ASE2000 Version 2 Communication Test Set

User Manual

www.kalkitech.com

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Contact Information

Applied Systems Engineering, Inc.
1671 Dell Avenue, Suite 200,
Campbell, California, 95008, USA

Telephone: (408) 364-0500
Fax: (408) 364-0550
Email: products@ase-systems.com

Technical Support Contact Information

Online Technical Enquiry Support: www.ase-systems.com/support

E-mail Support: support@ase-systems.com

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1. Overview

Welcome to ASE2000 Version 2, the first major release of the ASE2000 Communication Test Set since it was first introduced in 1998. ASE2000 Version 2 contains all the functionality of Version 1 plus several new features, enhancements for ease of use, and upgrades requested from our many users over the years.

The ASE2000 is a communication protocol analyzer and communication test tool designed for operation in the SCADA industry with emphasis on protocols used predominantly in the electric power utility industry. The ASE2000 supports over 80 such protocols, both serial and network based. As a full-featured SCADA communication test tool, the ASE2000 supports three basic modes of operational testing; **Line Monitor Mode, Master Simulation Mode,** and **RTU Simulation Mode**. These are essentially functional test modes and exist within the two ASE2000 operational modes; **Exchange Mode** and **Task Mode**.

Line Monitor Mode is one of the primary uses of the ASE2000 and is used to provide visibility into communication occurring between a master station and remote devices (RTUs, IEDs, or PLCs). As such, one of the main features of the ASE2000 is the capability to operate as a line monitoring device, presenting communication message data in raw (numeric) format, and also interpreting those messages into protocol specific English text for ease of understanding. Input point values are extracted from the message and can be viewed in a separate tabular formatted view.

In addition to monitoring communication on a serial line or network connection, the ASE2000 can also operate as either a master or remote device to further exercise, test, and diagnose problems.

Master Simulation Mode provides the ability to simulate a master and to issue messages to exercise and diagnose problems in a remote device. All information and views available in Line Monitoring mode are also available in Master Simulation mode. The main difference is operational in that the ASE2000 takes the place of the master in transmission of messages to the remote device.

RTU Simulation Mode provides the ability to simulate one or more remote devices to exercise the master and diagnose potential problems. All information and views available in Line Monitoring mode are also available in RTU Simulation mode. The main difference is operational in that the ASE2000 takes the place of the remote device (or devices) in transmission of messages to the master.

For video demonstrations of ASE2000 Communications Test Set V2, visit the Applied Systems Engineering website: http://www.ase-systems.com/videos/trainingvideo.asp.

2. Version 1 / Version 2 Comparison

Version 1 of the ASE2000 Communication Test Set was first released in 1998 with thousands of copies currently in use worldwide. And, while some areas of ASE2000 Version 2 have a slightly different look and feel than Version 1, there was a significant effort made to provide a familiar operating interface for users already familiar with Version 1 to minimize the learning requirement in making the transition from Version 1 to Version 2.

2.1. Exchange Mode and Task Mode Highlights

The most significant difference between ASE2000 Version 1 and Version 2 is the addition of **Task Mode** operational mode. ASE2000 Version 1 has a single, unnamed, operational mode but, with the addition of **Task Mode** in Version 2, it became necessary to distinguish between the two Version 2 operational modes. In Version 2, the test set features provided in Version 1 as well as a Version 1 “look and feel” is available in Version 2 **Exchange Mode** and, to a certain extent, can be thought of as Version 1 “compatibility mode”. The main conceptual different between the two modes is in the way communication is organized. For the most part, the same capabilities exist in both **Exchange** and **Task Modes**. In addition, **Task Mode** supports some complex operations such as file transfers and embedded DNP3 security messages. These capabilities are only partially available in **Exchange Mod**e. **Exchange Mode** can support multiple operations, such as scanning a device for data while also periodically issuing control output requests. **Task Mode** currently supports single operations only.

Exchange Mode operations are based on the selection and configuration of one or more protocol messages or exchanges. The terms message, protocol message, and exchange will be used interchangeably in this document. The user selects one or more messages, edits them as necessary for the point configuration of the target device, and enables communication for the appropriate functional mode; Monitor, Master, or RTU. Some detailed knowledge of the protocol may be required for message preparation. Content of all messages must be configured in advance and message content cannot be edited once communication starts.

Task Mode is a new mode of operation introduced in Version 2 and is intended to provide a simple, easy to use interface to commonly used test set functions that do not require a detailed knowledge of the protocol. As the name implies, it presents a “task” oriented interface for selecting test set functionality. For example, instead of a list of individual exchanges, the user is presented with a set of functional “tasks” such as “Initialization”, “Acquire Data”, ”Controls”, etc. Within each task group is a set of exchanges that, for the selected protocol, provide the functions specific to the task group. Instead of configuring individual exchanges as in **Exchange Mode**, the user must configure devices (RTU, IED, PLC, etc.) in terms point types and point counts and the device configuration is used in **Task Mode** to automatically configure the appropriate protocol message for the desired task. Once a device configuration is entered, it is saved permanently is a device database where it can be re-selected for future test sessions. When operating in **Task Mode**, Master Simulation and RTU Simulation actions are performed on a single, selected device. Monitor Mode supports monitoring of one or more selected devices.

2.2. Exchange Mode and Task Mode Operational Basics

From an operational perspective:

- **Exchange Mode** operates as an ASE2000 Version 1 Test Set. The user selects a protocol, is presented with an applicable set of exchanges (messages), configures and enables one or more of these exchanges, and starts communication. Master Simulation, RTU Simulation, and Monitor modes appear very similar, if not identical, to those in Version 1. Some manual editing of the default exchanges to account for specific point configurations may be necessary prior to start of communication. The actual editing steps required are largely dependent on the protocol selected and is very similar to Version 1 editing requirements.

- **Task Mode** communication is based on point configuration information for a particular device. Before starting **Task Mode** operation for the first time, the user must define one or more devices (RTUs, IEDs, PLCs). The properties for defining a device include a protocol, device address, and point configuration information (point types, addresses, and counts). Device definition is persistent (retained when the ASE2000 is stopped and restarted). The user starts **Task Mode** operation by first selecting a device from the pre entered list. The ASE2000 responds by displaying a list of tasks applicable to the protocol of the selected device. Tasks are grouped in functional categories such as *Initialize, Acquire Data,* and *Time Sync*. The user proceeds by selecting a grouping and a task within the selected group.

In **Master Simulation** mode, communication is started by selecting one of the Transmit ICONS (Send Once or Send Continuously). The ASE2000 automatically transmits messages required to accomplish the selected task.

Monitor Mode contains a single task, selection of which starts the line monitoring process. Data response interpretation uses point information entered during the device configuration step.

For some protocols, such as Harris, Conitel, and CDC, the ASE2000 can only parse point data from a communication message if it knows, in advance, the device's point configuration. For these, message interpretation replies on correct user data base configuration information entry.

For other protocols such as IEC and DNP3 where point configuration can be determined from the communication message, the ASE2000 automatically creates data base entries for undefined points. For these protocols, data base configuration information definition is desirable, but not 100% required. It suffices to enter only the correct device address or ID.

Task Mode monitoring is oriented to a single device. If you wish to monitor multiple devices on a communications line, and have a protocol that requires advanced knowledge of the devices configuration then you may find the Exchange Mode better suited for this operation.

RTU Simulation mode also contains a single task. The ASE2000 builds response messages based on point information entered during the device configuration step. Complete point configuration information must be entered for all RTU Simulation devices being used, regardless of protocol.

During online operation in RTU Simulation mode, values for individual points can be manually entered in the Point Values view.

Both Exchange and Task Mode support RTU simulation of a single device. Task Mode enforces this by only responding to messages addressed to the selected device.

2.3. Other Version 1 and 2 Comparisons

- **Line Monitor View.** Both ASE2000 Versions 1 and 2 show master/remote communication messages in a **Line Monitor View** with Interpreted Data at the right and Raw Data at the left. The entirety of each message is always shown. For ASE2000 Version 1, this is the only way to view communication line traffic. ASE2000 Version 2 supports this view as well as the new **Messages View**.
- **Messages View.** This view provides an alternate format presentation of master/remote communication messages, one message per line, with time, direction, and message name. This compact format allows presentation of many more messages, in the same monitor space, than the **Line Monitor** view, and makes it easier to locate a particular message. Clicking on any message generates an expanded view of that message, frequently with more information than contained in the **Line Monitor** View. The **Messages View** is useful when the user wants to see details of selected messages only. The **Line Monitor View** is useful to see details on all messages.
- **Tool Bar.** In response to user requests, the layout has been changed to include ICONs for frequently selected options.

3. Software Installation

The ASE2000 Version 2 Test Set is a .NET application that can operate under Windows XP, Windows Vista, or Windows 7 and 8 and requires installation of both ASE and Microsoft components.

ASE
- ASE2000 Version 2 software
- BCOM-USB or USB Dongle I/O driver

Microsoft
- .NET Framework 4 (Later releases of the ASE2000 may require a newer version of Framework).
- SQL Server, Compact Edition Version 3.5

3.1. Windows Operating System Support

ASE2000 Version 2 operates under Window XP, Vista, Windows 7 and 8. It is not supported on older Microsoft operating systems or in any non-Windows operating system. A single ASE2000 executable is supported on both 32-bit and 64-bit versions of the operating systems but requires installation of the appropriate I/O driver, 32-bit or 64-bit, for the Windows system being used.

3.2. Hardware Requirements

ASE2000 Version 2 operation requires an ASE-manufactured BCOM-USB device or USB Dongle. (An exception exists for trial mode).

The ASE2000 Version 2 will not operate with an ASE PCMCIA communication card unless a BCOM-USB or USB Dongle is also present.

ASE's BCOM-USB device contains two RS-232 channels both capable of bit or byte communication. It also supports 5 VDC power and RS-232 connection to ASE's dual channel modem, similar to connection with ASE's PCMCIA card.

Users with a PCMCIA-based ASE2000 Version 1 package and wishing to upgrade to Version 2 must also upgrade their PCMCIA card to a BCOM-USB device or ASE USB Dongle. Contact ASE sales at sales@ase-systems.com for details on the upgrade process.

ASE2000 Version 1 will continue to operate with the BCOM-USB device as long as release 1.47 or later is installed. That is, upgrade customers will be able to use Version 1 or Version 2 software with the BCOM-USB device. Upgrade customers are allowed to retain their PCMCIA card until the new BCOM-USB device is delivered.

For serial operations, the ASE2000 can use both ports on the USB-BCOM board or any other serial port as long as it is supported by a Windows compatible COM port I/O driver.

For network operation, the ASE2000 operates over any standard network device (NIC) using a standard Windows I/O driver.

3.3. Installation Setup

Microsoft components, .NET Framework and SQL Server, if not already present, will be automatically installed during the ASE2000 installation process. Only the English language versions will be automatically installed. If non-English versions are required, they should be installed manually before the ASE2000 installation. This requires Internet connection.

3.4. Installation Procedure

To install and run the ASE2000 Version 2:

- For non-English operation, make sure the appropriate language .NET Framework and Compact SQL components are installed before installing the ASE2000
- Install the ASE2000 Version 2 software. This will install .NET Framework and Compact SQL components if required.
- For a fully licensed version, install the I/O driver for the ASE BCOM-USB dual channel device or USB key. Install the driver version appropriate for your Windows version (32-bit or 64-bit).
- For a trial version, download and install a trial version setup program from www.ase-systems.com. More details can be found on that web site

4. Quick-Start Guide

The following “Quick-Start” sections contain step-by-step procedures that will enable the user to quickly get “up-and-running” for basic test set operations. Quick-Start procedures are provided for the Operational Modes, Task and Exchange, and for the Communication Modes, Master Simulation, RTU Simulation, and Monitor.

The procedures consist of steps which are common for any test set operation and steps that are protocol dependent. The set-up for any test set operation consists of the following main areas:

1. Physically connect Test Set PC to the communication circuit
2. Launch ASE2000 Test Set application
3. Select Operational Mode, Task Mode or Exchange Mode
4. Select and configure protocol
5. Configure communication settings
6. Select Communication Mode and start communicating

Additional “quick-start” information is contained in protocol specific sections. These sections can be located by performing a search on the string “quick-start” (omit the quotes).

4.1. Physical Connection to Communication Circuit

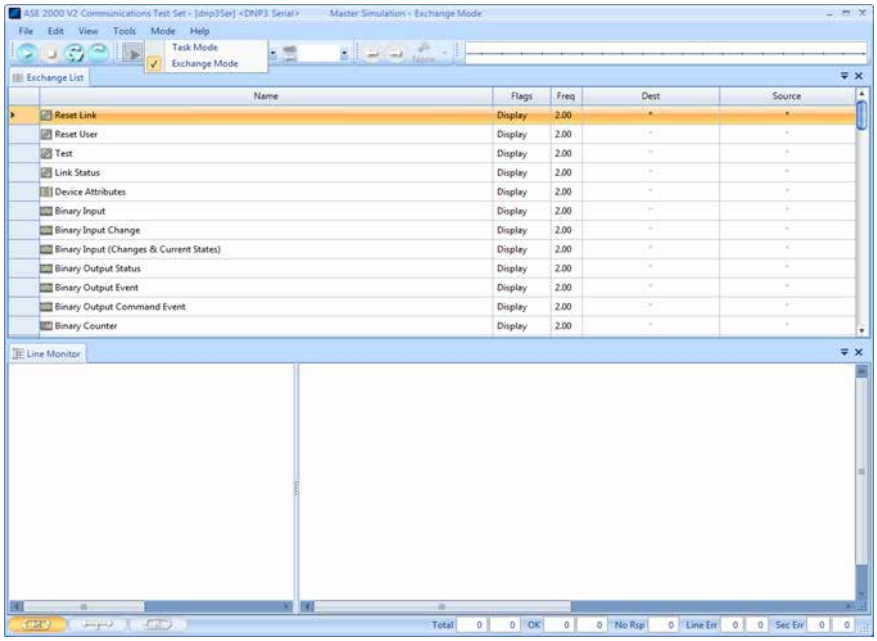
The first step of set-up is the physical connection of the test set PC to the communication circuit. How the test set PC is connected to the communication circuit depends on a number of factors but it is basically determined by the physical characteristics of the communication circuit and the test set Communication Mode to be used. Refer to the diagrams and descriptions contained in the section ASE2000 Cabling for the configuration that matches the test environment to be used. Once the physical connection has been made, proceed to the next step.

4.2. Launch ASE2000 Test Set Application

From the Windows Start button, select “All Programs > ASE>ASE2000 V2 Communications Test Set>ASE2000 V2 Comm Test Set” or, if a shortcut was previously created on the desktop, select the ASE2000 V2 icon to launch the ASE2000 application.

4.3. Select Operational Mode – Task Mode or Exchange Mode

Once the ASE2000 application has started, the next step is to select the desired Operational Mode. If it is the first activation of the ASE2000 software on the PC, the ASE2000 will, by default, start in Exchange Mode. If there have been previous executions of the ASE2000 on the PC, the default Operational Mode will be the mode the test set was in upon exit of the previous execution. Also, if the last Operational Mode was Exchange Mode and the test environment was saved in a MONX file, the last used MONX file will automatically be opened on start-up. If in Task Mode at the time of exit of the previous execution, then Task Mode will be the default start-up Operational Mode and the default “active RTU” will be the last RTU selected. To select other than the default Operational Mode, select Mode from the task bar then select the desired mode.



4.4. Selection and Configuration of Protocol

The method for selection and configuration of protocol will depend on the Operational Mode.

4.4.1. Exchange Mode Protocol Selection and Configuration

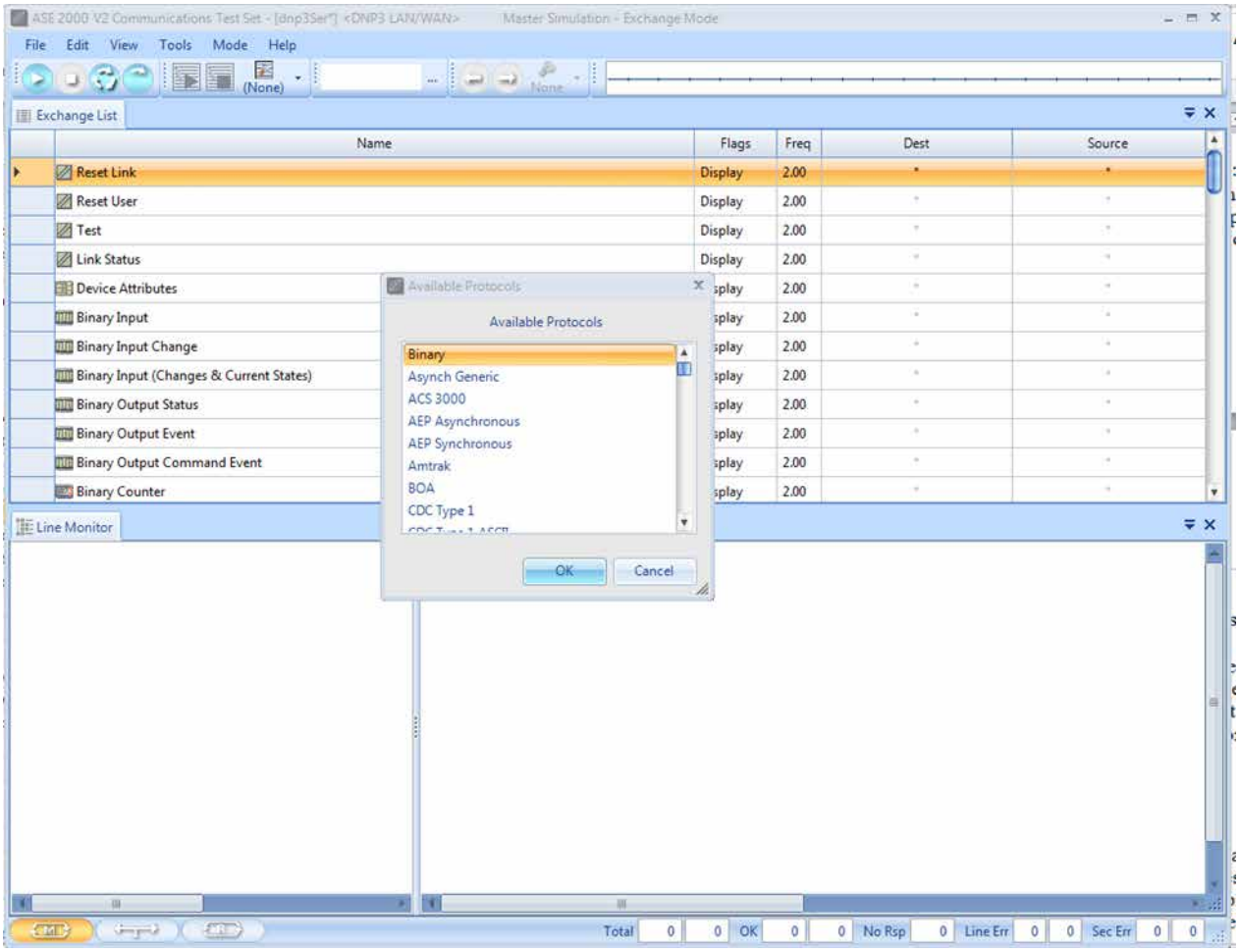
In Exchange Mode, protocol selection is performed in one of four ways:

- Default protocol on start-up – If the default Operational Mode on start-up is Exchange Mode and there was a saved “MONX” file during the previous execution, the last used MONX file will automatically be loaded on start-up. This will establish operational parameters based on what was previously set in the MONX file.

- Open existing MONX file – To establish an operating environment based on a previously saved MONX file, from the task bar select “File > Open” and browse to the folder containing the previously saved MONX file. Select the file and then select “Open”. This will establish operational parameters based on what is contained in the MONX file.

- Open existing MON file – A MON file is similar to a MONX file, but created by ASE2000 Version 1 software. The procedure for opening a MON file is similar to opening a MONX file. The file type, MON or MONX, is selectable from a pull down list in the bottom right portion of the file open menu.

- Select protocol from protocol menu – On initial execution of the test set software or if a protocol is required for which there is no existing MONX file, the required protocol is selected from the Available Protocols menu. From the task bar select “File > Select Protocol” then select the required protocol from the list. The Exchange List view will be updated to contain the set of exchanges (commands, protocol messages) specific to the selected protocol. All other operational parameters will be set to default values and will have to be modified for the current test environment. This may include communication settings, device specific settings (RTU ID, point configuration, etc.), and protocol specific settings.

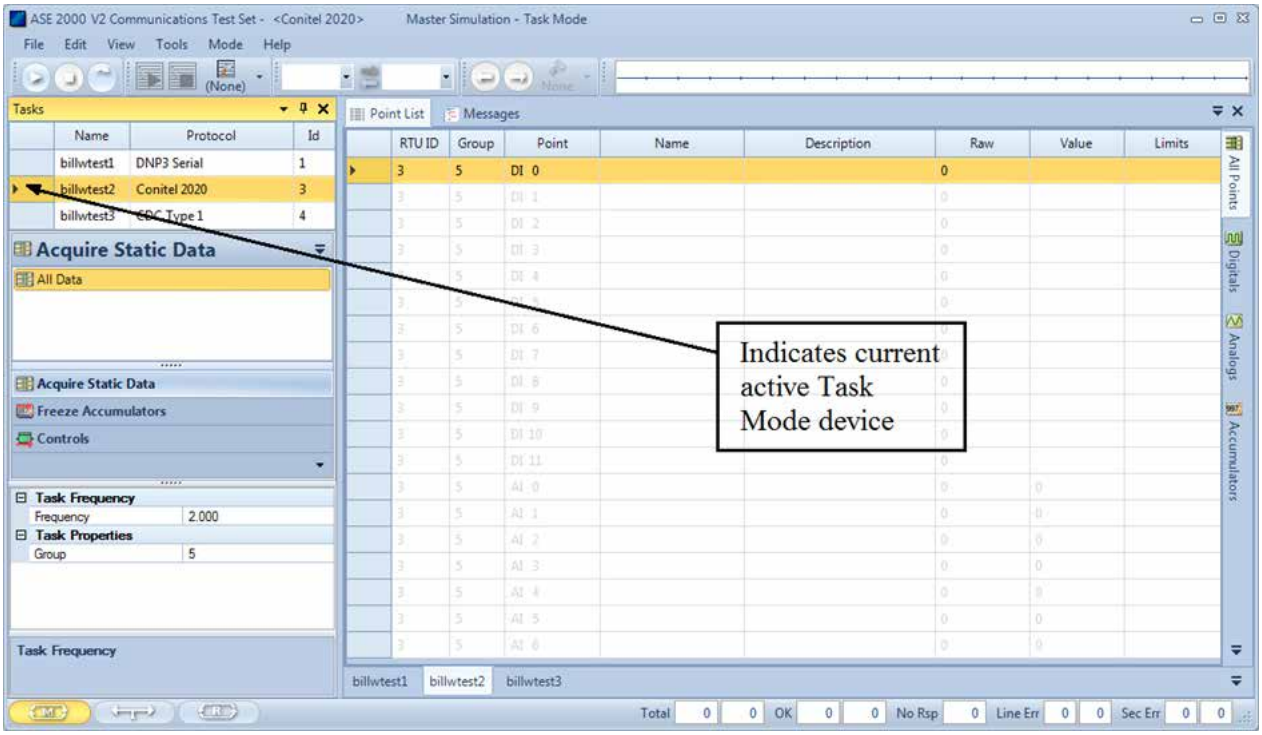


4.4.2. Task Mode Device Selection and Configuration

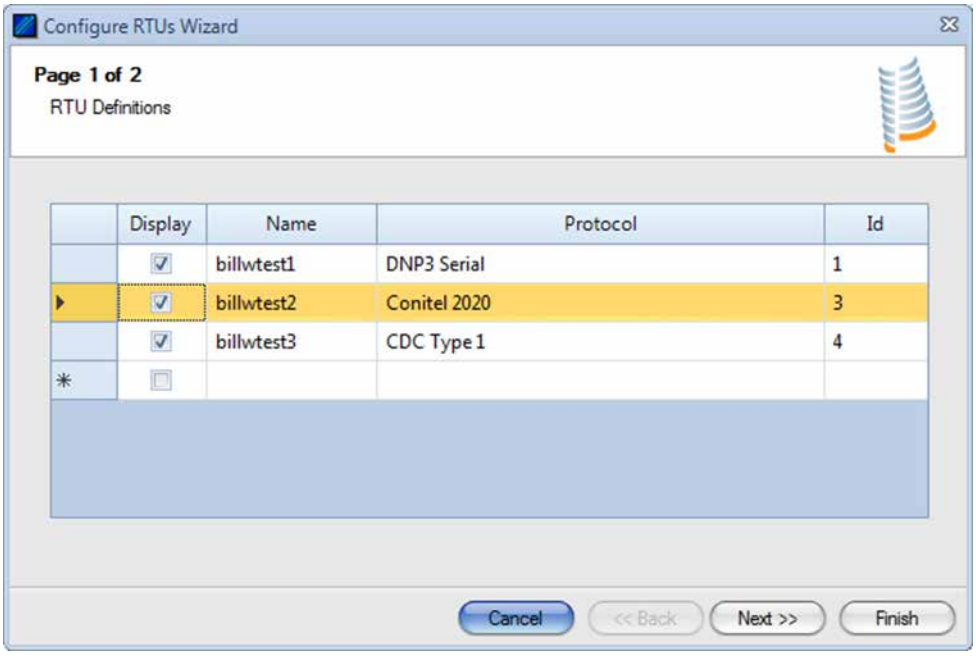
In Task Mode, protocol selection and configuration is accomplished by selecting a device where protocol is a property of the device selected. Device selection is performed in one of three ways:

- **Default device on start-up** – If the default Operational Mode on start-up is Task Mode and there was an “active” device during the previous execution, the last active device will be the default active device on start-up.

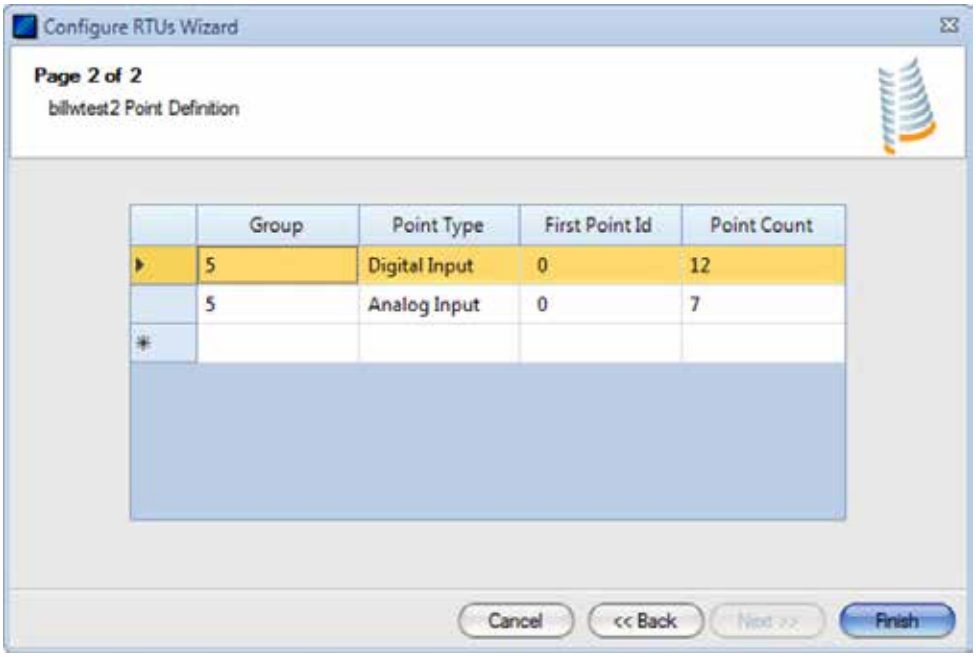
- **Select previously defined device** – To select a device that is different than the current active device, select from the list of displayed devices in the “Task” window. If the required device has been previously defined but does not appear in the list of displayed devices, select “Edit > Configure RTUs…” and check the “Display” check box for the desired device then select “Finish”. The device should now be displayed in the devices area of the Task window and can be selected as the active device by clicking on the line containing the device.



- **Define new device** – On initial execution of the test set software or if a new device definition is required, use the “Configure RTUs Wizard” to define the new device. Select “Edit > Configure RTUs…” to bring up the Configure RTUs Wizard page. On the line containing the *, enter the device Name, Id, and select the appropriate protocol from the Protocol drop-down list. When the device information has been entered, select the “Next>>” button which will bring up the point configuration display. Using the entry fields, enter “Point Type”, “First Point Id”, and “Point Count”. When the point configuration entry is complete, select the “Finish” button to exit the Configure RTUs Wizard.



Enter device name, select device protocol from pull-down list and enter device (RTU) Id. Note that not all protocols are fully supported in Task Mode. If the box in the Display column is checked, the device is *Active* and will appear in the Task pane. Then, select Next to enter device point configuration.



4.4.3. CSV Point List Import / Export

A new RTU and point list may also be imported from text files. The file format used is CSV (comma-delimited values), a text-viewable format interchangeable with Excel and other applications. In some regions, characters other than comma are used as delimiters and are also supported.

A simple example of the file format looks like this (as viewed in Notepad):

Name,Protocol,Id,PointName,PointType,PointId
Conitel,Conitel 2020,5,,AI,0
Conitel,Conitel 2020,5,,AI,1

In Excel, this same file appears as:

Name	Protocol	Id	PointName	PointType	PointId
Conitel	Conitel 2020	5		AI	0
Conitel	Conitel 2020	5		AI	1

In the above example, the RTU name is ‘Conitel’, the Protocol is ‘Conitel 2020’, and the RTU Id is 5. Each line defines a point of type ‘AI’; the first with a point Id of 0 and the second is 1. Note that no point names are provided, but the delimiting commas are still required to maintain positioning order with the header description in the first line.

Other point fields may be provided, but the minimum requirement is for PointType and PointId to be provided with a header line and at least one data point. The minimum data is therefore:

PointType,PointId
AI,0

During import, the user is prompted for additional information necessary to create the RTU: RTU Name, Protocol and RTU Id.

Importing Point Lists

To import a new RTU and its points from a CSV file, select Import from the File menu and choose CSV Point List from the sub-menu.

An Open File dialog box will appear. Choose a directory and filename and press the '**Open**' button to begin the import. During import processing, the user is prompted to confirm the RTU Name, Protocol and RTU Id. If any information is missing, it must be provided before continuing. Duplicate RTU names are not allowed. Press '**OK**' to proceed with importing.

After a successful import, the RTU is added to the Current RTU List and its points are displayed in the lower grid. An imported RTU is not automatically set to Active. To activate the imported RTU, use the '**Configure RTUs…**' wizard. Another import may be started by pressing the '**Import**' button.

If the import is not successful, the import file contents and detailed information on the import attempt may be viewed. Correct any issues flagged with '***' and retry the import.

Exporting Point Lists

Users may also export an existing RTU and its points to a CSV file for viewing and editing in Excel. Since all supported columns are written out, the export feature is helpful in creating a template for one or more new RTU Point Lists. To access the Export feature, select Export from the File menu and choose CSV Point List from the sub-menu.

The Export dialog box will appear. Select one of the RTU from the Current RTU List. All defined RTU are displayed in the list whether Active or not. When the RTU is selected, its point list is displayed in the grid below. All fields are read-only. To make changes to the RTU before export, close this dialog and use the '**Configure RTUs…**' wizard. To export the point list data press the '**Export**' button to choose a directory and filename. Press the '**Save**' button to write the CSV file.

