetry network.
- 2 The application of the RTCM corrections at the remote WinFrog stations is then done the same way as for any other RTCM device. Two points to keep in mind:
 - When selecting the RTCM received via the telemetry as a device, such as the case of configuring the RTCM-104 output device, the RTCM source to select will appear in the list as the operator assigned name for the telemetry device.
 - When adding the RTCM received via the telemetry as a data type, select **TELEMETRY,*,DGPS-COR's** where the * is the operator assigned name for the telemetry device.

For further information refer to the **GPS Calculations Extension Module** chapter.

File Transfer

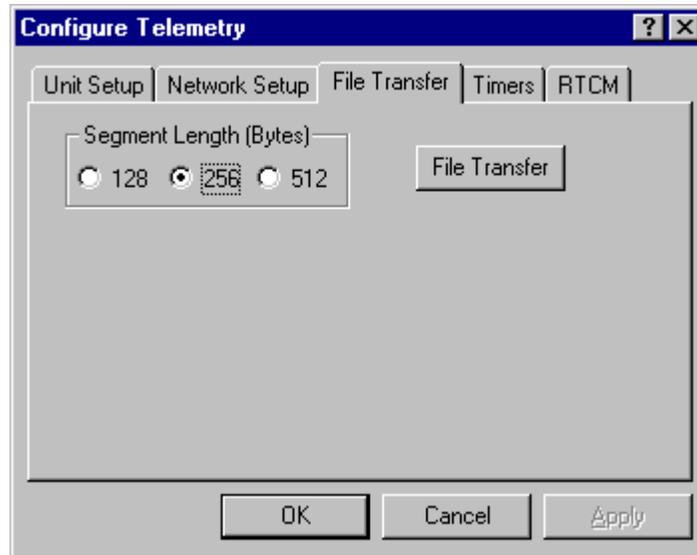
WinFrog's telemetry capabilities can be used to send files over a telemetry network. This allows the user to send data from one computer to be received by a specific remote computer on the network. Any file type is supported. This is a convenient way to transfer working files and daily reports.

Note: this functionality is independent of the **Working File Transfer** supported by the **Remote Control** operation (see **Chapter 16**).

File transfers use the **Link** and **Link Ack** type of broadcast messages. The former contains the file segments (see below, Step 3)

To Send a File via Telemetry

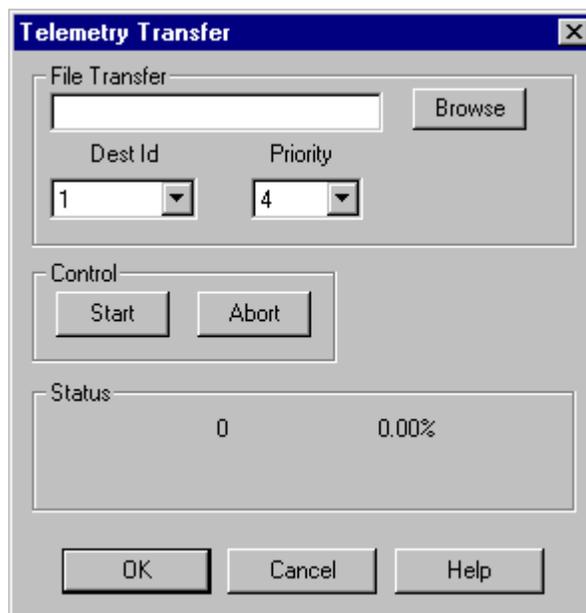
- 1 Select **Configure > I/O Devices... > Configure**, select the telemetry device and click OK.
or
from within the **I/O Devices** window, select the Telemetry device, right-click and choose **Configure Device** from the pop-up menu.
- 2 Click the **File Transfer** tab in the configuration dialog.



- 3 Select the desired **Segment Length (Bytes)**.

