



IT900 PLC Studio

User Manual

February 2011

Copyright © YITRAN Communications Ltd.

PRELIMINARY information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. YITRAN Communications reserves the right to change or discontinue these products without notice.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of YITRAN Communications semiconductor products and disclaimers thereto appears at the end of this document.

Table of Contents

1. ABSTRACT	6
2. PLC STUDIO APPLICATION.....	6
2.1 PLC STUDIO SOFTWARE INSTALLATION PROCEDURE	6
2.2 PLC STUDIO PC PROGRAM OVERVIEW	7
2.2.1 Main Screen.....	7
2.2.2 Connect Option and Window	8
2.2.2.1 COM Port Selection	8
2.2.3 The General Menu.....	10
2.2.3.1 Disconnect Option	10
2.2.3.2 Connect Option.....	10
2.2.3.3 Go Online Option	10
2.2.3.4 The Go Offline Option	10
2.2.3.5 Clear All Option	10
2.2.3.6 Quit Option.....	10
2.2.4 The Node Configuration Menu	11
2.2.4.1 System Parameters.....	11
2.2.4.2 NL Manager Option	14
2.2.4.2.1 Admission Table Button (valid for Base Station access only)	15
2.2.4.2.2 Configuration Button.....	15
2.2.4.2.3 Topology Button (valid for BS only)	21
2.2.4.2.4 The Init Button	22
2.2.4.2.5 The Refresh Button	22
2.2.4.2.6 The Node Key Button.....	22
2.2.4.2.7 The Neighbour Networks Button	22
2.2.4.2.8 The Node Info Button.....	24
2.2.4.2.9 The Leave Network Button	25
2.2.4.3 NL Manager Main Display Screen.....	26
2.2.4.3.1 The Station Display	26
2.2.4.3.2 The Network Concentrator Display	27
2.2.4.3.3 The Auto Refresh checkbox	27
2.2.4.4 Set Default Parameters	27
2.2.4.5 Init Option	28
2.2.4.6 Refresh Address.....	28
2.2.4.7 Node Configuration Displays	28
2.2.4.7.1 The Node Configuration Display	28
2.2.4.7.2 The IT900 Response Display	29
2.2.5 Transmitter Control Section	30
2.2.5.1 The Transmitter Menu	30
2.2.5.1.1 The TX Settings Option	31
2.2.5.1.2 The Send Option.....	34
2.2.5.1.3 The Break Option	35
2.2.5.1.4 Multisession Statistics	35
2.2.5.1.5 The Clear Option	35
2.2.5.1.6 The Accumulate Option	35
2.2.5.2 The Transmitter Display	36
2.2.5.2.1 The Transmission Progress Bar.....	36

2.2.5.2.2	The Transmitter Control Display	37
2.2.5.2.3	The Transmission Statistics Display	37
2.2.5.2.4	Multiple Session Transmission	38
2.2.5.3	The Receiver Menu	40
2.2.5.3.1	The 'More' Option	40
2.2.5.3.2	The Statistics Option	41
2.2.5.3.3	The Data Logger Option.....	41
2.2.5.3.4	The Clear Option	42
2.2.5.3.5	The Hexadecimal Option.....	43
2.2.5.3.6	The Show RX Window Option	43
2.2.5.4	The Receiver and Routed Statistics Displays	44
2.2.5.4.1	The Receiver Statistics Window	45
2.2.5.4.2	Routed Statistics Display.....	45
2.2.5.5	The Freeze Checkbox	46
2.2.6	More Functions Menu	47
2.2.6.1	Local Firmware Update	47
2.2.6.2	Remote Firmware Update.....	48
2.2.6.3	Remote Firmware Update Buttons	49
2.2.6.4	Remote Download Settings	49
2.2.6.4.1	Download Mode.....	49
2.2.6.4.2	Stages	50
2.2.6.4.3	Robust.....	50
2.2.6.4.4	Network Load.....	50
2.2.6.4.5	Load Firmware	51
2.2.6.4.6	Status	51
2.2.6.4.7	Peer to Peer.....	51
2.2.6.5	Remote Firmware Update Download Process.....	52
2.2.6.6	The User Mode Option.....	53
2.2.6.7	The Versions Option.....	54
2.3	USING THE PLC STUDIO WITH THE IT900 PLATFORM.....	55
2.3.1	System Verification Test.....	55
2.3.2	Coverage Test Guidelines	58
2.3.2.1	Issues to Be Aware Of.....	58
2.3.2.2	Test Procedure	59

Table of Figures

Figure 1: Device Manager Screen	6
Figure 2: PLC Studio Application Main Screen	7
Figure 3: Connect Screen and Process	9
Figure 4: General Menu	10
Figure 5: Node Configuration Menu	11
Figure 6: Configurable Parameters Window	11
Figure 7: NL Manager Window	14
Figure 8: NL Admission Table Window	15
Figure 9: NL Mng Configuration Window, Base Mode	16
Figure 10: NL Mng Configuration Window, Adaptive Mode	17
Figure 11: Network Topology Window	21
Figure 12: NLMng Node Key Window	22
Figure 13: Neighbour Networks Window	23
Figure 14: Node Info Button	24
Figure 15: Leave Network Window	25
Figure 16: NL Manager Window	26
Figure 17: Set Default Parameters	27
Figure 19: Node Configuration Displays	28
Figure 20: Main Screen Display During Transmission	29
Figure 21: Transmitter Control Section	30
Figure 22: Transmitter Menu	30
Figure 23: TX Settings Window	31
Figure 24: TX Multisession Transmission Result Window	35
Figure 25: Transmitter Display	36
Figure 26: Main Screen During Transmission - Transmission Progress Bar	36
Figure 27: Selection of Multiple Session Transmission	38
Figure 28: TX Multisession Window	38
Figure 29: Receiver Menu	40
Figure 30: Received Packets Window - More Option	40
Figure 31: Receiver Statistics Screen	41
Figure 32: Data Logger Window	42
Figure 33: The Data Logger Text File	42
Figure 34: Extended Main Screen - RX Window	43
Figure 35: Receiver Statistics and Routed Statistics Displays	45
Figure 36: More Functions Menu	47
Figure 37: Local Firmware Update Window	47
Figure 38: Remote Firmware Update Window	48
Figure 39: Select Download Mode	49
Figure 40: Select Stages	50
Figure 41: Select Robustness	50
Figure 42: Select Network Load	50
Figure 43: Load Firmware	51
Figure 44: Status Area	51
Figure 45: Peer to Peer	51
Figure 46: User Mode Window	53
Figure 47: Versions Window	54
Figure 48: Reset Response On Power-up	56
Figure 49: Station Type and Status Verification	57
Figure 50: STK Link LED	59
Figure 51: Network Topology on Coverage Test Setup	60

Table of Tables

Table 1: Parameters and Buttons of the Configurable Parameters Window	12
Table 3: RX Type Filter Options.....	13
Table 4: Configuration Fields and Buttons in the NL Admission Table Window	15
Table 5: Operation Mode Options.....	18
Table 6: System Settings Parameters	18
Table 7: Parameters of the Timers	19
Table 8: Base Station Parameters.....	19
Table 9: The Admission Mode Options	19
Table 10: The Net ID Select Mode Options.....	20
Table 11: Configuration Options.....	20
Table 12: Configuration Fields and Buttons in Network Topology Window	21
Table 13: Configuration Fields and Buttons in Node Key Window	22
Table 14: Configuration Fields and Buttons in Neighbour Networks Window	23
Table 15: Configuration Fields and Buttons in Node Info Window	24
Table 16: Station Display, NL Manager Window.....	26
Table 17: Network Concentrator Display, NL Manager Window	27
Table 19: Node Configuration Display	28
Table 20: TX Settings – Session Section	32
Table 21: TX Settings - Packet Header Settings Section	32
Table 22: TX Settings - Service Options	33
Table 23: TX Settings – Packet Payload Editor	34
Table 24: TX Settings – Random Payload Generator	34
Table 25: Accumulate Option: Activation and Deactivation	35
Table 26: Transmitter Control Summary Display	37
Table 27: Transmission Statistics Display	37
Table 28: TX Multisession Screen Parameters	39
Table 29: TX Multisession Window Buttons.....	39
Table 30: Receiver Section of the Main Screen	44
Table 31: Receiver Statistics Display.....	45
Table 32: Routed Statistics Display	45
Table 33: Remote Download Window Buttons	49

1. Abstract

This document describes the PLC Studio application utilized with Yitran's IT900 based platforms, its usage and configuration options.

2. PLC Studio Application

2.1 PLC Studio Software Installation Procedure

For using the PLC Studio PC application with Yitran's IT900 STK4 platform, first install the driver for the USB to UART Bridge assembled on the STK4 platform.

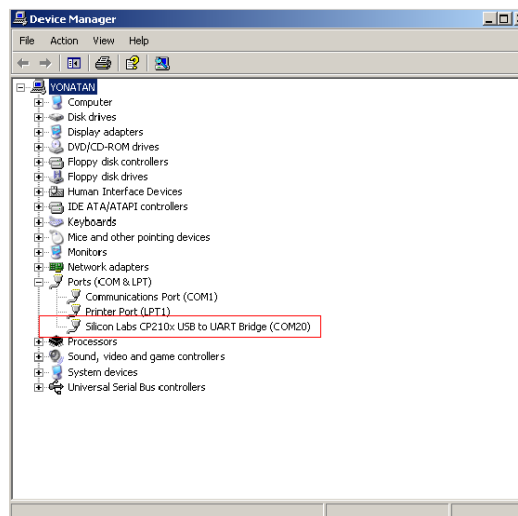
To install the driver, run the installer executable file (CP210xVCPInstaller.exe) located within the "PLC Studio Software" folder on the documentation CD.

Follow the steps below to verify proper installation of the USB to UART Bridge driver:

1. Power on the STK4 platform connected to the PC via USB cable
2. Right click on the *My Computer* icon.
3. Select *Properties* on the *System Properties* screen.
4. Choose the *Hardware* option and click on *Device Manager*.
5. In the *Ports (COM & LPT)* list, verify that a virtual COM port was allocated for the USB to UART Bridge.

The following figure describes the *Device Manager* screen:

Figure 1: Device Manager Screen



Once the Driver is installed properly, copy the PLC Studio executable file (extension ".exe") from the "PLC Studio Software" folder to your desired destination on the PC's local hard drive.

Note: It is important to copy the PLC Studio to a local location on your hard drive as various configuration files that will fail to work otherwise.

For First Time Use:

The first time you open the PLC Studio, the *User Mode* screen will appear. Entry to the Studio is password protected. Set the user mode to USER-NL and use the password "usnl".

2.2 PLC Studio PC Program Overview

The PLC Studio PC application enables the following functionalities:

1. Device Settings and configuration.
2. Message transmission.
3. Message reception.
4. Transmission and reception statistics.
5. Network Layer configuration and monitoring.

SPECIAL NOTE:

The PLC Studio program consists of several options that may appear as disabled in the various menus and screens. These options are used in different user modes, or for different hardware, and therefore are not described in this user guide and should be ignored.

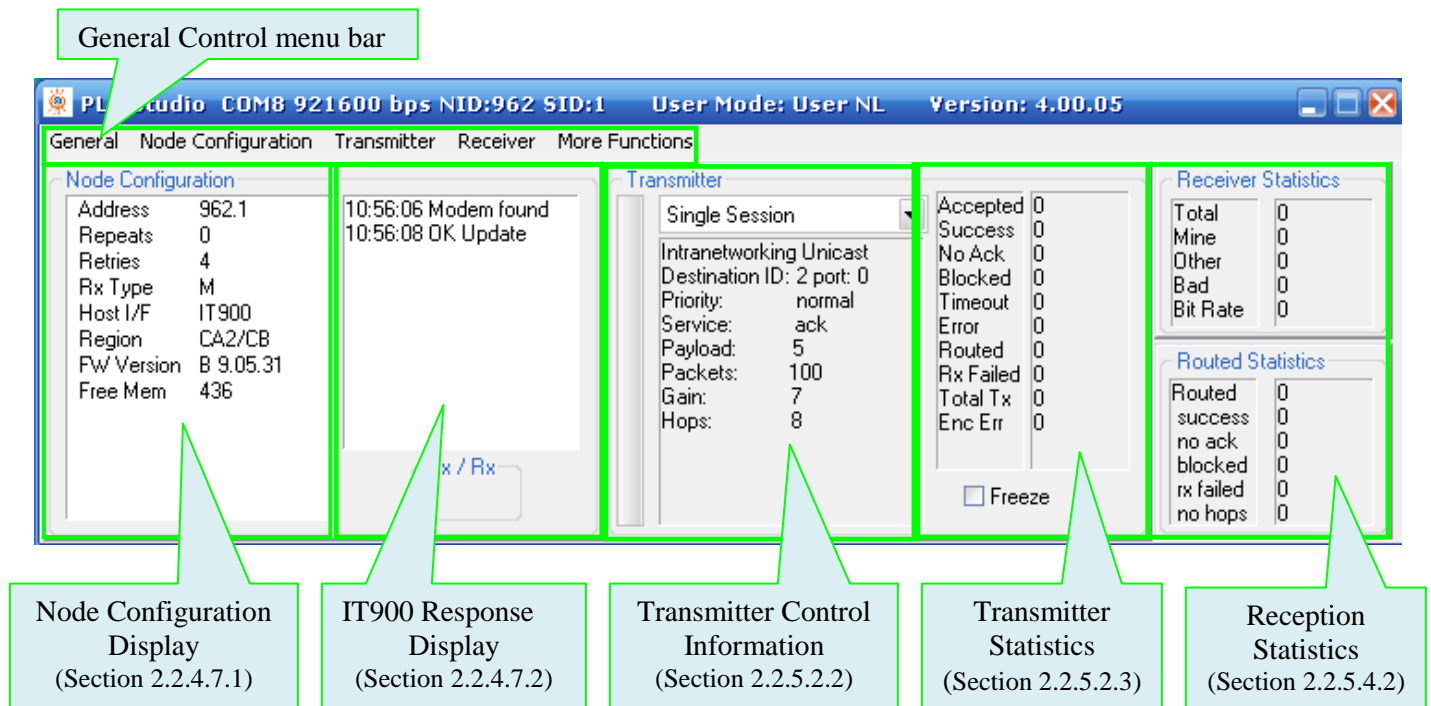
2.2.1 Main Screen

The PLC Studio program main screen appears when the program is activated. The main screen consists of general control menus and sections. This window also provides summary information regarding connection status and user mode in the window header.

! Note:
The Connect window appears automatically when the program is activated, allowing configuration of the USB port (virtual COM port) and baud rate.

The following figure describes the main screen of the PLC Studio application:

Figure 2: PLC Studio Application Main Screen



2.2.2 Connect Option and Window

Upon activation, the Connect window appears automatically. Use this window to select the PC virtual COM port of the IT900 platform and set the port data rate.

**Note:**

It is possible to use a single PC to run a number of PLC Studio applications simultaneously, one for each IT900 platform.

2.2.2.1 COM Port Selection

Follow the steps below to select the correct virtual COM Port connection:

1. Select the *Connect* option found in the *General* menu (this step is required only when COM Port Selection is not performed during system activation).
2. Select the desired COM port – the PLC Studio will provide an option for selecting available ports only.
3. Click *Apply* button.
4. The Studio's Response Display should indicate "IT900 Found".

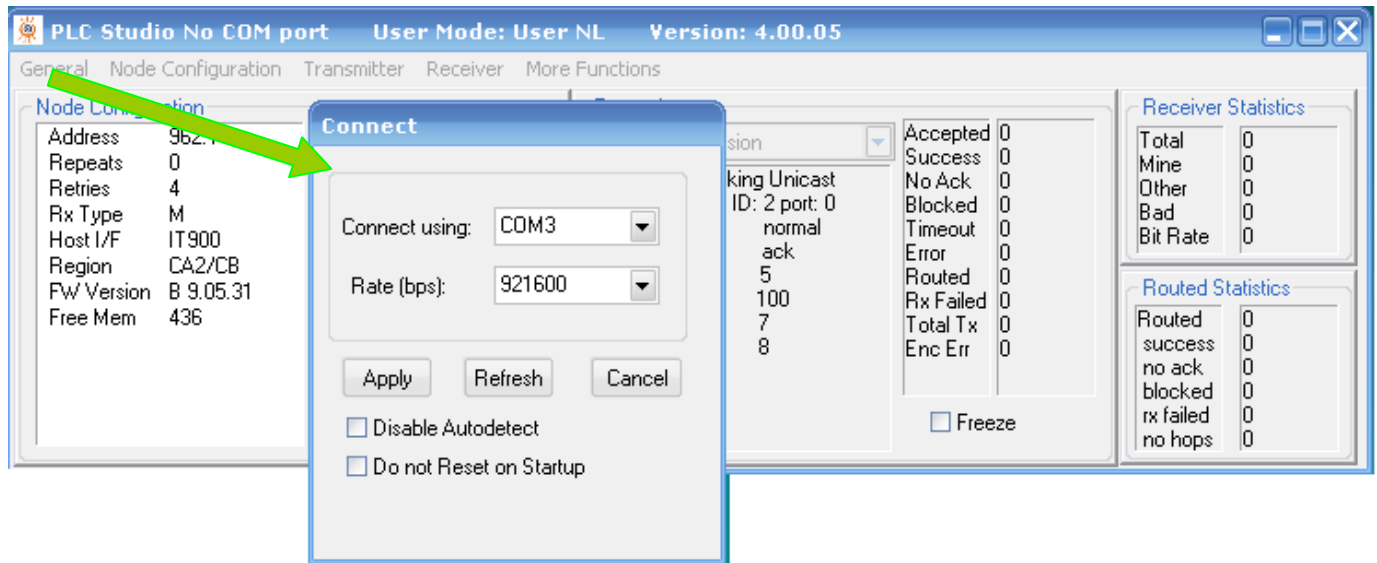
Additional options in the Connect Screen:

- *Disable Autodetect* Checkbox – PLC Studio automatically detects available COM ports on the PC (including Virtual COM ports) and the user may choose from the list of available COM ports only. When this checkbox is set, this feature is disabled.
- *Do not Reset on Startup* Checkbox – PLC Studio resets the board (sends reset command via UART) every time it connects. When this checkbox is set, this feature is disabled.

Proprietary Information

The following figure describes the *Connect* screen and process:

Figure 3: Connect Screen and Process



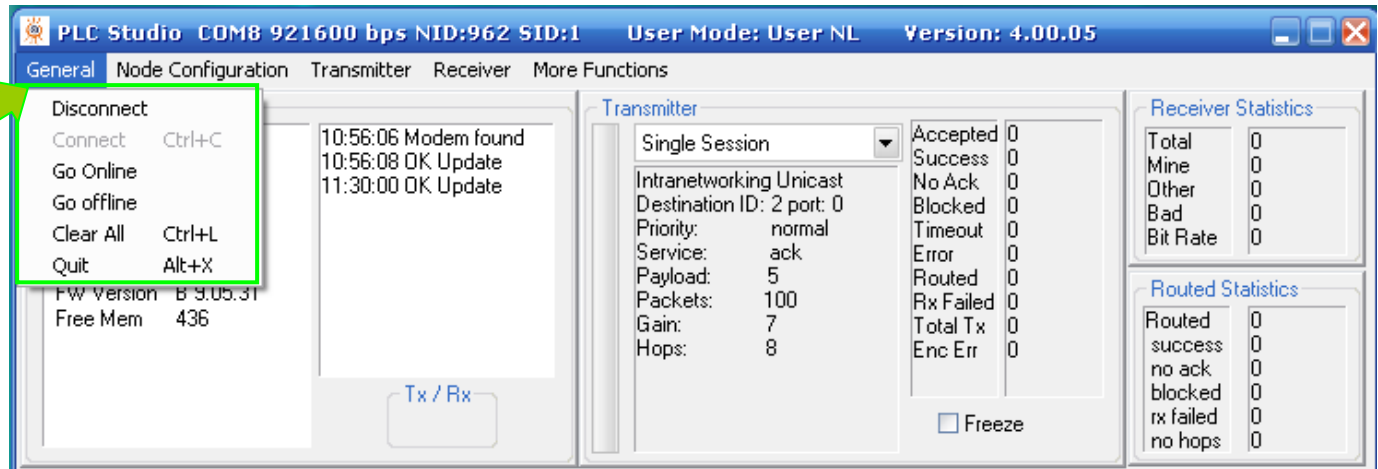
Note:

The COM port rate should be set at 921600bps for all bands (except CENELEC-A2, which is currently unsupported). If the rate is set to an inappropriate value, the IT900 platform will not work correctly. The resulting response for setting the rate improperly is equivalent to the response shown for non-existence of the IT900.