4.5. Protocol Specific Configuration

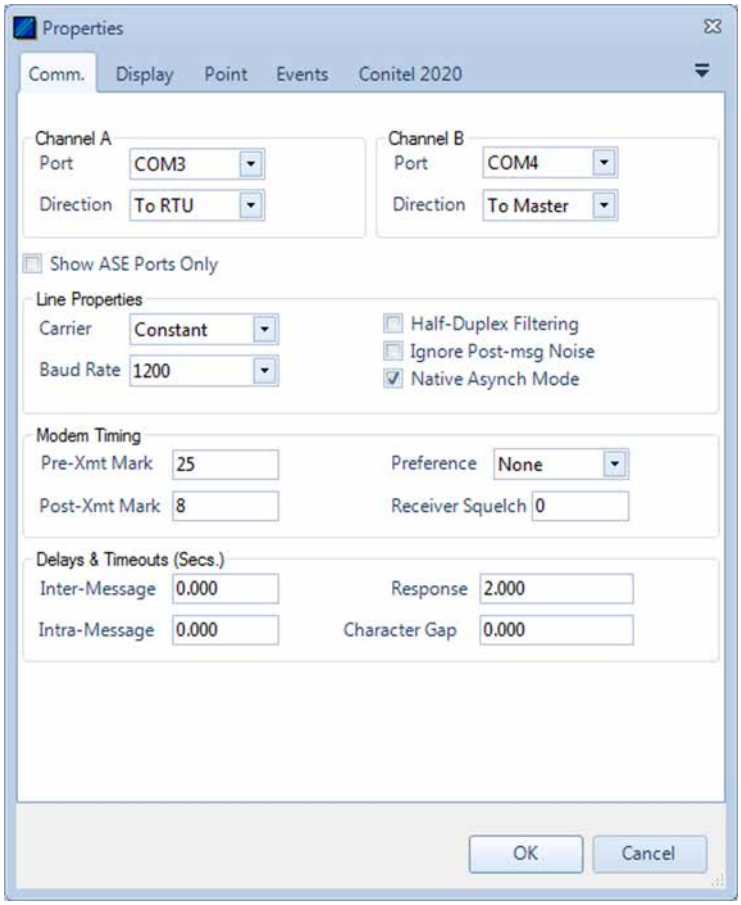
Quick-Start instructions for protocol specific information is contained in individual protocol specific sections. These sections can be located by performing a search on the string "quick-start" (omit the quotes). Perform the required protocol specific configuration then proceed with Configuration of Communication Settings.

4.6. Configuration of Communication Settings

With the physical connection between the test set PC and the communication circuit established, the ASE2000 software running, and the Operational Mode established, the next step is to set the communication parameters to reflect the physical properties of the connection. The next sections describe the procedures for setting parameters for serial data communication and for network connections.

4.6.1. Communication Settings for Serial Data Communication

Configuration of communication settings for serial data utilizes the Properties display and Comm tab. From the main task bar, select "Tools > Properties > Comm tab".



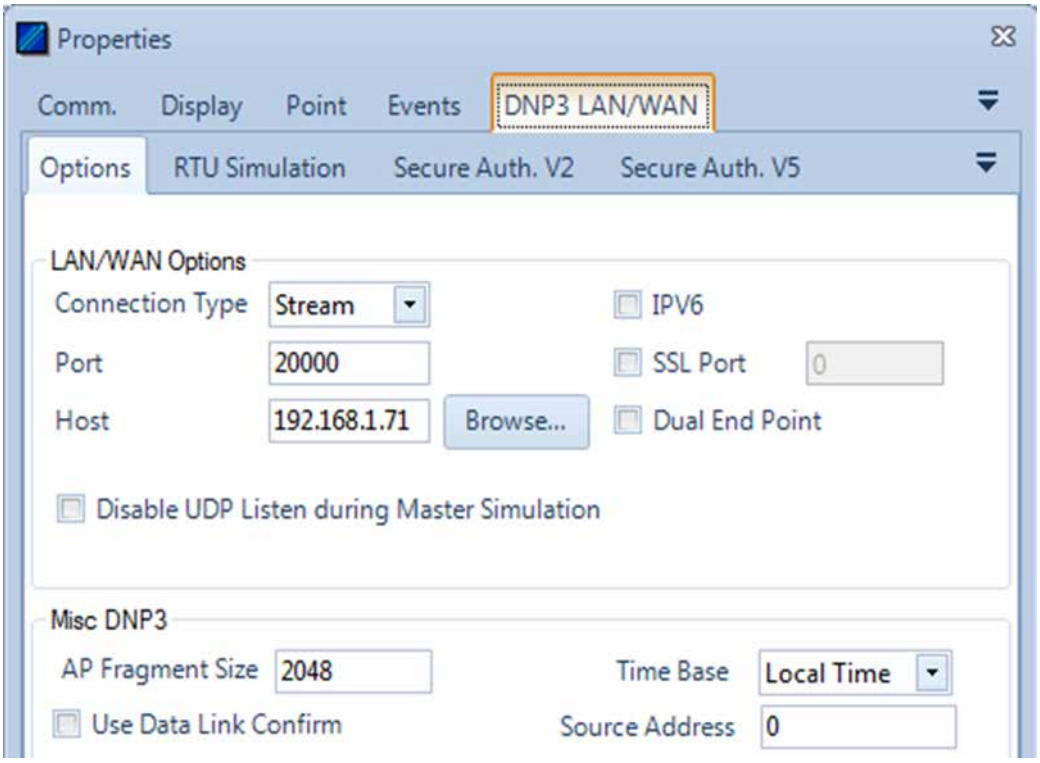
Verify current settings and, where appropriate, modify the settings for the current test session. **NOTE**: If a switch to a different Operational Mode is performed after modification of a communication setting, re-check the settings as they may have changed as a result of the mode switch.

1. Verify the Channel A and Channel B Direction settings reflect the physical connection between the test set PC and equipment being tested. If working in Master Simulation or RTU Simulation mode, only one channel connection is necessary.
2. Under Line Properties, set Carrier setting. In most cases, Switched or Constant will be used. If the physical connection utilizes a Null Modem or a real modem, the setting should be Switched. Otherwise, use Constant. For the other settings, see the more detailed description of the communication settings.
3. Verify Baud Rate matches baud rate of device to be communicated with.
4. If the selected protocol is byte-oriented, check the “Native Async Mode” check box. For bit-oriented protocols, un-check it.
5. The default Modem Timing settings will usually work in most circumstances.
6. The default Delays & Timeouts will usually work in most circumstances.

Communication Settings for Network Communication

Configuration of communication settings for network communications utilizes the Properties display and the “protocol specific” tab (DNP3 WAN/LAN, Modbus TCP, or IEC 60870-5-104). From the main task bar, select Tools > Properties > “protocol specific” tab. In most cases, the default parameters will be sufficient. For Master Mode, it is necessary to enter the IP address of the Slave device. This is entered in the Host field. For RTU Simulation and Monitor Mode it is not necessary to enter an IP address. Select IPv6 when monitoring devices or providing Host addresses using the broader IPv6 address space. (Other options are protocol specific and described in their respective sections.)

▶ *IPv4 is a 32-bit Internet Protocol addressing mechanism represented as four 8-bit decimal values separated by dots as in: “192.168.0.148”. With the explosion of the internet and devices using these addresses, IPv6 was introduced with a larger, 128-bit addressing mechanism in the form of eight 16-bit hexadecimal values separated by colons as in: “2013:08be:9ce8:0000:0000:0000:ff00:034d”.*



4.7. Select Communication Mode and Start Communicating

With the previous quick-start steps complete, the next step is to select the desired Communication Mode.

In the lower left corner of the test set screen is a set of Communication Mode selection icons.

The leftmost icon  selects Master Simulation Mode.

The middle icon  selects Monitor Mode

The rightmost icon  selects RTU Simulation Mode

With Communication Mode selected, start/stop communication by selecting the desired action from the “Player Bar”. The Player Bar is normally located in the upper left area of the test set screen. The content of the Player Bar is context sensitive and displayed content will depend on Operational Mode and Communication Mode.

The  icon is the Start Communication icon and is used in all modes

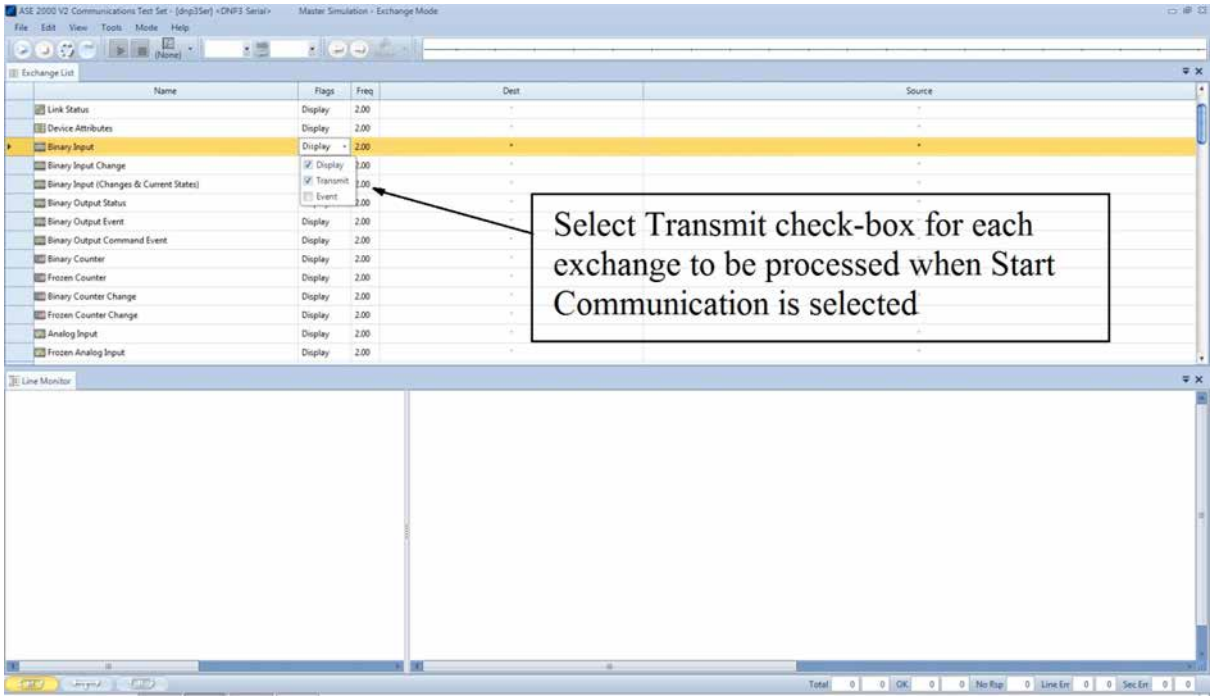
The  icon is the Stop Communication icon and is used in all modes

The  icon is the Send Continuous icon and is only used in Exchange Mode / Master Simulation Mode

The  icon is the Send Once icon and is only used in Exchange Mode / Master Simulation Mode

4.7.1. Exchange Mode – Master Simulation Mode

Three communication options are available; Send Once, Send Continuous, Selected Exchanges. Send Once and Send Continuous are used with a single exchange. From the Exchange View, select the line containing the desired exchange then select Send Once or Send Continuous. It is also possible to specify multiple exchanges to be used in a communication session. This is done by selecting the Flags field for the desired exchanges, setting the check-box for Transmit, and selecting the Start Communication Player icon. All exchanges with the Transmit flag set will be repeated continuously at the configured frequency.



4.7.2. Exchange Mode – Monitor Mode

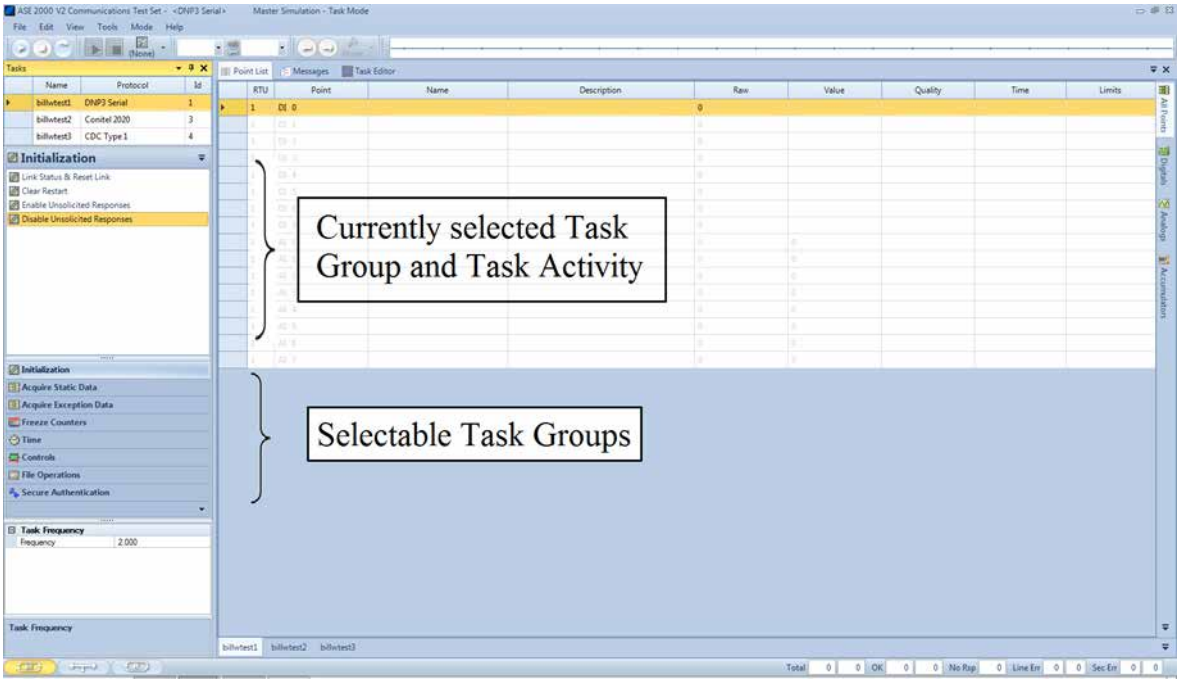
Select the Start Communication icon.

4.7.3. Exchange Mode – RTU Simulation Mode

Select the Start Communication icon.

4.7.4. Task Mode – Master Simulation Mode

In Exchange Mode, one or more individual exchanges are selected for processing. In Task Mode, Task Activities are selected for processing. The actual protocol exchanges associated with each Task Activity are pre-determined based on protocol.



Select the desired Task Group, select the desired Task Activity, and then select the Start Communication Player icon. The selected activity will be repeated continuously at the configured frequency. To perform the selected activity once, select the Once icon.

4.7.5. Task Mode – Monitor Mode

The only Task Group available is “Scan Responses” so no “Task” selection is necessary. Select the Start Communication icon

4.7.6. Task Mode – RTU Simulation Mode

The only Task Group available is “Scan Responses” so no “Task” selection is necessary. Select the Start Communication icon

5. File Types

The ASE2000 Communication Test Set V2 interacts with several different file types referenced in their respective topics:

MONX files contain Exchange Mode configuration information including the protocol, window layout, and user and data entry values. The default file extension for an ASE2000 Version 2 configuration file is MONX. MONX files are not compatible with ASE2000 Version 1 configuration files, whose extension is MON. ***MONX files are applicable to Exchange Mode operation only*** and can neither be saved nor opened while running in Task Mode.

MON files contain Exchange Mode configuration information similar to .MONX files, but were generated with ASE2000 V1. Once opened in ASE2000 V2, it is recommended to save the configuration in a .MONX file. Changes made to the configuration cannot be saved to a .MON file format.

MSGX files contain Communication Message data as shown in the Line Monitor and Messages view. A saved MSGX file can be sent to another ASE2000 user for viewing.

CSV files are 'Comma-Separated Value' columnar data stored in a readable text format. CSV files are supported by Microsoft Excel for convenient handling. Although the comma "," character is most frequently used as the column delimiter, other displayable punctuation characters (non-alphanumeric) are supported. During a Point List import operation, the delimiting character will be determined by examining the file contents.

PCAP/PCAPNG files are capture files produced by the Wireshark network utility. Beginning with Build 2.17, these files may be directly imported into the ASE2000 V2 Test Set.

TXT files are text files containing communication message data. Beginning with Build 2.18, communication data represent as text may be imported into the ASE2000 V2 Test Set if compliant with representation guidelines.

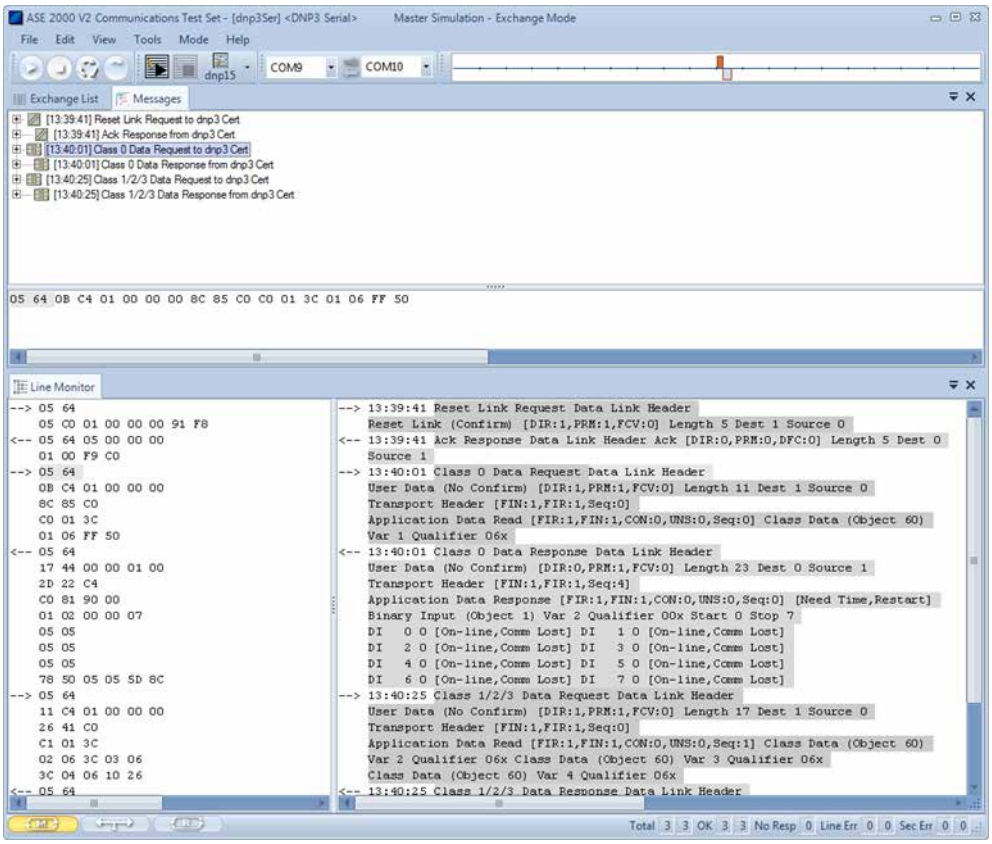
6. Communication Message Processing

This section describes the test set capability for saving and viewing previously saved communication messages. Communication Messages are *initially* generated as the result of communication or attempted communication between two or more devices. From the test set perspective, Communication Messages result from Master Mode operation, Monitor Mode operation, or RTU Simulation Mode operation and applies to both Exchange Mode and Task Mode. During a live communication session (Master Mode, RTU Simulation, or Monitor Mode), communication messages are always stored in the *Current Message Buffer*. This is an internal temporary storage area within the test set specifically intended to store communication message data. In addition, the *Current Message Buffer* is used to store:

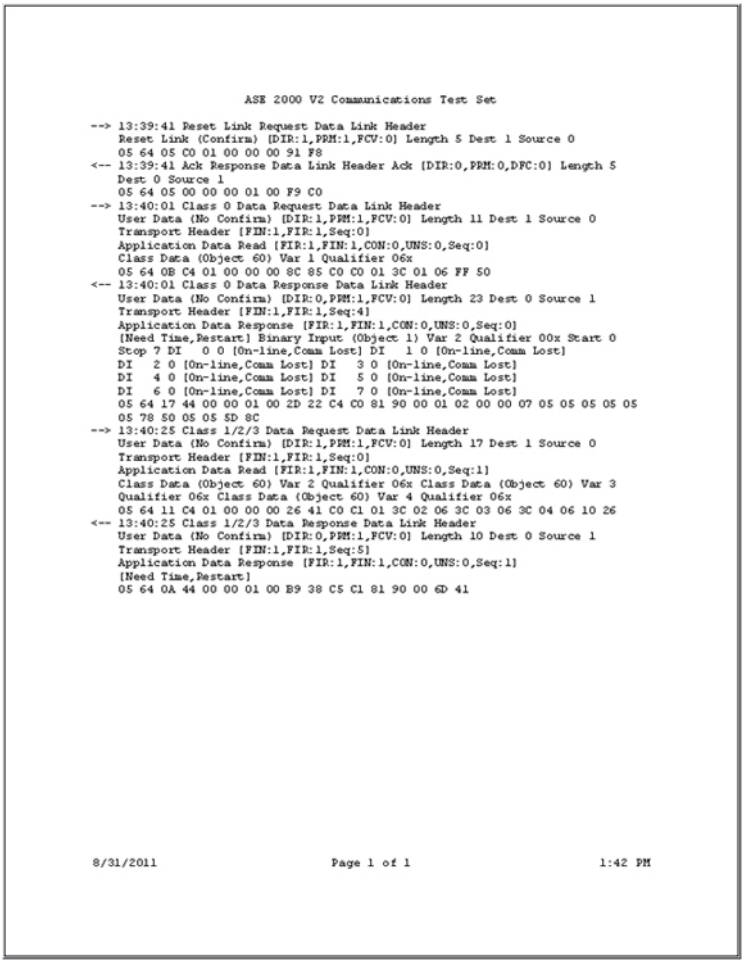
- Communication message data resulting from importing previously saved message data from a .MSGX file (File > Import> Communication Messages).
- Communication message data previously stored in a capture file when the View Capture option is selected.

When the “File > Export > Communication Messages” option is selected, the data stored in the *Current Message Buffer* will be written to the designated .MSGX file.
The Line Monitor or Messages views will display data currently in the *Current Message Buffer* regardless of where the message data was obtained.

The following screen shot illustrates the same message data displayed in the Messages view and the Line Monitor view.



Also, the message data as shown in the Line Monitor View can be printed to a Windows supported printer, a searchable PDF file, or other printer file types. Printing to a file provides a convenient means for sharing the message data with another party. In the printed version of the message data, the raw data as show in the left window pane above is merged with the interpreted message data as shown below.



ASE 2000 V2 Communications Test Set

```
--> 13:39:41 Reset Link Request Data Link Header
    Reset Link (Confirm) [DIR:1,PRM:1,FCV:0] Length 5 Dest 1 Source 0
    05 64 05 C0 01 00 00 00 91 F8
<-- 13:39:41 Ack Response Data Link Header Ack [DIR:0,PRM:0,DFC:0] Length 5
    Dest 0 Source 1
    05 64 05 00 00 00 01 00 F9 C0
--> 13:40:01 Class 0 Data Request Data Link Header
    User Data (No Confirm) [DIR:1,PRM:1,FCV:0] Length 11 Dest 1 Source 0
    Transport Header [FIN:1,FIR:1,Seq:0]
    Application Data Read [FIR:1,FIN:1,CON:0,UNS:0,Seq:0]
    Class Data (Object 60) Var 1 Qualifier 06x
    05 64 0B C4 01 00 00 00 8C 85 C0 C0 01 3C 01 06 FF 50
<-- 13:40:01 Class 0 Data Response Data Link Header
    User Data (No Confirm) [DIR:0,PRM:1,FCV:0] Length 23 Dest 0 Source 1
    Transport Header [FIN:1,FIR:1,Seq:4]
    Application Data Response [FIR:1,FIN:1,CON:0,UNS:0,Seq:0]
    [Need Time,Restart] Binary Input (Object 1) Var 2 Qualifier 00x Start 0
    Stop 7 DI   0 0 [On-line,Comm Lost] DI   1 0 [On-line,Comm Lost]
    DI   2 0 [On-line,Comm Lost] DI   3 0 [On-line,Comm Lost]
    DI   4 0 [On-line,Comm Lost] DI   5 0 [On-line,Comm Lost]
    DI   6 0 [On-line,Comm Lost] DI   7 0 [On-line,Comm Lost]
    05 64 17 44 00 00 01 00 2D 22 C4 C0 81 90 00 01 02 00 00 07 05 05 05 05 05
    05 78 50 05 05 5D 8C
--> 13:40:25 Class 1/2/3 Data Request Data Link Header
    User Data (No Confirm) [DIR:1,PRM:1,FCV:0] Length 17 Dest 1 Source 0
    Transport Header [FIN:1,FIR:1,Seq:0]
    Application Data Read [FIR:1,FIN:1,CON:0,UNS:0,Seq:1]
    Class Data (Object 60) Var 2 Qualifier 06x Class Data (Object 60) Var 3
    Qualifier 06x Class Data (Object 60) Var 4 Qualifier 06x
    05 64 11 C4 01 00 00 00 26 41 C0 C1 01 3C 02 06 3C 03 06 3C 04 06 10 26
<-- 13:40:25 Class 1/2/3 Data Response Data Link Header
    User Data (No Confirm) [DIR:0,PRM:1,FCV:0] Length 10 Dest 0 Source 1
    Transport Header [FIN:1,FIR:1,Seq:5]
    Application Data Response [FIR:1,FIN:1,CON:0,UNS:0,Seq:1]
    [Need Time,Restart]
    05 64 0A 44 00 00 01 00 B9 38 C5 C1 81 90 00 6D 41
```

8/31/2011 Page 1 of 1 1:42 PM

There are two basic facilities for saving and viewing previously saved messages, the Message Export/Import facility and the Capture facility. The two facilities provide similar capability in that they both store communication message data in a form that can be later retrieved and viewed. The differences are that the Message Export/Import facility can be used to save whatever is currently in the *Current Message Buffer* and is limited by the size of the *Current Message Buffer* whereas the Capture facility must be enabled prior to the start of a communication session.

6.1. Message Export/Import Facility

This facility is used to save current message data and to retrieve message data previously saved in a MSGX file. Since the save process is initiated after a communication session has occurred and while the data of interest is still in the *Current Communication Buffer*, it is a useful tool for preserving an unexpected occurrence for later analysis.

To save the contents of the *Current Communication Buffer*, communication must be stopped. Select “File>Export>Communication Messages”, specify a folder and file name, select “Save”.

To retrieve message data from a previously saved MSGX file, Select “File>Import>Communication Messages”, specify a folder and file name, select “Open”. The contents of the specified file will be read and stored in the *Current Communication Buffer* where it can be viewed in the Messages view, the Line Monitor view, and printed from the Line Monitor view.

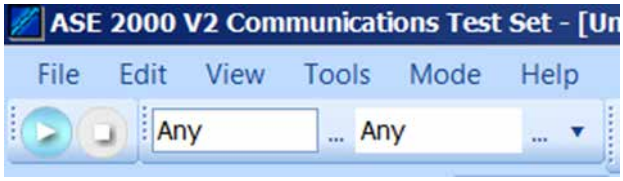
6.2. Message Import Wireshark Files

Release 2.17 and later allows import of *pcap* and *pcapng* files generated by the network traffic capture program Wireshark. This feature is available only for Wireshark files containing DNP3 LAN/WAN, IEC 60870-5-104, or Modbus/TCP traffic.

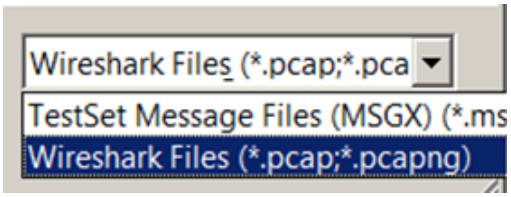
The ASE2000 V2 must be licensed. While data captured by a licensed ASE2000 V2 and saved to a MSGX file can be loaded and read by an unlicensed ASE2000 V2 or by the free ASE Message Viewer utility, Wireshark file data import is a licensed feature only.

To import an applicable Wireshark file:

- Exchange Mode: File menu ➔ Select Protocol, choose the applicable protocol
- Task Mode: Select or create a device for the applicable protocol
- It is recommended to select Monitor mode so that filters for both master and remote can be entered as described in the next bullet. Import may work in some, but not all, cases from other modes
- To determine message direction, IP addresses for master and remote devices must be entered in the IP filter area at the top of the ASE2000 screen. A filter of “Any” can be used for DNP3 since that protocol contains direction information in each message. “Any” will not work for IEC 60870-5-104 or Modbus/TCP



- Under Tools, Properties, and the tab specific to the protocol being used (it is always the rightmost tab), make sure that the *Port* setting is the same as used when Wireshark created the file. The ASE2000 sets this field to the default port for each protocol, but a different port can be configured
- Open the file: File menu ➔ Import ➔ Communication Messages
- From the pull-down list in the bottom right corner of the file open menu, set the type to Wireshark



- Locate and open the file

The Wireshark file will be opened with data applicable to the selected protocol extracted and shown in the line monitor and messages views, the same as if the ASE2000 had detected those messages in a normal monitoring session.

A Wireshark file may contain more messages than the in-memory import of the Test Set supports. If this is the case, start a Test Set capture before import to place Wireshark messages in a Test Sets capture file, which can then be viewed or searched. The user may also want to use the capture filter feature to pinpoint the messages of interest.

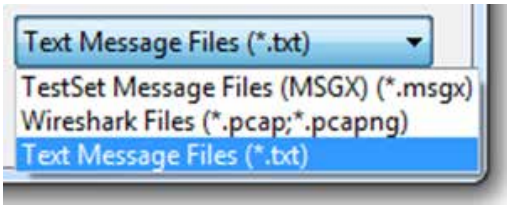
6.3. Message Import Text Files

Release 2.18 and later allows import of message data from text files, usually with a *.txt* file extension.

The ASE2000 V2 must be licensed. While data captured by a licensed ASE2000 V2 and saved to a MSGX file can be loaded and read by an unlicensed ASE2000 V2 or by the free ASE Message Viewer utility, text file import is a licensed feature only.

To import message data from a text file:

- Exchange Mode: File menu ➔ Select Protocol, choose the applicable protocol
- Task Mode: Select or create a device for the applicable protocol
- It is recommended to choose Monitor mode so that filters for both master and remote can be entered as described in the next bullet. Import may work in some, but not all, cases from other modes
- Open the file: File menu ➔ Import ➔ Communication Messages
- From the pull-down list in the bottom right corner of the file open menu, set the type to Text Message Files



- Locate and open the file

The text file will be opened with data applicable to the selected protocol extracted and shown in the line monitor and messages views the same as if the ASE2000 V2 had detected those messages in a normal communication session.

6.3.1. Text Message File Structure

Data in the text file must comply with the following requirements to be successfully parsed into protocol message data.

- **Direction Indicator** – Master to Slave: '>' character must proceed data bytes
- **Direction Indicator** – Slave to Master: '<' character must proceed data bytes
- **Time Stamp** – Time (if present): must be enclosed within '[' and ']' characters and must comply with ISO 8601 format. This is a time zone independent date and time representation
- **Data stream** – Data is a sequence of hexadecimal bytes separated by space characters. Bit protocol data may be parsed if expressed as if it was received by ASE hardware

6.3.2. DNP3 Example

Here is a text file data example for the DNP3 protocol.

```
> [2016-05-03T13:36:11.2837940-07:00] 05 64 05 C9 41 00 00 00 B0 88
< [2016-05-03T13:36:11.2847125-07:00] 05 64 05 0B 00 00 41 00 91 5B
> [2016-05-03T13:36:11.3823358-07:00] 05 64 05 C0 41 00 00 00 FF FE
< [2016-05-03T13:36:11.3833393-07:00] 05 64 05 00 00 00 41 00 D2 6B
```

6.4. SPT Import Files

Release 2.21 and later allows import of message data from SPT files using a .001 extension. This is supported for several protocols (tested using DNP3, Modbus RTU, CDC Type 1 and 2, and Conitel 2020) using ASE2000's SPT traffic log files. ASE 2000 can display the details of traffic through SPT products using existing offline traffic log files. These logs can be easily retrieved from already running SPT gateways using SPT Editor. Note: Users using SPT products must save these files using .001 file type.