A file is transferred in multiple segments, one segment per transmission, until the complete file is transmitted. This controls the size of each segment of the file that is being transferred. The larger the segment size, the faster the file transfer. However, the more susceptible the transfer is to radio noise interference and possible aborting of the process. The smaller the segment, the slower the transfer, but the less prone to radio noise interference. This setting is only required at the transmitting station and, therefore, can be modified as it is determined to be required.

- 4 Click the **File Transfer** button. The **Telemetry Transfer** dialog box opens.



- 5 Designate a file either by typing the path and file name in the **File Transfer** entry field or by clicking the **Browse** button and navigating to the file.
- 6 From the **Dest Id** dropdown menu, select the Ship ID of the destination WinFrog station.

This menu displays all Ship ID numbers that are currently visible on the network.

- 7 Select the message priority from the **Priority** dropdown menu.

Priority values range from 2 to 4, with 2 being the highest priority and 4 being the lowest. This priority setting is ranked the same way as those discussed in **To Configure the Telemetry Device**, item 4, and as such sets the priority of the **File Transfer** messages with respect to other broadcast messages.

Generally, the message priority should be set to 4 (lowest) as the network speed is sufficient to transfer files in a timely manner. Only exceptional conditions will warrant increasing the priority of a vehicle's message, as this will obviously be to the detriment of other vehicles messaging. An example of this is the transfer of critical working files.

- 8 Click the **Start** button, in the **Control** area of the **Telemetry Transfer** dialog box, to begin the file transfer.

File transfer is accomplished using the **Link** message type. A new **Link** message is sent after receiving a **Link Ack** from the destination station. If a **Link Ack** is not received in the allowed time, the same **Link** message is re-transmitted.

The following information is displayed in the first line of the **Status** area of the **Telemetry Transfer** dialog box:

- Total size of file being transferred
- Segment number being transferred
- Percentage of file already sent

The following additional messages appear in the second line of the **Status** area when sending a file (these messages are also displayed in the **I/O Devices** window for the telemetry device):

Link Message Complete	Indicates the link message has successfully been transferred.
Segment n Sent to IDs p% Done	Indicates that segment number n was sent to Ship ID number s and that the file transfer is p percent complete.
Segment n Re-sent to IDs p% Done	Indicates that segment number n was re-sent to Ship ID number s and that the file transfer is p percent complete. This message may indicate a communication problem.
Final Segment Sent to IDs	Indicates that the final segment of the file being transferred is being sent to Ship ID number s .
Final Segment Re-sent to IDs	Indicates that the final segment of the file being transferred is being re-sent to Ship ID number s . This message may indicate a communication problem.

File Cannot Be Sent	Indicates that there is a communication problem and that the file could not be transferred.
No response after n times retryLink Aborted	Indicates that WinFrog unsuccessfully attempted to connect n times with the receiving computer and the link was aborted.

Note: the file transfer can be stopped at any time by clicking the **Abort** button in the **Control** area. Also, this dialog can be exited and re-accessed later to examine the file transfer status without affecting the file transfer.

Receiving a File

WinFrog automatically starts receiving a file sent via telemetry when the station's Ship ID number matches that entered in the **Telemetry Transfer** dialog box in the WinFrog transmitting station. The file is stored in the telemetry directory.

To Change the WinFrog Telemetry Directory

- 1 Select **File > Select Working Directories** to open the **Working Directories** dialog box.
- 2 Select the **Filing Directory** radio button by clicking the radio button next to the **Telemetry** entry field or enter a user-defined directory.

For a detailed description of this dialog box, see the **Working Directories** chapter.

- 3 Click **OK**.

When WinFrog is receiving a file via telemetry, several different messages may be displayed in the **I/O Devices** window for the appropriate telemetry device:

Last Link Aborted. New link Rx'ed	Indicates that the last link was aborted due to a communication problem and that a new link has been received.
New Link Rx'ed	Indicates that a new link has been received for file transfer.
Filename Link Msg n Rx'ed	Segment number n for the file Filename has been received.
Filename Final Seg Rx'ed	Final segment for the file Filename has been received. The file transfer is complete.
Invalid Link Received s	Indicates that an invalid link message status s was received.