2.2.3 The General Menu

The following figure describes the items found under the *General* menu:

Figure 4: General Menu



2.2.3.1 Disconnect Option

This option disconnects the device from its Host only. This option also allows the user to perform port settings, such as switching to a different port connected to a different device, without closing the PLC Studio window.

2.2.3.2 Connect Option

The connect option opens the *Connect* Window (refer to Figure 3), in which the user can select a connection port and rate (see Figure 3). This option is enabled only when the device is disconnected from the Studio.

2.2.3.3 Go Online Option

Choosing this option allows the user to change the mode from *Go Offline* (refer to Section 2.2.3.4) and returns the mode to normal communication operation. Upon reset, the device's default is set on ONLINE mode.

2.2.3.4 The Go Offline Option

Choosing this option allows the user to change the mode from *Go Online* (refer to Section 2.2.3.3) to standby mode and disables the device's communication operation.

2.2.3.5 Clear All Option

This option simultaneously clears the following displays:

1. IT900 response display (*Node Configuration* section) – refer to Figure 5.
2. Transmission statistics – refer to Figure 24.
3. Receiver display – refer to Figure 28.

NOTE: This option can also be selected with the keyboard shortcut **CTRL+L**.

2.2.3.6 Quit Option

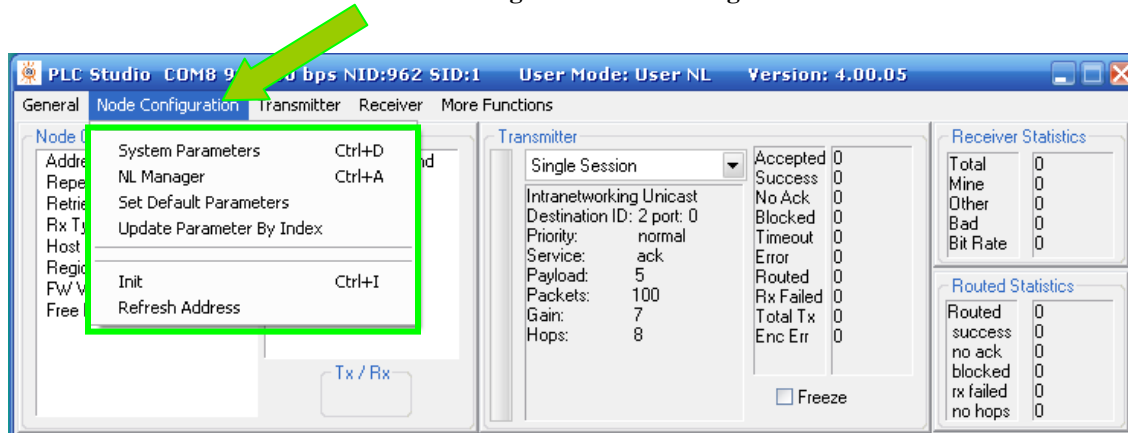
Choosing this option will close the screen and end the session.

NOTE: This option can also be selected with the keyboard shortcut **ALT+X**.

2.2.4 The Node Configuration Menu

The *Node Configuration* menu enables the user to change and monitor IT900 configurations. The following figure describes the items found in the *Node Configuration* menu:

Figure 5: Node Configuration Menu



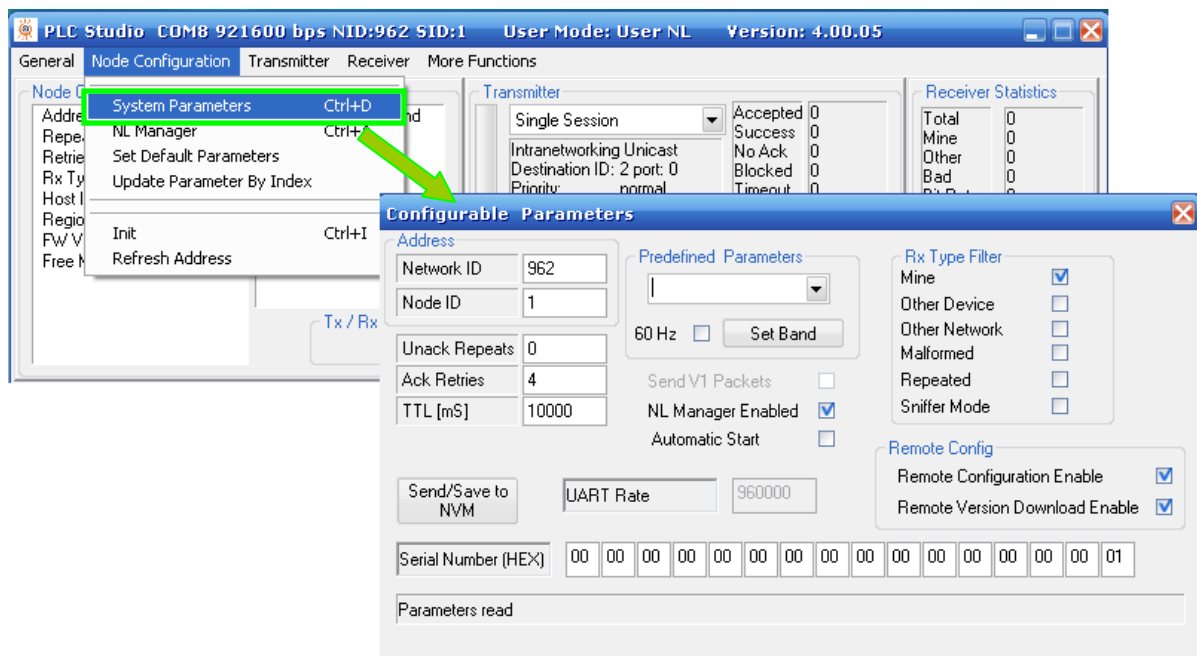
2.2.4.1 System Parameters

This option opens the *Configurable Parameters* window, which allows the user to view and set the device configuration parameters.

NOTE: This option can also be chosen by the keyboard shortcut **CTRL+D**.

The following figure describes the *Configurable Parameters* window:

Figure 6: Configurable Parameters Window



Proprietary Information

The following table describes the configuration options and buttons of the *Configurable Parameters* window:

Table 1: Parameters and Buttons of the Configurable Parameters Window

Configuration Field/Button	Description
Address	The <i>Address</i> field allows configuration and monitoring of local node address. The address is divided into a Network ID and a Node ID (which is the Source ID). When the <i>NL Manager Enabled</i> checkbox is checked, the addresses are set automatically by the Network Layer and should not be set manually by the user.
Unack Repeats	The number of retransmissions in the repetitive unacknowledged service (refer to Table 20 for more information).
Ack Retries	The number of time to send retransmissions when sending packets in ACK mode (refer to Table 20 for further more information).
TTL	The TTL (Time To Leave) parameter represents the maximal time (in mSec) that packet may wait in transmission queue before it contends the channel (first in line). If the packet has not been sent within the TTL, it will be reported as <i>Blocked</i> by the PLC Studio.
Send/Save to NVM	This button saves the DL/NL Parameters configuration settings to the IT900 NVM. It is required to use this button in order to save changes in parameters configuration.
UART Rate	This window allows monitoring the current configuration of the Interface UART rate.
Serial Number (HEX)	The serial number is a unique number assigned to each IT900 device. The number is located on the NVM and can be set by the user. The number is composed of 16 bytes, represented on the screen by a hexadecimal representation (HEX).
Predefined Parameters	This section sets predefined parameters for the required frequency band (the specific band supported by the IT900 platform according to its assembled front-end). One of the following standards may be chosen: FCC (US), ARIB (Japan), CENELEC A/A4 (Europe Outdoor) and CENELEC B (Europe Indoor). In order to select the appropriate default parameters, choose the appropriate band and click the <i>Set Band</i> button. The default parameters for the specific band will be applied after automatic reset is preformed and after the user has exited the <i>Configurable Parameters</i> window.
60 Hz	For optimal immunity against periodic noise, this checkbox should be marked when the PLC Device is operating on a 60Hz power line network. When modem operates in FCC band, this check box should be always marked (even if PLC device operates on 50Hz powerline network).
Send V1 Packets	When this option is checked, the modem transmits packets in D1 packet format. This option is not available when NL Manager is enabled.
NL Manager Enabled	Enabling the NL Manager allows the Adaptive Routing and Automatic Addressing mechanisms to work. The NL Manager must be enabled in order to access the PLC Studio <i>NL Manager</i> screen (refer to Section 2.2.4.2).
Automatic Start	When checked, the device is set to perform an automatic start, meaning it does not require a host. The device will perform a self initialization upon reset of the board. When unchecked, this function is disabled and the device will not initialize automatically without a host.
RX Type Filter	This section enables the user to define the packet types that the IT900 transfers to the PLC Studio program. To enable an option simply select it. Refer to Table 2 for more information.

Configuration Field/Button	Description
Remote Configuration Enable	This section allows the user to Disable/Enable Remote Configuration option. When disabled, the IT900 will not allow configuration of parameters remotely.
Remote Version Download Enable	This section allows the user to Disable/Enable Remote Version Download option. When disabled, the IT900 will not allow to update version remotely.

The RX Type Filter section enables the user to select packet types to be transferred from the IT900 to the PLC Studio program.

The following table describes the *RX Type Filter* options:

Table 2: RX Type Filter Options

Option	Description
Mine	Packets sent to the node address.
Other Device	Packets sent to other nodes in the same network (same Network ID).
Other Network	Packets sent to a different network (different Network ID).
Malformed	Packets with bad CRC or length.
Repeated	Packets sent to this node to be repeated.
Sniffer Mode	All packet types mentioned above will be posted to application.

2.2.4.2 NL Manager Option

The IT900 NL (Network Layer) transparently creates and maintains a tree type topology network. The logical network consists of a Network Coordinator (NC) node responsible for network formation activities. All other nodes in the logical network are Remote Stations (RS). The main mechanisms provided by the NL Management are the Automatic Addressing and the Adaptive Routing.

The NL Manager provides access to configuration and monitoring of NL Management parameters and databases. Some of the NL Manager options are valid for BS, others are valid for RS and the rest are valid for both types. The NL Manager options can be accessed only when the *NL Manager Enabled* checkbox is set (checked by default).

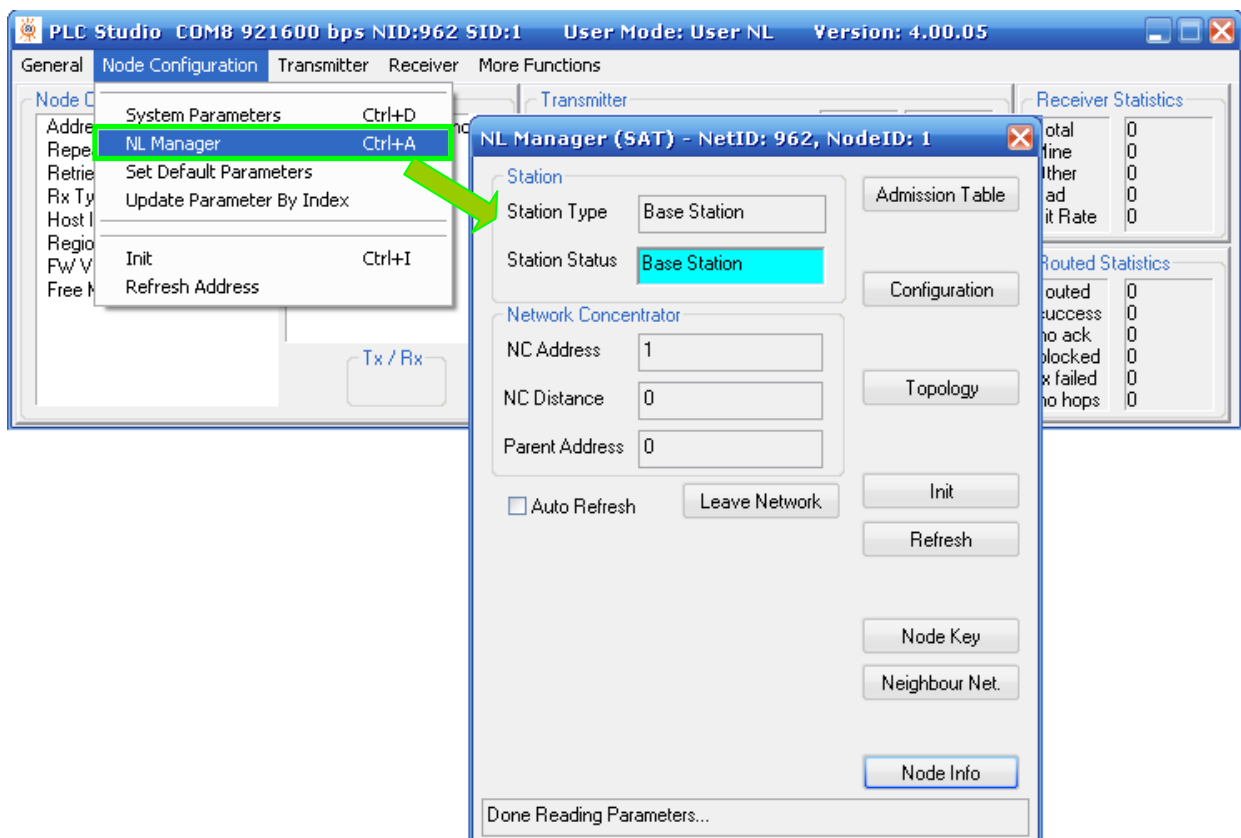


Note:

Once the NL Manager is enabled, the devices addresses will be set automatically by NL Management Automatic Addressing mechanism. If there were any initial addressing settings made by the user, they will not remain and the automatic settings of the NL will take place.

The following figure describes the *NL Manager* window:

Figure 7: NL Manager Window



Note:

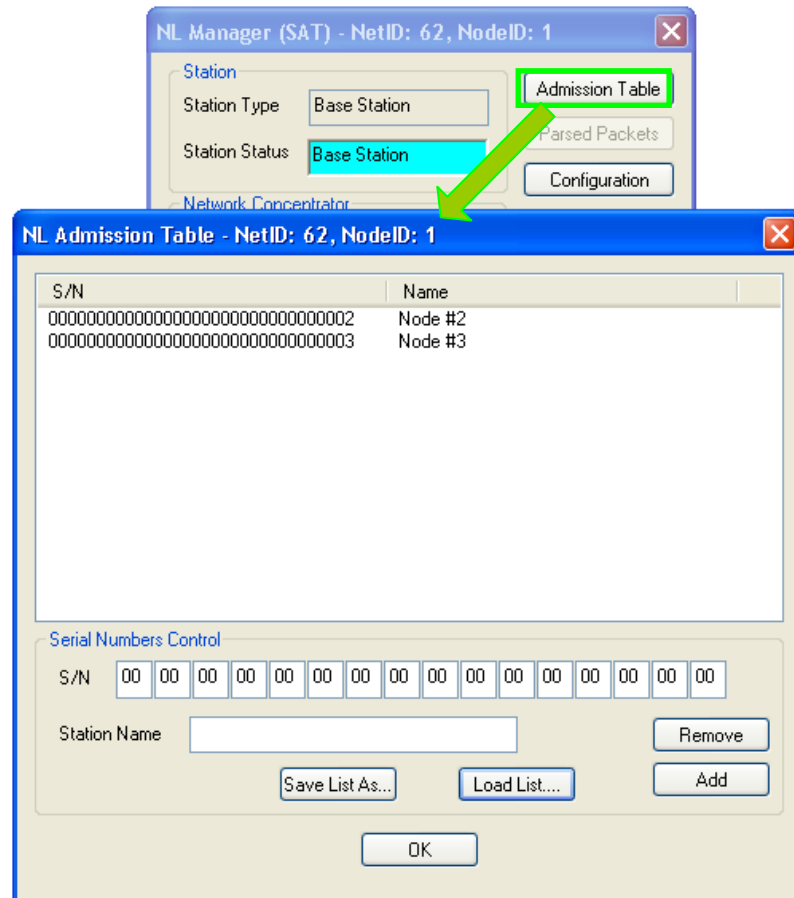
The Admission Table and Topology functions/buttons are valid for Base Station only.

2.2.4.2.1 Admission Table Button (valid for Base Station access only)

Clicking this button opens the *NL Admission Table* window, which allows the user to insert different stations to the admission table using the Device's Serial Number. If the user chooses the Admission Mode to be *App Approval* mode, the admission table will be referred to (see Section 2.2.4.3 for more information).

The following figure describes the *NL Admission Table* window:

Figure 8: NL Admission Table Window



The following table describes the configuration fields and buttons found in the *NL Admission Table* window:

Table 3: Configuration Fields and Buttons in the NL Admission Table Window

Configuration Field/ Button	Description
Serial Number (S/N)	The device's Serial Number the user is interested to enable admission to the network.
Station Name	The user may name the station for easier control of the nodes in the network.
Remove	Add Station to table.
Add	Remove Station from table.
Save List As...	Save current inputted list.
Load List	Load table previously saved.
OK	Apply admission table settings.

2.2.4.2.2 Configuration Button

Clicking *Configuration* opens the *NL Mng Configuration* window, which allows the user to configure and set the parameters for the Network Layer.

The following figures describe the *NLMng Configuration* window in Base and Adaptive modes, respectively:

Proprietary Information

Figure 9: NL Mng Configuration Window, Base Mode

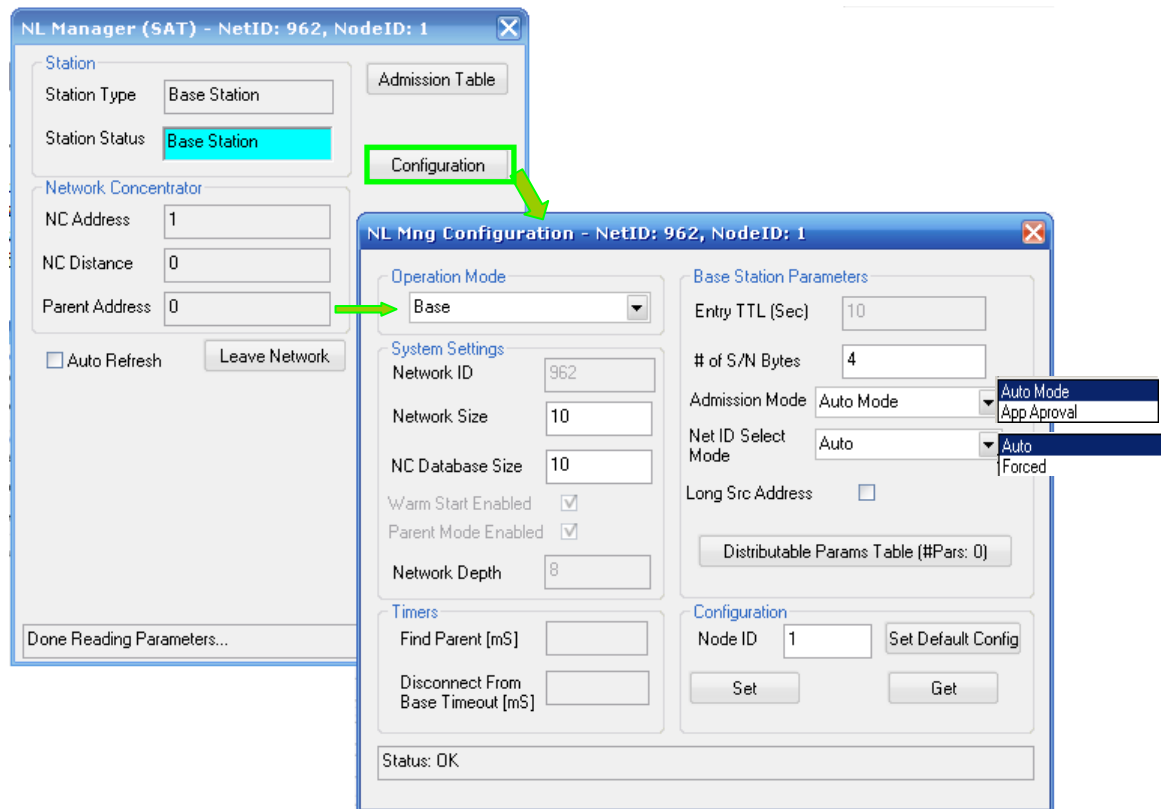
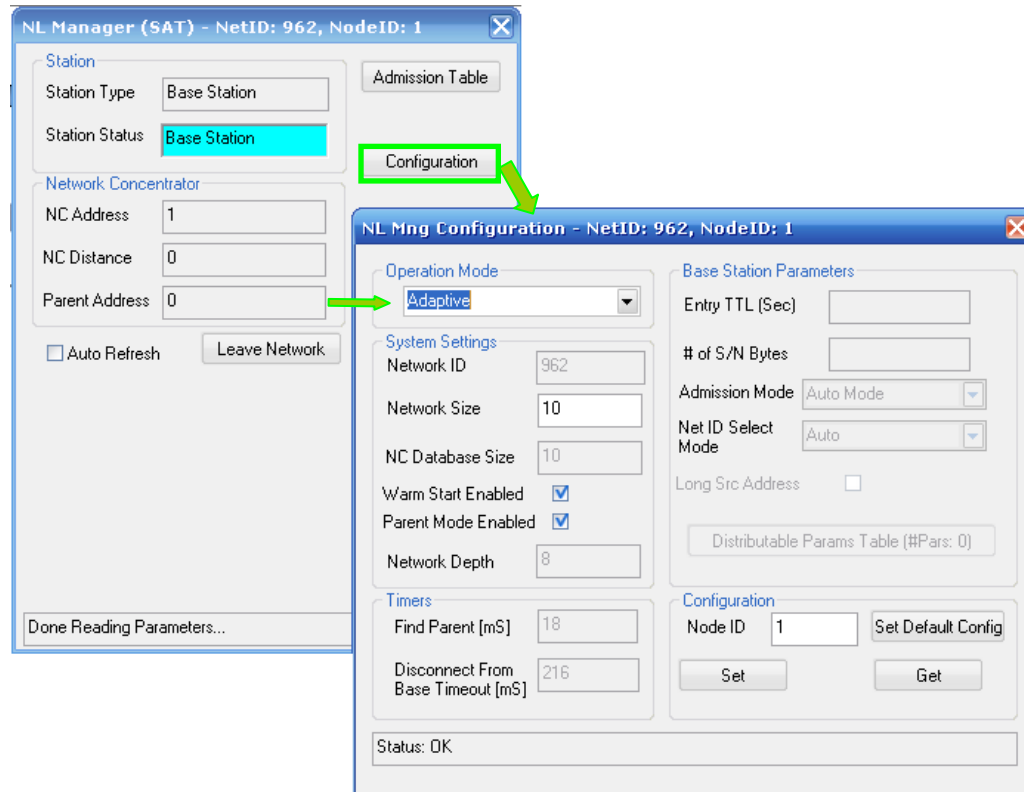


Figure 10: NL Mng Configuration Window, Adaptive Mode



2.2.4.2.2.1 Operation Mode

The following table describes the *Operation Mode* options:

Table 4: Operation Mode Options

Parameter	Description
Adaptive (default setting)	In this mode the device is set to be a Remote Station (RS). The Device ID (Node and Network ID) and route to Base are assigned automatically.
Base	In this mode the node is set as a Base Station (BS). The Node and Network ID are assigned to the Base automatically.