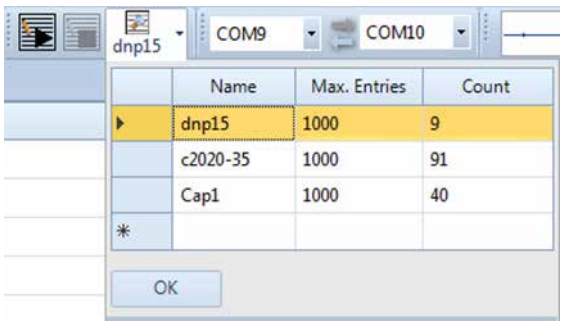
6.4.1. DNP3 Example

02/14/2018 15:30:08:>W DNP 3.0(1:1) [48.812] PHY .....: 3C 03 06 3C 02 06 3C 01 06 39 9D
02/14/2018 15:30:08:>W DNP 3.0(1:1) [49.125] PHY Rcv (10): 05 64 25 44 00 00 01 00 D9 8D
02/14/2018 15:30:08:>W DNP 3.0(1:1) [49.437] PHY Rcv (36): C7 C7 81 10 00 01 01 00 00 07 00 1E 04 00 00 07
02/14/2018 15:30:08:>W DNP 3.0(1:1) [49.437] PHY .....: 1D 36 00 00 00 00 00 00 00 00 00 00 00 00 00 00
02/14/2018 15:30:08:>W DNP 3.0(1:1) [49.437] PHY .....: 00 00 FF FF

6.5. Message Capture Facility

This facility provides similar capability to the Message Export/Import facility in that it also provides for saving and retrieving message data. The primary difference is that it allows the user to store a much larger number (user configurable) of messages. Also, message capture must be enabled prior to starting a communication session. Unlike the Message Export/Import facility, the Message Capture facility does not use a Windows file to store message data but rather a Capture Database that contains one or more Capture Sessions.

To initiate a capture session, use the Capture name select drop-down menu in the task bar to select an existing capture name or define a new name and specify the maximum size, in messages. The Count field shows the number of messages currently stored in the named capture session.



The currently select capture session name is displayed in the Task Bar.

Capturing can be started, stopped, and paused using the "player" buttons located in the task bar. The capture player controls are independent from the communication player buttons so that it is possible to start, stop, and pause capturing without affecting data communication. However, only communication messages that occur while capturing is active (start button pressed) will be saved. It is important to be aware of the functioning of the capture player buttons as it affects when data is captured and when the contents of the capture session are reset.

- Pressing the Play button  will cause new communication messages to be stored in the

current capture session as they occur. The Play icon will be replaced by the Pause  icon and the Stop  icon will be selectable. If capturing was in a stopped state, rather than a paused state, when the Play button was pressed the prior contents (if any) of the capture session will be reset (erased).

- Pressing the Pause  icon will suspend capturing and the Pause icon will be replaced with the Play icon. The Stop icon will still be selectable since capturing is only in a paused state. Capturing can be resumed without resetting the contents of the capture session by pressing the Play icon.

- Pressing the Stop  icon will stop message capturing. CAUTION, from a stopped state, pressing the capture play button will cause the contents of the currently selected capture session to be erased.

With capturing and communication both in a stopped state, the contents of the currently selected capture session can be viewed by selecting “File>View Capture” or a different capture file may be selected for viewing.

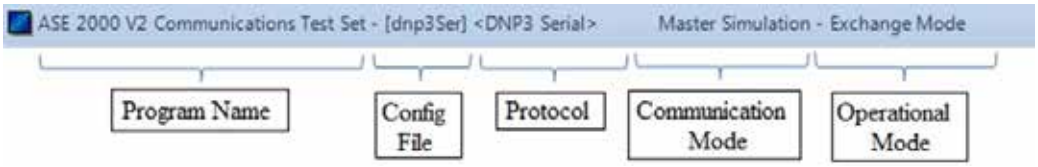
7. Screen Layout

The main areas of the ASE2000 screen are, top to bottom:

7.1. Title Line

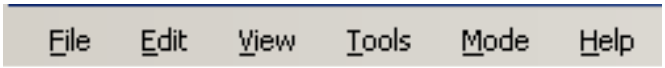
The Title Line appears at the top of the screen and presents operational information:

- Program Name
- The loaded MONX (configuration) file name
- The currently selected protocol
- Communication Mode (Master Simulation, RTU Simulation, or Monitor mode)
- Operational Mode (Exchange or Task mode)



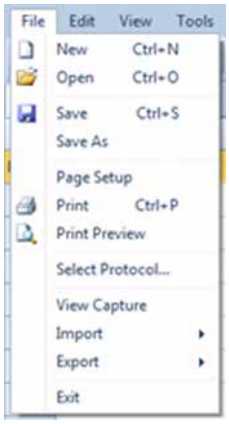
7.2. Menu Bar

The Menu Bar, the second line from the top, contains the set of pull-down menus.



7.2.1. File Menu

Contents of the file pull-down menu are as shown. Some of the entries in the File Menu are context sensitive and will be “grayed out” if the option is not available in the current test set mode or test set operation. The first four options are used to create, open, or save a MONX file in Exchange Mode.



The print menu items are present only for views that support printing. This would include Line Monitor, Event Log, Line Analyzer, and Point List.

Individual items on the file pull-down menu are:

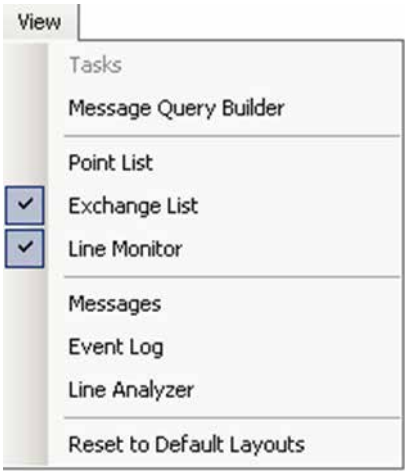
New	Set the ASE2000 to default setting and initial values. Valid in Exchange Mode only
Open	Open an existing MONX file (or ASE2000 Version 1 MON file)
Save	Saves current information into the last used MONX file
Save As	Same as Save, except that you will be prompted to enter a file name prior to saving
Page Setup	Enter print configuration information
Print	Print the current contents of the Line Monitor view
Print Preview	Print preview of the current contents of the Line Monitor view
Select Protocol	Valid in Exchange Mode only, allows selection of any licensed communication protocol. (Task Mode protocol is determined from the selected RTU device.)
View Capture	Views contents of the currently selected capture file. A capture file contains information from a communication session. Available capture files are listed in the sub-menu.
Import	Used to import previously saved Communication Messages (MSGX) file, DNP3 Certification Procedure file, or RTU Point List data in CSV format.
Export	Used to export Communication Messages to a MSGX file for later retrieval and analysis, DNP3 Certification Test results file, or RTU Point List data in CSV format.
1-File Name 2-File Name 3-File Name 4-File Name	The most recently accessed MONX files are shown for convenience (Exchange Mode only).
Exit	Exits the ASE2000

7.2.2. Edit Menu

The Edit pull-down list is context sensitive and appears differently depending on the active view. The contents of this pull-down list are explained later under the section for each applicable view.

7.2.3. View Menu

The View pull-down list provides access to the various Test Set views. Enabled views are identified with a check-box. A disabled view is enabled by selecting that view. An enabled view is disabled by selecting that view.

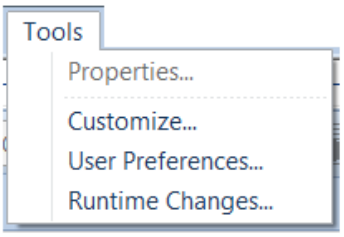


Tasks	Enables the Task List, available only in Task Mode. Task Mode is a new feature not present in ASE2000 Version 1
Point List	The current Point List view is similar to that in ASE2000 Version 1. It displays point names, values, and other point information

Exchange List	The current Exchange List is the same as in ASE2000 Version 1. It displays all exchanges (messages) supported by the currently selected protocol. The Exchange View is not available when operating in Task Mode
Line Monitor	The communication Line Monitor view is the same as in ASE2000 Version 1. It displays raw data and expanded interpretation of all communication messages
Message List	Presents communication line messages in an alternate form to that of the Line Monitor view. The Message List's compact presentation (one message per line) allows more messages to be shown at one time than in the Line Monitor view.
Event Log	The Event Log is the same as in ASE2000 Version 1. It presents one line for each event detected, as explained in the subsequent discussion of the Events Properties Tab
Line Analyzer	The Line Analyzer is a special view available only for serial protocols and only when operating with an ASE-manufactured communication equipment. It presents a millisecond-resolution plot of receive data and carrier (DCD) on each of two input lines
Select Protocol	Valid in Exchange Mode only, allows selection of any licensed communication protocol. (Task Mode protocol is determined from the selected RTU device.)
View Capture	Views contents of the currently selected capture file. A capture file contains information from a communication session. Available capture files are listed in the sub-menu.
Import	Used to import previously saved Communication Messages (MSGX) file, DNP3 Certification Procedure file, or RTU Point List data in CSV format.
Export	Used to export Communication Messages to a MSGX file for later retrieval and analysis, DNP3 Certification Test results file, or RTU Point List data in CSV format.
1-File Name 2-File Name 3-File Name 4-File Name	The most recently accessed MONX files are shown for convenience (Exchange Mode only).
Exit	Exits the ASE2000

7.2.4. Tools Menu

The tools pull-down menu contains three or four selections:



- *Properties* – allows entry of many editable properties. This contains much of the information that, for the ASE2000 Version 1, was found in the Properties pull-down lists. Properties are discussed below by group.

- *Customize* – controls content of the Tool-Bar line. By default, all Tool-Bar content is enabled. Items can be removed by un-checking their selection. For more information, see the Tool-Bar description in next section.

- *User Preferences* – allows customization of ASE2000 display colors

- *Runtime Changes* – appears only in Exchange Mode when communication is active. It supports

changing “Forced Error” conditions in real time. For DNP3 protocol in RTU Simulation mode, it also supports changing “Internal Indication” settings. Both can be altered from appropriate Properties menu entries, accessible when communication is not active. Please refer to descriptions in those sections.

Communication Properties

Comm Tab

The Comm Properties tab contains information controlling serial communications.

Some options apply only to ASE devices.

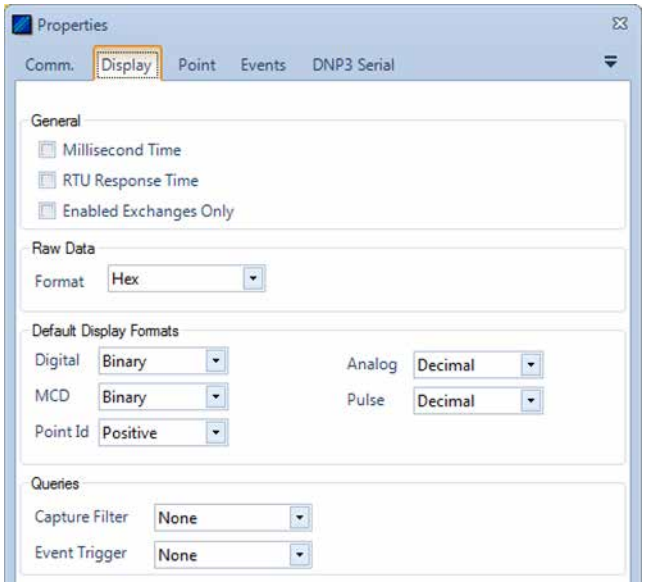
Channel A and B	Defines the communication port(s) to use for serial protocols. Two ports are typical for monitor mode operations, and one port for RTU or Master Simulation mode • RTU Simulation mode uses the **To Master** port for communication to the master • Master Simulation mode uses the **To RTU** port for communication to the RTU, IED, or PLC • Line Monitoring mode expects to receive messages from the master on the **To Master** port, and messages from the RTU on the **To RTU** port
Show ASE Ports Only	If checked, only ports on ASE-manufactured communication equipment are shown in the Ports pull-down list. If unchecked, all system COM ports are shown
Carrier	Controls treatment of the RTS, CTS, and DCD signals • *Constant:* In RTU and Master Simulation modes, causes the ASE2000 to assert RTS on start-up and keep RTS asserted until the user ends the communication session. (RTS is never asserted in Monitor Mode.) CTS is not checked or required for transmission. DCD is not checked or required for reception • *Switched*: On transmission, RTS is asserted before each message. The message is sent after the Pre-Mark time has elapsed following detection of CTS. RTS is de-asserted after the Post-Mark time has elapsed following transmission of the last data bit. On reception, DCD is required • *Switched by RTU Only*: operates in Constant mode for messages sent from the master (transmission in Master Simulation mode or reception in any other mode) and switched mode for message sent from the RTU (transmission in RTU Simulation mode or reception in any other mode) • *Switched RS-485*: On transmission, RTS is asserted before each message. The message is sent after the Pre-Mark time has elapsed following RTS assertion. RTS is de-asserted after the Post-Mark time has elapsed following transmission of the last data bit. CTS is not checked or required for transmission. DCD is not checked or required for reception
Baud Rate	Standard baud rates can be selected from the pull-down list. Other baud rates can be entered manually. The BCOM-USB supports rates to 56 KB for byte protocols and to 9600 for bit protocols
Half-Duplex Filtering	The ASE2000 assumes operation over a full-duplex line, or (if half-duplex) with half duplex equipment that squelches the receiver while the ASE2000 is transmitting. For half-duplex circuits with no squelch capability, data transmitted by the ASE2000 may be echoed back to the ASE2000 causing the ASE2000 to display transmitted messages twice. Setting the **Half Duplex Filtering** option may, in some cases, filter out duplicate occurrence of transmitting messages. This option operates by discarding input data received while the transmit CTS signal is on

Ignore Post-Msg Noise	Can eliminate noise caused when external modems shut down. If enabled, the ASE2000 discards all input data received after it determines that a complete message has been received. Discarding continues until the incoming carrier (DCD) drops
Native Asynch Mode	For byte protocols such as DNP3, there are two ways to operate an ASE manufactured serial card: Bit Mode and Native Asynch Mode. Bit mode provides the ASE2000 with control over low level timing properties, but can result in extra communication errors at higher baud rate. Native Asynch Mode operation may remove these communication errors
Pre-Xmit Mark	For switched carrier operation, specifies the time, in milliseconds, between detection of CTS and transmission of the first data bit
Post-Xmit Mark	For switched carrier operation, specifies the time, in milliseconds, between transmission of the last data bit and de-asserting RTS
Preference	This option is applicable to insertion of pre-mark and post-mark times in transmission of legacy (bit) protocol messages. Because of hardware operation, the actual inserted time may exceed the sum of the entered times by as much as 7 bits (i.e., the time required to transmit 7 bits). The ASE2000 has the option of assigning this excess to the pre-mark time, the post-mark time, or both. The Preference option can be used to specify one of these two times to be transmitted as accurately as possible. Any excess time will be assigned to the non-specified time. (For no specification, half the excess time is assigned to each). In practice, we have found this option to be useful only for old CDC protocol devices, which operates best by selecting Post-Mark
Receiver Squelch	Used for reception of data in switched carrier mode. Defines a time, in milliseconds, starting on incoming carrier (DCD) detection. Data received during this time is discarded
Inter-Message	A minimum time between ASE2000 transmissions of consecutive messages. Does not apply to messages received by the ASE2000. This setting applies to all messages except the Operate message in a select-before-operate sequence
Intra-Message	Similar to the Inter-Message delay explained above, applies only to the Operate message in a select-before-operate sequence
Response	Time the ASE2000 waits for a response from the RTU before declaring a response timeout
Character Gap	Time in seconds the ASE2000 should add between characters when calculating how long to wait for a response from the RTU before declaring a response timeout

Display Properties

Display Tab

The Display Properties tab contains information located under Properties/Display in the ASE2000 Version 2 Test Set.

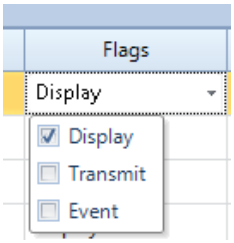


Millisecond Time	If checked, each message sent or received is time-stamped to the nearest millisecond (based on accuracy of the PC clock). If unchecked, messages are time-stamped to the nearest second
RTU Response Time	If checked, each RTU response message is shown with an elapsed millisecond time, calculated from the last bit transmitted of the prior master request to the first bit of the corresponding RTU response. This feature requires ASE serial communication hardware and is not available with standard COM ports
Enabled Exchanges Only	If checked, only enabled exchanges identifiable by ASE2000 are displayed (see next topic, 'Filtering Exchanges', for details).
Raw Data Format	Controls display format of raw communication words shown in the Line Monitor and Messages views
Default Display Formats	Controls presentation format of interpreted data values for each supported point type (Digital, MCD, Analog, and Pulse) and for the Point ID
Capture Filter	Settings for the Capture Filter (see topic Message Query Manager for more information)
Event Trigger	Settings for the Event Trigger (see topic Message Query Manager for more information)

Filtering Exchanges

The ASE2000 V2 has two methods to limit the messages displayed in Exchange Mode.

To display only specific exchanges, disable all unwanted exchanges by removing the '*Display*' flag from all exchanges except those to be displayed and checking the *Exchange Filtering* option on the Display tab of the Properties dialog. The '*Display*' flag may be set or unset by clicking in the Flags and adding or removing the check next to the Display option. This flag can also be modified from the *Exchange Properties* menu. For example, removing the "*Display*" flag from all except control exchanges and checking *Enabled Exchanges Only* will cause the ASE2000 to display only control messages.



A convenient benefit of this option is derived from logic the ASE2000 uses to "identify" an exchange. Identification requires an input message with data that matches an entry in the exchange list. A "Match" requires all pertinent properties of the message be the same, including content items such as function code and device ID. If data for an incoming message is as defined in an exchange in all aspects except the device ID, then the message is not identifiable (for purposes of this discussion).

A global device ID value can be entered to apply to all exchanges. If set, messages received from any other ID cannot be identified. Therefore, setting the global device ID and checking Enabled Exchanges Only will cause the ASE2000 to display messages to and from the selected device only.

Filtering of exchanges also applies to Print operations.

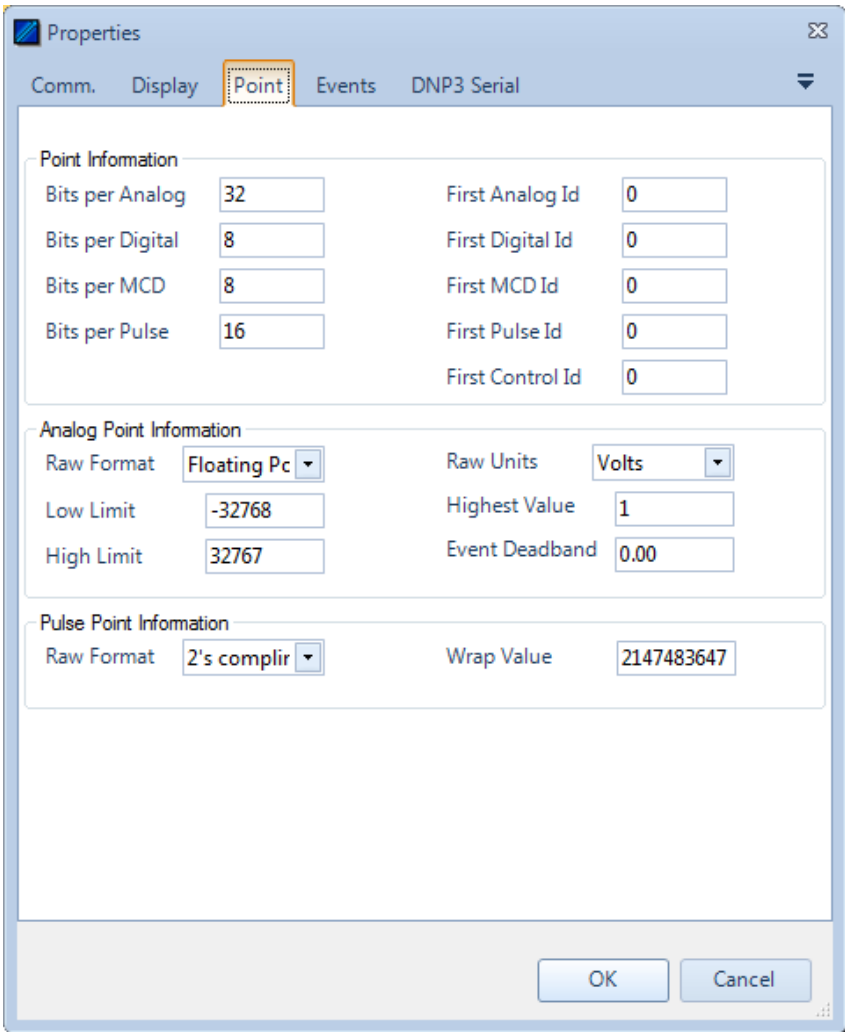
Protocol Properties

Protocol Tab

Default Exchange Values	The contents of the list of enterable values in this section changes based on the currently selected protocol. (The example above is for DNP3.) The list provides the ability to enter default values for key protocol message components such as Device Address, Group Number, Point Number, and so on
Message Times	Controls values to use when transmitting messages containing date and time information, typically for time synchronization and sequence of events. The default is to use system (PC) time, but each component (hour, minute, etc.) can be set to a specific value
Force Errors	The contents of this section change based on the currently selected protocol and define a list of errors the ASE2000 can generate in message compilation and transmission. This feature is useful for verification that a given device can process an errant message correctly. The last item in the list is always "*Randomly Select From Those Checked*". If selected, the ASE2000 will occasionally send a message with one type of error selected from all those checked. If "*Randomly Select From Those Checked*" is not checked, then an errant message is sent every time and will include errors corresponding to all checked items.

Point Properties

Point Tab

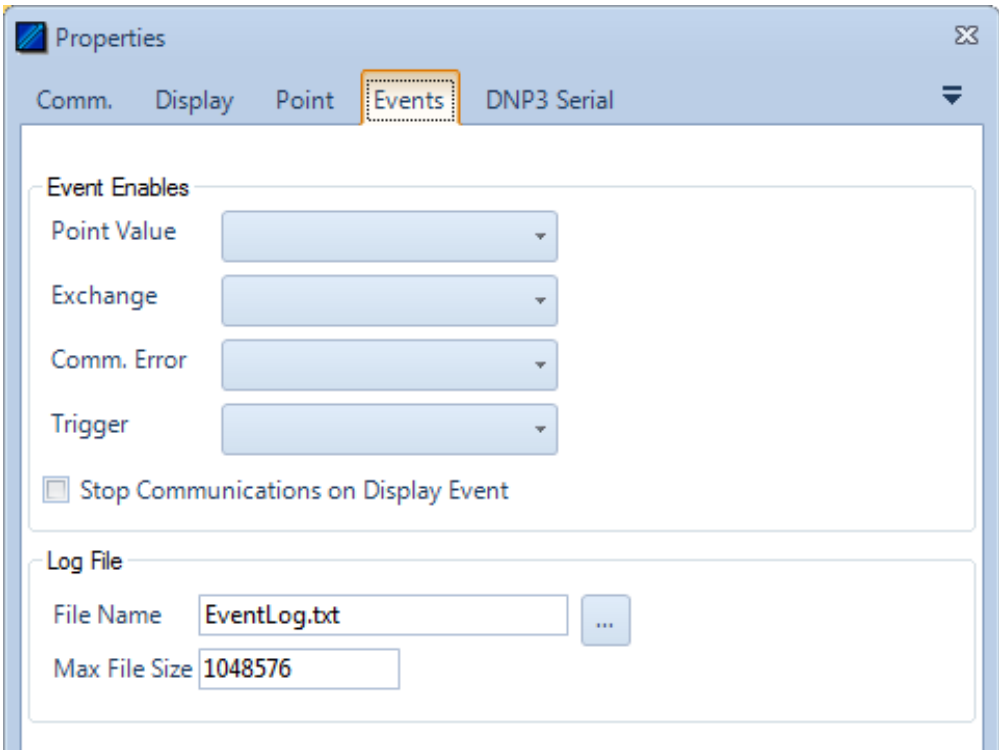


The Point Tab allows customization of input and output point interpretation parameters. For the most part, information in this section is set according to the rules of the active protocol and changes may cause the ASE2000 to process point data incorrectly. The user should not change information in this menu unless absolutely certain that the change is correct. Changes should not be made as a "guess" to correct a perceived problem.

Bits Per …	Defines the number of data bits for each point or block of points. For example, if analogs are 12 bits each and digitals are reported in blocks of 8 bits each, then the corresponding entries should be 12 and 8. These fields in particular should not be changed unless absolutely certain that your device is configured different than the protocol standard
First … ID	For each point type, contains the index of the first point returned in a communication message. This field is present because some companies consider the first point reported from a device to be index ‘1’, while others consider the first point to be index ‘0’. The value entered here is used for assigning point IDs when an ID not explicitly contained in the communication message. For example, no point ID information is contained in a Conitel message. When the protocol message contains point ID information, such as is the case for DNP3, the message information is always used
Analog Point Information	Contains several fields controlling analog value conversion and display. The ASE2000 provides default settings consistent with the active protocol. This field is present and enterable because some protocols support more than one type of analog input conversion
Raw Format	Controls converting raw data bits to a numeric value 2’s Compliment, Sign Magnitude, BCD, 1’s compliment, and Unsigned convert the value as described Redac Special is used only for Redac 70H and Redac 70DE protocols Bias 2048 is a linear conversion where a raw value of all 0’s represents the smallest negative number, all 1’s represents the largest positive number, and the mid-value (‘1’ in the most significant bit and all 0’s elsewhere) represents 0. Getac LP is used only for Getac 7020-LP protocol Reverse Bias is used as the inverse of Bias-2048. Conversion is basically the same, but the sign of the result is changed
Low and High Limits	Are used for RTU simulation and specify the minimum and maximum values the ASE2000 will transmit. They also specify the maximum value for Raw units display (see next paragraph)
Raw Units and Highest Value	When the selected analog display format is “Volts per Ma”, analog values are converted between the linear scale of 0 to High Limit to the linear scale of 0 to Highest Value For example, consider a raw input value of 1024 and a High Limit of 2048. This represents 50% of full scale (1024 is 50% of 2048). 50% is applied to Highest Value, which, if 1, results in a displayed value of 50% of 1, or 0.5. Another way of looking at this is to consider an A/D converter that accepts inputs from 0 to 1 volt and that digitizes those inputs to a value between 0 and 2048. An input of 0.5 volts will digitize to 1024, which the ASE2000 will display as 0.5. If the Raw Units setting is Volts, then the full ASE2000 display is 0.5 volts.
Pulse Point Information	Contains fields controlling pulse accumulator (counter) value conversion and display.
Raw Format	Is similar to that for analogs
Wrap Value is	Used only for RTU simulation and specifies one more than the maximum value the ASE2000 should transmit.

Events Properties

Events Tab



The ASE2000 can detect four classes of events and the user can configure action for the ASE2000 to perform as an event is each class is detected. The classes are:

- Point Value – A change in state of certain digital points, or an analog value exceeding an alarm limit or returning within limits after having previously exceeded a limit. Points to be considered in event processing are defined from the Point Values view
- Exchange – Detection of any *event-enabled* exchange. Event exchanges are specified from the Exchanges properties menu
- Comm Errors – Any communication error, including parity, security, and timeout
- Trigger – Any trigger configured

Each event class can be enabled for Display, Log, or Audible processing, or for any subset thereof

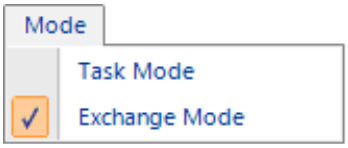
- Display processing causes a one-line entry to appear in the Line Monitoring view
- Log processing causes an entry to be written to the text log file
- Audible processing causes the PC audible to be sounded briefly

The ***Stop Communications on Display Event*** option, if checked, causes the ASE2000 to stop communication after detection of any event with *Display* processing enabled

Other Tabs

Other protocol-dependent tabs may be present depending on the currently selected protocol. Please refer to protocol-dependent sections of this document for more information.

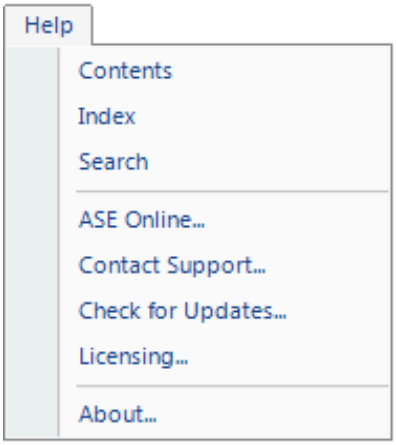
7.2.5. Mode Menu



Used to switch between Task Mode and Exchange Mode.

7.2.6. Help Menu

The Help menu appears as shown below.



Contents, Index, and Search are standard Help system options

ASE Online opens a browser to the Applied Systems Engineering home page. In addition to ASE Product information, ASE2000 support information can be accessed by clicking on the **Support** target and then selecting ASE2000 Knowledge Database.

Contact Support composes an Email to ASE Support. Questions should be answered within one business day. (ASE is located in the Pacific Time zone)

Check for Updates interrogates the ASE web site for new ASE2000 Version 2 releases. Updates are free for one year after the date of purchase. Extended software (and hardware) support contracts are available. The current software-update expiration date is located under Help and Licensing…

Licensing lists the license type (trial, temporary, or normal) and expiration date.

A Trial license is available for evaluation and does not require any ASE hardware.

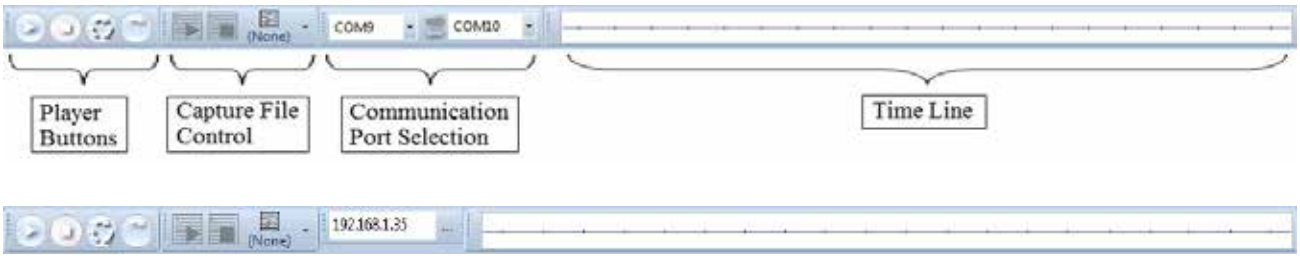
A temporary license provides full functionality for a specified time. This is granted to customers upgrading from a version 1 Test Set until the prior version 1 hardware is returned (typically a PCMCIA card)

A temporary license is upgraded, via Email, to a full license on return of version 1 hardware. A normal license allows full functionality with no expiration date

About provides the ASE2000 build date and version number

7.3. Tool Bar

The Tool Bar is divided into four areas as shown in the following diagram.



Tool Bar for Network Protocols in Master or RTU Simulation Mode

Tool Bar for Network Protocols in Monitor Mode

Some areas may change based on current mode and protocol settings. Examples above appear for:

- Master simulation mode for a serial protocol, and
- Master simulation mode for a network protocol, and
- Monitor mode for a network protocol

7.3.1. Player Buttons

Player Buttons are used to start and stop communication.