2.2.4.2.2.2 System Settings

The table below describes the Systems Settings Parameters of the *NL Mng Configuration* window:

Table 5: System Settings Parameters

Parameter	Description
Network ID	Network ID part of logical address.
Network size	The <i>Network Size</i> field indicates the maximum number of nodes that can be included in the physical network (the physical network can contain multiple logical networks). The Network Layer periodic timers and Database sizes are set automatically according to the value of this parameter. The <i>Network Size</i> value should be identical for all station participating in the same logical network.
NC Database Size (BS Only)	The <i>NC Database Size</i> (valid for BS only) defines the number of entries in the NC's Routing and Addressing databases. The value of this parameter should be set to the maximal number of Remotes allowed to participate in the logical network. The size of all NC related databases is set automatically when this value is changed.
Warm Start Enabled	Warm Start is a NL start-up sequence mode in which a node restores its NL management data from its Non-Volatile Memory (NVM) and operates according to its state before it was shut-down (i.e. retains address, routing state with its parent, distance from the NC, etc.). When this checkbox is enabled, warm start will take place after power on.
Parent mode enabled	If enabled, the station can function as a Network parent. When disabled, the station can function only as Network tree leaf.
Network Depth	Maximal number of hops in the network. Must be set to the same value for all stations in the network.

Proprietary Information

2.2.4.2.2.3 The Timers Section

This section allows the user to monitor the value of Remote Station timers used for adaptive routing maintenance. The value of these timers is derived from the *Network Size* parameter and set automatically once *Network Size* is changed.

The following table describes the timers that can be monitored through the *Timers Section*:

Table 6: Parameters of the Timers

Parameter	Description
Find Parent (mS)	This field indicates the period of time (in mSec), in between every Find Parent request.
Disconnect From Base Timeout (mS)	When the RS indicates it is not connected to the BS for the specified time (in mSec), the RS initiates the search of a new network.

2.2.4.2.2.4 The Base Station Parameters Section

The following tables describe the parameters of the *Base Station Parameters* section:

Table 7: Base Station Parameters

Parameter	Description
Entry TTL (Sec)	This field is used for monitoring the Time-To-Live of an Entry in the S/N Table without referring to the station represented by the entry. The value of this parameter is derived from the <i>Network Size</i> parameter and set automatically once <i>Network Size</i> is changed.
# of S/N Bytes	This field indicates the number of LEAST significant bytes (LSB) to be saved in the Serial Number (S/N) table. The user should make certain that ALL stations in the network have different numbers when only the indicated number of LSB is taken into account.
Admission Mode	Admission Mode options are described in Table 8.
Network ID Select Mode	This field is enabled for Base Stations (BS) only. When Net ID Select Mode is configured to <i>Auto</i> , the BS will automatically allocate the Net ID (NID). When Net ID Select Mode is in <i>Forced</i> mode, the Net ID is controlled by the PLC Studio program. The range of the NetID is 1 to 1023.
Long Src Address	This field can be enabled for Base Stations (BS) only. When checked, the address of the source node in the received intranetworking packet indication will be the S/N and not the logical ID

Table 8: The Admission Mode Options

Parameter	Description
Auto Mode	In this mode there are no admission restrictions.
App Approval	In this mode, before a new node tries to enter the network, its Serial Number is searched for in the Admission table and when found admitted to the network (otherwise it is not admitted).

Table 9: The Net ID Select Mode Options

Parameter	Description
Auto	In this mode the NetID of the Base Station is assigned automatically.
Forced	In this mode the user may select the NetID of a new Base Station. When this option is chosen, the Network ID field is enabled and the required NetID may be entered.

Table 10: Configuration Options

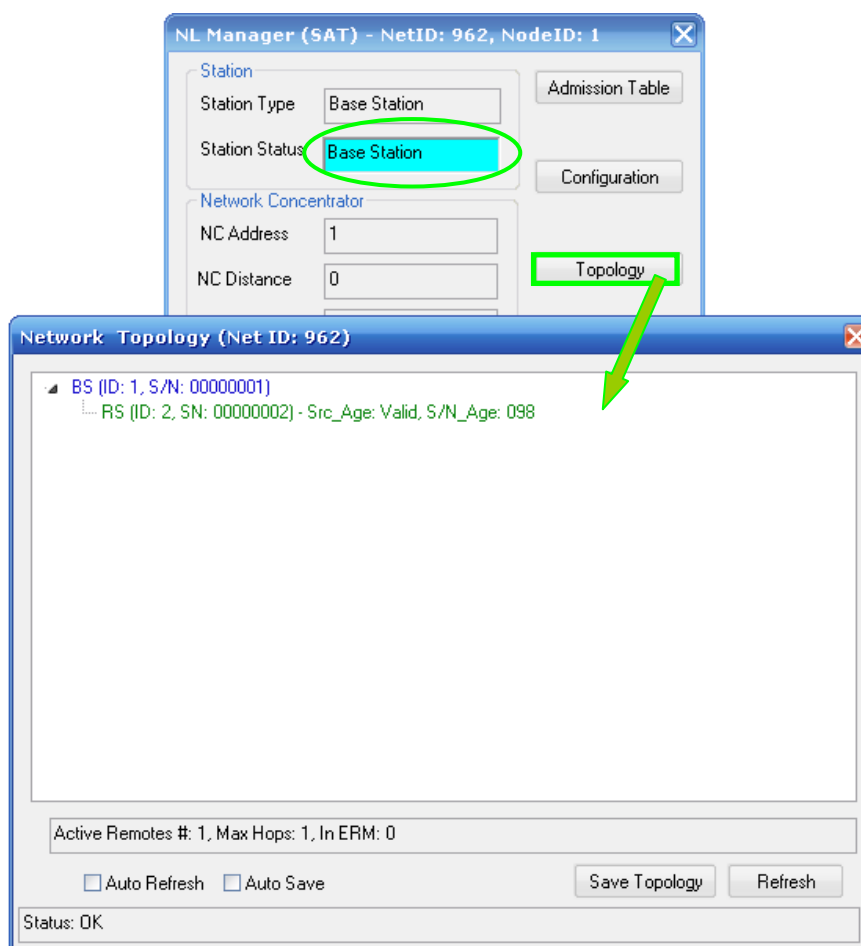
Configuration Field/Button	Description
Node ID	This field can be accessed only by a BS and allows the user to configure and monitor a Station remotely (only by the BS). Enter the NodeID and required configuration. For Remote stations this field is disabled and fixed to the current NodeID.
Set	Clicking this button allows saving configuration settings to the NVM of the relevant station.
Get	Clicking this button allows displaying the configuration of the relevant station on the configuration screen.
Set Default Config Button	Clicking this button sets the Default Configuration Parameters to the relevant station. In order to view the stations' new parameters, click the 'Read' Button (refer to Section 2.2.4.2.2).

2.2.4.2.3 Topology Button (valid for BS only)

The *Topology* button is enabled only for a Base Station and opens the *Network Topology* window, which shows the connections between different stations. The Top station is the BS and the remaining are RS, where each RS can also be a parent of other RS. The topology has the characteristics of a tree; the source is the BS and every child is a sub tree. Note that the Network Topology is derived from the *Node Info* database.

The following figure describes the *Network Topology* window:

Figure 11: Network Topology Window



The following table describes the configuration fields and buttons of the *Network Topology* window:

Table 11: Configuration Fields and Buttons in Network Topology Window

Configuration Field/Button	Description
Auto Refresh	When Auto Refresh checkbox is checked, the <i>Network Topology</i> screen will be automatically updated with the current topology every few seconds.
Auto Save	Automatically saves a copy of the current topology.
Save Topology	Saves a copy of the current topology.
Refresh	Click the Refresh button to read the current topology on demand.

Proprietary Information

2.2.4.2.4 The Init Button

Click the *Init* button to reset the IT900 modem.

2.2.4.2.5 The Refresh Button

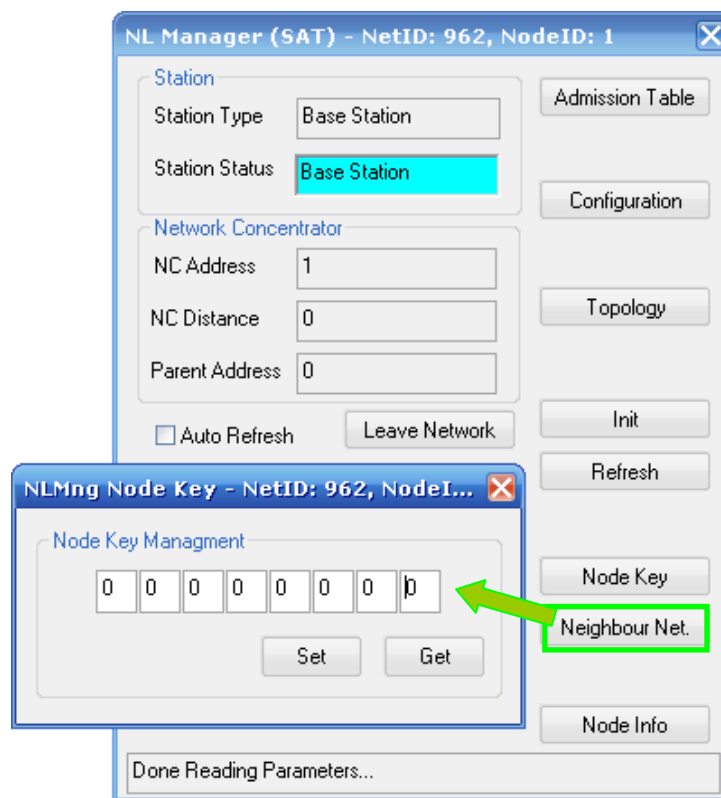
Clicking the *Refresh* button will update the *NL Manager* main screen display with current information.

2.2.4.2.6 The Node Key Button

The node key feature enables the RS to confirm its connection to the BS. If a RS finds a connection to a BS, but the node key of the found BS is not the same as the Node Key of the RS, the Station does not connect to that BS and starts a search for a different BS. The *Set* and *Get* buttons will set/get the Node Key of the local station.

The following figure describes the *NL Manager - Node Key* window:

Figure 12: NLMng Node Key Window



The following table describes the configuration fields and buttons of the *Node Key* window:

Table 12: Configuration Fields and Buttons in Node Key Window

Configuration Field/Button	Description
Node Key	The Node key parameter is 8 bytes long and should be entered in hexadecimal format
Set	Click to set the Node Key value
Get	Click to read the Node Key value

2.2.4.2.7 The Neighbour Networks Button

The *Neighbour Net* button opens the *Neighbour Networks* window, which shows the following information:

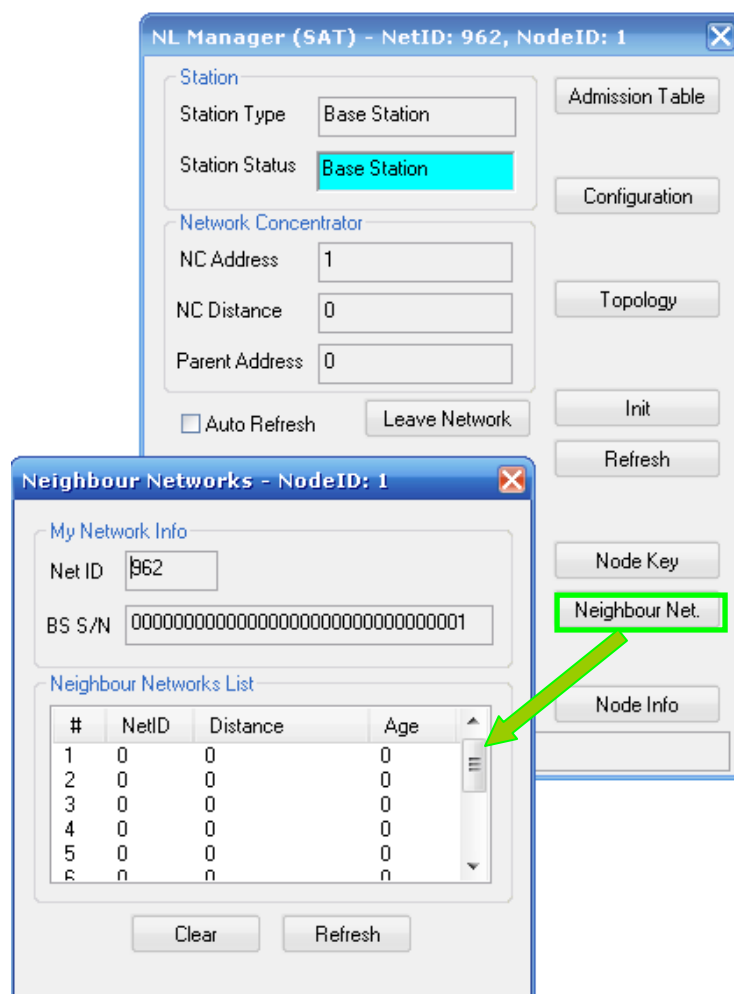
1. *My Network Info* - the *Net ID* of the current station and the Base Station's Serial Number (BS S/N).

Proprietary Information

2. The *Neighbour Networks List* - a list containing of the networks around the current station and their shortest distances to the current station. It also holds the *Age* of the Network, so if the network has aged, its *NetID* can be used for new networks.

The following figure describes the *Neighbour Networks* window:

Figure 13: Neighbour Networks Window



The following table describes the configuration fields and buttons of the *Neighbour Networks* window:

Table 13: Configuration Fields and Buttons in Neighbour Networks Window

Configuration Field/Button	Description
Refresh	Click the Refresh button to read the data currently stored in the Neighbour Networks table
Set	Click this button to clear the Neighbour Networks table

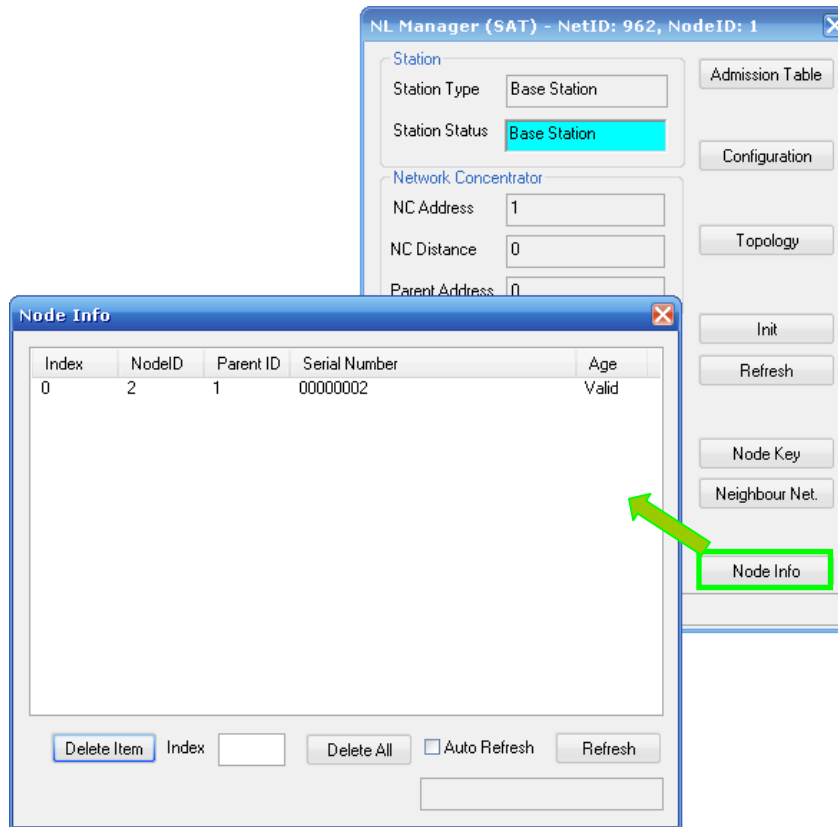
Proprietary Information

2.2.4.2.8 The Node Info Button

The *Node Info* button opens the *Node Info* window. This window provides a list of all Remote Stations participating in the logical network and the status of their link with the Base Station (through the *Age* field).

The following figure describes the *Node Info* option:

Figure 14: Node Info Button



The following table describes the fields and buttons in the *Node Info* window:

Table 14: Configuration Fields and Buttons in Node Info Window

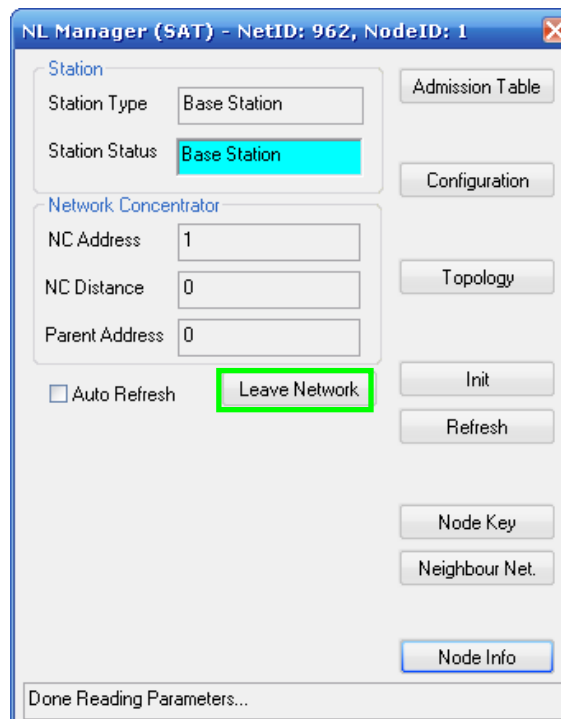
Configuration Field/Button	Description
Delete Item	Removes a selected item from the list in the Node Info window.
Index	Defines the item to be deleted, after the Delete Item option is selected.
Delete All	Click this button to clear the Node Info window.
Auto Refresh	Automatically updates the data in the Node Info window.
Refresh	Click the Refresh button to update the data in the Node Info window.