ICON	Name	In Exchange Mode	In Task Mode
	Start/Continues	Starts Master Simulation, RTU Simulation, or Monitor operation, as configured	In Master Simulation mode, starts or continues repetitive transmission of messages for the current task. In Monitor or RTU Simulation mode, simply Starts or Continues communication.
	Send Continuously	Starts repetitive transmission of the selected (highlighted) exchange	N/A
	Send Once	Transmits the selected (highlighted) exchange once	Transmits messages associated with the current task once

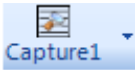
ICON	Name	In Exchange Mode	In Task Mode
	Stop	Stops communication	Stops communication
	Resume	N/A	Resumes communication

7.3.2. Time Line

The Time Line contains a real-time presentation of communication traffic showing data and carrier signals in both directions (master requests and device responses)

7.3.3. Capture File Control

A capture file records communication line traffic over a period of time. A capture file contains message information obtained while enabled.

ICON	Name	Description
	Start	Starts file capture
	Stop	Stops file capture (should use an enabled icon)
	File Selection	Used to specify and enable a specific capture file. The ICON contains the name of the currently active (most recently selected) file, **Capture1** in this example

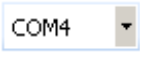
Information recorded to the active capture file can be viewed by selecting File and View Capture or clicking the file selection icon

7.3.4. Communication Port Selection

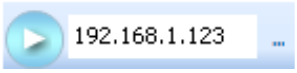
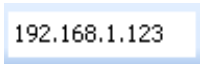
This section can show one of two sets of ICONs. The first is shown when a serial protocol is selected. The second is show for network protocols.

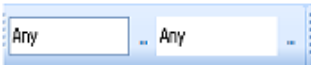
Serial Protocol Ports, Master and RTU Simulation

The serial protocol set allows entry of two COM ports. One COM port, identified as “To RTU”, communicates to the RTU (IED or PLC). In Master Simulation mode, it is the only port used. The other COM port, identified as “To Master”, communicates to the master. In RTU Simulation mode, it is the only port used. Both ports are used in Line Monitoring mode. Messages from the RTU should be received on the “To RTU” port and messages from the master on the “To Master” port[1].

ICON	Name	Description
	COM ports	Pull-down lists allow for COM port selection
	Direction	Switches the “To RTU” and “To Master” ports

1 When monitoring communication for a protocol with direction information in the message, such as DNP3, the ASE2000 interprets messages correctly regardless of which port is “to RTU” and which is “To Master”

Network Protocol Ports, Master and RTU Simulation		
The ***network protocol set*** allows entry of the target IP address and includes some limited control over connection processing. It appears as: 		
ICON	Name	Description
	Target Node	The data entry in the middle of the network protocol ICON area allows entry of a target device, either as an IP address or a node name. This field should be entered if the ASE2000 is to initiate a connection, most typically done when acting as a master. This field can be left blank when the ASE2000 is accepting a connection, or when operating in monitor mode. An IPv6 address may be entered if the IPv6 check-box in the Properties page has been selected.
	Browse	Enables a network browser and selection of a network node by name. Right-clicking on the Browse icon will allow selection of a network interface card when more than one is present.
	Connect Disconnect	Normally, a TCP/IP connection is automatically made when master mode communication starts and closed when communication complete. Selecting this target will establish the connection immediately which will remain until explicitly closed. This is useful for IEC 60870 5 104 protocol

Network Protocol, Monitoring Mode		
ICON	Name	Description
	Filter Nodes	In monitor mode, all detected traffic for the selected protocol is displayed. In networks with multiple connections, it may be desirable to display traffic only for a particular device. An IP addresses entered into the left of the two entry fields shown identifies the master in a remote/master connection. The right field identifies the remote. An IPv6 address may be entered if the IPv6 check-box in the Properties page has been selected. The ASE2000 will only process communication for the address or addresses entered. Entry also identifies IP address is for the master and which for the remote. This information is contained in communication messages for some protocols such as DNP3, but not for others such as Modbus.
	Browse	Enables a network browser and selection of a network node by name. Right-clicking on the Browse icon will allow selection of a network interface card when more than one is present.

7.4. Work Space

The main client area of the screen is called the work space. The work space is the container for all the documents that are used to interact with the test set. Each document has a “Tab” which identifies the document.

7.4.1. Drag Repositioning

Tab documents can be repositioned at runtime by dragging the tab header and dropping it on a new position of the drag indicator. The drag indicator is the control in the center of the workspace (not the indicators at the edge or the work space).

As the tab document is dragged over the indicator the screen will highlight the new position the document will assume.

If the tab document is dropped away from the drag indicator, a “floating” document is created. This document is not attached to the main screen. This might be useful in a situation where multiple monitors are attached.

7.4.2. Context Menu

The work space shows a context menu when the right mouse button is clicked on the tab of a document. This menu has several commands that can be used to operate with the work space. The two split commands (horizontal & vertical) can be used to slip the workspace effectively creating two independent workspaces.

7.5. Docking

The work space area real-estate can be maximized by utilizing the docking system. The docking system allows document to be attached or docked to edges of the screen.

7.5.1. Drag Repositioning

Documents can be repositioned at runtime by dragging the header and dropping it on a new position of the docking drag indicators. Drag indicators are placed on each edge of the workspace.

As the tab document is dragged over the indicator the screen will highlight the new position the document will assume.

Creating a docked document essentially splits the workspace, thus if you drag a document over this docked workspace, the workspace drag indicator for this work space will also appear. This can be used to add multiple documents to the same docked work space.

A docked document can also be dragged back to a workspace effectively undocking the document.

If the tab document is dropped away from the drag indicator, a “floating” document is created. This document is not attached to the main screen.

7.5.2. Auto Hide

By pressing the pin button located in the docked header the auto hide state can be toggled. When the docked workspace is in the auto hide state, the documents are shown as tabs on the side of the screen. When you hover the mouse over the tab the document will slide out. Moving the mouse away from the document will result in the document sliding back to the tab state.

7.5.3. Context Menu

By pressing the drop down button on docked header a context menu can be displayed,

7.6. Layout Persistence

Each test set mode (Task & Exchange) has a separate work space layout state. The workspace layout is persisted so that the next time the test set is activated or the test set mode is changed the work space layout is returned to its previous state. Default layouts exist for each Test Set mode and a menu command exists to restore the default layout.

7.7. Layout Guidelines

Each Test Set document has a preferred orientation. Some documents are vertically oriented and work best either docked or positioned to the right or left edge of the workspace. The rest of the documents have a horizontal orientation and work best as a tabbed document within a workspace.

7.8. Status Line

The status line at the bottom of the display area appears as follows.

7.8.1. Communication Mode

The three ICONs at the left edge are used to select Communication Mode. The ICON corresponding to the current mode is shown is a different color. The current mode is also identified on the title line.

ICON	Description
	Selects Master Simulation Mode
	Selects Line Monitoring Mode
	Selects RTU Simulation Mode

7.8.2. Communication Statistics

The right portion of the status bar shows communication statistics, representing totals for all communication since the ASE2000 was started.

Each statistic type (except for No Rsp) contains two counters. The first (left) counter contains statistic information for *Messages Sent by The Master*. The second (right) counter contains statistic information for *Messages Sent by The RTU*.

Messages Sent by the Master means:
- In Master Simulation mode, messages sent by the ASE2000
- In RTU Simulation mode, messages received from the master
- In Line Monitor mode, messages detected on the channel designated as “To Master”

Messages sent by the RTU means:

- In Master Simulation mode, messages received from the RTU
- In RTU Simulation mode, messages sent by the ASE2000
- In Line Monitor mode, messages detected on the channel designated as “To RTU”

Individual counters and their meanings are:

Total	The left cell is total Messages Sent by the Master”. The right cell is total “Messages Sent by the RTU”
OK	Of the total messages transmitted in either direction, the number processed with no communication error
No Resp	Of the total “Messages Sent by the Master”, those to which the RTU should have responded but did not
Line Error	Of the total messages transmitted in either direction, the number detected with word parity or framing errors
Sec Error	Of the total messages transmitted in either direction, the number detected with protocol security errors such as CRC, BCH, or Checksum

Totals can be reset by right-clicking in the Status Bar and selecting ***Reset Statistics***

8. View Menu Details

The Views menu allows selection of which displays (views) will be visible.

Many of the displays contain information which can be modified using check boxes, radio buttons, and text data entry. Check boxes and radio buttons are self-explanatory but the methods for text data entry require some explanation. Most displays that support text data entry utilize what is referred to a “grid” format where the information is organized in a set of rows and columns. Individual data items are located in “cells” and it is the contents of the cell that is modified. In general, there are two basic edit modes that can be implemented, “Edit on Entry” and “Edit on Keystroke”. The ASE2000 utilizes the “Edit on Keystroke” mode. In this mode focus is given on entry but edit mode does not begin until a key stroke or mouse click. A row header can be selected and a delete key will delete the row. A cell cannot be left without validation occurring.

The behaviour of Edit on Keystroke for each cell type is described.

- Checkbox – A single mouse click on the checkbox will select the row, activate the cell and change the checkbox.
- Textbox – A single mouse click will select the row and activate the cell. A keystroke or another mouse click will begin edit mode. Note that a cell value can be effectively changed with two actions, a mouse click and a keystroke. This is the same number of actions as “edit on entry”.
- ComboBox – A single mouse click will select the row and activate the cell.
  - Another mouse click displays the drop down arrow, and clicking the arrow shows the drop down box.
  - A keystroke begins the autocomplete feature of the Combobox and displays the drop down arrow. This is the most efficient way to deal with a ComboBox.
- CheckBoxDropDown – A single mouse click will select the row and activate the cell.
  - Another mouse click displays the drop down arrow, and clicking the arrow shows the drop down box.
  - Arrow keys and space bar may be used to select/deselect an option

8.1. Tasks

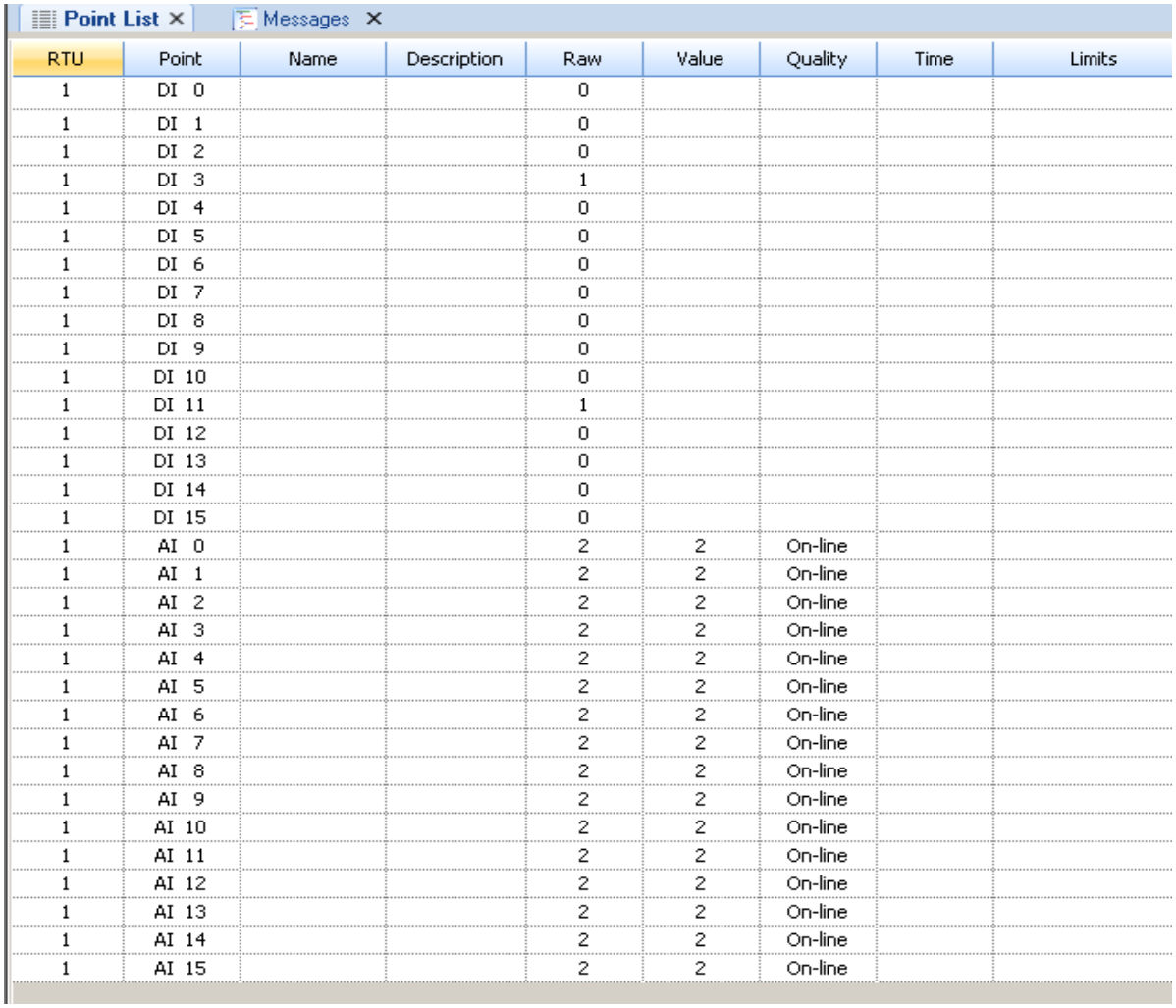
The Tasks List view, applicable only in Task Mode, allows the user to select and perform Tasks. Please refer to the section on Task Mode operation.

8.2. Point List View

8.2.1. Point List Overview

The Points List view displays information about all input points detected on the communication line. The display is organized by device. When data for more than one device address has been detected, TABs appear on the bottom of the Points List view to select the correct RTU.

The tabular presentation contains one point per line. If the point has been detected recently on the communication line, its value appears in bold font. If the value has changed recently, it is shown with a solid background. If the value has not been detected recently, it is shown in normal font.



Point List | Messages

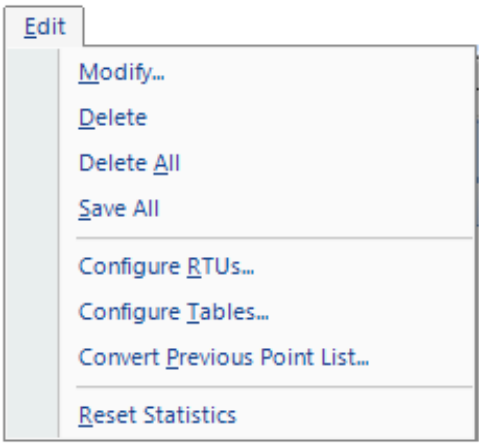
RTU	Point	Name	Description	Raw	Value	Quality	Time	Limits
1	DI 0			0				
1	DI 1			0				
1	DI 2			0				
1	DI 3			1				
1	DI 4			0				
1	DI 5			0				
1	DI 6			0				
1	DI 7			0				
1	DI 8			0				
1	DI 9			0				
1	DI 10			0				
1	DI 11			1				
1	DI 12			0				
1	DI 13			0				
1	DI 14			0				
1	DI 15			0				
1	AI 0			2	2	On-line		
1	AI 1			2	2	On-line		
1	AI 2			2	2	On-line		
1	AI 3			2	2	On-line		
1	AI 4			2	2	On-line		
1	AI 5			2	2	On-line		
1	AI 6			2	2	On-line		
1	AI 7			2	2	On-line		
1	AI 8			2	2	On-line		
1	AI 9			2	2	On-line		
1	AI 10			2	2	On-line		
1	AI 11			2	2	On-line		
1	AI 12			2	2	On-line		
1	AI 13			2	2	On-line		
1	AI 14			2	2	On-line		
1	AI 15			2	2	On-line		

Points List columns are:

RTU	Remote device ID
Point	Point type and ID
Name	Optional point name, user enterable
Description	Optional point description, user enterable
Raw	Value reported in the communication protocol. Analog and counter values are converted to decimal. Digital points are shown as one or two-bit values as defined by the protocol
Value	Raw value converted according to user entered rules. For analogs, the user can specify a scale and offset for linear conversion. For digitals, the use can supply state names such as OPEN for a raw value of 0 and CLOSE for a raw value of 1
Quality	As reported by the protocol
Time	A time stamp, if reported in the communication message for the associated point. If not reported, the field is blanked
Limits	User defined low/high limits for analogs. If entered, information is shown in red when the point's value is outside the limits.

8.2.2. Edit Menu for Points List View

When the Points List View is in focus, the Edit Menu appears as follows.



Modify presents a menu for editing parameters for any of the currently defined points

Delete deletes the currently highlighted point

Delete All deletes all points

Save All saves all point information as currently shown. User entered information is automatically saved, but point values and quality are not. This option is useful to create a snapshot of the current point settings and values

Configure RTUs is used to define new RTUs and for adding points to existing RTUs

Configure Tables is used to edit certain global parameter settings such as analog high/low alarm limits, analog conversion coefficients, pulse accumulator conversion coefficients, and digital point state names

Convert Previous Point List is used to import an ASE2000 version 1 point list. This action will erase any existing RTU or point definitions

8.2.3. RTU Simulation and Task Mode

The Point List View has additional capabilities when running as the RTU Simulation Task Mode.

- The user may enter values in the Raw data column, which will be transmitted in the next applicable message

- An extra column called **Increment** appears and is applicable for generation of analog point values. A point's **Raw** value is automatically calculated in each applicable response by adding the **Increment** value to the previously transmitted **Raw** value.

Values in the **Raw** or **Increment** columns may be copied forward by selecting multiple rows and right-clicking to display a pop-up menu. Choose 'Copy Raw Value' or 'Copy Increment'. The value from the first row selected is copied to all selected rows. To select multiple rows, click once in the first row to select it and hold down the Shift key while clicking in the last row. All selected rows will be highlighted.

8.3. Exchange List View

The Exchange List appears when operating in **Exchange Mode**. It contains a set of rows, one for each exchange (message) applicable to the selected protocol.

It also contains a set of columns for standard message components applicable to the protocol. For example, DNP3 protocol defines Destination and Source address fields used in each message. When DNP3 is the active protocol, the Exchange List view contains Dest and Source columns.

Another protocol, such as Conitel, includes components called RTU ID, Group, and Point. Those column headings appear when Conitel is the active protocol.

The Exchange List View shown below appears for DNP3 protocol.

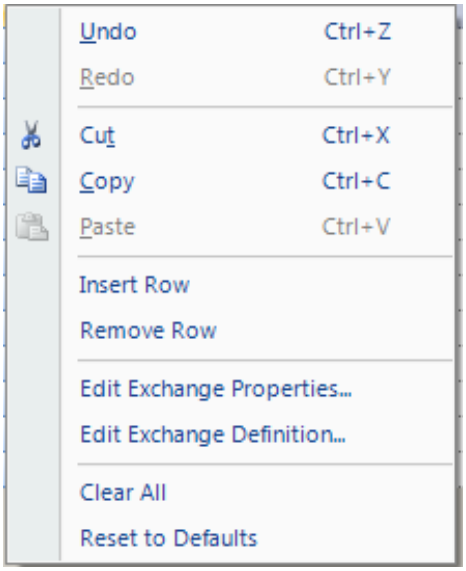
Name	Flags	Freq	Dest	Source
Reset Link	Display	2.00	*	*
Reset User	Display	2.00	*	*
Test	Display	2.00	*	*
Link Status	Display	2.00	*	*
Device Attributes	Display	2.00	*	*
Binary Input	Display	2.00	*	*
Binary Input Change	Display	2.00	*	*
Binary Input (Changes & Current States	Display	2.00	*	*
Binary Output Status	Display	2.00	*	*
Binary Output Event	Display	2.00	*	*
Binary Output Command Event	Display	2.00	*	*
Binary Counter	Display	2.00	*	*
Frozen Counter	Display	2.00	*	*
Binary Counter Change	Display	2.00	*	*
Frozen Counter Change	Display	2.00	*	*
Analog Input	Display	2.00	*	*
Frozen Analog Input	Display	2.00	*	*

Each line contains one exchange (message) that exists for the selected protocol, DNP3 in this case. From this list, the user can:

- Edit an exchange, directly in the grid or utilizing a dialog
- Select a single exchange for transmission
- Create and delete exchanges

8.3.1. Exchange View Menu

To edit an exchange, select the exchange and then the Edit pull-down menu or, alternatively, right-click anywhere in the row. This will display an edit menu.

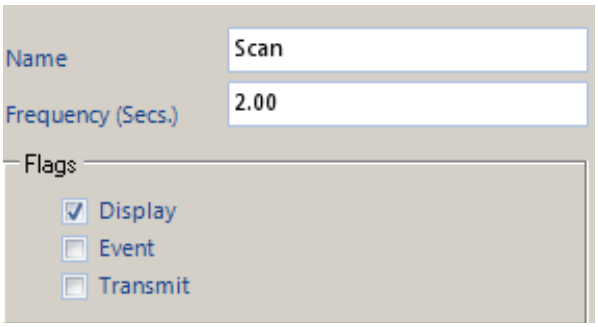


- **Cut, Copy, Paste, Insert Row, Remove Row**, and **Clear All** operate on the entire row according to conventional meanings
- Since there is no concept of a “blank” exchange, **Insert Row** will present a list of exchanges defined for the active protocol, requiring the user to select one to complete the **Insert Row** operation
- **Reset To Defaults** erases all existing exchanges, replacing them with the default set for the active protocol
- **Edit Exchange Properties** requests a menu for editing exchange information such as device and point addresses and transmission frequency. More details are provided below
- **Edit Exchange Definition** requests a menu for editing detailed structural exchange information. It is useful primarily for adjusting scan messages for most legacy protocols. Editing the exchange definition is not supported for IEC 60870-5-10x and DNP3; for these protocols, use Edit Exchange Properties.

Edit Exchange Properties

The Exchange Properties Menu supports editing several key properties about each exchange. However, since these properties can differ significantly from protocol to protocol, most details have been located in the protocol-specific sections.

The properties common to all protocols and shown in the example below are used for **Master Simulation** mode.



Please note the **Transmit** flag and **Frequency** field when reading the following section on **Starting Communication**.

Edit Exchange Definition

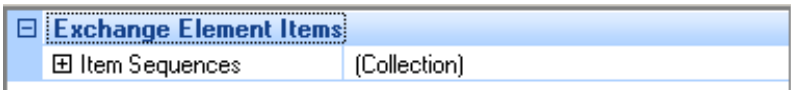
The Exchange Definition Menu is relevant to most legacy protocols. Editing the exchange definition is not supported for DNP3 or for any of the IEC protocols; instead use Edit Exchange Properties. This menu provides visibility into ASE2000's internal exchange definition data structure. It can be used to modify the structure of any exchange, including:

- Altering point types and values,
- Changing function codes, and
- Moving key fields

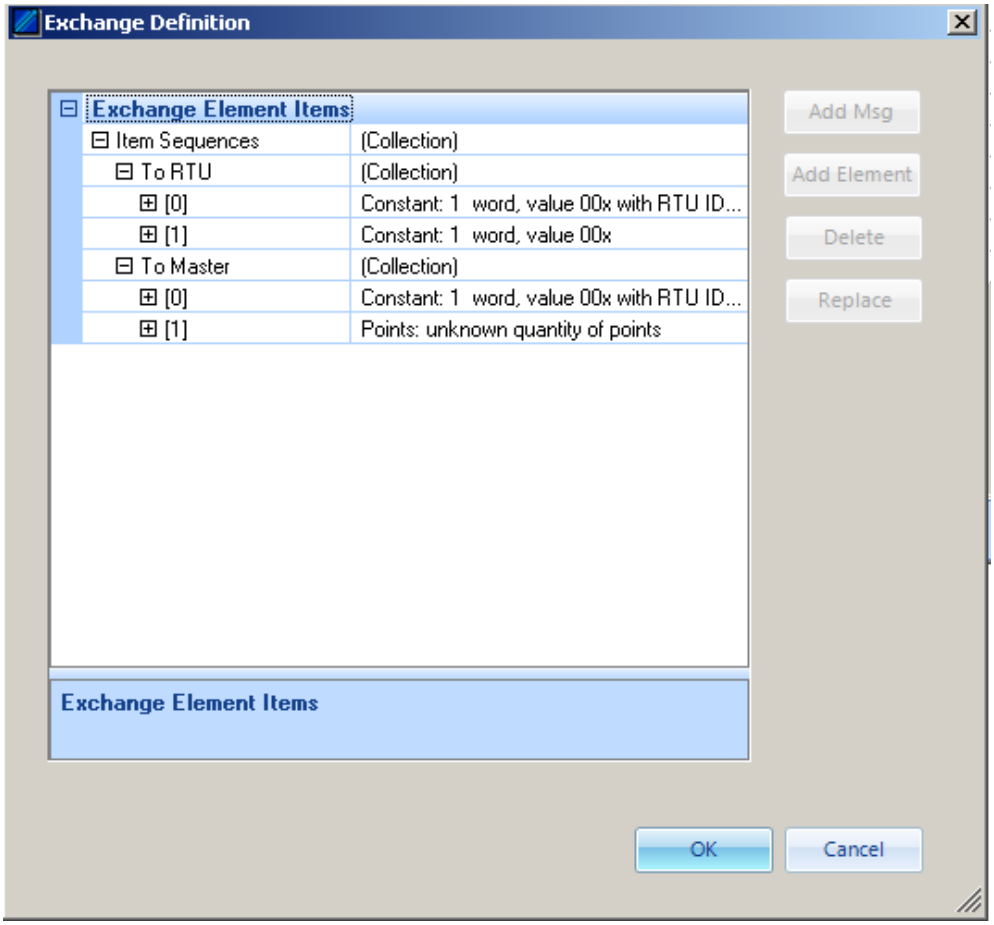
The most common use of this menu would be to **alter point information**. Any other modification may have significant impact on ASE2000 operation. Use in one of these alternate manners is very rare and should not be undertaken unless absolutely sure about the impact.

This section provides an overview of the Edit Exchange capabilities and specific examples on its use to modify input point information.

The menu presents the internal structure of the selected exchange in an expandable tree view.



Clicking the [+] at the left of the Exchange Definition (Item Sequences) expands definition. The example below shows the expansion for the Conitel protocol Scan Exchange.



An exchange is broken into a request message, identified as **To RTU**, and a response message, identified as **From Master**. (Some exchanges such as a broadcast pulse accumulator freeze may only have a request portion with no response.)

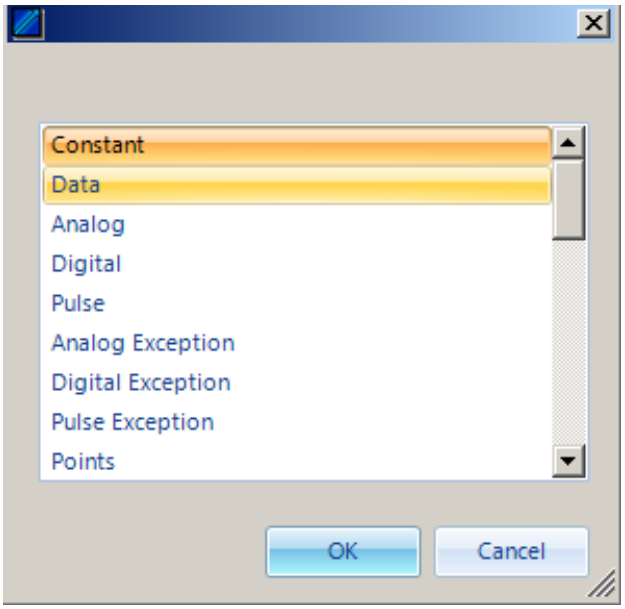
Each message is defined as a set of communication words. The ASE2000 builds a communication message as a sequence of these words, with the definition of a word dependent on the protocol.

- For any protocol using 26/31 BCH communication, each word is 12 bits
- For Indactic 33/41 protocol, each word is 16-bits
- For any other protocol, each word is 8 bits

To edit the exchange definition, highlight any of the elements in the exchange and select one of the buttons at the right.

- **Add Msg** will add a new message, either **To RTU** or **To Master**. Use of this option is not recommended
- **Add Element** will add a new line within the current message immediately after the selected element. Please refer to the following discussion on **Point Definition Editing**
- **Delete** will delete the current element
- **Replace** is the same as selecting **Delete** followed by selecting **Add Element**

Selecting either Add Element or Replace results in the following menu.



This menu presents a list of supported element types. The most commonly used elements are:

- Analog – Defines one or more analog input points
- Digital – Defines one or more digital input point blocks. The number of bits in each block is protocol dependent
- Pulse – Defines one or more pulse accumulator (counter) input points
- Analog Exception – Defines one or more analog information blocks, each containing a point number and value
- Digital Exception – Defines one or more digital information blocks, each containing a point number and point state
- Pulse Exception – Defines one or more pulse accumulator blocks, each containing a point number and value

Use of any other element type is rare and not discussed here. If interested, please contact ASE for details.

Point Definition Editing

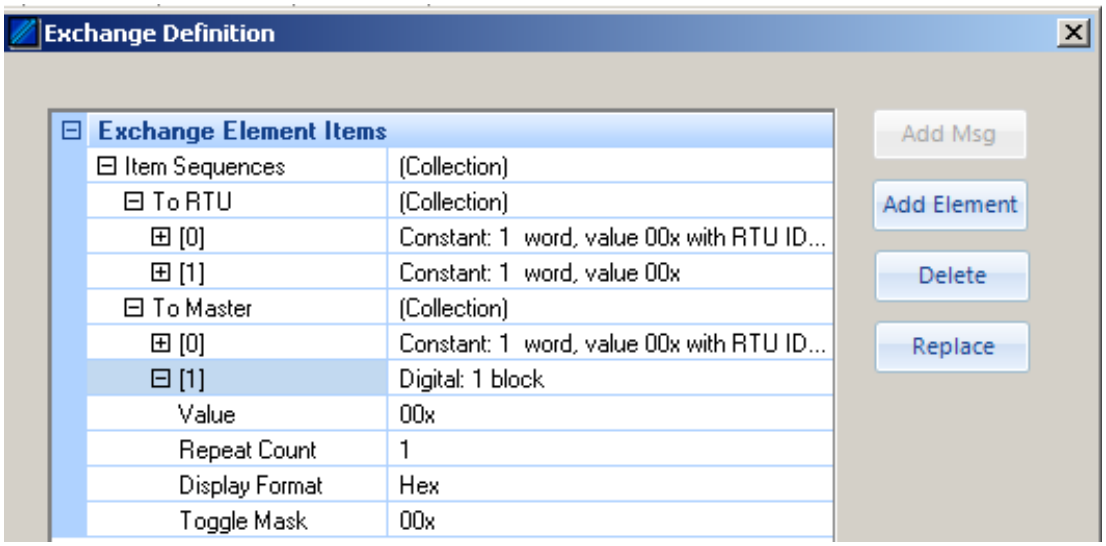
The main use of the Edit Definition menu is to modify the definition of a scan response. Let's take the case above for Conitel protocol. That protocol defines a single scan message called **Scan**. The response to a scan message is a set of points of one or more types. For example, a response may include a set of analog points, a set of digital points, or both analogs and digitals. Similarly, pulse accumulator data may be included.

The ASE2000 cannot know, in advance, the data content of a scan response. This is a RTU hardware dependency. The default scan exchange contains is shown above. The final element is **Points: Unknown Quantity of Points**. This is exactly what the ASE2000 knows about the exchange; only that some number of points will be returned: neither the number nor the type is known.

Let's assume that a particular scan response contains 2 blocks of digital input points followed by 7 analog points. To define such a message:

- Highlight the **Points** element
- Select **Replace**
- Select **Digital**

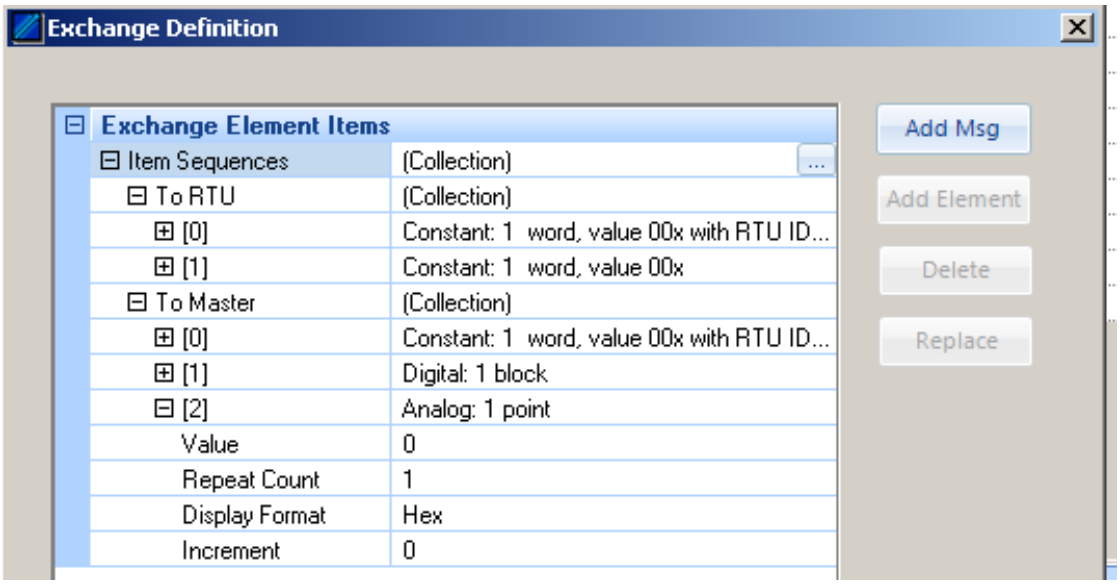
Restore the original Edit Exchange Definition menu. This will now appear as:



The **Point** entry was replaced by a **Digital** entry.

- Set the Repeat Count to 2, for 2 blocks
- Select Add Element
- Select **Analog**

Restore the original Edit Exchange Definition menu. This will now appear as:



A new **Analog** element has been created

- Set the Repeat Count to 7, for 7 analog points, or, alternatively, to 0. A count of 0 always means that the rest of the message is a sequence of values of the current type. So, 7 means 7 analogs, and 0 means the rest of the message are analogs
- Select OK to end the editing process

The edited definition will cause the input message to be parsed accordingly.

This type of editing is useful for protocols where:

- The type of point returned in a scan request is known by the user, but is neither known in advance by the ASE2000 nor can be deduced from the input message
- The number of points in the data response is known by the user, but is neither known in advance by the ASE2000 nor can be deduced from the input message

In all other cases, the ASE2000 should be able to analyze the input message and display input data point appropriately without editing the Exchange Definition

▶ *Note that exchanges are not used in Task Mode so exchange editing is not required. The ASE2000 automatically makes similar adjustment based on user entered Point Information*

Other Uses

There is one more important aspect of the Exchange Definition menu applicable to RTU Simulation. As a RTU, the ASE2000 can respond with a value for each input point and can modify this value in each scan response.

Refer to the data entry menus for analog and digital input points.

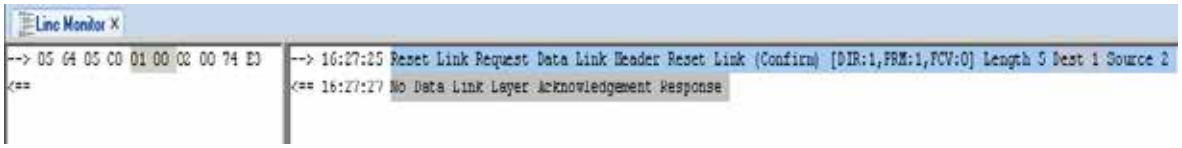
- The **Value** field defines the value to be included in the next scan response. For analog and pulse accumulator points, this is a raw numeric value. For digital input points, value defines a block of points. The rightmost bit is the state of the first point. Other point states occupy successive bits to the left
- For analog points, the **Increment** field specifies a number to add to the **Value** field after each response. The new **Value** will be used in the next response. Once a maximum analog value has been reached (depending on the protocol) the sign of the **Increment** field will change,

resulting in a **Decrement**, until a minimum value is reached. Therefore, the value will ramp up and down between high and low limits.

- For pulse accumulator points, the **Increment** field is similar to analogs, except that the value will wrap after exceeding the logical maximum for the protocol. Except when exceeding the wrap-around value, the value never decrements
- Digital points contain a **Toggle Mask** field instead of an **Increment**. After every response, the value is Exclusive-ORed with the mask to produce a value for the next transmission.

8.4. Line Monitor View

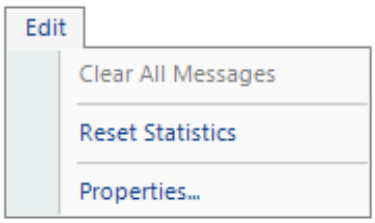
The line monitor view shows communication messages in raw and interpreted format. Raw data is shown in the left pane and interpreted data in the right pane. Clicking on data in either pane highlight the data selected and also the corresponding data in the alternate pane. In the sample below, the user clicked on the DNP3 Destination address field in the interpreted pane to show the corresponding data bytes in the raw data pane.



▶ *Messages can be saved by selecting File>>Export>>Communication Messages. A .MSGX file records the current communication messages. This file can be sent to another ASE2000 user to review the communication session.*

8.4.1. Edit Menu for Line Monitor View

When the Line Monitor View is in focus, the Edit Menu appears as follows



Clear All Messages erases the Line Monitor view contents

Reset Statistics zeroes communication statistics counters on the Status line

Properties presents a menu for modifying Line Monitor View text color and font

8.4.2. Raw Text Export

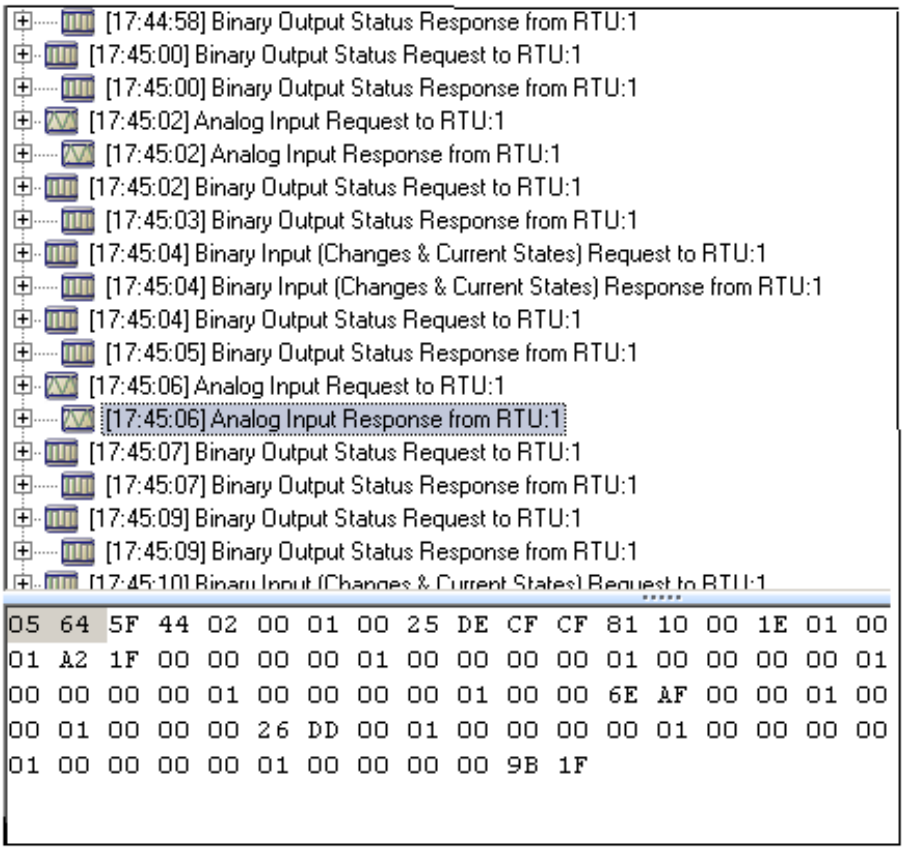
Beginning with version 2.20, the user can right click the line monitor panes and select “Export Raw Text Data” to save the raw data to a text (.txt) file. This can also be re-imported if the format is unchanged.

8.5. Messages View

The Messages View is an alternate presentation format containing the same information as in the Line Monitoring view. One message is shown per line making the Messages View a more compact presentation than the Line Monitor, but with (initially) less interpreted information about each.

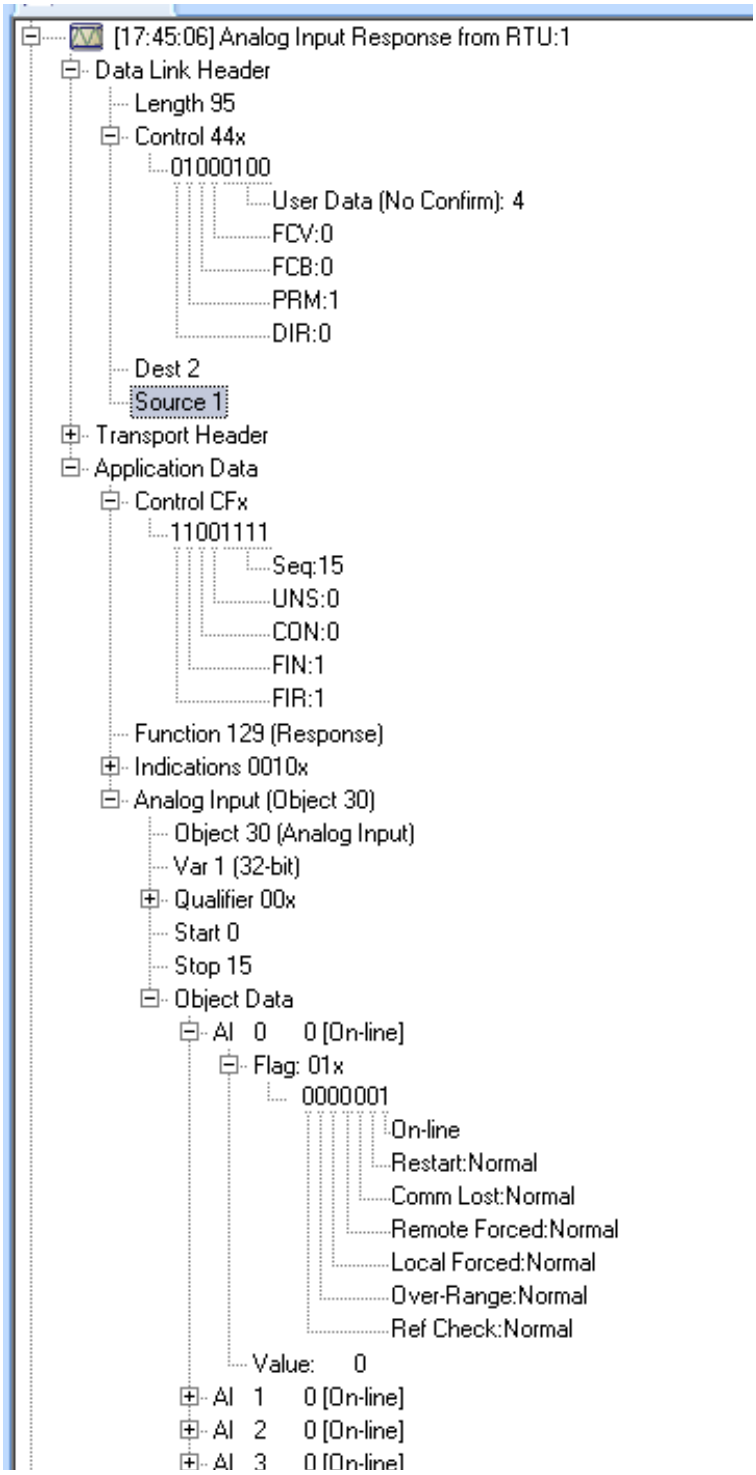
The messages view contains a main viewing pane on top and a smaller viewing pane on bottom. The upper viewing pane shows a list of messages by name. The lower viewing pane shows the interpreted data for the one message selected in the upper pane.

The sample below is from a DNP3 protocol communication session.



This screen shows a series of messages with one of the Analog responses highlighted. The raw data for this response is shown in the lower pane.

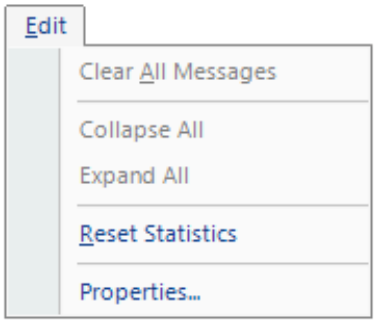
If more details are required for a particular message, they can be obtained by clicking on the [+] at the left edge of the message. In the case above, repetitive clicking of [+] targets will result in:



As you can see, the tree expansion can be continued several levels to significantly detail the message. There was insufficient room in a single page to show everything, but the capabilities should be obvious.

8.5.1. Edit Menu for Messages View

When the Messages View is in focus, the Edit Menu appears as follows



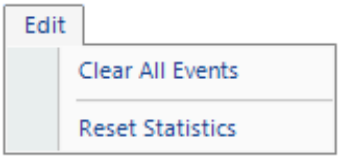
Clear All Messages erases the Messages view contents
Collapse All collapses all expanded messages
Expand All expands all messages
Reset Statistics zeroes communication statistics counters on the Status line
Properties presents a menu for modifying Messages View text color and font

8.6. Event Log

The Event Log presents one line for each event detected. More information on event processing can be found in the discussion of the Properties pull-down menu and the Events tab.

8.6.1. Edit Menu for Event Log View

When the Event Log View is in focus, the Edit Menu appears as follows



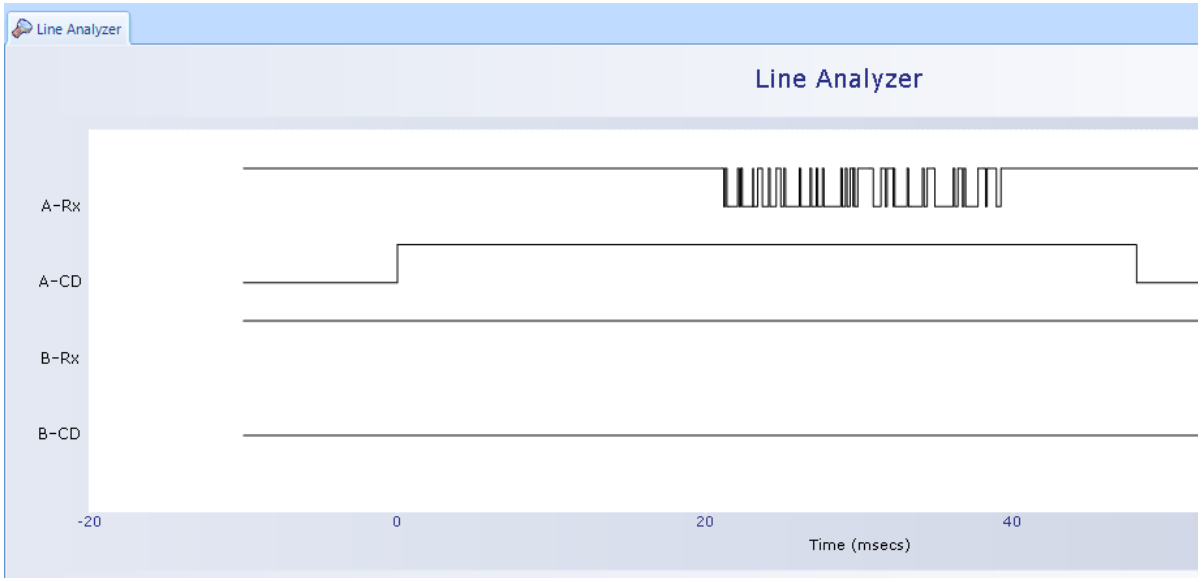
Clear All Events erases the Event Log view contents
Reset Statistics zeroes communication statistics counters on the Status line

8.7. Line Analyzer

This view is available only for serial protocols and only when operating with an ASE manufactured I/O card. It presents a millisecond-resolution plot of receive data and carrier (DCD) on each of two input lines. To create Line Analyzer data:

- Select the Line Analyzer view
- Connect the serial cables to receive data on all required circuits (To RTU, To Master, or both)
-  Select the start ICON

Data and carrier signals on each incoming line will be monitored. When sufficient data is collected, the Line Analyzer view is updated.

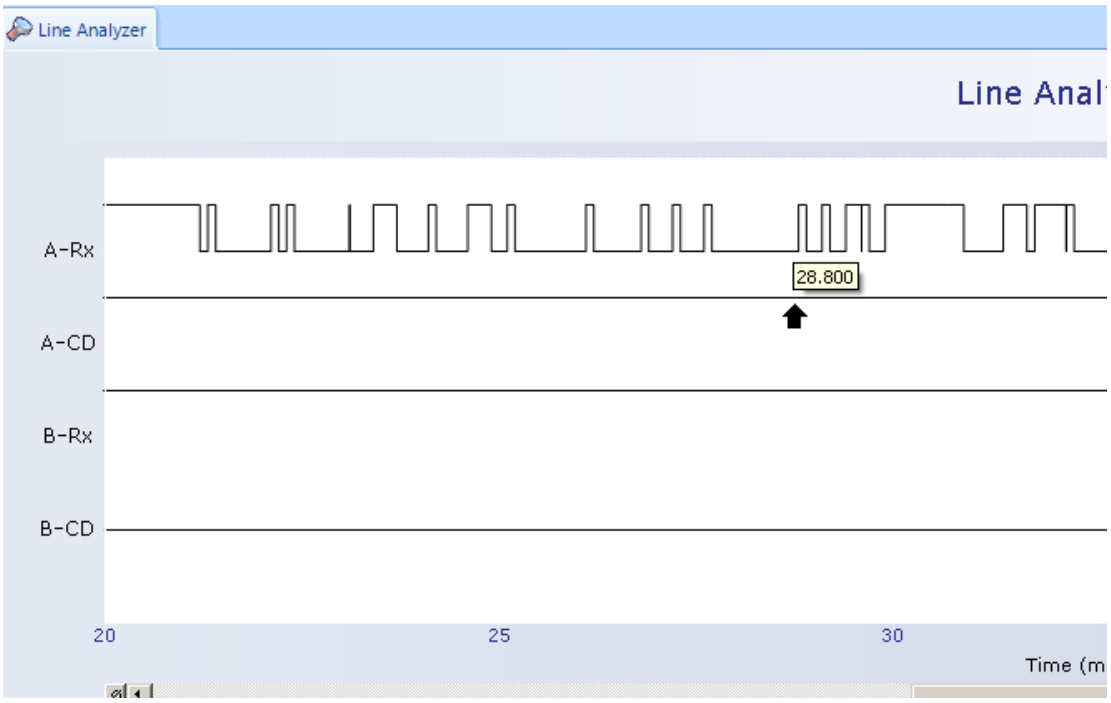


The above plot shows data and carrier detected on line A. Plots would also be updated if a message was detected at about the same time on line B. it was not in this example. A time reference is shown at the bottom of the view. Several controls are available.

The most useful is zoom:

- Left click on the left edge of an area to zoom
- Keeping the left mouse button pressed and move to the right edge
- Release the mouse button

Proceeding as above on the prior display produces:



Note the expanded data presentation. Also, note that moving the cursor over any point of the plot shows the time of occurrence of that point. In the example above, the cursor was moved to the start of a bit occurring at 28.8 milliseconds after the start of data collection.

8.7.1. Edit Menu for Line Analyzer View

When the line Analyzer View is in focus, the Edit Menu appears as follows

Clear erases Line Monitor view data
Properties presents a menu for modifying Line Analyzer View text color and font
Reset Statistics zeroes communication statistics counters on the Status line

9. Exchange Mode

Exchange Mode, if not the current mode, can be entered by selecting **Exchange Mode** from the Mode pull-down menu.

Exchange Mode uses the views and displays presented in the prior sections, primarily the Exchange View. Please refer to discussions on the Exchange View for more information.

For those familiar with ASE2000 Version 1 operation, Exchange Mode is, effectively, Version 1 operation.

9.1. Starting Communication

Exchange mode works in one of three Communication Modes: Master Simulation, RTU Simulation, and Monitor.

9.1.1. RTU Simulation and Monitor Mode

 For RTU Simulation and Line Monitor operation, communication is started by selecting this target from the tool-bar line.

9.1.2. Master Simulation

In Master Simulation mode, four targets are displayed.

 causes the currently selected exchange to be transmitted once. The ASE2000 will wait for a response and then stop. This option does not appear if no exchange is selected.

 causes the currently selected exchange to be transmitted once immediately and then again at every time interval thereafter, as defined by the **Frequency** field in the Exchange Properties menu. A new request may be delayed while the ASE2000 waits for a response to a previous request. This option does not appear if no exchange is selected.

 causes all messages with the **Transmit** flag set to be transmitted at their specified frequencies. A message is first sent at a time as defined by its **Frequency**. For example, if the **Transmit** flag is set on two messages, one with a frequency of 2.0 seconds and the other with 5.0 seconds, then the first message will be sent 2.0 seconds after this target is selected.

 stops any active transmission

10. Task Mode

10.1. Task Mode Operation

▶ *This section provides **Task Mode** operations overview. Since tasks are protocol specific, please refer to the appropriate protocol appendix for further details.*

Task Mode operation is started by selecting **Task Mode** from the Mode pull-down menu.

Task Mode is an alternate method for building and analyzing communication messages. It works from information contained in a device (RTU, IED, PLC) database. Each device is identified by name and includes the device's protocol, address, and point list. The point list defines all input points by type (analog, digital, counter) and address.

Task Mode operation is always based on one device selected from the device data base.

For operation in Master Simulation Mode, only one device may be active at a given time. The ASE2000 issues requests to that device.

For Monitor Mode operation, one device can be active.

For RTU Simulation Mode, one device can be active.

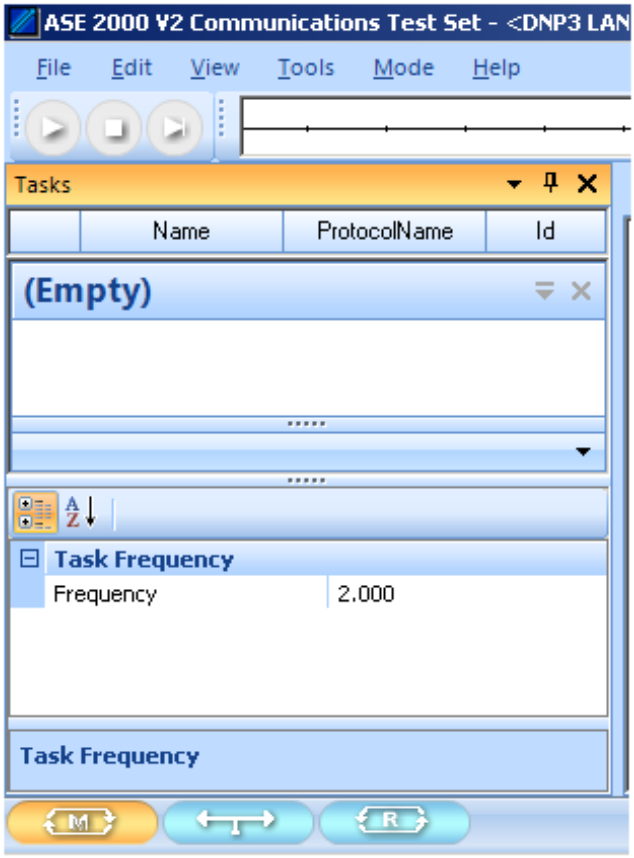
The ASE2000 automatically builds messages from the device database based on the task, mode, and active device. The Exchange List is not used in the **Task Mode** and the user is not required to edit any exchange definition information.

The steps for **Task Mode** configuration and operation are:

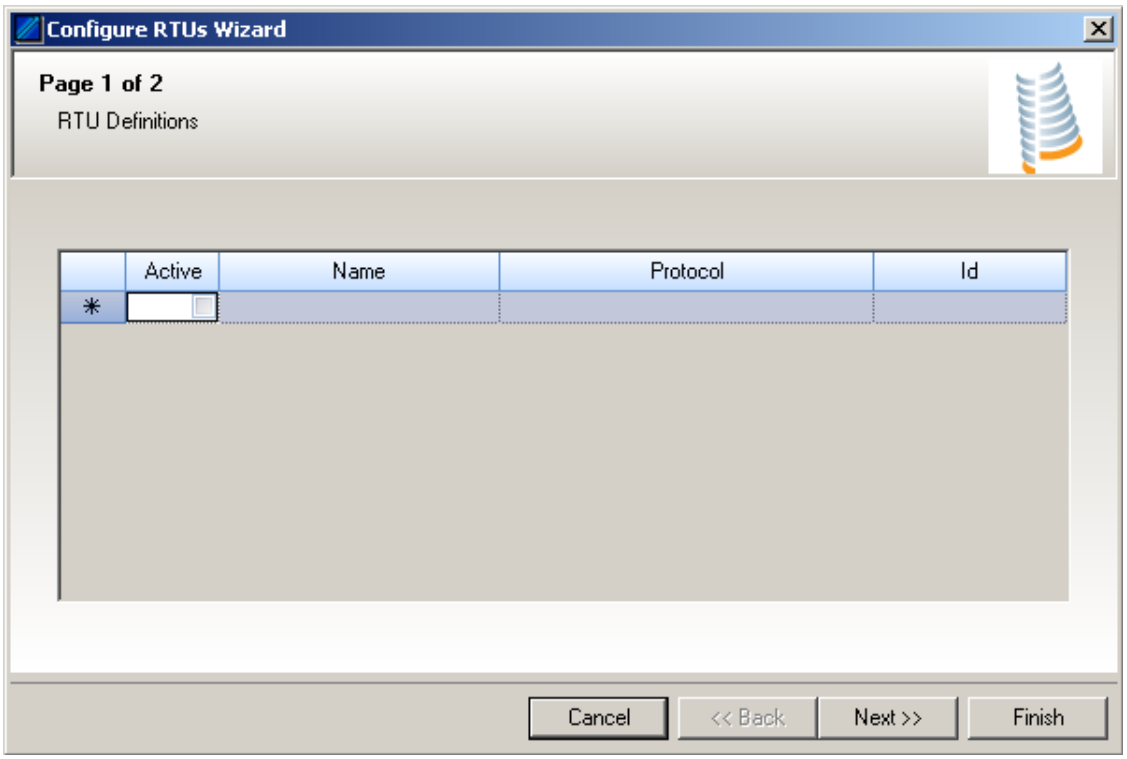
- Create one or more devices in the device database. (Information entered is saved and available whenever the ASE2000 is restarted)
- Select the communication mode (Master, RTU, or Monitor)
- Select one device from the device data Select a Task Group
- Select a Task from within the selected Group
- Start communication

10.2. Device Definition

After installing the ASE2000 for the first time, the device database is empty and the **Task Mode** view appears as follows.

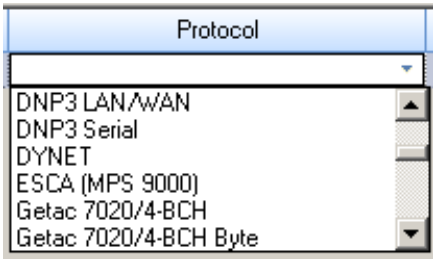


To define a device, right-click anywhere on the device title line (the area showing Name, Protocol Name, Id). The device database definition form appears.



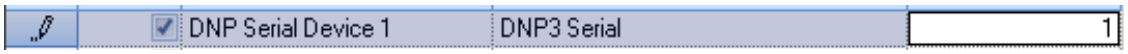
To define a new device:

- Enter an alphanumeric name in the Name field
- Click in the Protocol area to display a pull-down list and select a protocol



- Enter the device ID (address)
- Optionally, setting the device's active status will activate the device for **Task Mode** operation

For example, an active DNP3 protocol device entry appears as:

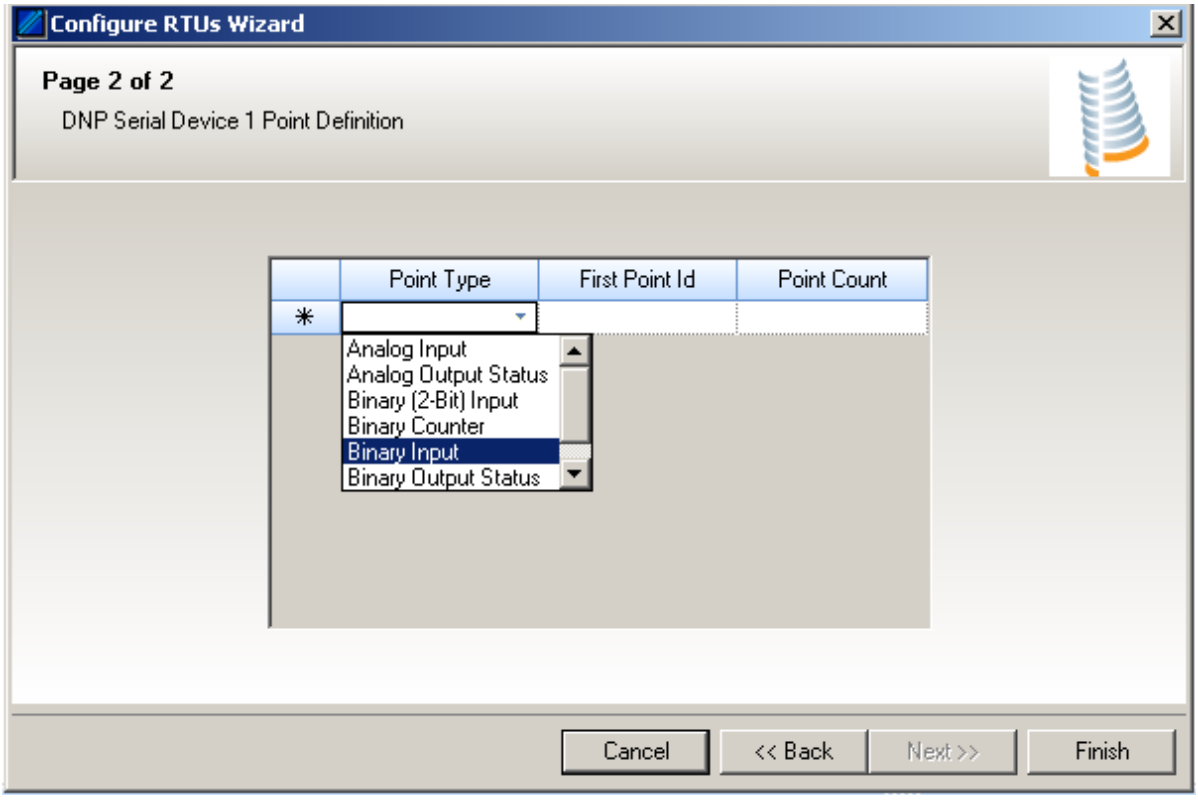


To continue with the point tables, select **Next >>**.