2.2.4.2.9 The Leave Network Button

The *Leave Network* button forces the node to leave its logical network. When *Leave Network* is used with a Remote unit, the Remote will set its addresses to default and restart automatically searching for available network. When *Leave Network* is used with Base unit, the Base will set its addresses to default and will establish a new logical network.

The following figure describes the *Leave Network* option:

Figure 15: Leave Network Window

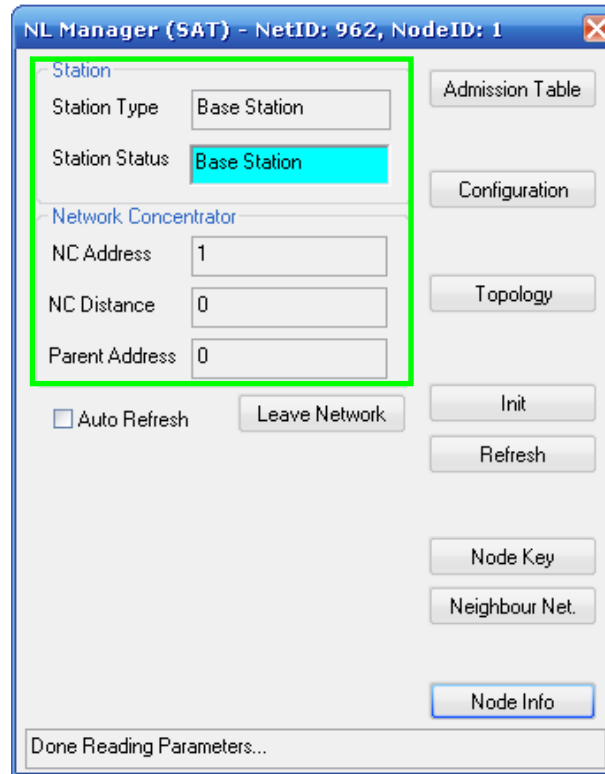


2.2.4.3 NL Manager Main Display Screen

This section describes the *NL Manager* main display screen.

The following figure describes the *NL Manager* window:

Figure 16: NL Manager Window



2.2.4.3.1 The Station Display

The following table describes the Station display:

Table 15: Station Display, NL Manager Window

Parameter	Description
Station Type	The type of the station, either “Base Station” or “Remote Station.” The station type is configured in the <i>Configuration</i> Screen.
Station Status	The status of the station: ‘ <i>Disconnected</i> ’ or ‘ <i>Connected to Base</i> ’. Note that a Node must be connected to the Base in order to communicate in its network. The status of BS will always be Base Station.

2.2.4.3.2 The Network Concentrator Display

This display shows the connection with the Network Concentrator.

The following table describes the fields in the Network Concentrator display:

Table 16: Network Concentrator Display, NL Manager Window

Parameter	Description
NC Address	The NodeID of the Base Station to which this node is connected.
NC Distance	The number of hops from this node to its Base Station.
Parent Address	The NodeID of the node's parent.

2.2.4.3.3 The Auto Refresh checkbox

The *Auto Refresh* checkbox, when checked, performs an automatic refresh of the *NL Manager* display every few seconds.

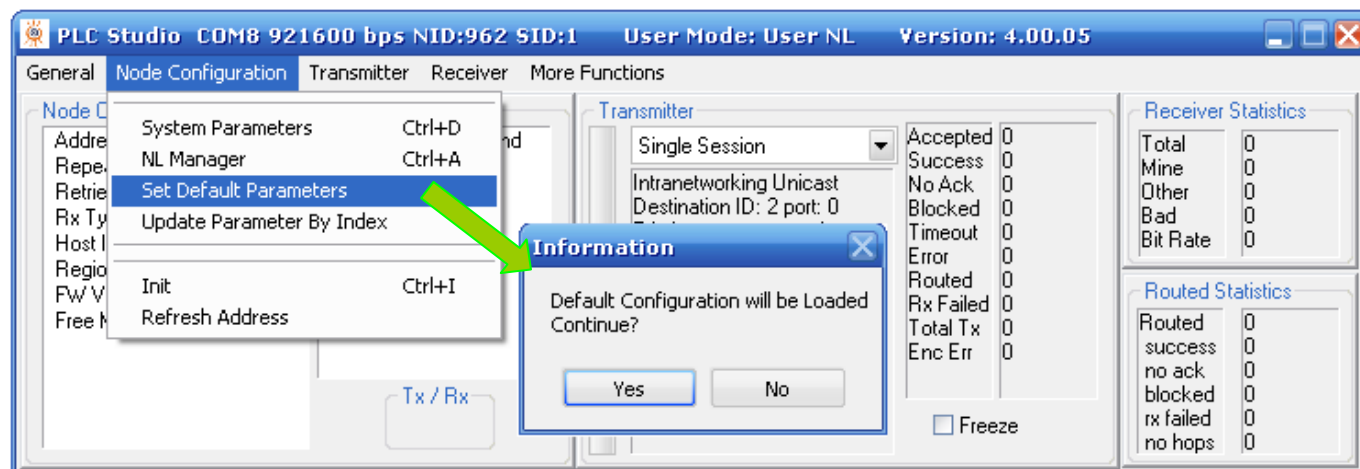
2.2.4.4 Set Default Parameters

This option sets the modem parameters to default configuration. To set the modem parameters to default, select *Set Default Parameters* and confirm the operation by clicking 'Yes' in the Information window that automatically appears. Then, select *Init* in the *Node Configuration* menu.

NOTE: On default configuration the modem is set to operate as Remote.

The following figure describes the *Set Default Parameters* option:

Figure 17: Set Default Parameters



2.2.4.5 Init Option

When *Init* is selected, the PLC Studio program resets the IT900 and configures it with the current configuration.

NOTE: This option can also be chosen by the keyboard shortcut **CTRL+I**.

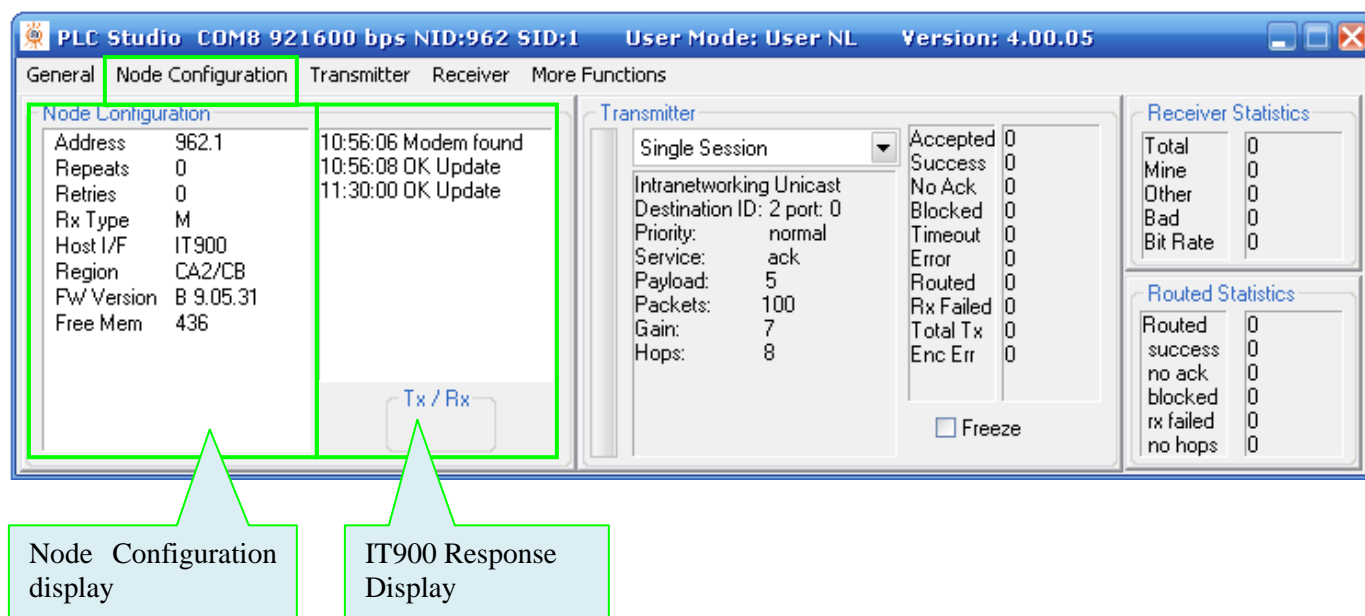
2.2.4.6 Refresh Address

When *Refresh Address* is selected, the NID and SID at the top of the PLC Studio are refreshed.

2.2.4.7 Node Configuration Displays

The following figure describes the *Node configuration* display and the IT900 response display, both of which are part of the PLC Studio's main screen:

Figure 18: Node Configuration Displays



2.2.4.7.1 The Node Configuration Display

This display summarizes the configuration of the node.

The following describes the information found in the *Node Configuration* display:

Table 17: Node Configuration Display

Information	Description	Configured By
Address	The address of the local IT900 node (IT900 platform connected to the PC and controlled by the PLC Studio program). The address format is NetID. NodeID, Note that when the <i>NL Manager Enabled</i> check box is set, the addresses are allocated automatically and should not be set by the user.	Section 2.2.4.2
Repeats	The number of retransmissions for the UNACK service. Refer to Table 20 for more details about the UNACK service.	Section 2.2.4.2
Retries	The number of retransmissions for the ACK service. Refer to Table 20 for more details about the ACK service.	Section 2.2.4.2
RX Type	The Incoming packet types that the IT900 transfers to the PLC Studio program (refer to Table 2).	Section 2.2.4.2

Proprietary Information

Information	Description	Configured By
Host I/F	When the chip wakes up on Safe Mode this field will indicate “ <i>Safe Mode</i> ”.	N/A
Region	Displays the selected configuration by region (band).	Section 2.2.4.2
FW Version	Firmware Version of the IT900 chip.	N/A
Free Mem	The size of the remaining free memory of the RAM. The amount of free memory depends on the sizes of the IT900 databases/queues (Tbl/Src Routing database, S/N database, TX queue) size. The Databases sizes are set automatically according to the ‘Network Size’ parameter.	Section 2.2.4.2

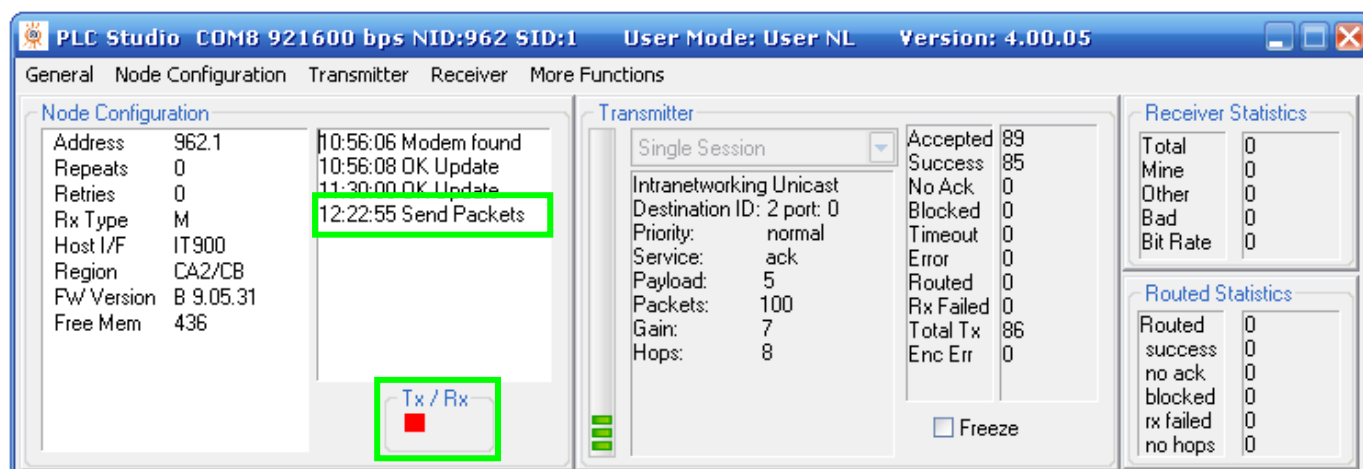
2.2.4.7.2 The IT900 Response Display

This display shows the IT900 response to the commands sent by the PLC Studio. These indications provide information on the connection between the PLC Studio and the IT900 on the platform connected to the program.

The display shows the time an event occurred and the IT900 response. The display’s TX / RX box turns red or green when transmitting or receiving, respectively.

The following figure shows the main screen display during transmission (notice the IT900 Response Display and the TX / RX box):

Figure 19: Main Screen Display During Transmission

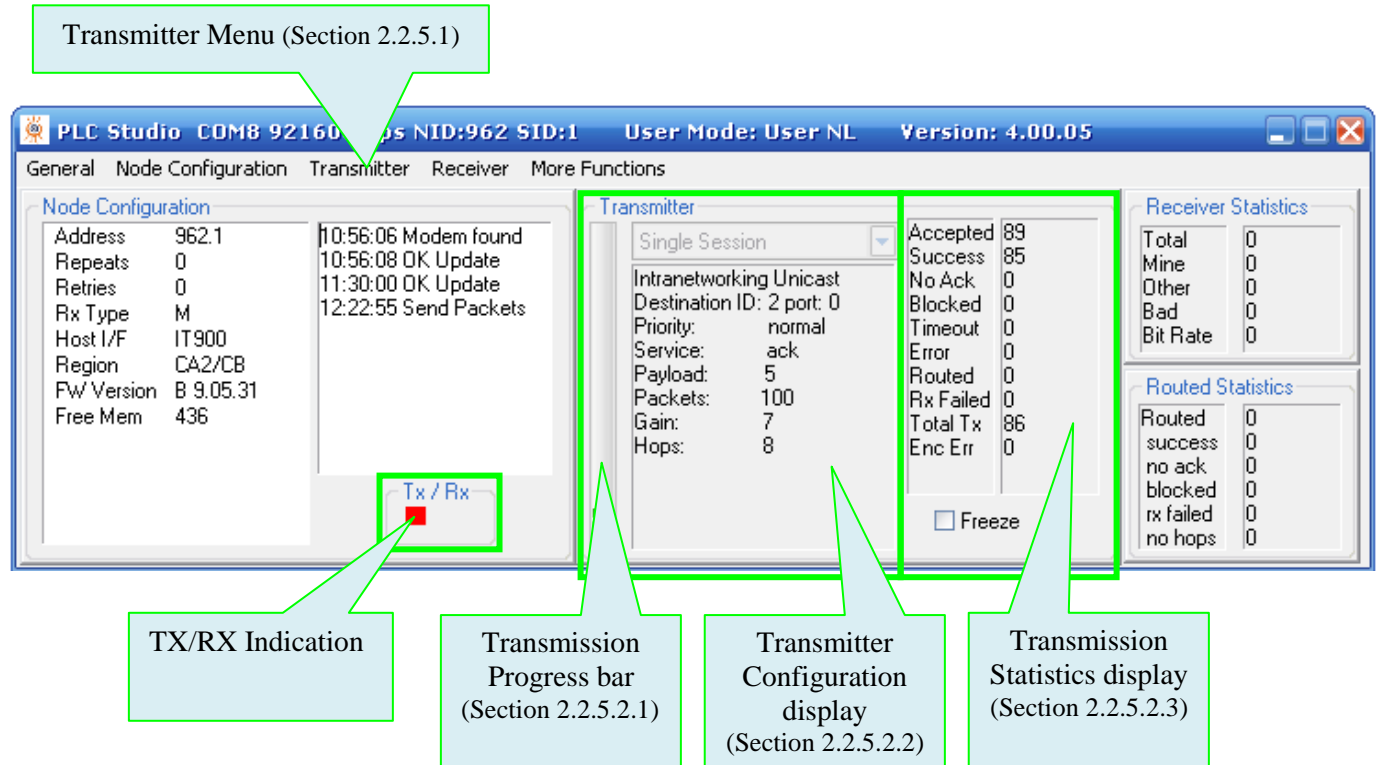


2.2.5 Transmitter Control Section

The *Transmitter* Control area enables the user to configure and send packets using the IT900 to another IT900 (or IT800) device.

The following figure describes the *Transmitter* Control section of the PLC Studio main screen:

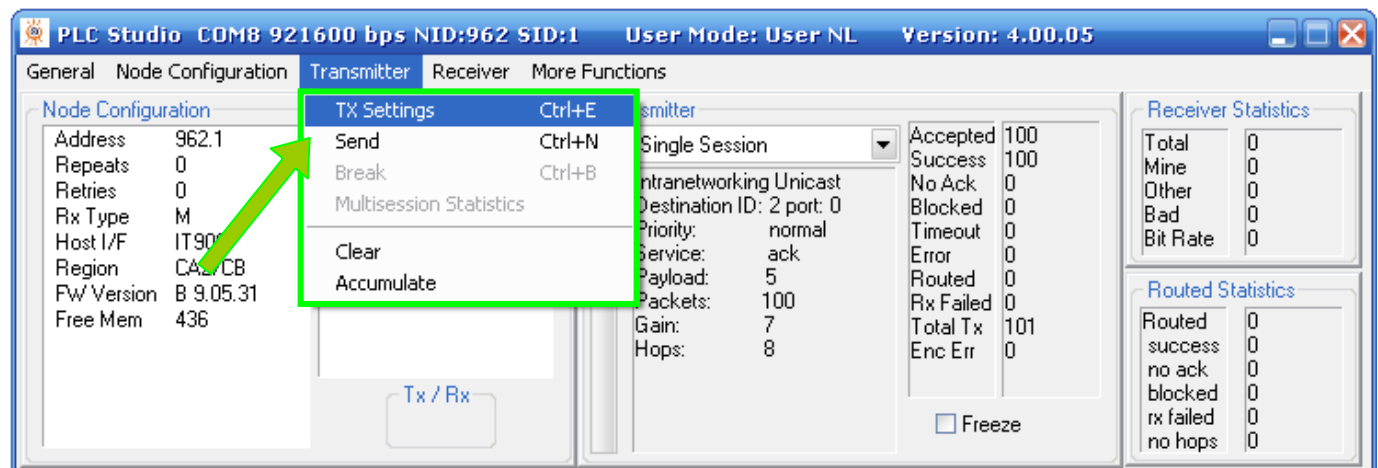
Figure 20: Transmitter Control Section



2.2.5.1 The Transmitter Menu

The following figure describes the *Transmitter* menu:

Figure 21: Transmitter Menu



NOTE: This option can also be chosen using the keyboard shortcut **CTRL+E**.

Figure 22: TX Settings Window



Proprietary Information

The following sections describe the various configuration fields and buttons in the *TX Settings* window.

2.2.5.1.1.1 The Session Section

The following table describes the configuration fields of the *Session* section:

Table 18: TX Settings – Session Section

Field	Description
Number Of Packets	The number of packets to be transmitted to the target. Identical packets are created with the same payload provided when using the <i>Packet Payload Editor</i> . The only difference may be in the packet number if added (refer to Section 2.2.5.1.1.4). Random packets are created using the <i>Random Payload Generation</i> (refer to Section 2.2.5.1.1.5). The default value is 100.
Host Delay	The PLC Studio can delay the transfer of data to be transmitted. This feature allows for an emulation of real life network load scenarios. The time for posting data from the PLC Studio to the IT900 (UART Interface) is shorter than the time for transmitting it on the power line. When packets are posted consecutively from the PLC Studio, the number of packets waiting for transmission in the IT900 queue will increase consistently. Once the IT900 reaches the point that it has no memory for buffering additional packets it will return transmission failure response marked as <i>Blocked</i> .

2.2.5.1.1.2

2.2.5.1.1.3 The Packet Header Settings Section

This section allows configuration of transmission parameters.

The following table describes the configuration fields of the *Packet Header Settings* section:

Table 19: TX Settings - Packet Header Settings Section

Field	Description
Packet Type	The different types of a the transmitted packet are detailed below: <ul style="list-style-type: none"> • Intranetworking Broadcast - transmission of information from a single source node to all the other nodes on the same logical network (having the same Net ID). • Intranetworking Unicast - transmission of information from a single source node to a single destination node on the same logical network (same Net ID). • Intranetworking Unicast Long - transmission of information from a single source node to a single destination node on the same logical network (same Net ID). The uniqueness of this data service is that it allows transmission of Intranetworking packet while specifying the destination's S/N instead of stating the destination logical address. The modem then converts the destination's S/N to the Logical Address and sends a regular Intranetworking Unicast packet on the power line. THIS TX TYPE IS VALID FOR BASE ONLY. Internetworking Unicast - transmission of information from a single source node to a single destination node on the any logical network (using destination's S/N). • Internetworking Broadcast - transmission of information that targets all the available networks.
Priority	The priority of the transmitted packet: Low/Normal/High where the default value is <i>Normal</i> . This feature allows a node with high priority transmissions to use the channel before nodes with lower priority transmissions.
Service	UNACK (Unacknowledged) and ACK (acknowledged) transmissions can be used. The default value is ACK. For further details refer to Table 20.

Proprietary Information

Field	Description
TX Modulation	This window allows setting the Modulation type for the specific packet. When this field is set to <i>AUTO</i> , the modem will use its adaptive rate mechanism to define the modulation type. For description of optional modulation types, please refer to the IT900 Data Sheet.
Gain	The Transmitted TX Power Level where the highest is 7 and the lowest is 0 (every step represents a 6DB difference).
Hops	This parameter represents the maximal number of hops (repeats) available for a single packet. For <i>Intranetworking Unicast</i> packets – From 0 (no hops) to 8 (maximum hops). For other packet types – From 0 (no hops) to 255 (maximum hops).
TTL	This window allows setting the TTL value for the specific packet. When this field is set to '0' the modem will use the default TTL value (configured through the <i>System Parameters</i> screen)
Destination ID	The logical ID of the target node. This field is relevant for packets from <i>Intranetworking Unicast</i> .
Destination Port	The Port ID of the target node. When Target node operates on top of IT900 Host Interface, this field should be set to 0.
Add Packet Number	When checked, the PLC Studio program adds a serial number to each packet as part of the payload (8 Bytes are added to the end of the payload). For Payload Section refer to Table 21.
Destination S/N	The Serial Number of the target node. This field is relevant for packets from <i>Internetworking Unicast</i> and <i>Intranetworking Unicast Over S/N</i> .

The following table describes the *Service* options:

Table 20: TX Settings - Service Options

Service	Description
ACK	Acknowledged service – data is re-transmitted until one of the following occurs, whichever comes first: <ol style="list-style-type: none"> 1. ACK from the destination node is received by the source node. 2. The number of retries reaches the limit set by the user (<i>System Parameters</i> option under <i>Node Configuration</i> – refer to <i>Retries</i> in Table 17). When an ACK is not received, the “No ACK” counter in the transmission statistics display increases (refer to Table 20).
UNACK	Unacknowledged service – the data is re-transmitted until the number of re-transmissions has reached the limit set by the user (<i>System Parameters</i> option in the <i>Node Configuration</i> section – refer to <i>Unack Repeats</i> in Table 17). No reception acknowledgement is expected from the destination node.

2.2.5.1.1.4 The Packet Payload Editor Section

This section allows payload editing.

The following table describes the configuration fields and buttons in the *Packet Payload Editor*:

Table 21: TX Settings – Packet Payload Editor

Function	Description
Transmission text box	The payload data of the packet is inserted here by the user.
Use hexadecimal	When checked, the <i>Packet Payload Editor</i> will allow the user to edit payload using hexadecimal representation.
Length	Payload length (in Bytes).
Load...	Press this button to open a text file containing the payload data.
Save As...	Press this button to save a text file containing the payload data. Default file name is "payload.txt".
Clear	Clears the transmission text box.

2.2.5.1.1.5 The Random Payload Generator Section

This section allows generation of a pseudo-random payload, which can be utilized for testing purposes.

The pseudo-random payload format "^xxxxxxxSSSSS...SSS" consists of the **symbol** "^", a **number** between 0 and 9999999 – generated using a counter and a **string** of Bytes with a **predefined length** generated using a function – for each number there is only one string representation of a certain length.

The following table describes the configuration fields and buttons of the *Packet Payload Editor* section:

Table 22: TX Settings – Random Payload Generator

Function	Description
Enable	When checked, enables the <i>Random Payload Generator</i> field and disables the <i>Packet Payload Editor</i> field.
Increment Counter	When checked, the counter will increment for each packet transmission.
ASCII Payload	When checked, the received data will be shown in a readable format (capital letters).
Reset Counter Button	Click to reset the counter for each transmission.
Length	Payload length (in Bytes) between 9 and 1900.

2.2.5.1.2 The Send Option

Select this option to start the packet transmission sequence, which will be executed according to the settings in the *TX Setting* screen (refer to Section 2.2.5.1.1).

NOTE: This option can also be chosen using the keyboard shortcut **CTRL+N**.

2.2.5.1.3 The Break Option

Choose this option to manually stop the packet transmission sequence while the transmission is taking place.

Special Notice: When using *Break*, packets will stop accumulating for transmission. However, the Receiving node will continue to receive packets from the transmitting node. This happens due to the space that the transmission holds for packets. *Break* will stop accumulation but the packets in that space will still be transmitted.

NOTE: This option can also be chosen using the keyboard shortcut **CTRL+B**.

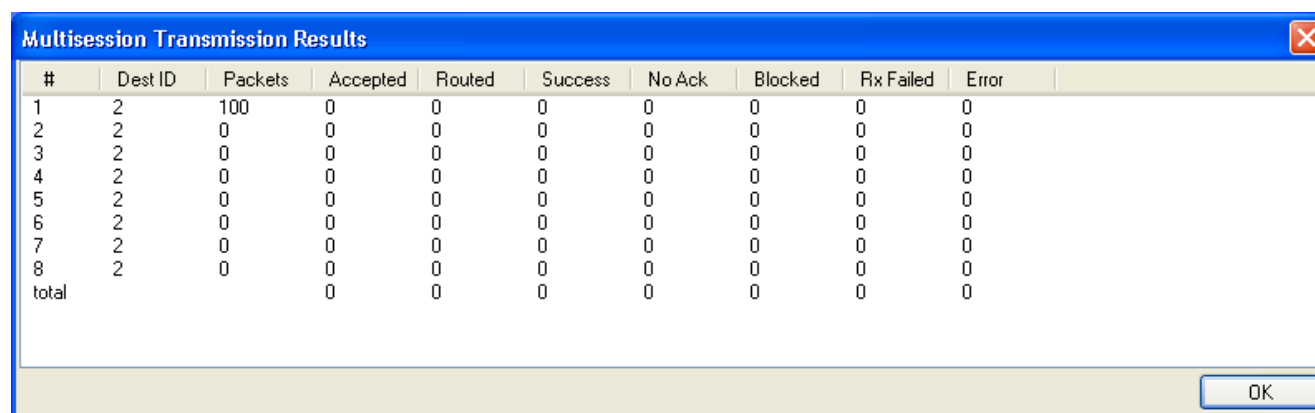
2.2.5.1.4 Multisession Statistics

The *Multisession Statistics* option is enabled when the Multisession transmission mode is set (refer to Section 2.2.5.2.4). The *Multisession Statistics* option opens the Multisession Transmission Result window, which monitors results and statistics of transmissions performed in Multisession transmission mode.

For more information about the Transmission Result window fields, refer to Section 2.2.5.2.3.

The following figure describes the *Multisession Statistics* Result window:

Figure 23: TX Multisession Transmission Result Window



#	Dest ID	Packets	Accepted	Routed	Success	No Ack	Blocked	Rx Failed	Error
1	2	100	0	0	0	0	0	0	0
2	2	0	0	0	0	0	0	0	0
3	2	0	0	0	0	0	0	0	0
4	2	0	0	0	0	0	0	0	0
5	2	0	0	0	0	0	0	0	0
6	2	0	0	0	0	0	0	0	0
7	2	0	0	0	0	0	0	0	0
8	2	0	0	0	0	0	0	0	0
total			0	0	0	0	0	0	0

2.2.5.1.5 The Clear Option

Select this option to clear the transmission statistics display (refer to Section 2.2.5.2.3).

2.2.5.1.6 The Accumulate Option

The following table describes the *Accumulate* option (activation and deactivation) window:

Table 23: Accumulate Option: Activation and Deactivation

ACCUMULATE Option	Description
Checked	When checked, the statistics of different transmission sessions are accumulated and presented in the Transmission Statistics Display after addition (refer to Section 2.2.5.2.3).
Unchecked	When unchecked, the statistics of the previous session are cleared when starting a new session, and the new statistics (not including the old ones) are presented in the Transmission Statistics Display (refer to Section 2.2.5.2.3).

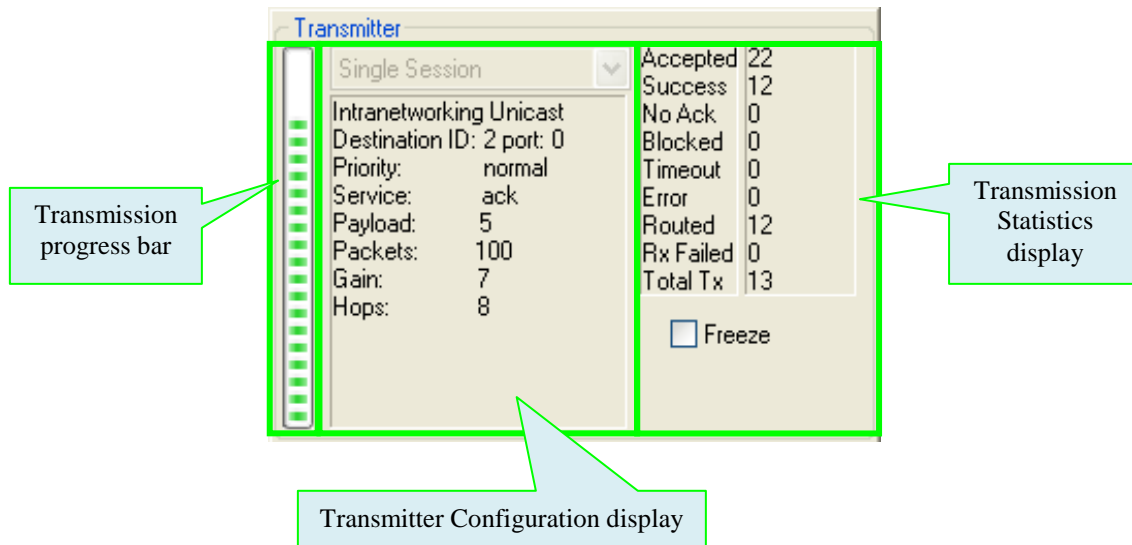
Proprietary Information

2.2.5.2 The Transmitter Display

This display, located on the main screen, allows the user to view the transmission sequence using a progress bar, a configuration information display and a statistics display.

The following figure describes the *Transmitter* display section:

Figure 24: Transmitter Display



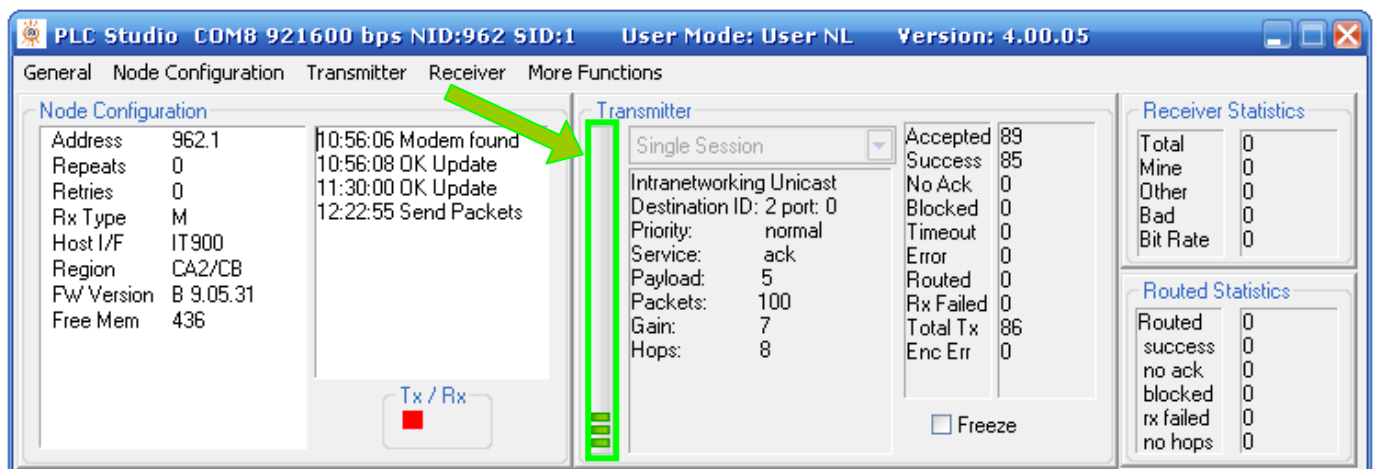
2.2.5.2.1 The Transmission Progress Bar

The Transmission Progress bar shows the progress during the transmission sequence.

Transmission sequence parameters are configured using *TX Settings*. The process itself is controlled using *Send*, *Break* and *Clear*.

The following figure describes the main screen display during transmission (notice the Transmission progress bar):

Figure 25: Main Screen During Transmission - Transmission Progress Bar



2.2.5.2.2 The Transmitter Control Display

This display (refer to Figure 24) shows the transmission configuration parameters (refer to Section 2.2.5.1.1). The following table describes the information on the *Transmitter Control* summary display:

Table 24: Transmitter Control Summary Display

Parameter	Description
Type	The type of transmitted packet - displayed on top of the Transmitter Configuration Parameters Display.
Destination ID	The ID of the target node to which packets are transmitted. The destination ID is displayed according to the format that it will be sent in the packet (Logical ID or Serial-Number). For broadcast packets, the 'Destination ID' is not displayed.
Priority	The priority of the transmitted packet - Low/Normal/High (refer to Table 19).
Service	UNACK/ACK. For further details about Service (refer to Table 20).
Payload	The length (in Bytes) of the data field, as set by the user in the transmission text box of the Packet Payload Editor (refer to Section 2.2.5.1.1.4 and Figure 22). This number includes the Packet Number and other service bits.
Packets	The number of packets to be sent as set by the user (refer to Section 2.2.5.1.1.1 and Figure 22).
Gain	The transmitted TX Power Level where the highest is 7, and the lowest is 0 (refer to Section 0).
Hops	The number of hops for the packet to be repeated (refer to Sections 0 and 0).

2.2.5.2.3 The Transmission Statistics Display

This display (refer to Figure 24) shows the *Transmission Statistics* as described by the table below:

Table 25: Transmission Statistics Display

Parameter	Description
Accepted	Indicates the acceptance (by the IT900) of a packet provided by the PLC Studio.
Success	Number of successful transmissions. In ACK service (refer to Table 20), only the number of transmitted packets that were acknowledged.
No Ack	When set to ACK (refer to Table 20) this parameter shows the number of packets that were not acknowledged (ACK was not received by the source node).
Blocked	Number of timed out transmissions – the IT900 was unable to transmit within a certain time (default is 3 sec in FCC/ARIB and 6 sec in CENELEC bands).
Timeout	The number of 15 second timed out communication sessions between the PLC Studio and the IT900.
Error	Not used (ignore).
Routed	Represents the number of packets that were routed via this node and sent to another destination.
RX Failed	This parameter works in ACK mode only (refer to Table 20) and represents the number of packets that the receiving side was not able to accept because of over load.
Total TX	The total number of packets sent via this node, of any kind.

The *Clear* option in the Transmitter Menu (refer to Section 2.2.5.1.5) clears the transmission statistics display.

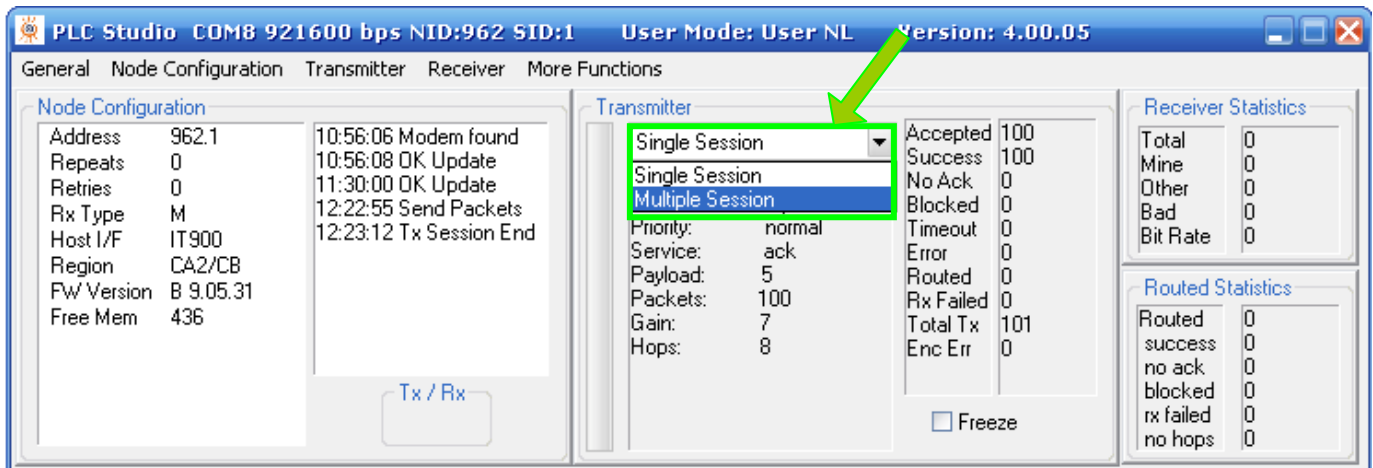
NOTE: The *FREEZE* checkbox is described in Section 2.2.5.5

2.2.5.2.4 Multiple Session Transmission

The PLC Studio provides an option to perform multiple session transmission in which one station transmits Intranetworking Unicast packets to several stations simultaneously. By default, the PLC Studio provides Single Session transmission services. To set the PLC Studio to operate in Multiple Session mode, select the *Multiple Session* option in the Transmitter Control on the Main Screen.

The following figure describes the selection of *Multiple Session* transmission option:

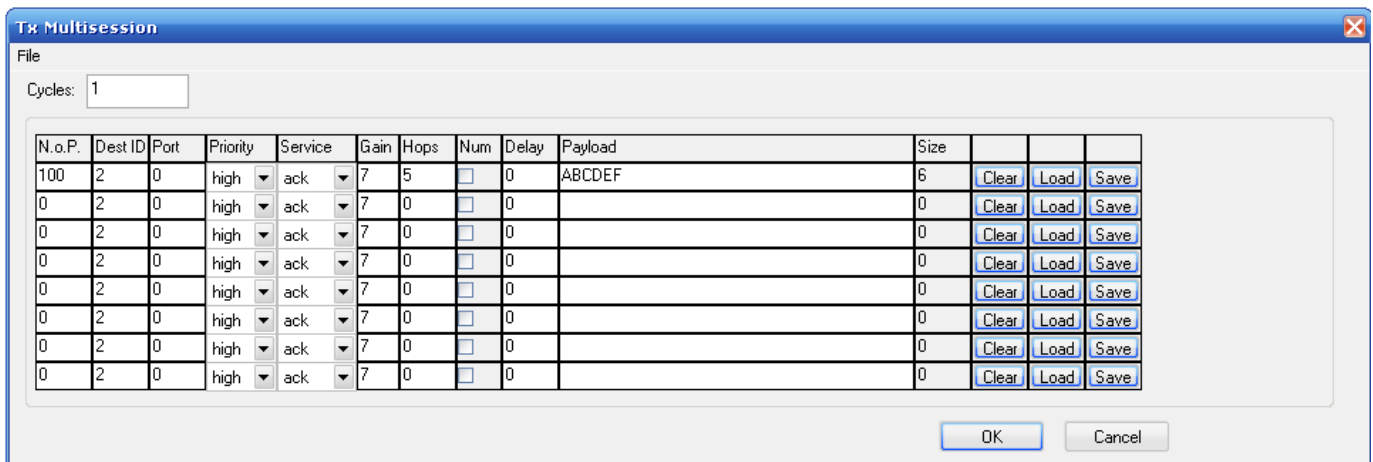
Figure 26: Selection of Multiple Session Transmission



Once the *Multiple Session* option is selected, the *TX Settings* option in the Transmitter section will display a *TX Multisession* screen instead of the *TX Settings* screen displayed on Single Session mode.