10.2.1. Point Definition

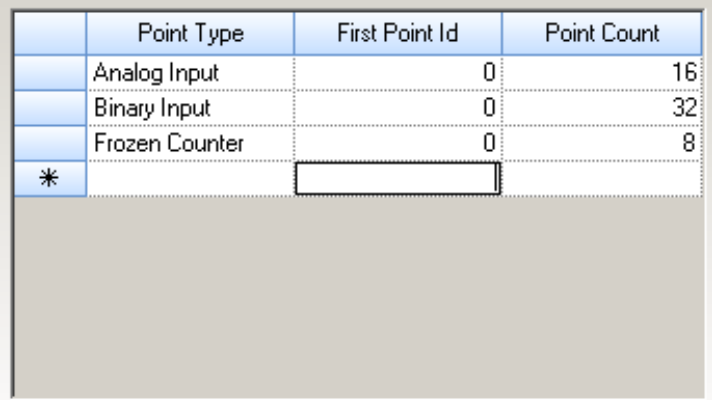
Selecting Next from the device definition phase generates an input point definition menu. All input points are defined, by point type, in blocks of contiguous point addresses. Each entry contains:

- **Point type**. Point type names appropriate for the device's protocol are presented in a pull-down list. In the example below, the pull-down list contains the set of DNP3 input point types
- **Point ID** defines the first point in a contiguous set of points
- **Point Count** defines the number of points with contiguous IDs starting at the entered Point ID



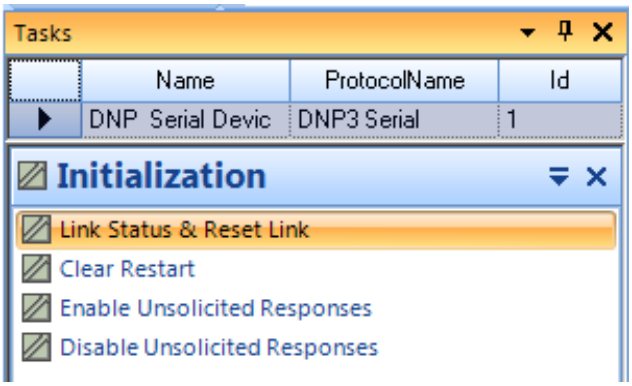
For example, assume a DNP3 device with:
- 16 analog inputs starting at address 0,
- 32 binary inputs starting at 0, and
- 8 frozen counters, also starting at 0

After all information is entered, the menu will appear as shown below.



Complete the definition process by selecting the Finish button.

The Task Menu now shows the newly defined device. Since the device was selected as the active device, the Task List now shows tasks from the first task group for the active device's protocol (DNP3).



Make sure the correct communication mode, Master Simulation, RTU Simulation, or Line Monitor, is selected. Following sections describe continuing procedures for each mode.

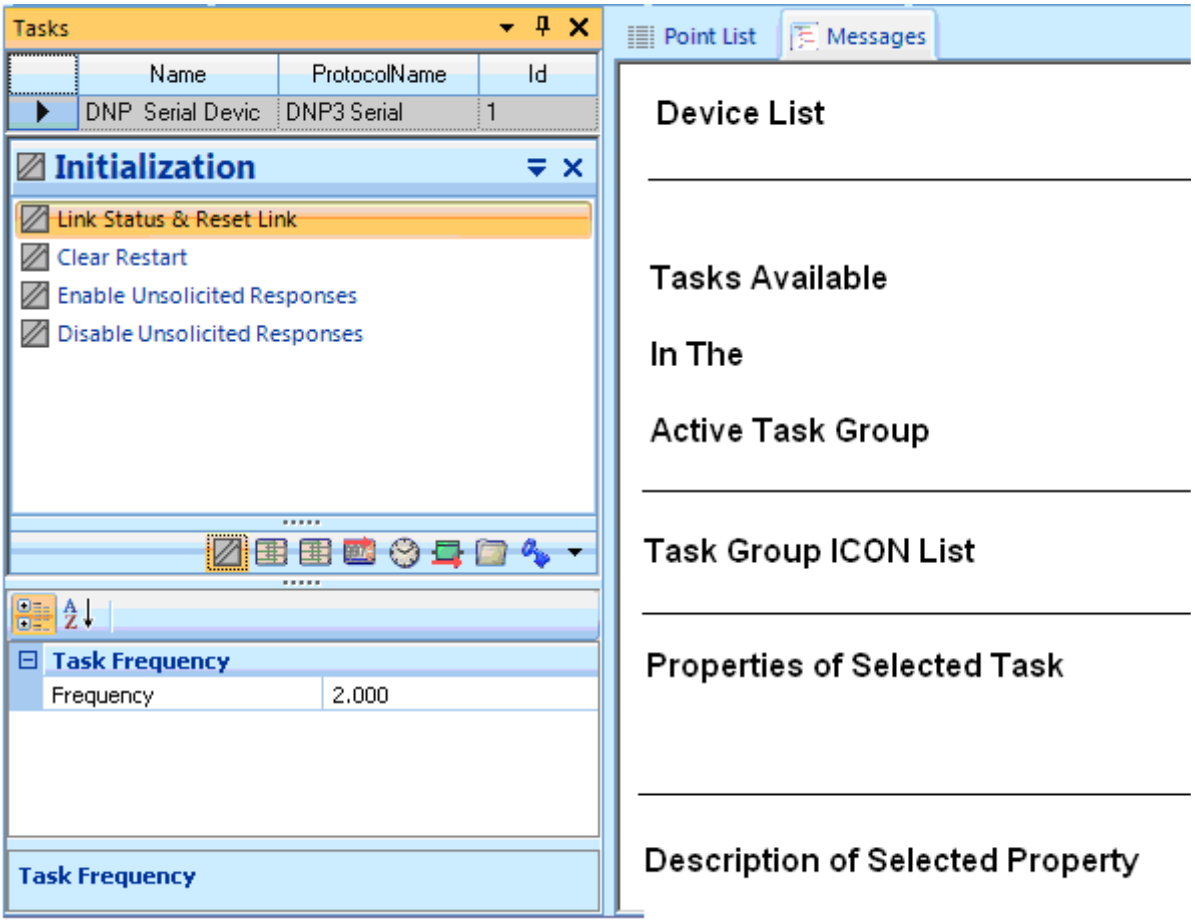
10.3. Task Mode Operation, Master Simulation Mode

10.3.1. Task Selection and Navigation

Tasks are presented in groupings applicable to each protocol. For example, DNP3 protocol has task groupings for:
- Initialization
- Acquisition of Static Data
- Acquisition of Event Data
- Counter operations
- Time related operations
- Control outputs
- File operations
- Secure Authentication

Other protocols may have some of the same or similar groups, some groups may be missing entirely, or other groups, not used for DNP3, may exist.

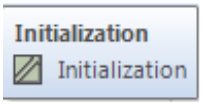
The sample Task Menu is shown below. The actual presentation is for DNP3 protocol, but other protocols show similar information.



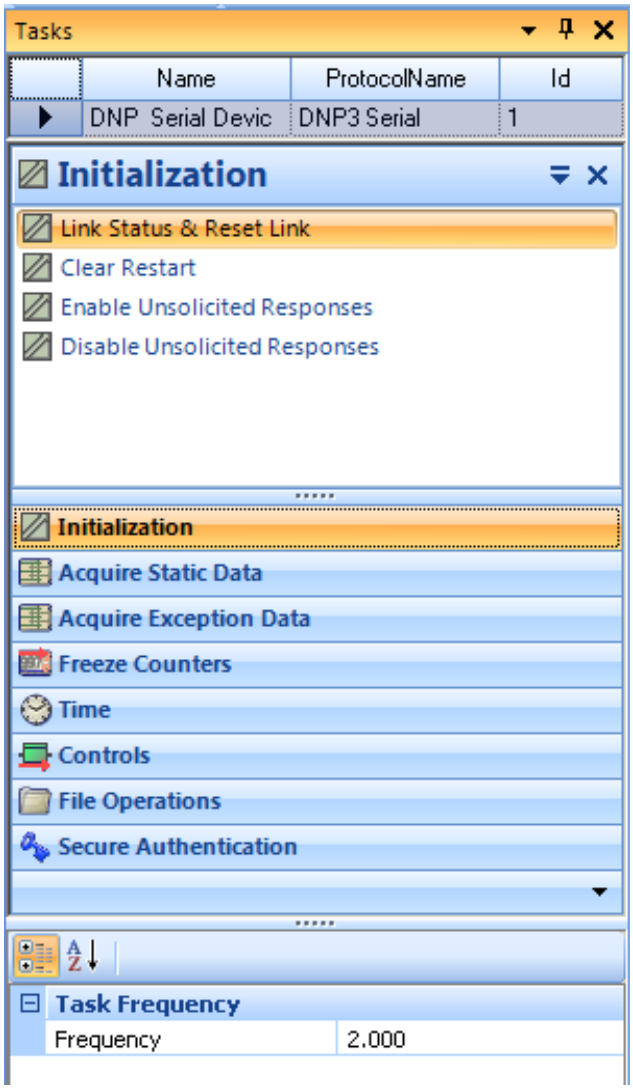
The Task menu layout contains information in four sections.

- The **Device List** with the active device highlighted is shown at the top of the view
- **Task Groups** are presented in a horizontal ICON row near the middle of the view. The active group is shown in a highlighted background color
- **Tasks** within the selected group are presented between the device and task group ICON lists. The active task is shown in a highlighted background color
- **Properties** applicable to the active task and their values are shown at the bottom of the view. These values can be changed if necessary

Because of its compact presentation, task groups are initially identified only by ICON. A Mouse over will show the group name, for Example



A less compact presentation is available from the 
Splitter control immediately above the ICON region. Select this splitter and, keeping the mouse button pressed, slide the mouse upwards. Names of all task groups appear.



10.3.2. Task Activation, General

To activate a task, select a task group and, within that group, the desired task. In the example above, the **Link Status & Reset Link** task is selected from the **Initialization** group.

To activate this task:

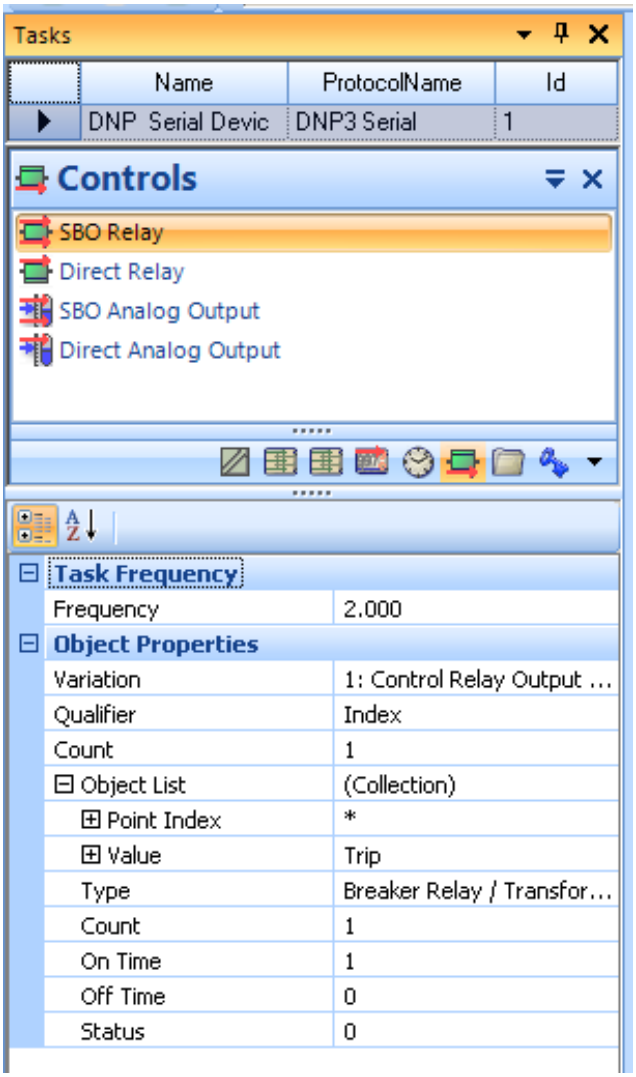
- Select to send messages required to accomplish this task once
- Or the Start icon to send task messages repetitively. The repetition rate is set in the tasks' **Frequency** property, enterable at the bottom of the Task View

Task communication messages are shown in the Line Monitoring and Messages views discussed previously.

10.3.3. Task Setup and Activation, Digital Control Tasks

Single Point Control

Control tasks require the user to enter key information before the task is initiated. Information is entered into properties for the selected task. While properties differ slightly depending on the protocol, the following is typical.



Control properties are more involved than those for most other exchanges. In this example for DNP3 (and the same for many other protocols) the user must enter:

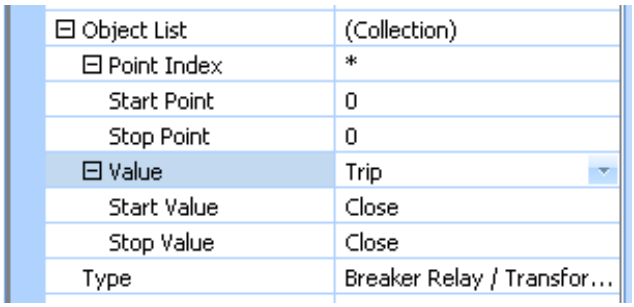
- **Point index**: The default, '*', indicates that no index has been entered. The ASE2000 will reject an attempt to start a control action until a valid address is entered
- **Value**: Choices in this example are trip and close. Names adjust as appropriate to the active protocol and control type.
- **On Time is part of a DNP3 control**: It is also part of many other protocols, but not all. The field does not appear if not applicable to the active protocol. The default is 1 millisecond.

Once correct values are entered for the above properties, the control task can be activated.

This will control a single point. If the Start icon is selected, the same point will be controlled multiple times.

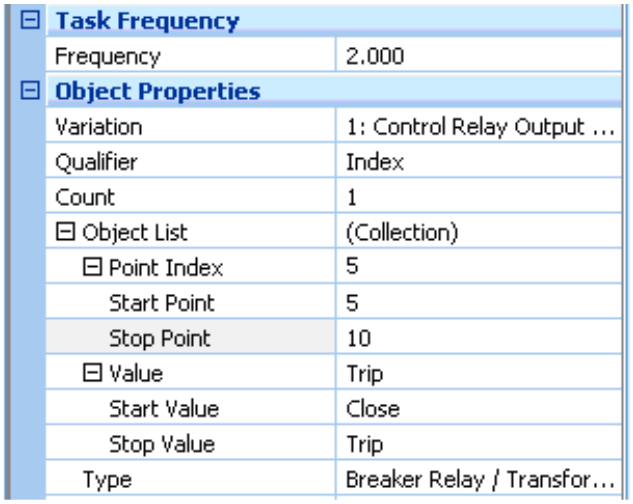
Multiple Point Control

To repetitively control a sequence of points, select the [+] target at the left of the **Point Index** and **Value** properties. The result is:



⊟ Object List	(Collection)
⊟ Point Index	*
Start Point	0
Stop Point	0
⊟ Value	Trip
Start Value	Close
Stop Value	Close
Type	Breaker Relay / Transfor...

Note that **Point Index** has subfields called **Start** and **Stop**. **Value** has subfields called **Start Value** and **Stop Value**. These specify control ranges. For example:



⊟ **Task Frequency**	
Frequency	2.000
⊟ **Object Properties**	
Variation	1: Control Relay Output ...
Qualifier	Index
Count	1
⊟ Object List	(Collection)
⊟ Point Index	5
Start Point	5
Stop Point	10
⊟ Value	Trip
Start Value	Close
Stop Value	Trip
Type	Breaker Relay / Transfor...

Configures the ASE2000 to issue both trip and close commands to points 5 through 10. If the Start icon is selected, one command is sent every period of time as specified by the **Frequency** property. Execution will continue until stopped .

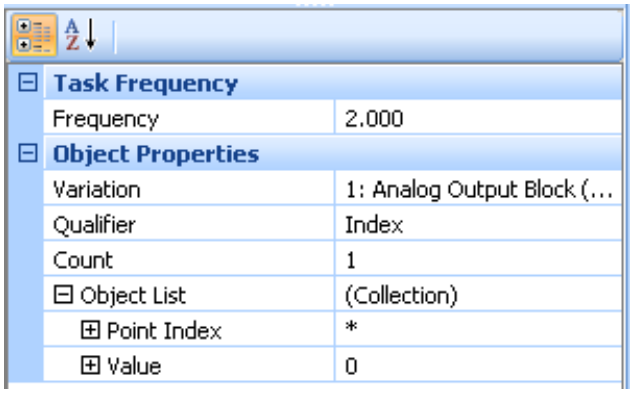
The sequence of commands is:

1. A command is issued to the **Point Index** (5) and the **Value** state (Trip).
2. In preparation for the next command, if the **Value** is not the same as the **Stop Value**, then it is set to the **Stop Value**
3. If the **Value** is the same as the **Stop Value**, then it is set to the **Start Value** and the **Point Index** is incremented.
4. If the **Point Index** is greater than the **Stop Point**, then it is set to the **Start Point**
5. Control continues with step 1

10.3.4. Task Setup and Activation, Analog Control Tasks

As for digital controls, analog control tasks require the user to enter key information before the task is initiated.

Single Point Control



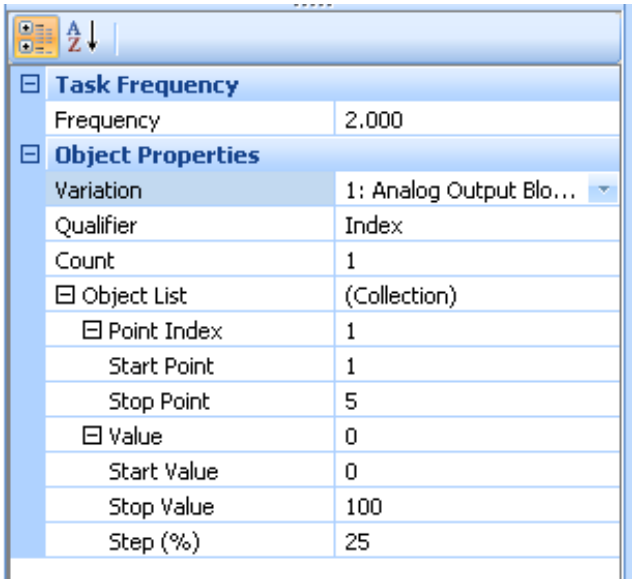
Before activating an analog control, the user must enter:

- **Control point index**: The default, '*', indicates that no index has been entered. The ASE2000 will reject an attempt to activate a control action until a valid index is entered
- **Value**: Analog output value. Unless modified, the default value, 0, is used

Once correct values are entered for the above properties, the control task can be activated. The setup discussed above will result in control of a single point with a single value. If the Start icon is selected, the same control (index and value) will be sent repetitively.

Multiple Point Control

Properties to control multiple points with multiple values are accessible by selecting the [+] targets at the left of the **Point Index** and **Value** fields.



The **Point Index** field has **Start Point** and **Stop Point** subfields, the same as described for Digital Controls. The **Value** field has **Start**, **Stop**, and **Step Percentage** subfields. The subfields define ranges for analog control commands.

For example, the settings shown above configure the ASE2000 to issue commands to:

- Analog output indices 1 through 5, with
- Values ranging from 0 to 100 in 25% increments

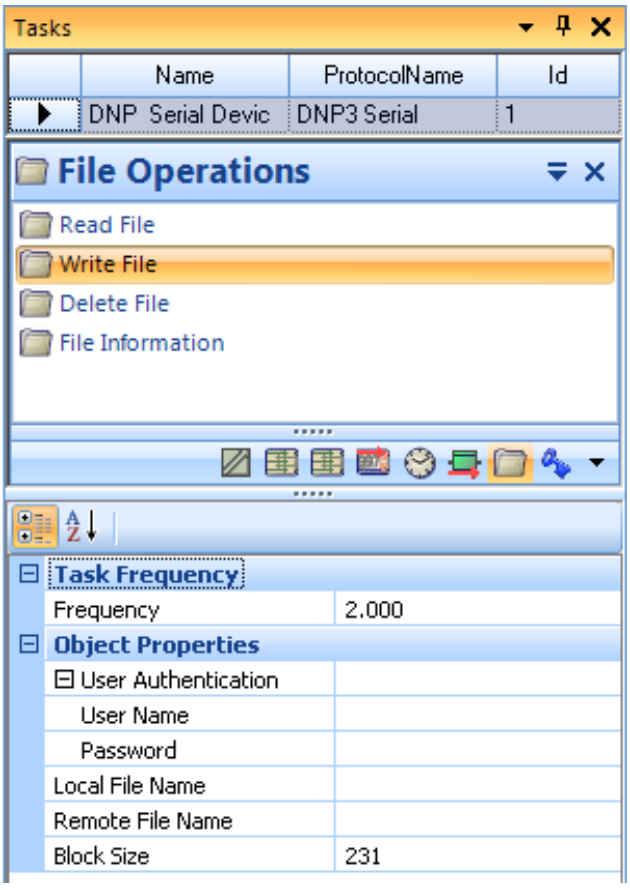
If values are entered into any of the subfields described above prior to activation of the analog output control task, and if activation was initiated with the repetitive transmission ICON, then the task will control multiple indices with multiple values consistent with field and subfield settings. Each transmission will control one index with one value as described in the following steps.

1. The first command will be issued to the **Point Index** (1) and **Value** (0)
1. In preparation for the next command, if the **Value** is equal to or exceeds the **Stop Value**, it will be set to the **Start Value** and the **Point Index** will be incremented. If the Point Index is then greater than the **Stop Point**, it will be set to the **Start Point**
1. Otherwise (**Value** less than **Stop Value**), the **Value** will be increased by the **Step** percentage applied to the difference between the **Start Value** and the **Stop Value**. (If the new **Value** is greater than the **Stop Value**, it will be set to the **Stop Value**.
2. The next command will be issued at the task's frequency with the modified properties

10.3.5. Task Setup and Activation, File Transfer Tasks

For applicable protocols, the ASE2000 can initiate and accept file transfer requests between a master and remote device.

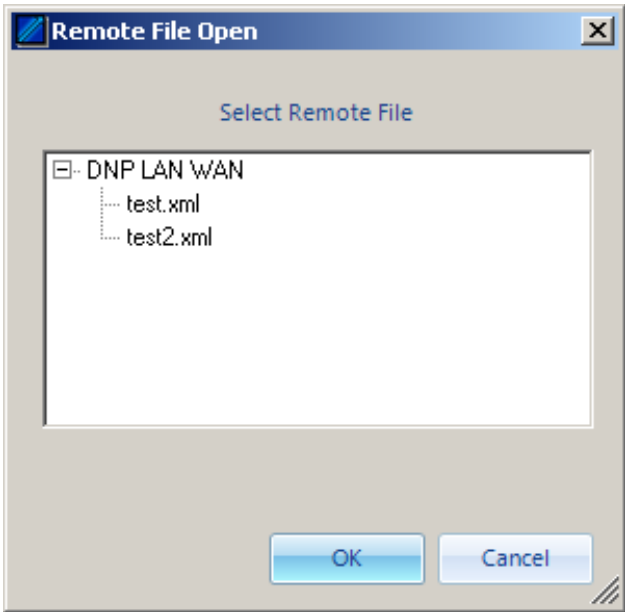
A sample Task Menu for the File Operations group of tasks is shown below.



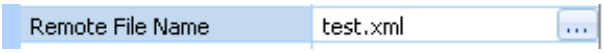
To initial a transfer, the user must enter a file name for the local machine and a file name for the remote device.

The local file is entered in the **Local File Name** property and can be a complete disk and path specification. The local machine can be browsed by clicking in the **Local File Name** field and selecting the browse target at the right of that field.

The remote file is entered in the **Remote File Name** property. If a file name is not known, the ASE2000 can browse the remote device using appropriate protocol commands (assuming directory operations are supported by the protocol and device). A remote browse operation is initiated the same way as a local browse operation: click the **Remote File Name** field and select the browse target at the right of that field. This initiates appropriate communication which, if successful, results in a menu like that shown below.

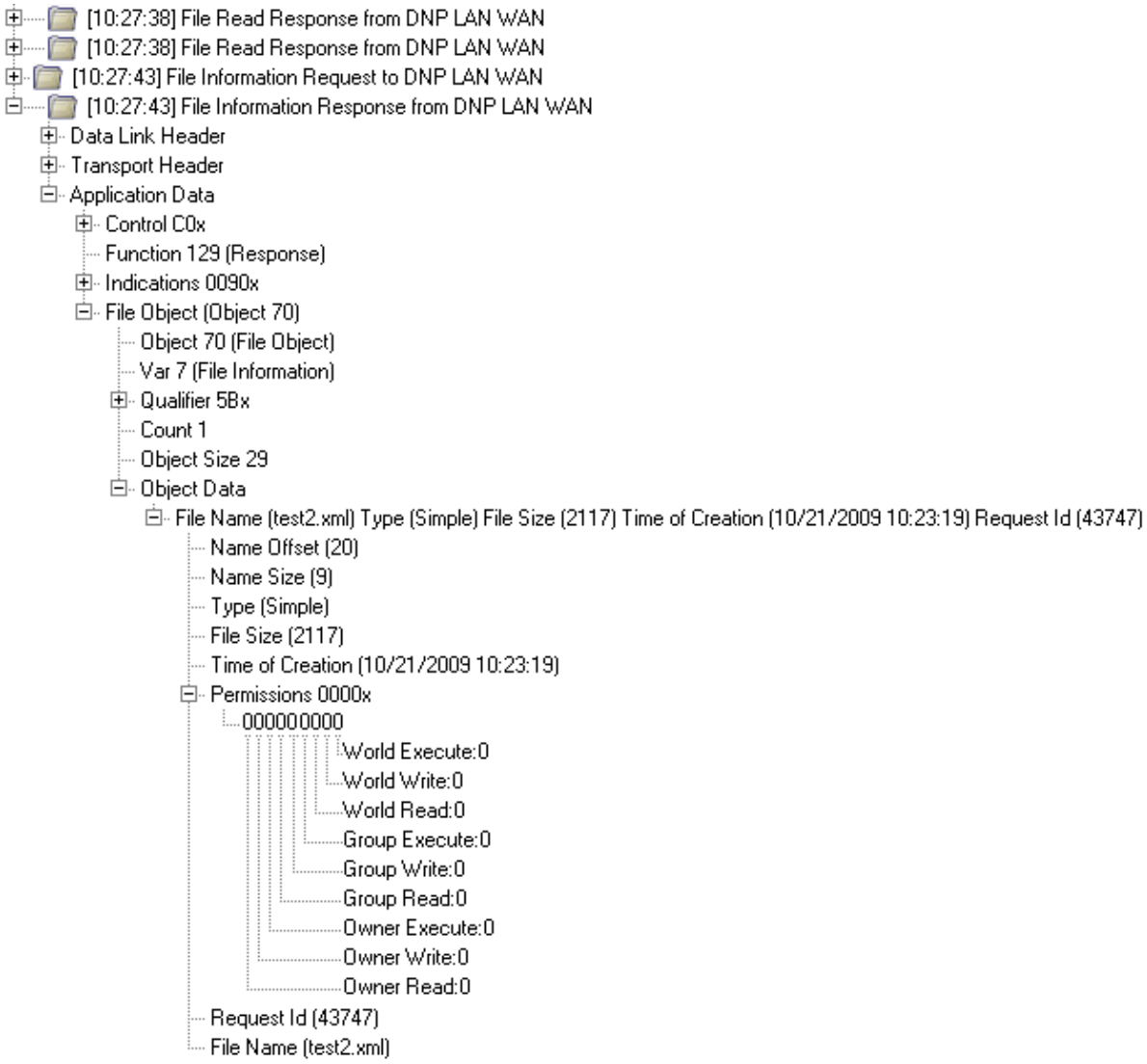


This shows all files reported by the remote device. Select a file and **OK**. The selected file name is placed in the **Remote File Name** field.



Note that the browse operation only fills in the **Remote File Name** field. It does not initiate the selected task: Read File, Write File, Delete File, File Information, or other as supported by the selected protocol.

Once the files names applicable to the selected task have been entered, start the file operation as you would start any other task. Messages are interchanged with the remote device until the operation completes (successfully or with errors). The Line Monitor and Messages Views provide additional information. As an example, following is an expanded **Messages View** for a successfully completed DNP3 **File Information** task.



10.4. Task Mode Operation, Monitor Mode

Monitor mode provides a single task called Scan Responses, selection of which starts the line monitoring process. Exactly one device from the device data base must be active. When operating on a party line where messages from multiple devices could be detected, it is recommended to use Exchange Mode.

Communication messages are received and interpreted according to protocol rules and the point information for the active device.

If the number of points reported by a device does not match the number of points defined in the point data base, and:

- Protocol rules are such that the ASE2000 can correctly parse the message and identify the point types, indices, and values, then the message is valid and the point data base is updated with the points reported. If more points are reported than defined, additional points are created. Points will be added to the Point Values view, but the device data base will not be modified.
- Protocol rules are such that when the ASE2000 cannot correctly parse the message, then results are unpredictable. Most likely, the ASE2000 will report a communication error and no point data base updates will be made.

10.5. Task Mode Operation, RTU Simulation Mode

RTU Simulation mode provides a single task called Scan Responses, selection of which starts the RTU Simulation process. Exactly one device from the device data base must be active. The ASE2000 cannot, in Task Mode, simulate responses to request for more than one device, this is not supported as there is only one state.

When a request for input data is received, the ASE2000 generates its response from the point configuration of the device data base. The example below shows values for seven analogs, twelve digitals, and one pulse accumulator point.

Point List | Messages

RTU ID	Group	Point	Name	Description	Raw	Value	Limits	Increment
1	0	AI 0			0	0		0
1	0	AI 1			0	0		0
1	0	AI 2			0	0		0
1	0	AI 3			0	0		0
1	0	AI 4			0	0		0
1	0	AI 5			0	0		0
1	0	AI 6			0	0		0
1	1	DI 0			0			0
1	1	DI 1			0			0
1	1	DI 2			0			0
1	1	DI 3			0			0
1	1	DI 4			0			0
1	1	DI 5			0			0
1	1	DI 6			0			0
1	1	DI 7			0			0
1	1	DI 8			0			0
1	1	DI 9			0			0
1	1	DI 10			0			0
1	1	DI 11			0			0
1	1	PI 1			0	0		0

In the initial case, the values and states for all points are 0. Different values can be entered in this view according to the following rules.

- An analog or pulse value, or a digital state, can be entered in the “raw” column. Any such value will be used in response to the next applicable scan
- For protocols that support change event processing, entering a new value will generate a change event
- For analog points, a value entered in the increment field causes the point value to be automatically adjusted after each scan response. The adjusted value is used in the subsequent response. In this manner, analog values will ramp up and down between high and low limits applicable to the protocol
- For pulse points, a value entered in the increment field causes the point value to be automatically incremented after each scan response. The new value is used in the subsequent response. Pulse values wrap around at a maximum applicable to the protocol
- For digital points, an increment value of 1 causes the point state to alternate between 0 and 1 at each scan response

Values in the **Raw** or **Increment** columns may be copied forward by selecting multiple rows and right-clicking to display a pop-up menu. Choose ‘Copy Raw Value’ or ‘Copy Increment’. The value from the first row selected is copied to all selected rows. To select multiple rows, click once in the first row to select it and hold down the Shift key while clicking in the last row. All selected

rows will be highlighted. The copy operation works within a single point type. If the selected rows contain both Analog and Digital points, the copy operation will stop when it reaches a new point type.

The table below shows examples of increment values entered for each point type.

Point List | Messages

RTU ID	Group	Point	Name	Description	Raw	Value	Limits	Increment
1	0	AI 0			0	0		0
1	0	AI 1			13	13		1
1	0	AI 2			0	0		0
1	0	AI 3			0	0		0
1	0	AI 4			0	0		0
1	0	AI 5			0	0		0
1	0	AI 6			0	0		0
1	1	DI 0			0			0
1	1	DI 1			0			0
1	1	DI 2			0			0
1	1	DI 3			0			0
1	1	DI 4			0			0
1	1	DI 5			0			0
1	1	DI 6			0			1
1	1	DI 7			1			1
1	1	DI 8			0			0
1	1	DI 9			0			0
1	1	DI 10			0			0
1	1	DI 11			0			0
1	1	PI 1			120	120		10

11. Remote Monitoring

ASE2000 version 2 release 2.16 and later adds the ability to monitor communication in a remote SPT or ASE Terminal server.