The following figure describes the *TX Multisession* window:

Figure 27: TX Multisession Window



Proprietary Information

The *TX Multisession* screen allows configuration of up to eight sessions.
The following table describes the *TX Multisession* window's parameters for each session.

Table 26: TX Multisession Screen Parameters

Parameter	Description
N.o.P	Number of packets to be sent in a session.
Dest ID	The ID of the target node to which packets are transmitted.
Port	The destination port to which packets are transmitted.
Priority	The priority of the transmitted packets (Low/Normal/High).
Service	ACK/UNACK.
Gain	Transmitted TX Power Level. The highest is 7, and the lowest is 0.
Hops	Number of hops, for the packet to be repeated.
Num	When checked, the PLC Studio program adds a serial number to each packet as part of the payload (8 Bytes are added to the end of the payload).
Delay	The delay (in msec) between two consecutive packets.
Payload	The payload data of the packet is inserted here by the user.
Size	The length (in Bytes) of the payload field, as set by the user in the transmission text box of the Packet Payload.
Clear button	Clears the payload text box.
Load button	This button opens a text file containing the payload data.
Save button	This button saves a text file containing the payload data.

The following table details the buttons of the *TX Multisession* window's buttons.

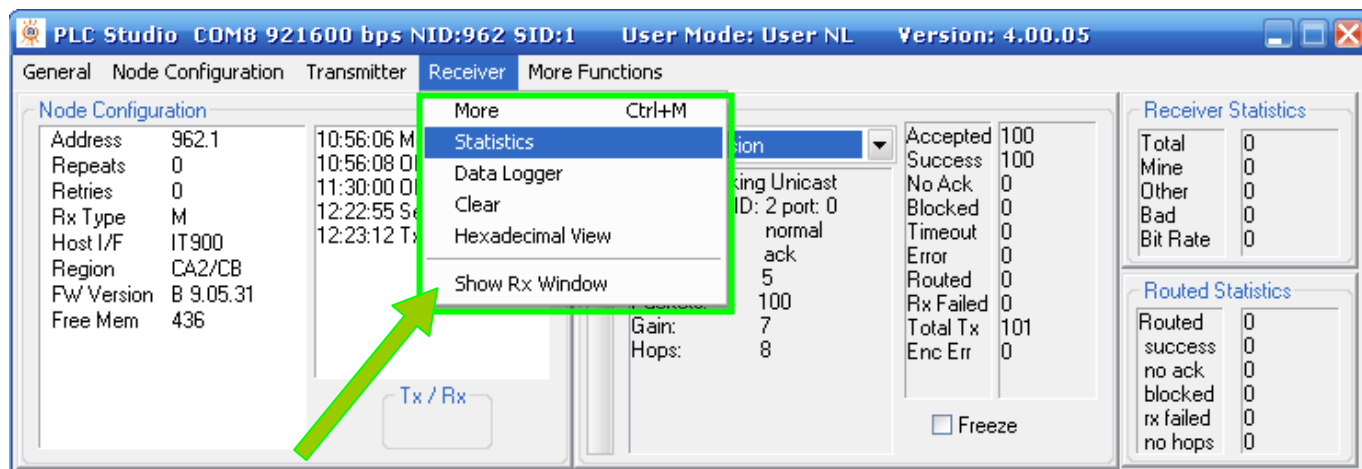
Table 27: TX Multisession Window Buttons

Button	Description
OK	Saves the current Multiple Session settings
Cancel	Exists from the Multiple Session settings without saving.
Cycles	Determines the number of cycles to be performed by each session

2.2.5.3 The Receiver Menu

The following figure describes the *Receiver* Menu:

Figure 28: Receiver Menu



2.2.5.3.1 The 'More' Option

This option will open a new screen in which all received packets are displayed (versus the display in the Received Packets Details where only the last 8 packets are shown (refer to Section 2.2.5.3.6). Packets that were received since the last time the *Clear* Option was selected (refer to Section 0) are displayed in this window.

NOTE: This option can also be selected using the keyboard shortcut **CTRL+M**.

The following figure describes the *Received Packets* window, which appears after selecting *More* option:

Figure 29: Received Packets Window - More Option

Received Packets														
#	Time	Type	M...	Packet Type	Mod.	Tone	Net	I Src	I Dest	O Src	F Dest	SQ	Prt	St
100	09:14:01.8	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
99	09:14:01.7	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
98	09:14:01.6	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
97	09:14:01.5	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
96	09:14:01.4	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
95	09:14:01.2	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
94	09:14:01.2	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
93	09:14:01.0	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
92	09:14:01.0	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
91	09:14:00.9	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
90	09:14:00.8	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
89	09:14:00.7	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
88	09:14:00.6	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
87	09:14:00.5	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
86	09:14:00.4	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
85	09:14:00.2	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
84	09:14:00.0	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
83	09:13:59.9	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
82	09:13:59.8	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
81	09:13:59.6	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
80	09:13:59.6	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
79	09:13:59.4	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
78	09:13:59.3	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
77	09:13:59.2	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac
76	09:13:59.1	mine	IT900	INTRANETWORK-UNICAST	DCS...	N/A	962	1	2	1	2	223	nor...	ac

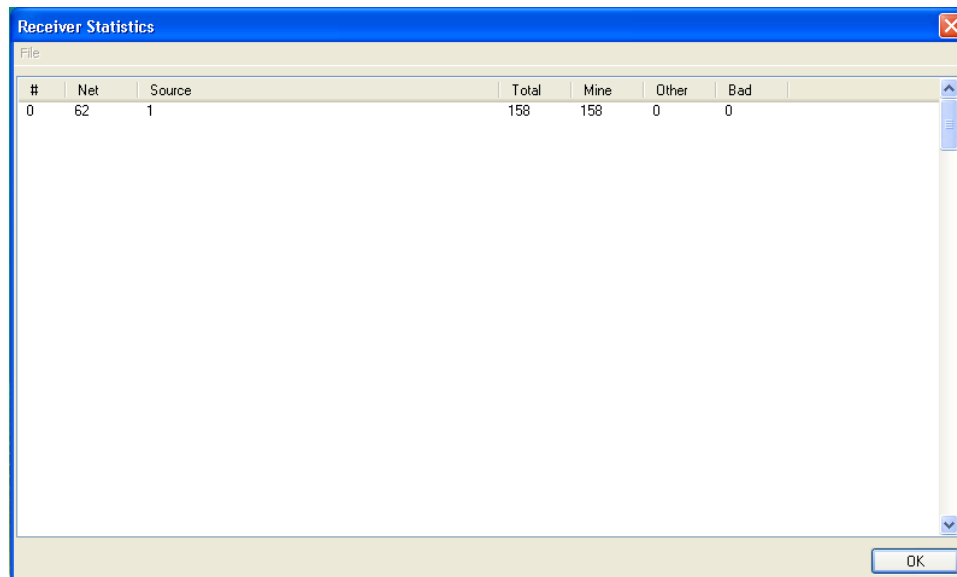
The information displayed on this screen is detailed in Section 2.2.5.3.1.

2.2.5.3.2 The Statistics Option

The *Statistics* option opens a new screen on which a statistics summary is shown. The data is calculated using the same parameters as those in the reception statistics display (except for the Rate) and are divided according to the source node, which is identified by a network address (Net) and ID (source ID). The reception statistics also divide between the Internetworking packets in which the source node is defined by 16 bytes S/N and intranetworking packets in which the source node is defined by 2 bytes Logical Node and Net ID.

The following figure describes the *Receiver Statistics* screen:

Figure 30: Receiver Statistics Screen



#	Net	Source	Total	Mine	Other	Bad
0	62	1	158	158	0	0

2.2.5.3.3 The Data Logger Option

The *Data Logger* is activated by clicking *Start* in the *Data Logger* window. The *Data Logger* captures the received packets and saves them as a log file (text file) in a folder titled “IT900 Data Logger,” which is created by the PLC Studio in the PLC Studio program folder.

The log file name is “IT900PacketsCOMx.tx” where **x** stands for the virtual COM port number connected to the IT900 platform. The file contains a table of the incoming packets detailing (for each packet) the network, source, destination, modulation, signal quality, payload test (if random payload generator is active) and the payload itself.

There is one file for each port. In order to create multiple logs for the same port, rename the log file manually (advisable) or move it to another location.

The Data Logger window shows the number of received packets and saved packets (numbers may differ if packets were received prior to pressing Start).

The user must click *Stop* to end packets capture. Select *Clear* to reset the Received and Saved counters.

Proprietary Information

The following figures describe the *Data Logger* window the *Data Logger Text* file:

Figure 31: Data Logger Window

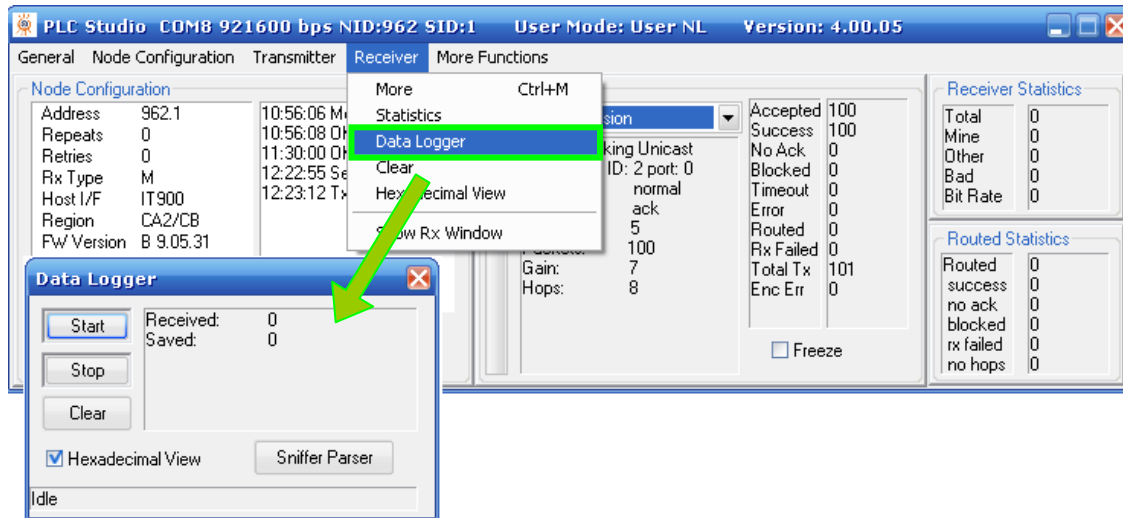
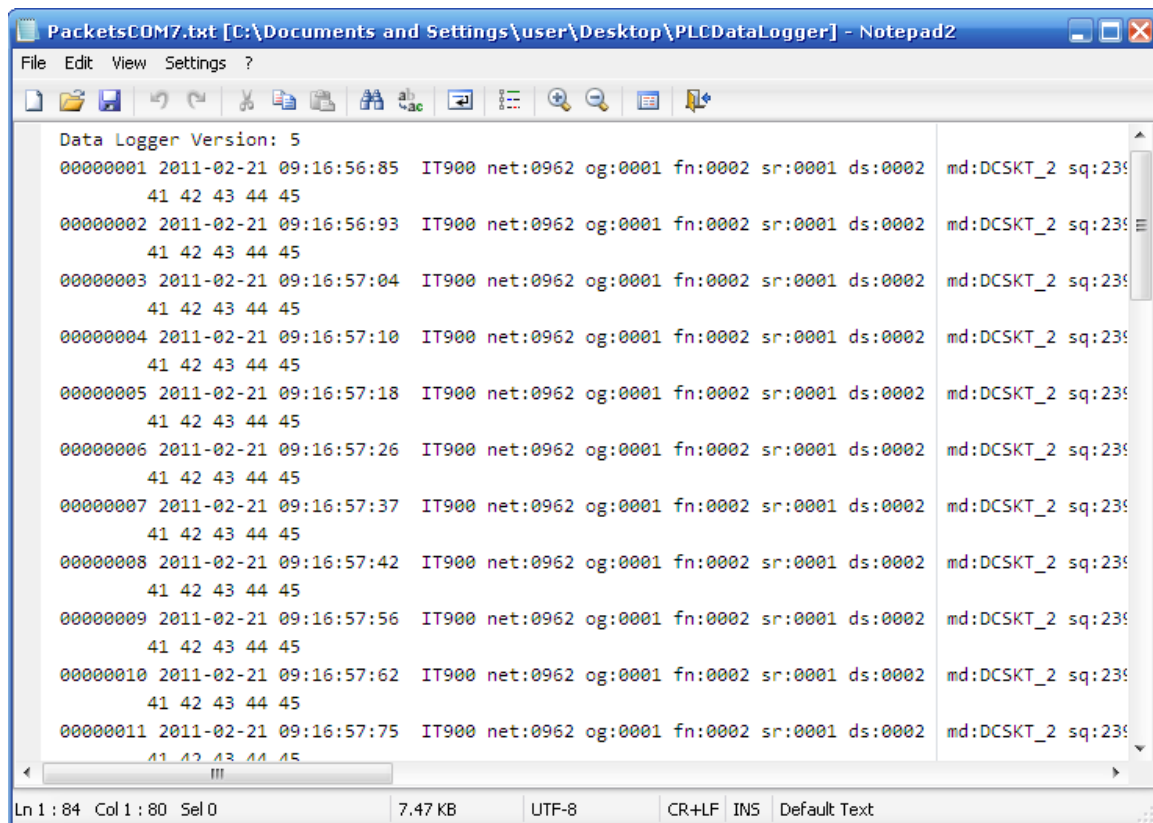


Figure 32: The Data Logger Text File



2.2.5.3.4 The Clear Option

This option clears the reception packets details display (refer to Section 2.2.5.3.6) and the reception statistics display (refer to Section 2.2.5.4).

2.2.5.3.5 The Hexadecimal Option

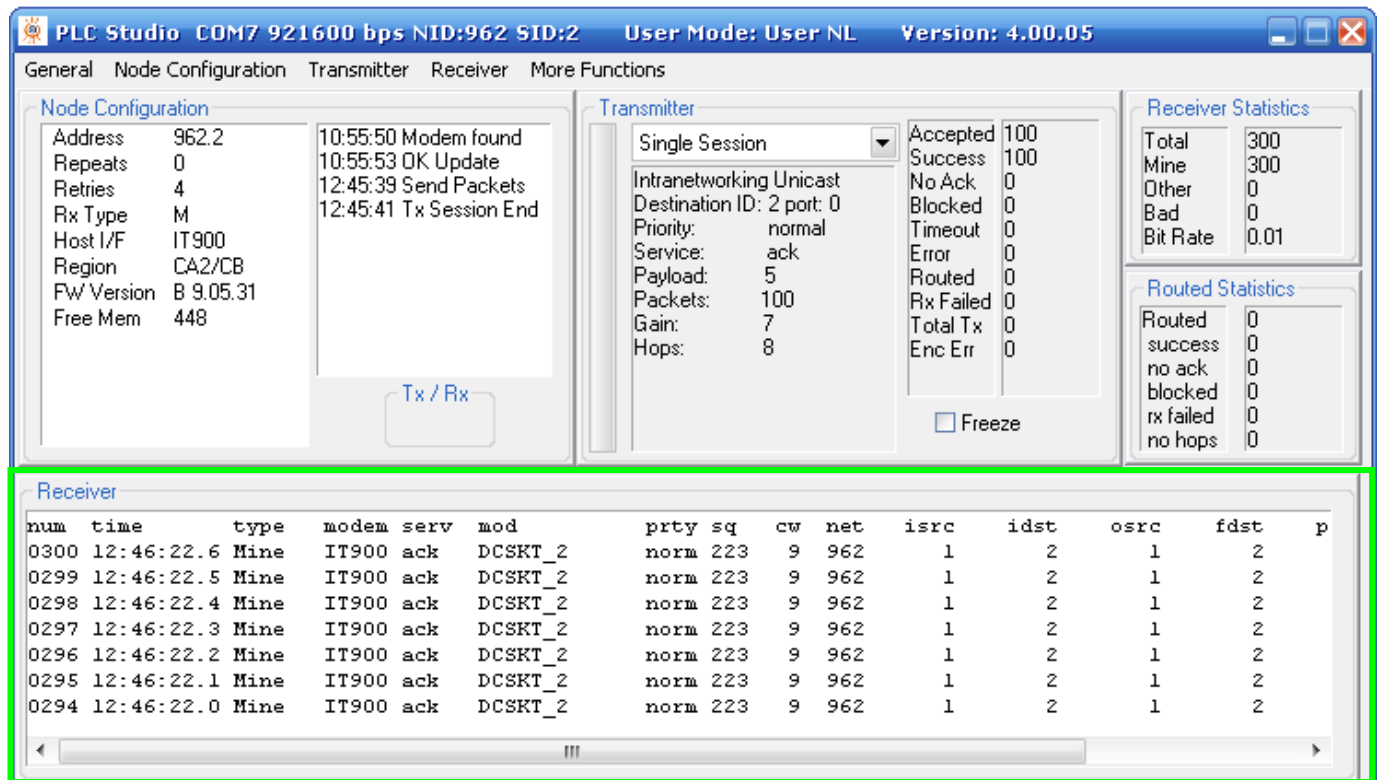
By selecting this option, the payload in its hexadecimal representation are displayed when the *RX Window* is open (refer to Section 2.2.5.3.6).

2.2.5.3.6 The Show RX Window Option

This option opens an additional part of the main screen that displays *Receiver* packets details including detailed information of the last 8 incoming packets. In order to view details for all incoming packets the *More* option (refer to Section 2.2.5.3.1) should be selected.

The following figure describes the main screen with *RX Window* selected:

Figure 33: Extended Main Screen - RX Window



Proprietary Information

The following table describes the information displayed in the *Receiver* section of the main screen:

Table 28: Receiver Section of the Main Screen

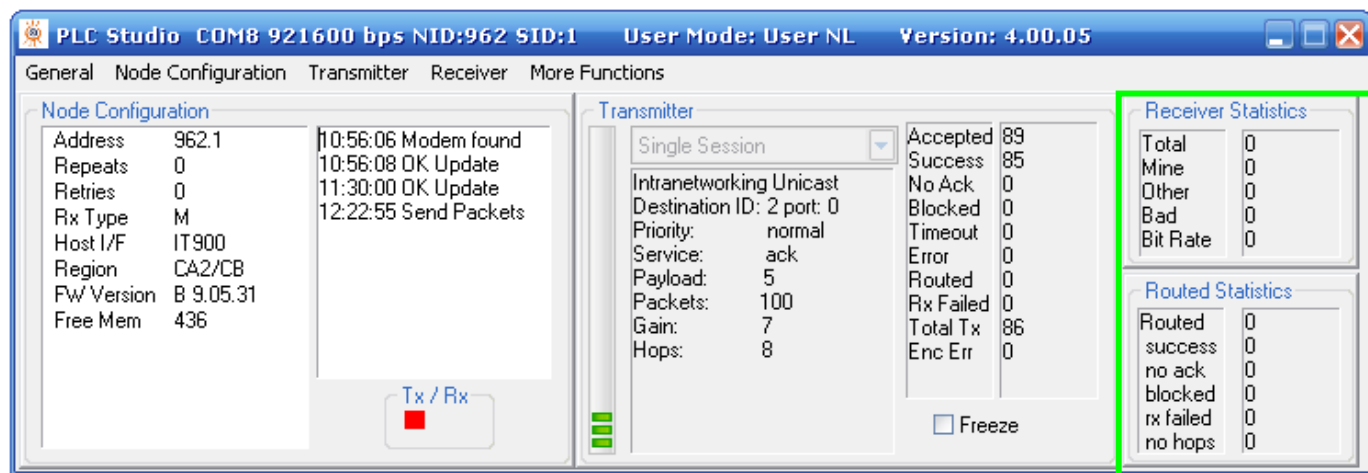
Parameter	Description
Num	The reception sequence number (according to the order of that the packets were received in).
Time	The time of reception.
Type	The type of the packet: "mine" (Mine)/"o.d" (Other Device)/"o.n" (Other Net)/ "bad" (Malformed). For further details refer to Table 2. For Internetworking packets, the type field is always Mine.
Packet Type	The type of transmitted packet: (refer to Table 19 for details about packet types) <ol style="list-style-type: none"> 1. Intranetworking Unicast 2. Internetworking Unicast 3. Intranetworking Broadcast 4. Internetworking Broadcast
Serv	Service - The type (Ack/ Unack) configured in TX Settings at the Transmission side (refer to Table 20). For Internetworking packets, the Serv field is always Unack.
Mod	Mod - The transmission modulation which was used to send the packet - (refer to tIT900 Data Sheet for modulation types)..
Prty	Priority – The Priority (Low/ Normal/ High) configured in TX Settings at the Transmission side (refer to Table 19).
SQ	Signal quality indication - between 255 (best) and 1 (worst).
CW	Contention Window – this parameter determines of what range to randomize a number in order to support back-off.
Net	The Network ID of the source node that sent the packet.
Isrc	Intermediate source. The node that sent the packet, intermediately.
Idst	Intermediate destination. The node next in line to be sent to, intermediately. When the received packets were broadcasted to the entire network (intranetworking broadcast), the Idst value is BC.
OSrc	The Node ID of the source node that sent the packet (the Source ID - SID).
Fdst	The final destination ID (DID) of the packet – the Node ID of the node to which the packet was sent. When the received packets are broadcasted to the entire network (intranetworking broadcast), the Fdst value is BC.
PSrc	Port Source. The port from which the packet was transmitted from.
Size	The payload length.
Payload	The payload data.
Serial Number	The S/N of packet source.
Payload	The payload data.
Payload	The payload data.

NOTE: The address fields (Net, Isrc, oSrc, Fdst) are irrelevant for Internetworking packets, and therefore are not displayed. The *RX Window/Receiver* display uses all address fields to display a packet's source S/N. Additionally; since the type and serv fields of Internetworking packets are constant the *RX Window/Receiver* display uses them in to differ between Internetworking Unicast and Broadcast packets.

2.2.5.4 The Receiver and Routed Statistics Displays

The following figure describes the *Receiver Statistics* and *Routed Statistics* displays:

Figure 34: Receiver Statistics and Routed Statistics Displays



2.2.5.4.1 The Receiver Statistics Window

The following table describes the *Receiver Statistics* display:

Table 29: Receiver Statistics Display

Parameter	Description
Total	Total packets received.
Mine	Received packets sent to this node (same NID and their DID is the Node's ID. i.e. DID=SID).
Other	Packets that are neither Bad nor Mine.
Bad	Packets that failed the CRC check or their actual length did not match the length of information provided in the packet's header.
Bit Rate	The average throughput, taking into account the time required for the PLC Studio to deliver the data to the IT900 over USB.

2.2.5.4.2 Routed Statistics Display

This display shows the transmission activity to the packets received to the host as routed packets. These packets are treated as packets for transmission and their statistics is represented on the main screen (refer to Table 25).

The following table describes the *Routed Statistics* display:

Table 30: Routed Statistics Display

Parameter	Description
Routed, success, no ack, blocked, RX Failed	Refer to Table 25.
No Hops	This parameter indicates whether there are no hops left for the packet, even though it is not its final destination.

2.2.5.5 The Freeze Checkbox

When checked, *Freeze* allows the user to put a hold on the following:

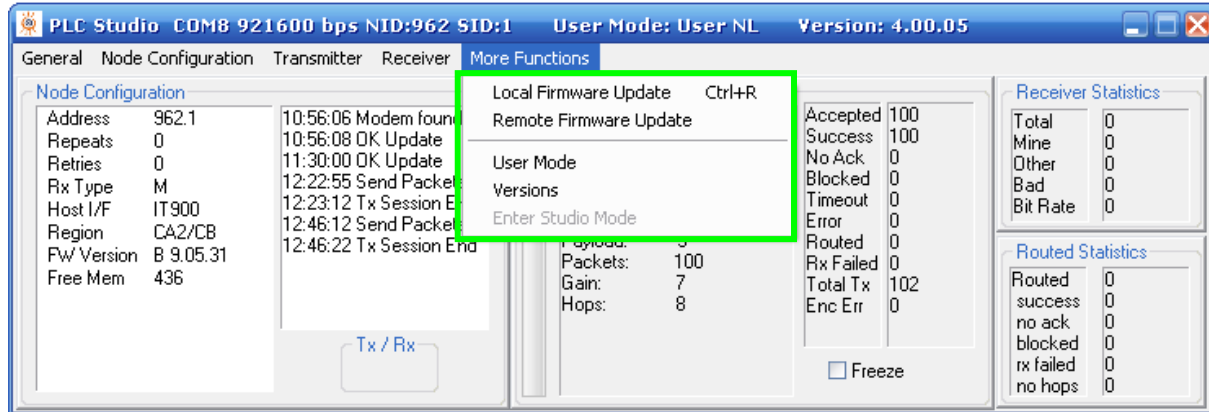
- The Transmission statistics display (refer to Section 2.2.5.2.3).
- The Receiver Statistics display (refer to Section 2.2.5.4).
- The Receiver data information display/RX window (refer to Section 2.2.5.3.6).

Each of the above will pause if they were running when the user selects *Freeze*. Note that the transmission will proceed; it is only the displays which will stop. The displays will continue running from the current package transmitted/ received when the checkbox is unchecked.

2.2.6 More Functions Menu

The following figure describes the *More Functions* menu:

Figure 35: More Functions Menu

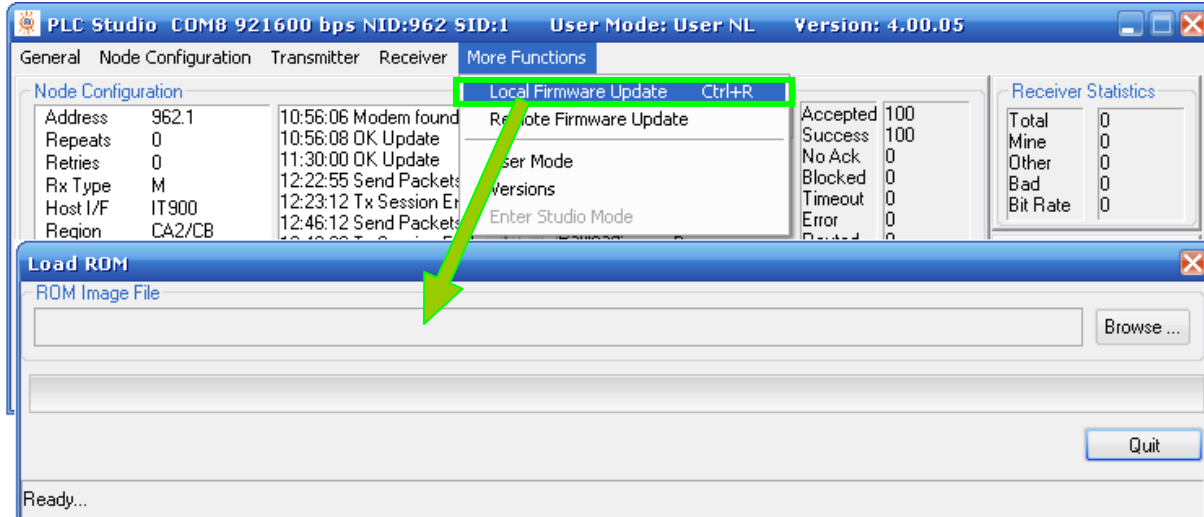


2.2.6.1 Local Firmware Update

This option is intended for allowing updates of the IT900 pre-flashed software version. When an update is issued by Yitran this option allows easy access to the updating file and then, by hardware reset, the file is loaded and the device is updated.

The following figure describes the *Local Firmware Update* window:

Figure 36: Local Firmware Update Window



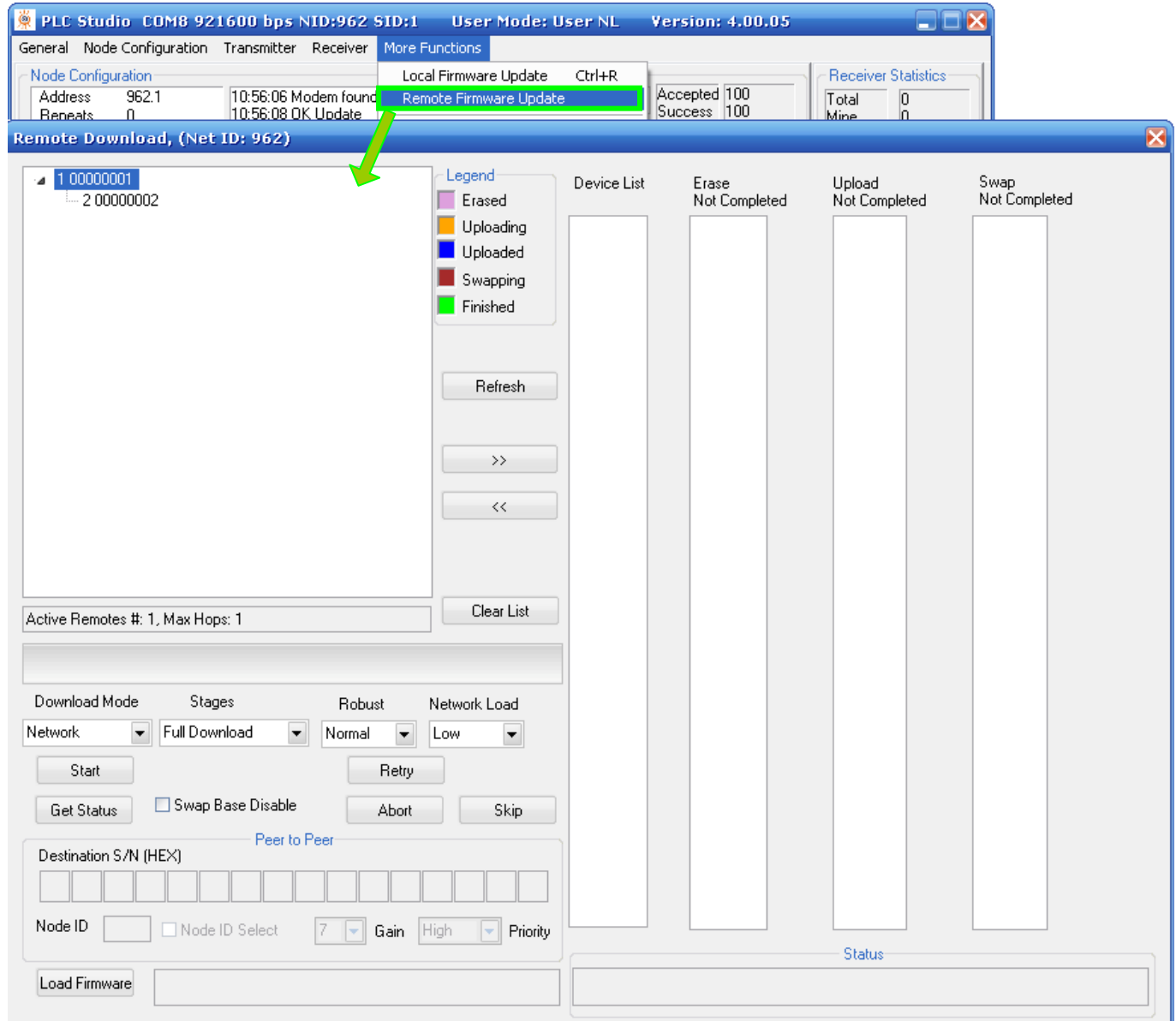
In order to update the device, load the specified file using the *Browse* button and navigate to the proper file. After loading the file, reset the device using the reset button on the device itself (hardware) or by disconnecting and then connecting again to the power supply. When the update is complete, click *Quit*.

NOTE: The Browse button is the only button used during the update process. All other buttons in the ROM Option screen should not be used unless instructed differently by Yitran Customer Support.

2.2.6.2 Remote Firmware Update

This module enables the user to update the firmware version remotely (via PLC).
The following figure describes the *Remote Firmware Update* window:

Figure 37: Remote Firmware Update Window



2.2.6.3 Remote Firmware Update Buttons

The following table describes the buttons featured in the *Remote Download* window and its functions:

Table 31: Remote Download Window Buttons

Button	Description
Refresh	Refreshes the Node Information window (refer to Figure 35).
>>	Allows the user to manually add a device to the list.
<<	Allows the user to manually remove a device from the list.
Clear List	Clears the list of nodes the user selected manually using the 'left' and 'right' arrows.
Start	Begins the update process according to the settings selected.
Get Status	Gives you an updated topology. For more information about a specific node in the network, stand your mouse on that node. The information provided includes the node's ID, current software version, application (if there is one) update version, boot version and status
Retry	Retries the update process according to the settings selected.
Abort	Stops the update process.
Skip	Skips the particular node being updated.
Load Firmware	Allows the user to navigate to the update file.

2.2.6.4 Remote Download Settings

The following describes the buttons in the Remote Download window used to define parameters of the remote download process.

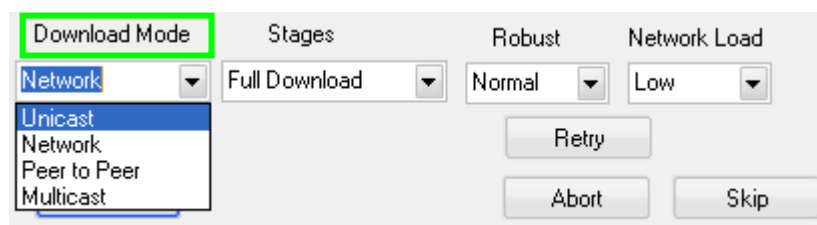
2.2.6.4.1 Download Mode

Download Mode is the method of update and has four options:

- Unicast – updates directly from the application to one specific node at a time.
- Network – updates all nodes at once in a broadcast. In this mode there is no need to select and add nodes).
- Peer to Peer – a direct unicast update, not necessarily from the base and with no hops from any node to any node (as long as there is a direct connection between nodes).
- Multicast – broadcast update to a list of selected nodes, all at once.

The following figure describes the *Download Mode* options to select from:

Figure 38: Select Download Mode



Proprietary Information

2.2.6.4.2 Stages

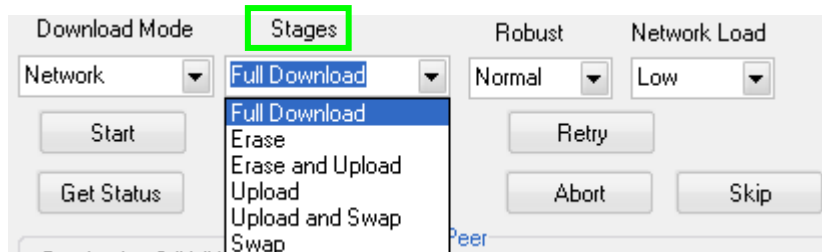
Stages are the specific operations to perform including:

- Full Download – performs Erase, Upload and Swap one after the other.
- Erase – erases storage for updated version upload to come.
- Erase and Upload – erases storage and uploads new version.
- Upload – uploads the version.
- Upload and Swap – uploads the version and swaps the current version with the newly updated version.
- Swap – swaps the current version to the newly uploaded version.

*NOTE: it is not possible to swap without a successful upload, and it is not possible to upload without a successful erase.

The following figure describes the *Stages* options to select from:

Figure 39: Select Stages

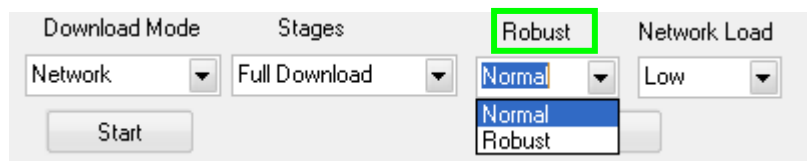


2.2.6.4.3 Robust

Robust option defines the number of retries to be used in the downloading process. When set to 'Robust', the update process will allow more retries than in the 'Normal' mode.

The following figure describes the *Robust* options to select from:

Figure 40: Select Robustness



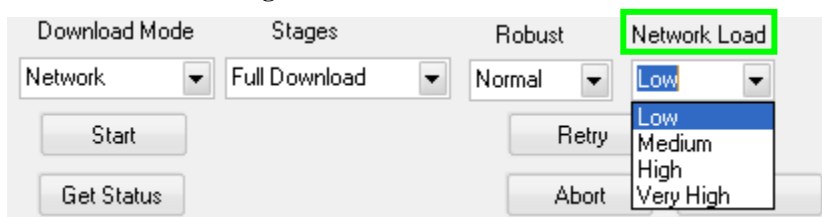
2.2.6.4.4 Network Load

Network Load determines how much bandwidth will be consumed in the download process.

Please note: a higher bandwidth will make the update process faster; however it will require a greater amount of the total bandwidth.

The following figure describes the *Network Load* options to select from:

Figure 41: Select Network Load

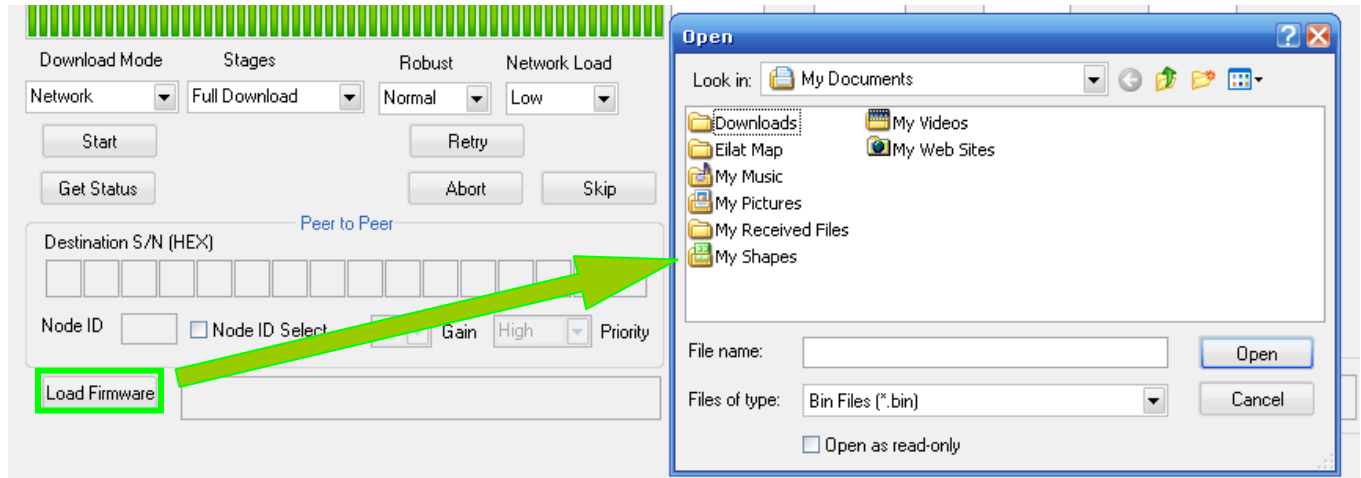


Proprietary Information

2.2.6.4.5 Load Firmware

Load firmware allows the user to select a file to be uploaded.
The following figure illustrates the *Load Firmware* button:

Figure 42: Load Firmware



2.2.6.4.6 Status

Progress can be monitored in the *Status* area, described in the following figure:

Figure 43: Status Area



2.2.6.4.7 Peer to Peer

This area and its options are available only in Peer to Peer Download Mode (refer to Section 2.2.6.4.1).
The updating node needs an address to know which node to update. This is accomplished by entering a S/N or Node ID.

- Destination S/N (HEX) is the serial number of the node to be updated.
- Node ID Select – checking this box will allow the user to enter only the Node ID.
- Gain – Controls the gain over the power line.
- Priority – Sets the priority of the transmission.

Figure 44: Peer to Peer



2.2.6.5 Remote Firmware Update Download Process

To utilize the Remote Download tool, please follow the steps below.

Step 1 – Get Status

- Click on “Get Status” to receive an updated topology.

Step 2 – Select Settings

- Download Mode
- Stages
- Robust
- Network Load

Step 3 – Select Nodes (if using Unicast, Peer to Peer or Multicast).

Note: For Peer to Peer be sure to enter either the S/N or Node ID of the node to be updated.