- The SPT product line includes the SPT-PC, SPT4-NET, and SPT-ARM. Remote monitoring is supported in SPT software release x.6.y or later (i.e., the middle digit must be at least 6)
- The Terminal Server product line must be based on an ARM processor. Older Pentium based processor solutions do not support remote monitoring

Remote monitoring allows the ASE2000 to make a network connection with any remote SPT or Terminal Server package with compatible software support and to display data just as if the ASE2000 were located at the remote site. Only non-intrusive monitoring operation is supported. No message transmission can be initiated in this mode.

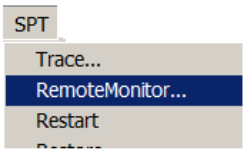
Non-intrusive terminal server hardware can be purchased for installation at remote locations to provide remote monitoring connectivity. These units can be configured as listening only to alleviate security concerns.

11.1. Activation

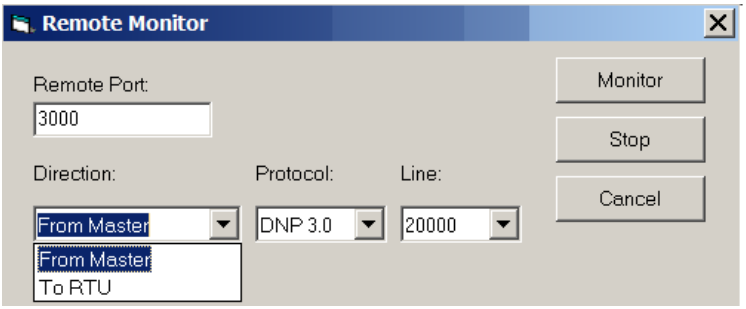
Remote monitoring requires activation at both the remote (SPT) site and at the local ASE2000.

11.1.1. SPT Remote Monitoring Configuration

SPT activation is accomplished through the SPT Editor, provided as part of the SPT package. From the editor, select the Remote Monitor option from the SPT pull-down.



To provide a selection list of all possible communication channels/ports into the SPT.



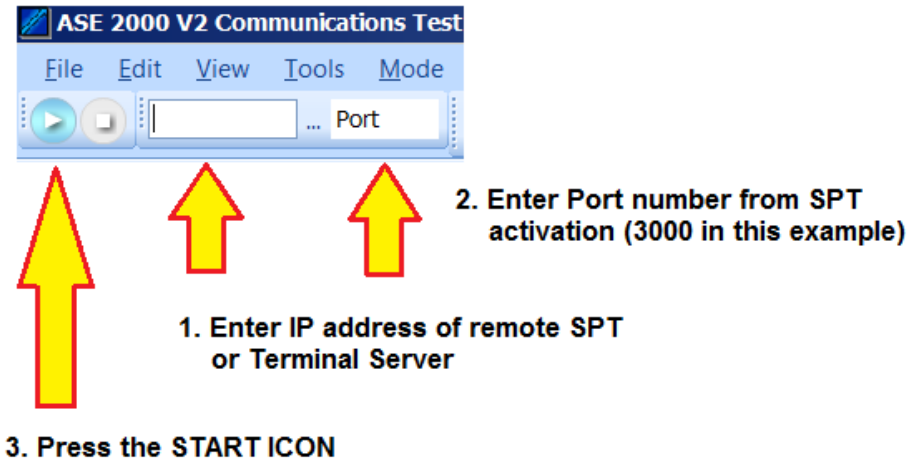
In this example, the SPT is configured to report data to the master over DNP3 LAN/WAN IP port 20000. After selecting the "**Monitor**" option, this communication traffic will be reported to a remote ASE2000 over port 3000. This is the default and can be changed.

11.1.2. ASE2000 Remote Monitoring Configuration

Once the SPT is configured to accept an ASE2000 connection, complete remote monitoring from the ASE2000 as follows:

- Select the correct protocol, either in Task or Exchange modes
- Enter Remote Monitoring mode from the bottom left portion of the screen

- To activate



Data will be reported from the SPT/Terminal Server and shown in the ASE2000 he same as a local monitoring session.

12. Project Saving

Beginning with version 2.21, users can now save task properties into a project file (.A2K). Some properties are not saved, as altering would affect the overall application behavior, hence user will need to make such task property changes explicitly after opening the project or starting the application.

To save a project, simply click “File” in the menu bar, then “Save As” and give the appropriate name and file location.

When a user saves a project, it will capture the following information from saved projects.

- Master / RTU Simulation mode
- Exchange/Task mode
- Task mode properties

Note: only static property settings that do not affect application behavior will be saved.

User can open the project by double clicking on the .a2k in Windows or by going to “File” in the menu bar and clicking “Open.

13. ASE2000 Cabling

This section describes various cabling configurations used to connect the ASE2000 for the different operational modes (Master Simulation, RTU/IED Simulation, Monitor Mode), the different hardware models (BCOM-USB, COM) and different connection types (Modem, RS-232). Cabling for network based communication is discussed in a separate section titled **ASE2000 Network Protocol Use**.

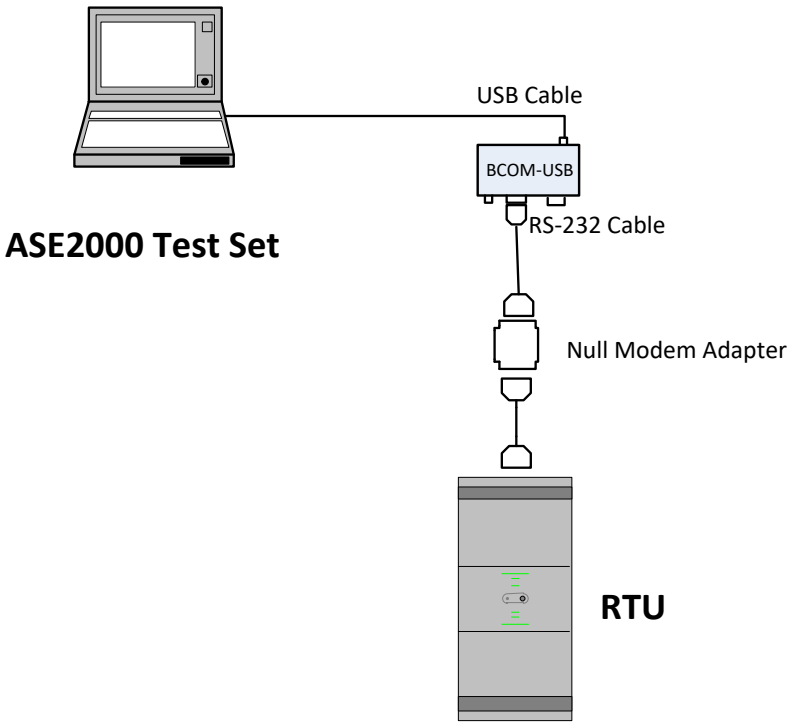
- **Master simulation**: In this mode, ASE2000 simulates the primary station (Master), allowing you to construct and transmit requests to one or more secondary stations (RTU/IED).
- **RTU simulation**: In this mode, ASE2000 simulates one or more secondary stations (RTU/IED), allowing you to construct responses or unsolicited messages and transmit them to the primary station.
- **Monitor**: In this mode, ASE2000 monitors the communication line connecting the primary station and one or more secondary stations and displays the messages exchanged between them.

For the three modes of operation, connections can be made at the RS-232 level, at the Telco level using ASE supplied or other modems, or at the network level for network based protocols.

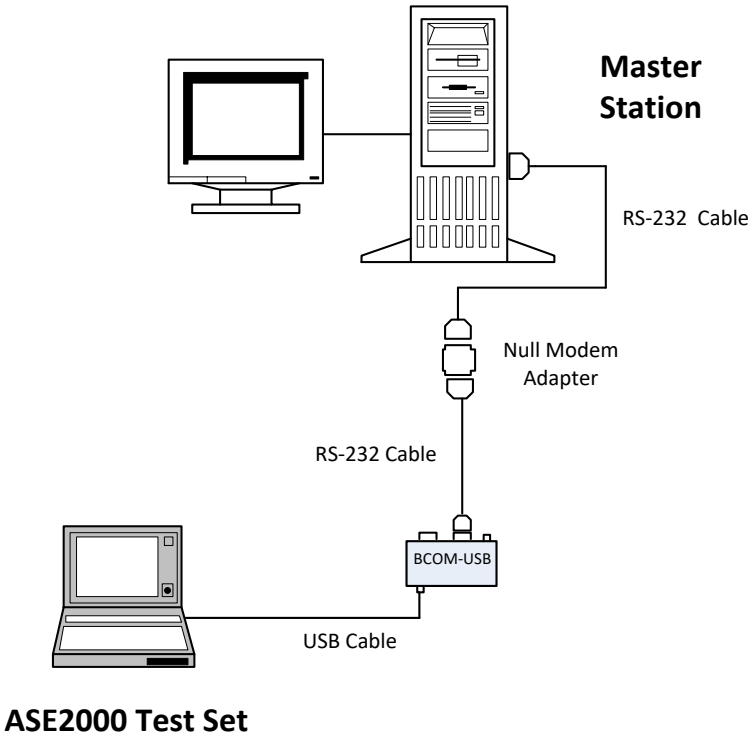
13.1. RS-232 Connections

The following figures illustrate different cabling configurations for connecting the ASE2000 Test Set equipment at the RS-232 level. The ASE Dual-Channel RS-232 PCMCIA I/O card is used in the illustrations but the same principles apply to any RS-232 I/O device.

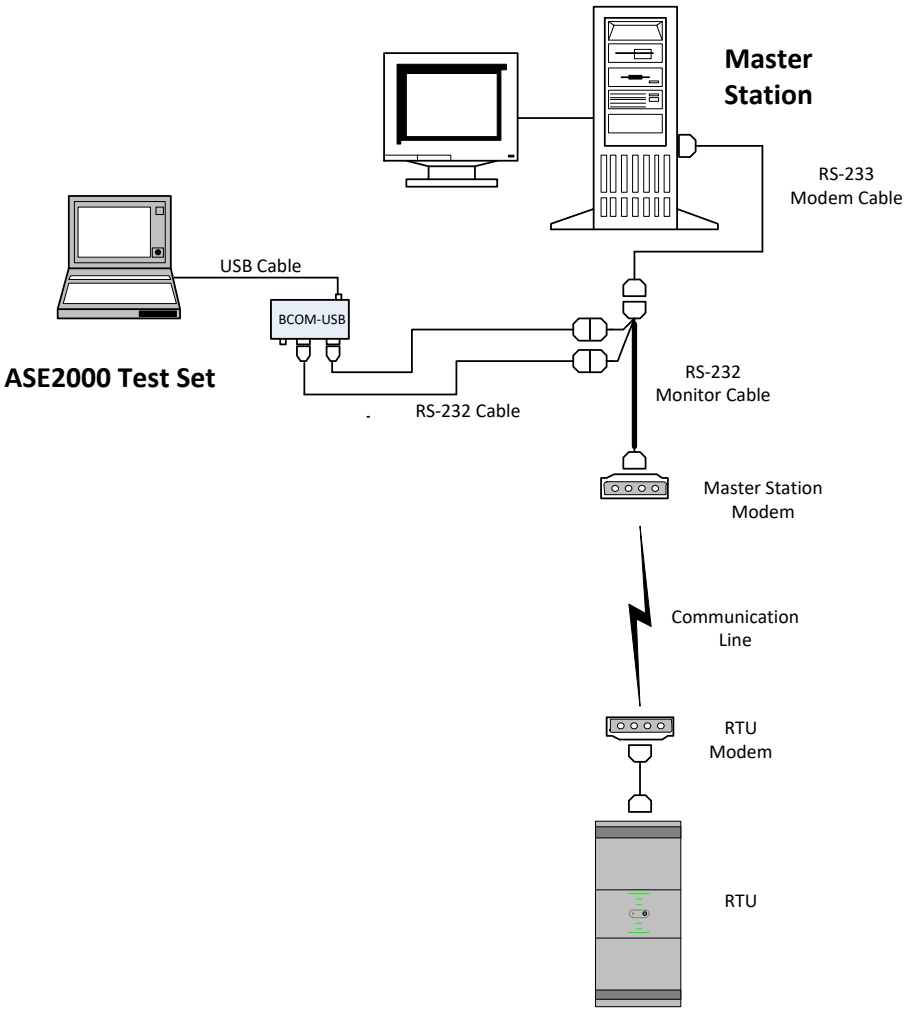
13.2. Master Simulation Mode – RS-232



13.2.1. RTU/IED Simulation Mode – RS-232



13.2.2. Monitor Mode – RS-232

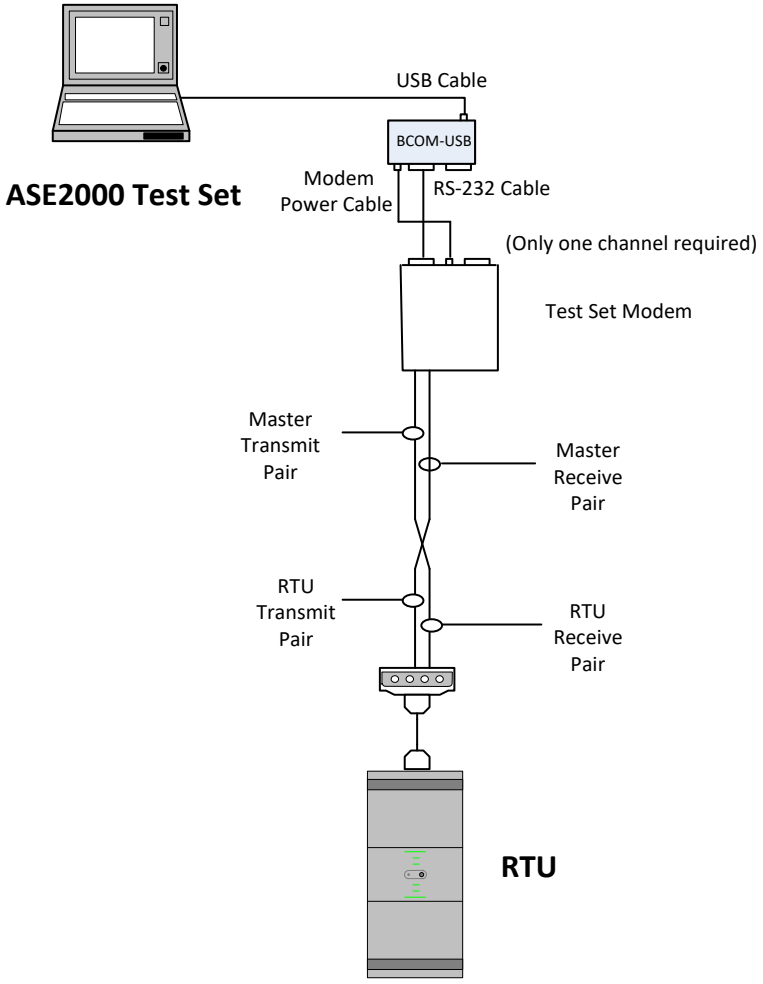


13.3. Modem Connections

The following figures illustrate different cabling configurations for connecting the ASE2000 Test Set equipment to the phone line circuits through a modem. The ASE Dual-Channel modem is used in the illustrations but the same principles apply to any modem. The ASE modem is a dual-channel modem with two DB-25 female connectors and a power connector on one side of the modem box, and two RJ-11 receptacles on the opposite side of the box. When using the modem for Monitor Mode, ASE recommends setting the monitor mode switch to the ON position to correctly balance the line. If you are not running in Monitor Mode, set this switch to OFF.

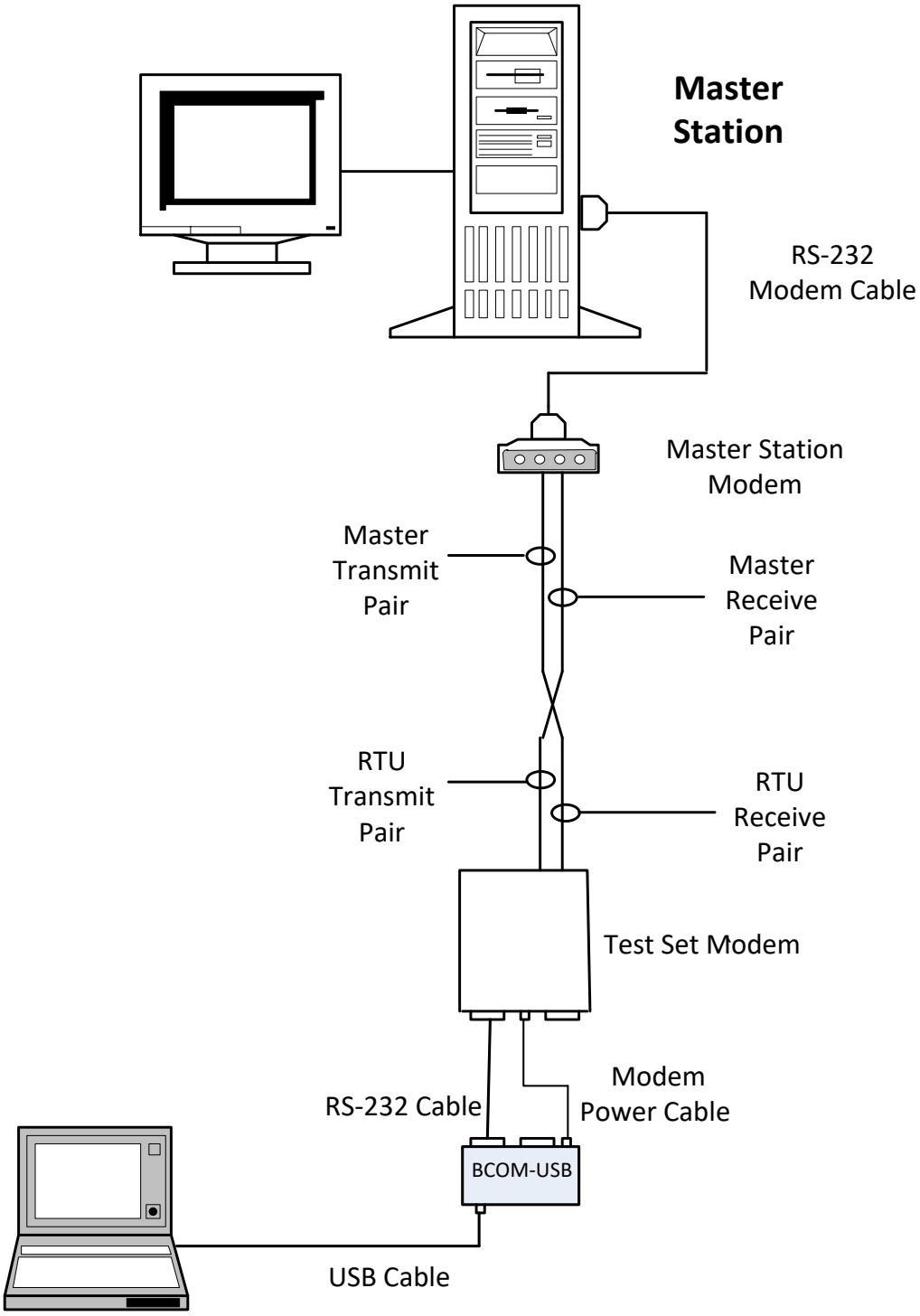
Note: When set to on, the switch forces the modem to run in high-impedance mode by removing the 600 load from the receive line.

13.3.1. Master Simulation Mode – Modem Connection

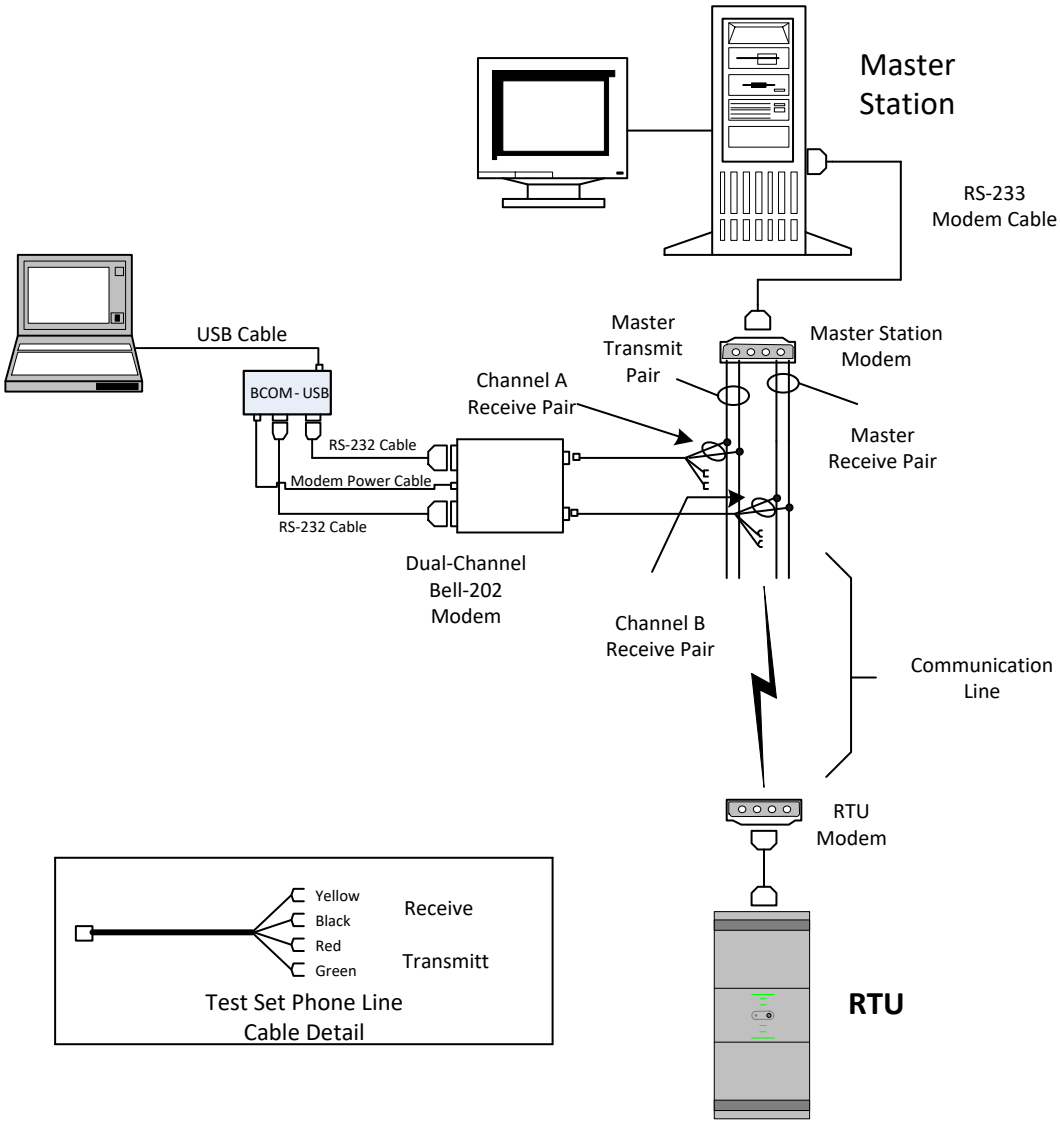


Master Simulation Mode
Modem Connection

13.3.2. RTU/IED Simulation Mode – Modem Connection



13.3.3. Monitor Mode – Modem Connection

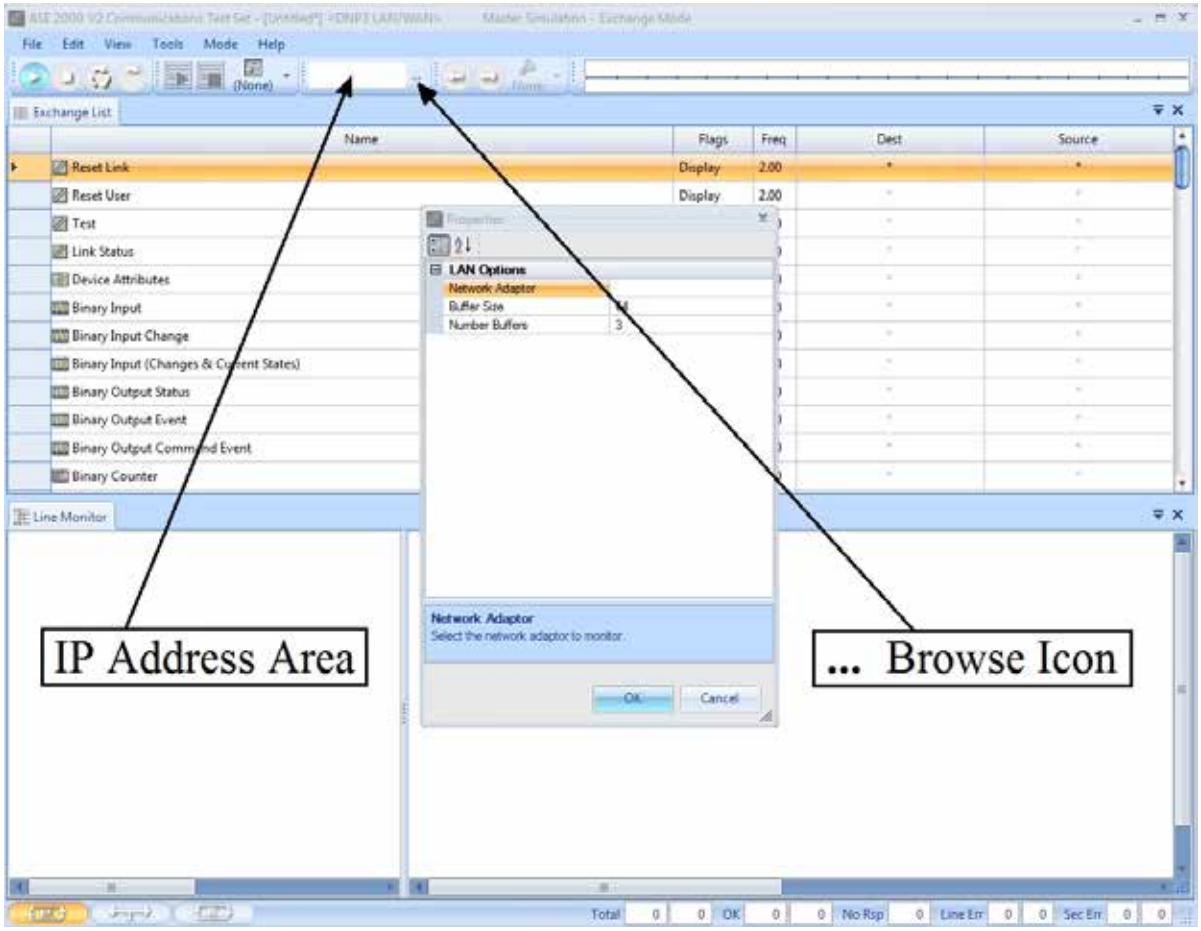


14. ASE2000 Network Protocol Use

The ASE2000 currently supports three network based protocols, DNP 3 LAN/WAN, Modbus TCP, and IEC 60870-5-104. All three Communication Modes, Master, RTU, and Monitor mode are supported but there are different physical connection requirements depending on which mode(s) is to be used.

The ASE2000 uses the standard PC network interface device (NIC) for all network communication but still requires that either the BCOM-USB device or ASE USB Dongle be installed on the PC where the ASE2000 software is to be run. Even though the PC network interface is used for network communication, the BCOM-USB or USB dongle is still used to enable the ASE2000 software.

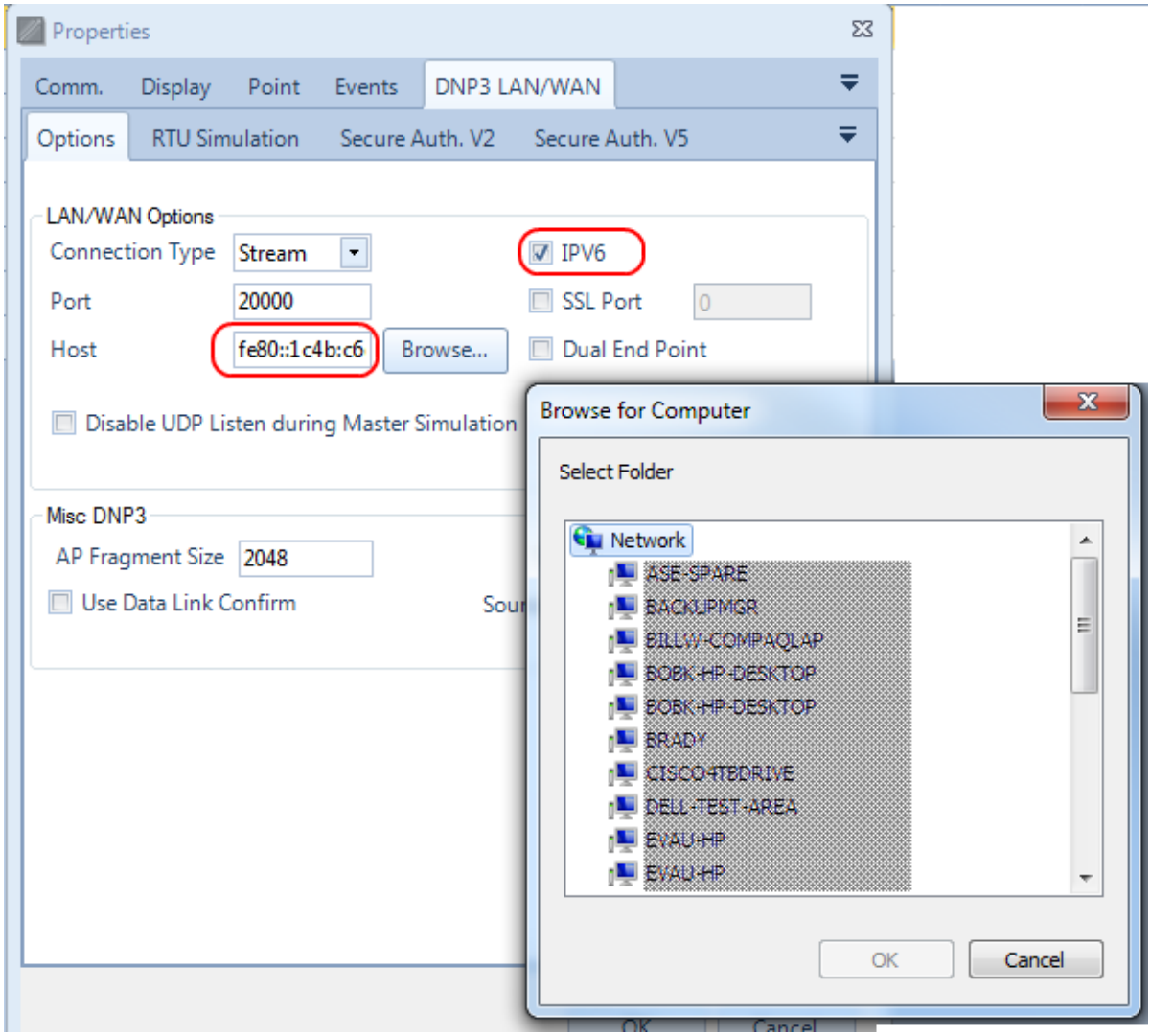
If the test set computer has multiple network adaptor interfaces, it may be necessary to designate which adaptor the ASE2000 test set should use. For devices with multiple adaptors, right-click the "…" field (Browse icon) to the right of the IP Address box and select Properties. From the list of available adaptors, select the appropriate adaptor.



Basic test set operation is the same for both network and serial protocols but there are a few set-up differences that the user must be aware of.

14.1. Master Mode

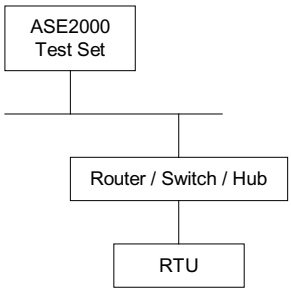
In Master Mode, the test set will operate as a Master and issue commands to and receive responses from a remote device. To address the proper device, it will be necessary to configure both the IP address and device (RTU/IED) address in the ASE2000. To set the network address of the remote device, select Tools > Properties >DNP3 LAN/WAN>Options tab (or other protocol as appropriate). Either Browse for the name of the remote (slave device) or enter the IP address in the Host field. Select IPv6 when entering Host addresses using the broader IPv6 address space.