Step 4 – Select Firmware

The load firmware being used can be seen, as illustrated in the figure below:

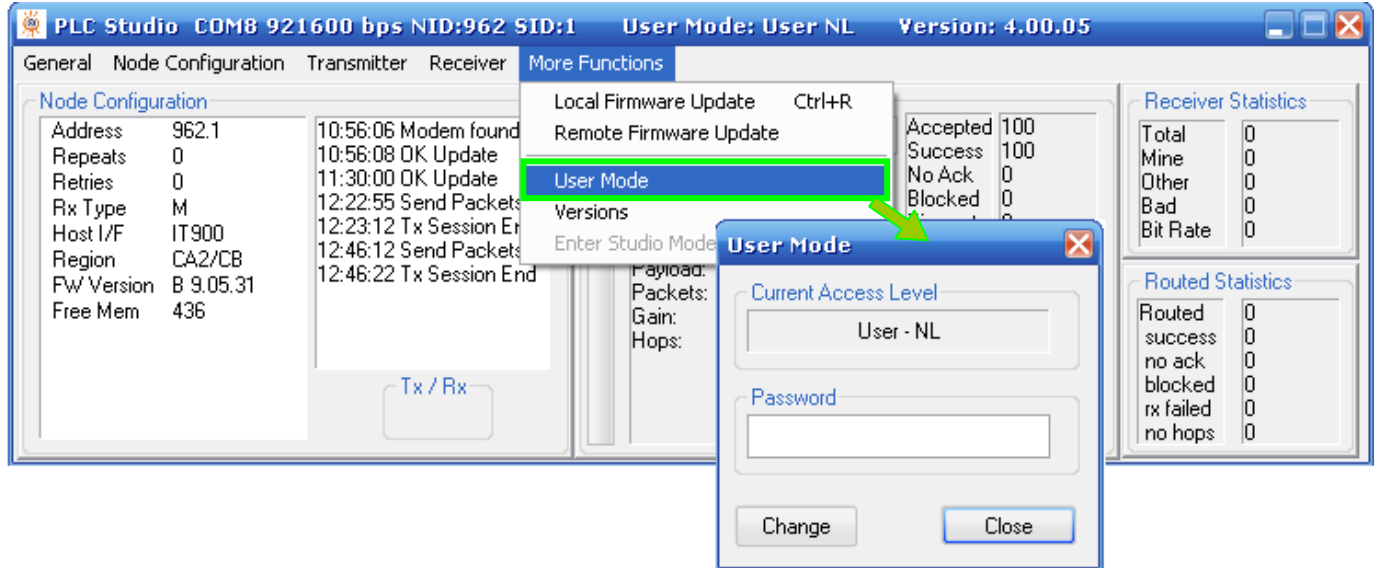
Step 5– click START.

2.2.6.6 The User Mode Option

The PLC Studio program has different user modes allowing different levels of access to the menus and screens. The User - NL mode is the default mode accessible to the customer and provides the required access for modem operation and configuration. Other modes are designated for maintenance and internal use by Yitran, so there is no need to modify the user mode during normal operation. If the PLC Studio is in non default mode the user may return to “User - NL” mode with the password "usnl".

The following figure describes the *User Mode* window:

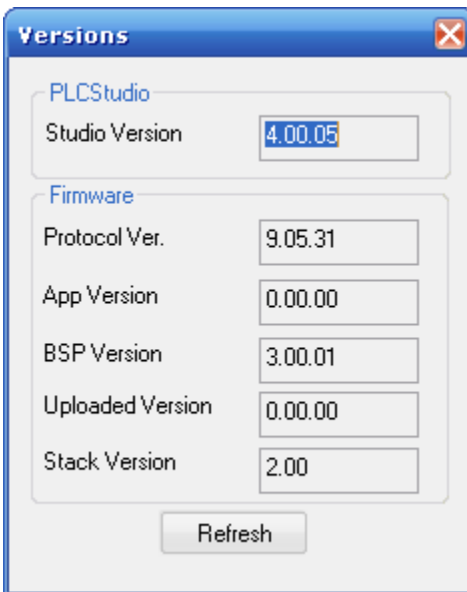
Figure 45: User Mode Window



2.2.6.7 The Versions Option

Selecting the Versions Option lists the PLC Studio, IT900 and BSP versions that are currently in use. The following figure describes the *Versions* window:

Figure 46: Versions Window



2.3 Using the PLC Studio with the IT900 platform

After installing the PLC Studio program (refer to Section 2.1) can be used with IT900 platform units for evaluation, testing and application development.

2.3.1 System Verification Test

Follow the steps below to perform system verification test using at list one PC with multiple active USB ports:

1. Install the PLC Studio software and the USB Bridge Driver in the PCs participating in the verification test (refer to Section 2.1).
2. Connect the USB cable between the PC USB port and the IT900 platform USB connector (multiple stations may be connected to a single PC).
3. Connect the power supply cable to the IT900 platform. **Connect all IT900 platforms to the SAME electrical strip (just for the verification test).** Connect each IT900 platform to a PSU and then connect the PSU to the strip.

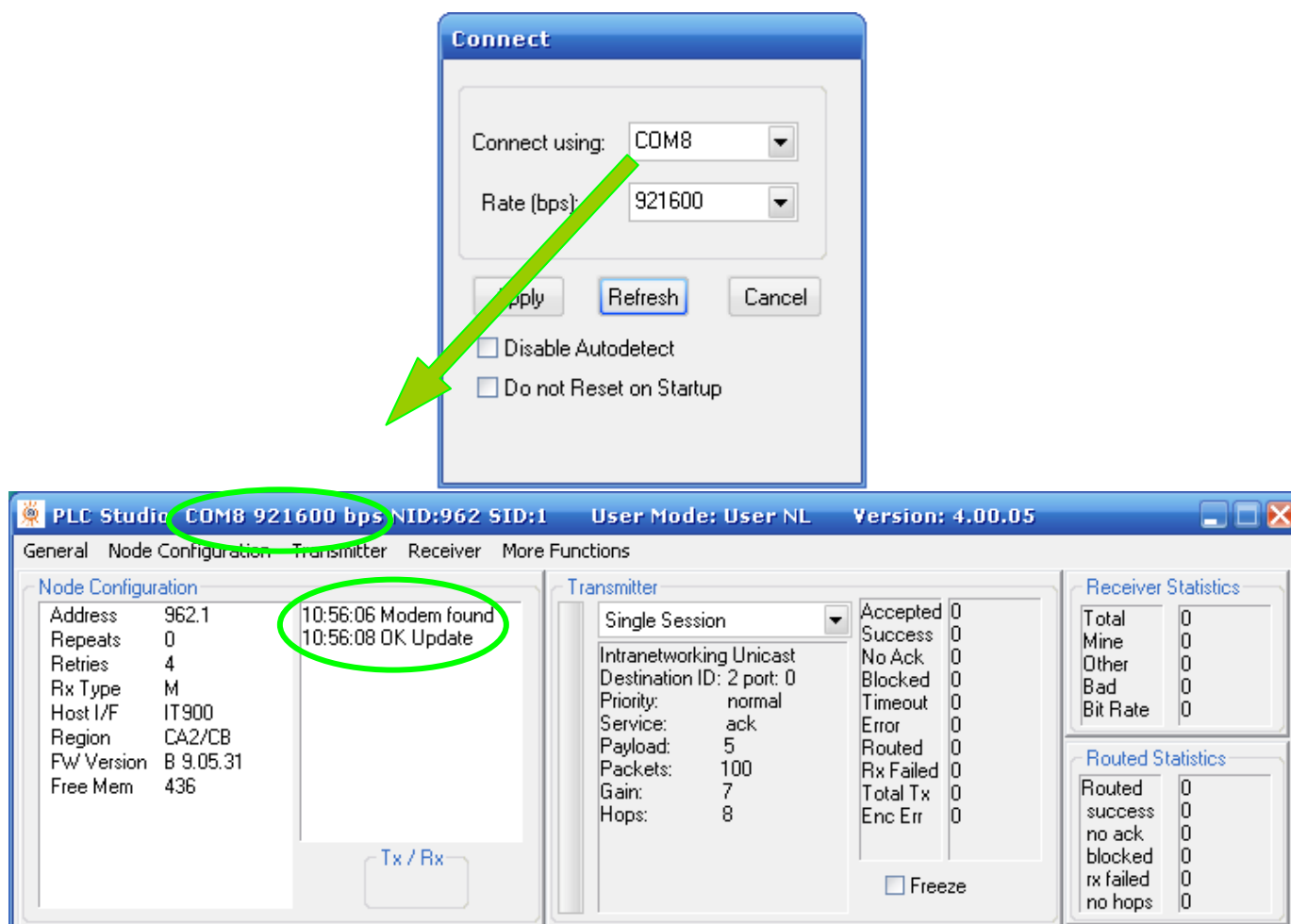


Important Note:

For the System Verification Test, the IT900 platform configured as a Base-Station must be among the stations connected to the power strip.

4. For each station, run the PLC Studio program and follow the steps 4-7.
5. In the *General* menu, select *Connect* (refer to Section 2.2.2) followed by the COM port that is connected to the IT900 platform. The rate should be 921600 bps for all bands (except CENELEC-A2, which is currently unsupported) unless otherwise instructed by Yitran Customer Service. Click *Apply* (refer to Figure 47).
6. If an error message appears notifying that "IT900 Platform not found..." (refer to Figure 47), click OK and re-check your USB port connection. Verify that this COM port is not used by other applications in the PC and that you have selected the proper rate and repeat step 4.
7. Verify that "IT900 Found" and "OK Update" are displayed in the Transmitter section of the PLC Studio's main window. Verify that the virtual COM port number, used in the PC, is the same as the port that appears in the window's header (refer to Figure 47).

Figure 47: Reset Response On Power-up

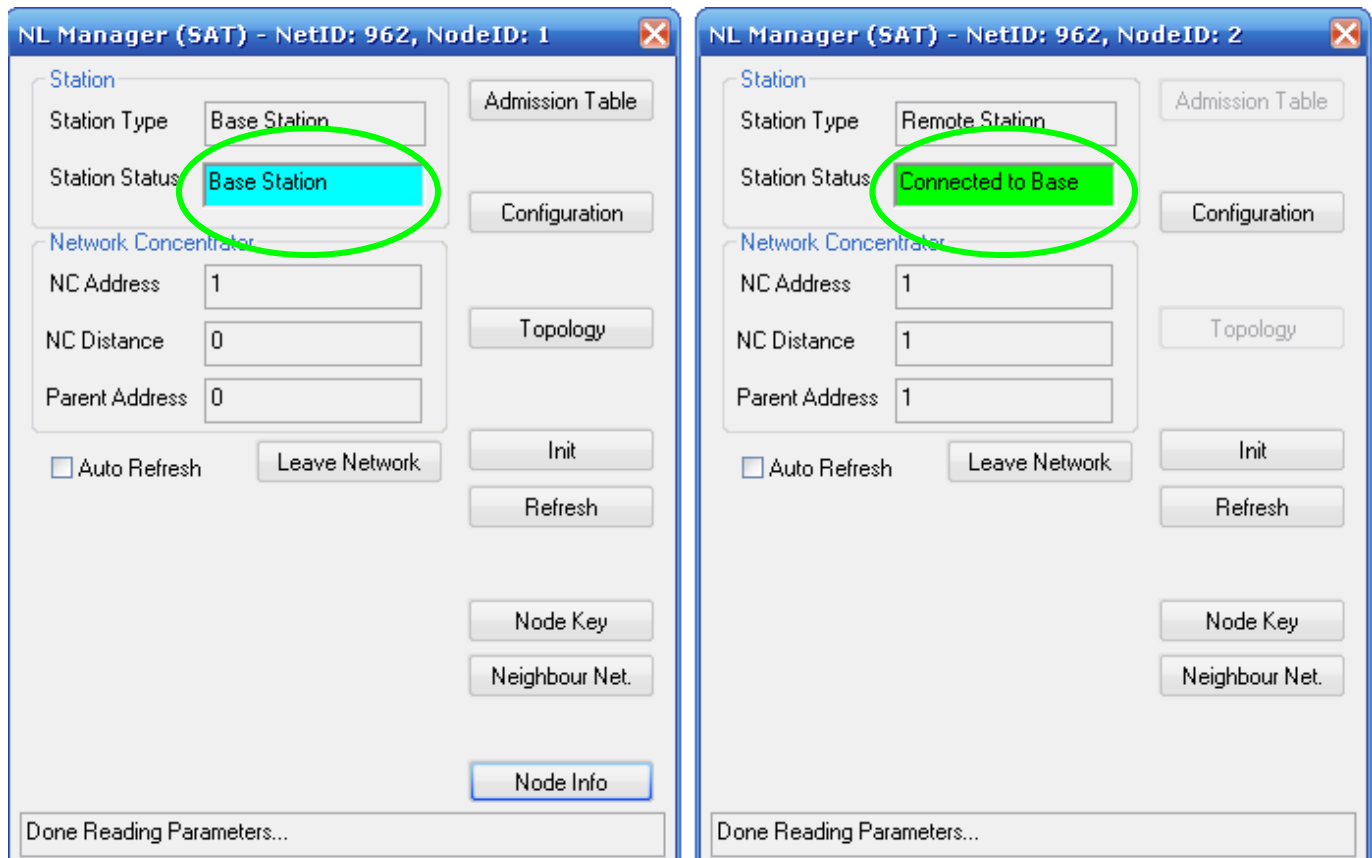


Important Note:

If any other responses other than those detailed above appear, select INIT (in the *Node Configuration* menu) and verify reception of the “OK Update” response. If the problem persists, disconnect and reconnect the PSU from the power strip.

8. Open the *NL Manager* menu (refer to Section 2.2.4.2).
For the Base-Station platform, verify that both the *Station Type* and *Station Status* fields are set to *Base Station* (refer to the left menu of the figure below).
For all other platforms, verify that the *Station Type* field is set to *Remote Station* and the *Station Status* field is set to *Connect To Base* (refer to right menu on the figure below).

Figure 48: Station Type and Status Verification



9. After successful completion of step 7, the system verification test is completed and the system is ready for use.

2.3.2 Coverage Test Guidelines

The PLC Studio and IT900 platform can be used to perform a coverage test to evaluate the communication between various outlets or locations. This section provides basic guidelines for such a test.

2.3.2.1 Issues to Be Aware Of

It is advisable to be aware of the following issues:

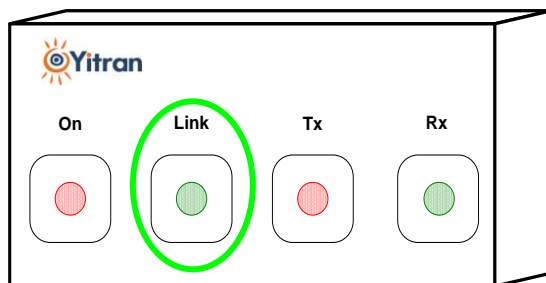
1. **Distances may not be as they appear** – Two outlets on the same wall, only a short distance physically apart from one another, may actually be very apart from a communication point of view. They may be connected with separate wiring to the main switchboard, on a different or same phase or even to different switchboards. Rooms in the same building may also be connected to different switchboards and even to different power sources (transformers). It all depends on the electrical wiring topology. Therefore if tests are conducted it is advisable to select locations where the electrical wiring topology is available to allow better understanding of the test results.
2. **Links may be asymmetrical** – A noise source located closer to one of the nodes creates an asymmetric link. The node closer to the noise source may not be able to receive the data sent to it while the other node is not influenced by the noise source (or only slightly influenced) and may be able to receive data.
3. **Out of range** – The IT900 provides the best performance over power line (highest dynamic range, highest robustness to various noise signals and more). Nevertheless, if the attenuation is higher than the dynamic range (~90dB) then the communication cannot be held directly and there might be a need for the automatic routing capabilities provided by the IT900.
4. **Communication obstacles** – It should be noted that objects such as transformers may introduce high attenuation and block the communication (depending on the transformer topology). Other obstacles such as electrical meters and communication between phases may also introduce some attenuation in the relevant frequency bands. The IT900 copes with signal distortions that may be caused by such obstacles and the ability to cross them depends on the level of the total attenuation. The sensitivity of an IT900based modem is <1mV enabling to cope with very high attenuation and to present very reliable communication in the presence of such obstacles.

2.3.2.2 Test Procedure

The coverage test setup should include one Base Station and one or more Remote Stations. **The coverage test should be performed only after system passed Verification test detailed in Section 2.3.1:**

1. Enable the *Automatic Start* option for stations participating in the test without being controlled or initialized by the PLC Studio.
2. Locate the Base-Station (BS) platform.
3. Locate the Remote Stations (RS) in various locations and wait for several seconds, a minute at the most, in order to allow the Remote Stations to connect to the network.
4. For each Remote Station, verify that the *Link Led* is lit (located on the IT900 PIM module and on STK2/3 platform). If the link LED is lit, the RS is connected to the BS, connectivity exists and the coverage test succeeded. Otherwise, try plugging the RS to a different socket.

Figure 49: STK Link LED

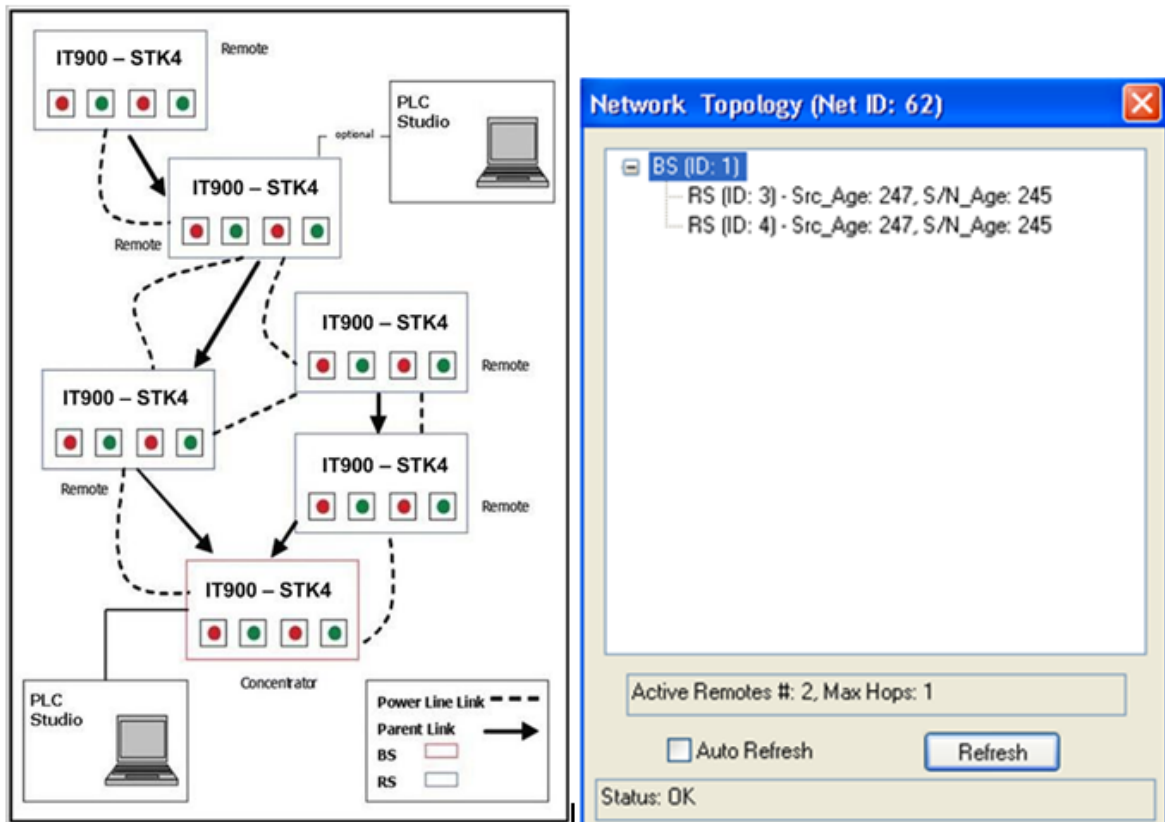


5. View the network topology in the PLC Studio connected to the BS in order to learn the addresses of the different nodes in the network (refer to Section 2.2.4.2.3).

Proprietary Information

The right figure below shows an illustration of a network coverage test setup including the power line links and routing links created by the Automatic Routing protocol. The figure on the left shows the network topology as should be displayed on the Network Topology window:

Figure 50: Network Topology on Coverage Test Setup



Note

The power line links and parent links described in the figures above are for illustration purposes only. Your network may be constructed automatically with different links. Also, the Node IDs displayed on the topology screen in the left figure above are not necessarily the same Node IDs in your created network.

Document Control

Revision	Date	Description
1.0	February 2011	Creation
1.1	October	Signal Quality (SQ) Indication Range updated

Important Notice

YITRAN Communications (YITRAN) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

YITRAN warrants performance of its products to the specifications applicable at the time of sale in accordance with YITRAN'S standard warranty. Testing and other quality control techniques are utilized to the extent YITRAN deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). YITRAN'S PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF YITRAN'S PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, the customer to minimize inherent or procedural hazards must provide adequate design and operating safeguards.

YITRAN assumes no liability for applications assistance or customer product design. YITRAN does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of YITRAN covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. YITRAN'S publication of information regarding any third party's products or services does not constitute YITRAN'S approval, warranty or endorsement thereof.