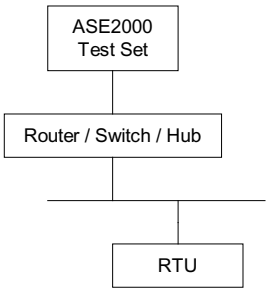
For DNP3 LAN/WAN, specify **Stream** for TCP or **Datagram** for UDP. Also for DNP3 LAN/WAN the Port address can be changed but it is recommended that the default value of 20000 be used. The protocol address (RTU address) of the device is specified the same as with the serial version of the protocol on the Exchange List view by double-clicking on the exchange name or setting the address on all exchanges using the "**Tools > Properties > Protocol**"

In Master Mode, there are no special connection requirements or connection restrictions. The test set PC can be connected directly to the remote device, through a router, a switch, or a hub as shown below.

Master Mode



Master Mode Example 1



Master Mode Example 2

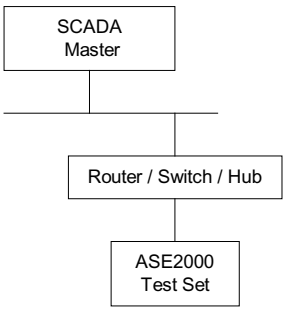
Once the address configuration and physical connection is complete, test set operation is the same as for serial operation.

14.2. RTU Mode

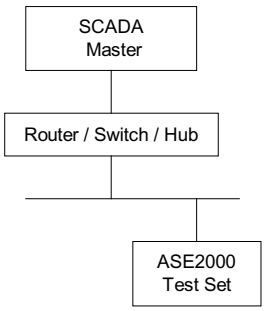
In RTU Mode, the test set will operate as a remote device and respond to commands received from a SCADA Master. Special configuration is not necessary for network communication. As the “remote” device, the test set software will accept incoming connection requests and, from that point on, test set operation is the same as with a serial connection. If the device protocol address is set to the default value *, the test set will respond to requests containing any address. Alternatively, a specific protocol address (RTU address) for the device is can be specified the same as with the serial version of the protocol on the Exchange List view by double-clicking on the exchange name or setting the address on all exchanges using the “**Properties > Protocol Specific > Exchange Defaults tab**”.

In RTU Mode, there are no special connection requirements or connection restrictions. The test set PC can be connected directly to the remote device, through a router, a switch, or a hub as shown below.

RTU Mode



RTU Mode Example 1



RTU Mode Example 2

Once the address configuration and physical connection is complete, test set operation is the same as for serial operation.

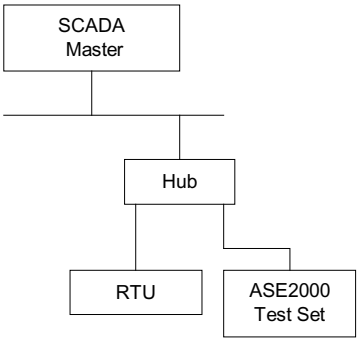
14.3. Monitor Mode

In Monitor Mode, the test set will monitor and display communication messages between two or more devices that are communicating using the designated network protocol.

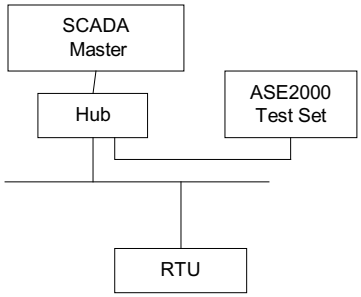
Unlike Master Mode and RTU Mode, there are physical connection requirements that must be followed in order for the test set to have access to the messages between the devices to be monitored.

In Monitor Mode, the ASE2000 test set forces the network interface to operate in what is called “promiscuous” mode. This allows the test set to read network messages that are not addressed to the device the test set is running on. In order for this to work, it is necessary for the test set PC and either the SCADA Master or the remote device to be on a common network segment. This is most commonly accomplished by plugging the devices into a common hub; not a router or switch. It is necessary to use a hub in this case so the messages between the devices being monitored will be present on the LAN segment the test set is connected to. A router or switch will only pass messages to a port if the addressed device is known by the switch or router to be connected to that port. So, if you connect the test set directly to a port on a router or switch for monitoring purposes it won’t work since the router/switch will not pass the data to that port. As described above, a router or switch can be used for Master or RTU mode but not Monitor mode. Since a hub passes all data to all connected ports, data for the devices being monitored will be available to the test set only if the test set and at least one of the devices being monitored is connected to the hub. It is possible, and most likely necessary, to use routers and switches in other parts of the network but a hub must be used for the monitored devices. See connection examples below.

Monitor Mode



Monitor Mode Example 1



Monitor Mode Example 2

As with serial communication, it is possible to filter the data processed and displayed by ASE2000 test set using network protocols. With serial communications, the filtering is accomplished by setting the device address on the Exchange List view. With network protocols, filtering can be set at the IP addresses level and the device address level.

To set an address filter at the IP address level, enter the host name or IP address of the device to be monitored. The default value “Any” will display messages between all devices on the network segment using the designated protocol. Select the IPv6 option on the LAN/WAN Properties page when entering Host addresses using the broader IPv6 address space.

15. ASE2000 V2 Command Line Options

The ASE 2000 V2 supports several command line options. To specify command line options you can:

1. Add them to a Windows shortcut
- Create a shortcut (select the ASE2000V2 from the start menu, right-click, Send to, Desktop (create shortcut))
- Right-click on the shortcut, Properties
- Add command line options to the Target value (outside the quotation marks)

2. Launch the ASE2000 V2 from the command line in a DOS window
- From the start menu, type 'cmd' into the search (or run) box
- On the command line, navigate to the ASE2000 V2 program directory
- Add command line options to the end of the program name

For example:
"C:\Program Files (x86)\ASE\ASE2000 V2 Communication Test Set\Ase 2000 Communication Test Set.exe" /task /rtu /start=500

The ASE2000 V2 command line options are as follows:

<filename> – open an Exchange mode configuration file (.MONX)
- Only effects Exchange mode
- For example: "Ase 2000 Communication Test Set.exe" DNP3-Serial.monx

/portA or /**portB** – assigns one or both port number(s)
- /**portA=COM<a>** and/or /**portB=COM<b>**
- The port number must include the '**COM**' prefix (/portb=11 is not valid)
- If the provided port number is not available, the option is ignored
- Command line port numbers override the default assignment

/reset – launch program with Default screen layout (use this option if the screen has been moved or arranged in error, such as losing the toolbars or menus)

/task – launch program in Task mode (default is the last mode used)

/rtu – launch the program in RTU Simulation mode

/monitor – launch the program in Monitor mode

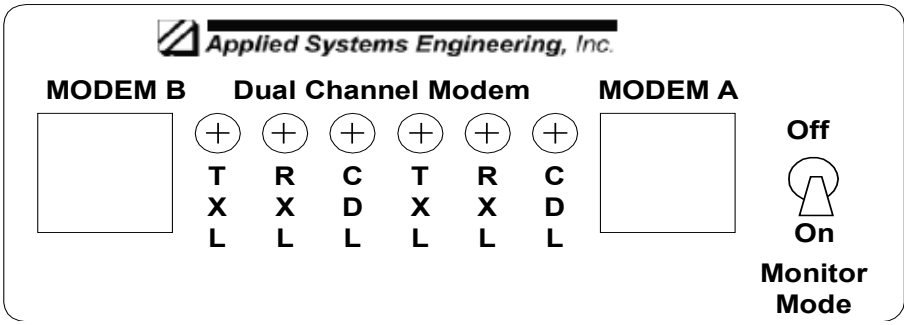
/name – select an active RTU in Task mode
- /**name=<rtuname>** where <rtuname> is an active RTU in the Tasks pane list
- For example: /**name=MB-235** or /**name="DNP3 Meter 14**"
- Use quotes around name if it includes spaces
- The name must match exactly including upper & lower case
- If the name is not found, the /**start** command is ignored

- If the program launches in Exchange mode, this option has no effect
- /**start** – start communications when launched
- /**start** or /**start=time** where **time** is an optional wait time before starting
- If **time** is not specified, a default wait of one second is used
- A **time** value of up to 120 will wait that number of seconds, for example /**time=10**
- A value greater than 120 will be interpreted as milliseconds, for example /**time=500**
- When /**start** is specified, communications will be started as though the start button was clicked according to the following:

	Exchange Mode	**Task Mode**
Master Simulation	Attempt to send exchanges with the Transmit flag set	Attempt to send first command in list of available tasks
Monitor Mode	Start monitoring	Start monitoring
RTU Simulation	Start scanning as RTU	Start scanning as RTU

16. ASE BELL-202 Dual-Channel Modem Adjustment

This section illustrates and explains the *gain* and *sensitivity* adjustments on the ASE Bell-202 Dual-Channel Modem.



Modem Adjustments

The modem contains six potentiometers as shown in the diagram above, three for Channel A and 3 for Channel B. The adjustments control transmitter gain, receiver gain, and carrier detect sensitivity levels.

> *Note: There are two types of potentiometers that are assembled in the modems. Most of the modems are supplied with white potentiometers but some modems manufactured after 1998 have yellow or orange colored potentiometers. The adjustment direction for these potentiometers is reversed from the white potentiometers. Consequently, the meanings of cw and ccw are interchanged.*

Make sure you identify the type of potentiometer before attempting adjustments.

The type of potentiometer can be determined by looking through the adjustment hole to determine the color.

16.1. Adjusting Modems with White Colored Potentiometers

TXL Transmitter Gain - Factory setting is 1/8 of a turn from the counter-clockwise (ccw) end. Transmit levels range from –50 dBm in the ccw direction to –6 dBm in the clockwise (cw) direction.
RXLReceiver Gain - Factory setting is ¼ of a turn from the counter-clockwise end. Receive sensitivity levels range from –6 dBm in the ccw direction to –54 dBm in the cw direction.
CDL Carrier Detect Sensitivity - Factory setting is completely counter-clockwise. Sensitivity is –30 dBm in the ccw direction to –48 in the cw direction.

TXL	Transmitter Gain - Factory setting is 1/8 of a turn from the counter-clockwise (ccw) end. Transmit levels range from –50 dBm in the ccw direction to –6 dBm in the clockwise (cw) direction.
RXL	Receiver Gain - Factory setting is ¼ of a turn from the clockwise end. Receive sensitivity levels range from –6 dBm in the cw direction to –54 dBm in the ccw direction.

CDL	Carrier Detect Sensitivity - Factory setting is completely clockwise. Sensitivity is –30 dBm in the cw direction to –48 in the ccw direction.

16.2. Adjusting Modems with Orange or Yellow Colored Potentiometers

TXL	Transmitter Gain - Factory setting is 1/8 of a turn from the clockwise (cw) end. Transmit levels range from –50 dBm in the cw direction to –6 dBm in the counter-clockwise (ccw) direction.
RXL	Receiver Gain - Factory setting is ¼ of a turn from the clockwise end. Receive sensitivity levels range from –6 dBm in the cw direction to –54 dBm in the ccw direction.
CDL	Carrier Detect Sensitivity - Factory setting is completely clockwise. Sensitivity is –30 dBm in the cw direction to –48 in the ccw direction.

17. RS-232 Cable And Adapter Pin-Out

17.1. DB-25 Connector PIN-OUT

Pin	Signal Name	Signal Description
1	----	Protective Ground
2	TXD	Transmitted Data
3	RXD	Request To Send
4	RTS	Request To Send
5	CTS	Clear To Send
6	DSR	Data Set Ready
7	GND	Signal Ground/Common
8	CD	Carrier Detect
9	---	+Voltage
10	---	-Voltage
11	---	----
12	SCF	2nd Line Detector
13	SCB	2nd Clear To Send
14	SBA	2nd Transmitted Data
15	DB	DCE Element Timing
16	SBB	2nd Received Data
17	DD	Received Element Timing
18	-----	Unassigned
19	SCA	2nd Request To Send
20	DTR	Data Terminal Ready
21	CG	Signal Quality Detector
22	RI	Ring Detector
23	CH/CI	Data Signal Rate Detector
24	DA	DTE Element Timing
25	----	Unassigned

17.2. DB-9 Connector PIN-OUT

Pin	Signal Name	Signal Description
1	CD	Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground/Common
6	DSR	Data Set Ready
7	RTS	Request To Send

8	CTS	Clear To Send
9	RI	Ring Indicator

17.3. DB-9 to DB-25 Adaptor

The following table illustrates the pin-out of a “standard” DB-9 to DB-25 adaptor.

DB-9	DB-25	Signal Description
1	8	DCD – Data Carrier Detect
2	3	RXD – Receive Data
3	2	TXD – Transmit Data
4	20	DTR – Data Terminal Ready
5	7	Com – Common
6	6	DSR – Data Set Ready
7	4	RTS – Request To Send
8	5	CTS – Clear To Send
9	22	RI – Ring Indicator

This type adaptor should be used whenever it is necessary to convert between a DB-25 and DB-9 connector.

17.4. DB-25 Null Modem Adaptor (Standard)

The following table illustrates the pin-out of a “standard” DB25 to DB-25 Null Modem Adaptor.

Signal Description	DB-25M	DB-25F	Signal Description
Protective Ground	1	1	Protective Ground
TXD – Transmit Data	2	3	RXD – Receive Data
RXD – Receive Data	3	2	TXD – Transmit Data
RTS – Request To Send**	4	8	DCD – Carrier Detect
CTS – Clear To Send**	5	8	DCD – Carrier Detect
DSR – Data Set Ready	6	20	DTR – Data Terminal Ready
COM – Common (Sig. Gnd)	7	7	COM – Common (Sig. Gnd)
DCD – Carrier Detect	8	4	RTS – Request To Send**
DCD – Carrier Detect	8	5	CTS – Clear To Send**
DTR – Data Terminal Ready	20	6	DSR – Data Set Ready

***Note: Pins 4 and 5 (RTS, CTS) on both the DB-25 Male and DB-25 Female side are tied together and connected to pin 8 (DCD) of the other side.*

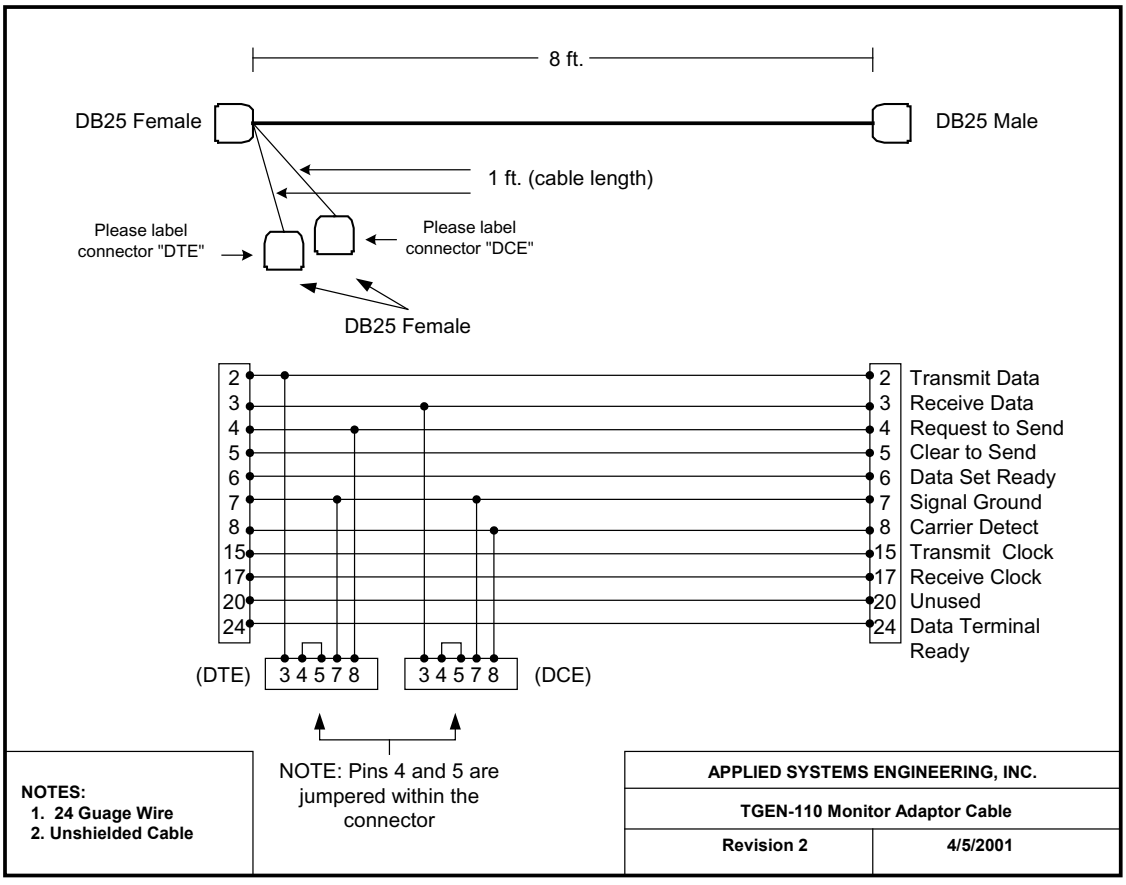
17.5. DB-9 Null Modem Adaptor (Standard)

The following table illustrates the pin-out of a “standard” DB9 to DB-9 Null Modem Adaptor.

Signal Description	DB-9M	DB-9F	Signal Description
DCD – Data Carrier Detect	1	7	RTS – Request To Send**
DCD – Data Carrier Detect	1	8	CTS – Clear To Send**
RXD – Receive Data	2	3	TXD – Transmit Data
TXD – Transmit Data	3	2	RXD – Receive Data
DTR – Data Terminal Ready	4	6	DSR – Data Set Ready
COM – Common (Sig. Gnd)	5	5	COM – Common (Sig. Gnd)
DSR – Data Set Ready	6	4	DTR – Data Terminal Ready
RTS – Request To Send**	7	1	DCD – Data Carrier Detect
CTS – Clear To Send**	8	1	DCD – Data Carrier Detect

***Note: Pins 7 and 8 (RTS, CTS) on both the DB-9 Male and DB-9 Female side are tied together and connected to pin 1 (DCD) of the other side.*

17.6. ASE RS-232 Monitor Adaptor Cable



18. ASE2000 Kit Contents

The ASE2000 is provided in kit form with all the necessary software, cables, adaptors, and documentation to configure an operational test set. The actual kit contents will vary according to ASE2000 model and are detailed in the following sections.

18.1. Model ASE2000-USB-M

- **ASE2000 Software Installation CD-ROM**. This CD contains both the ASE2000 Application software installation files and the I/O driver files for the ASE dual-channel BCOM-USB device and the SafeNet Pro/SuperPro Security Plug (dongle).
- **ASE dual channel BCOM-USB device**
- **USB Cable – PC to BCOM-USB**
- **USB to ASE 2-Channel Modem Power Cable**
- **Two RS-233 Cables, each with a DB-9 Female connector on one end and a DB-25 Male connector on the other end**.
- **ASE Bell-202 or CCITT V.23 dual-channel modem and** two RJ-11 cables with fork-lug connectors (optional only with the BCOM-USB models)
- **DB-25 female-female gender changer**
- **DB-25 null modem adapter**
- **DB-9 to DB-25 adaptors**
- **RS-232 monitor-mode adapter cable**
- **ASE2000 documentation** - ASE2000 Communication Test Set User Guide.

18.2. Model ASE2000-USB-RS

- **ASE2000 Software Installation CD-ROM**. This CD contains both the ASE2000 Application software installation files and the I/O driver files for the ASE dual-channel BCOM-USB device and the SafeNet Pro/SuperPro Security Plug (dongle).
- **ASE dual channel BCOM-USB device**
- **USB Cable – PC to BCOM-USB**
- **Two RS-233 Cables, each with a DB-9 Female connector on one end and a DB-25 Male connector on the other end.**
- **DB-25 female-female gender changer**
- **DB-25 null modem adapter**
- **DB-9 to DB-25 adaptors**
- **RS-232 monitor-mode adapter cable**
- **ASE2000 documentation** - ASE2000 Communication Test Set User Guide.

18.3. Model ASE2000-COM

- **ASE2000 Software Installation CD-ROM**. This CD contains both the ASE2000 Application software installation files and the I/O driver files for the ASE dual-channel BCOM-USB I/O card and the SafeNet Pro/SuperPro Security Plug (dongle).
- **SafeNet parallel port (LPT) or USB dongle** for desktop or laptop PCs. The hardware dongle included in this package enables the ASE2000 software.
- **Two RS-233 Cables, each with a DB-9 Female connector on one end and a DB-25 Male connector on the other end.**

- **DB-25 female-female gender changer**
- **DB-25 null modem adapter**
- **DB-9 to DB-25 adaptors**
- **RS-232 monitor-mode adapter cable**
- **ASE2000 documentation** - ASE2000 Communication Test Set User Guide.

19. ASE2000 Kit Components

19.1. ASE dual channel BCOM-USB device with two RS-232 cables, USB cable, and BCOM-USB to ASE 2-Channel Modem power cable.

19.2. ASE Bell-202/CCITT V.23 Dual-Channel Modem

19.3. DB-25 Female-Female Gender Changer

19.4. DB-9 to DB-25 adapter

19.5. RS-232 Cable with DB-9 Female and DB-25 Male

19.6. SafeNet USB Port and Parallel Port (LPT) dongle

20. BCOM-USB Device Guide

20.1. BCOM-USB Overview

BCOM-USB is a 2-channel, serial RS-232 device that connects to a PC through a USB port. This device is intended to be used with the ASE2000 Communication Test Set and replace the BCOM-PCMCIA board which, due to the eventual obsolescence of the PCMCIA/CardBus interface on PCs may not be usable on newer PCs. In addition to handling the traditional byte oriented protocols such as DNP3, Modbus, IEC 870-5-101, etc. the BCOM-USB will also handle bit-oriented protocols such as Conitel 2020, CDC Type I and II, as well as SDLC/HDLC protocols.

Please see the ASE web site at http://www.ase-systems.com/DNP-3-protocol/DNP-3.asp for a complete list of supported protocols.

20.2. BCOM-USB Device Description

The BCOM-USB device kit consists of the following items:

- 2-channel BCOM-USB device
- Two DB-9 Female / DB-25 Male Cables
- 6’ USB Cable with standard A / B connectors
- 6’ Power cable to power the ASE 2-channel Bell-202 test set modem

20.3. BCOM-USB Components

When provided as an “Upgrade Kit” to an existing ASE2000 Test Set kit with a PCMCIA card, parallel port dongle, or USB dongle, the above components plus documentation and software installation CD will be provided. The RS-232 Monitor Cable, DB-9 to DB-25 adaptors, NULL modem adaptor, and gender changer from the original test set kit will be retained and used with the BCOM-USB. The test set enabling device, BCOM-PCMCIA card or dongle, must be returned as part of the Upgrade Procedure.

When provided with a new, complete ASE2000 Communication Test Set, the BCOM-USB components together with the other standard test set kit cables and adaptors will be provided.

The front of the BCOM-USB device has a USB connector for connection to a PC and LED indicators for serial communication activity indications. Each channel has:

TX – Transmit Data
RX – Receive Data
RTS – Request To Send
CTS – Clear To Send
CD – Data Carrier Detect
ERR – Error Indication

Front View

The back of the BCOM-USB device has two DB-9 Male connectors and a Modem Power connector. The +5VDC Modem Power connector (MDM PWR OUT) is only for powering the ASE 2-channel Bell-202 Test Set Modem from the BCOM-USB device. **IT MUST NOT BE USED FOR ANY OTHER PURPOSE!**

Rear View

WHEN CONNECTING THE POWER CABLE BETWEEN THE BCOM-USB DEVICE AND 2-CHANNEL ASE BELL-202 TEST SET MODEM, THE USB CABLE BETWEEN THE PC AND BCOM-USB DEVICE MUST BE DISCONNECTED.

CONNECT ALL POWER AND RS-232 CABLES BEFORE CONNECTING THE BCOM-USB DEVICE TO THE PC.

The bottom of each BCOM-USB device contains a serial number which is used for device registration and BCOM-USB license management. For certain support and upgrade situations, you may be asked to provide this serial number.

Bottom View

20.4. BCOM-USB RS-233 pin-out

The following table illustrates the pin-out of the BCOM-USB 9-pin connectors.

DB-9	Signal Description
1	DCD – Data Carrier Detect
2	RXD – Receive Data
3	TXD – Transmit Data
4	DTR – Data Terminal Ready
5	Com – Common
6	RXCLKIN – Receive Clock In
7	RTS – Request To Send
8	CTS – Clear To Send
9	TXCLKOUT – Transmit Clock Out

20.5. BCOM-USB I/O Driver Installation

This section describes the steps necessary to install the I/O drivers for the BCOM-USB Device. There are several sets of I/O driver distribution files for different versions of Windows and, for Windows 7/8/8.1, a set of driver files for 32-bit systems and another for 64-bit systems. It is extremely important that the correct set of files be used for the specific Windows environment. For Windows 7/8/8.1 systems, a set of digitally signed driver files are provided for both the 32-bit and 64-bit versions of the driver.

The BCOM-USB I/O Driver files are provided on the ASE2000 Communication Test Set software distribution CD and are also available for download from the ASE web site at:

http://www.ase-systems.com/ASE2000-test-set/ase2000-downloads.asp

The digitally signed Windows 7 versions of the driver are available on the ASE web site and on ASE2000 Communication Test Set software distribution CD Version 1.52 and later.

There are two separate sections below containing I/O driver installation instructions; one section for Windows 2000/XP/Vista and another section for Windows 7 and 8. **Please note, a 64-bit version of the BCOM-USB driver is available for Windows 7 and Windows 8**.

There are many similarities in the driver installation instructions between Windows 2000/XP/Vista and Windows/8/8.1 but there are important differences so please follow the instructions appropriate for the version of Windows being used.

Regardless of the version of Windows being used, the driver installation process will involve the installation of two separate drivers for each of two serial I/O channels (COM Ports). There are four components which Windows must install for a complete installation. As a result, there are many repetitive steps which must be followed to insure a complete installation of the components required for the BCOM-USB I/O driver. **DO NOT ABORT THE INSTALLATION UNTIL ALL COMPONENTS HAVE BEEN INSTALLED**.

If installing from the ASE2000 Communication Test Set software distribution CD, insert the CD in the PC. The CD is configured to “auto run” the ASE2000 Installation procedure so cancel out of this operation. At this point, the Driver installation files can be copied to the PC hard driver and installed from there or installed directly from the CD.

20.5.1. BCOM-USB Windows 2000/XP/Vista I/O Driver Installation

*Note: If you are installing the BCOM-USB I/O driver on a Windows 7 or Windows 8 system, go to the section "**Windows 7 I/O Driver Installation**".*

The I/O driver files are distributed on the ASE2000 Installation CD as shown in Figure 1 below and may also be obtained from the ASE web site at www.ase-systems.com.

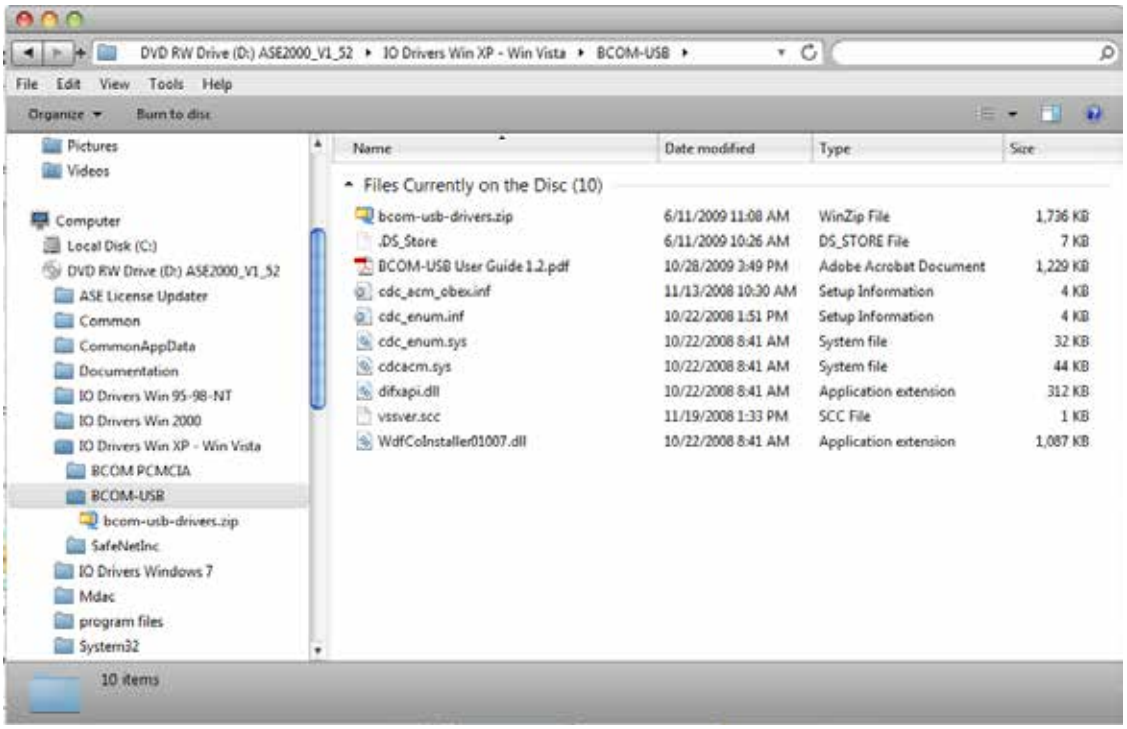


Figure 1

The set of files will be the same whether obtained from the Installation CD or the web site and the same set of files is used for Window 2000/XP/Vista.

Connect the BCOM-USB device to the PC using the supplied USB cable. Following the connection, Windows will launch the "New Hardware" Wizard. This will be used for the I/O driver installation.

1. When the following screen appears, select the radio button "No, not this time" and then select "Next".

Figure 2

2. Select the radio button “Install from a list or specific location” then “Next”.

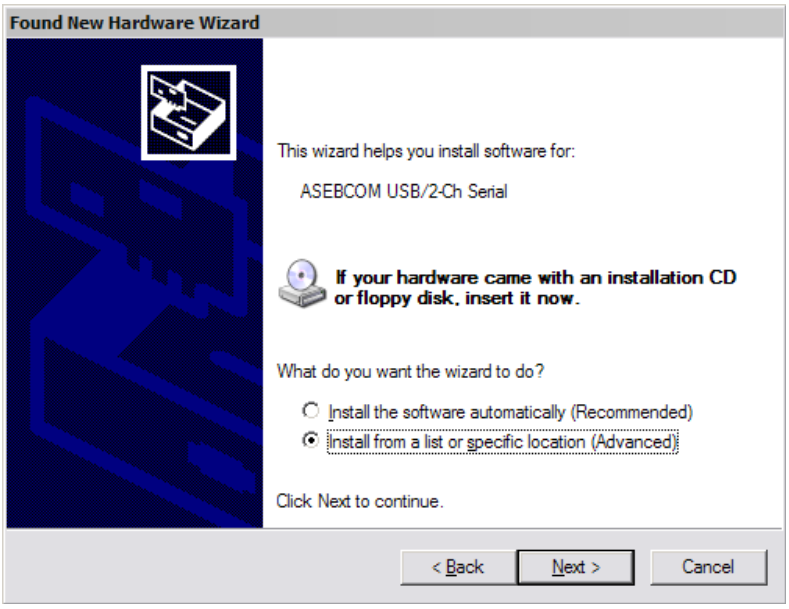


Figure 3

3. Browse to the folder containing the I/O driver installation files then select “Next”.

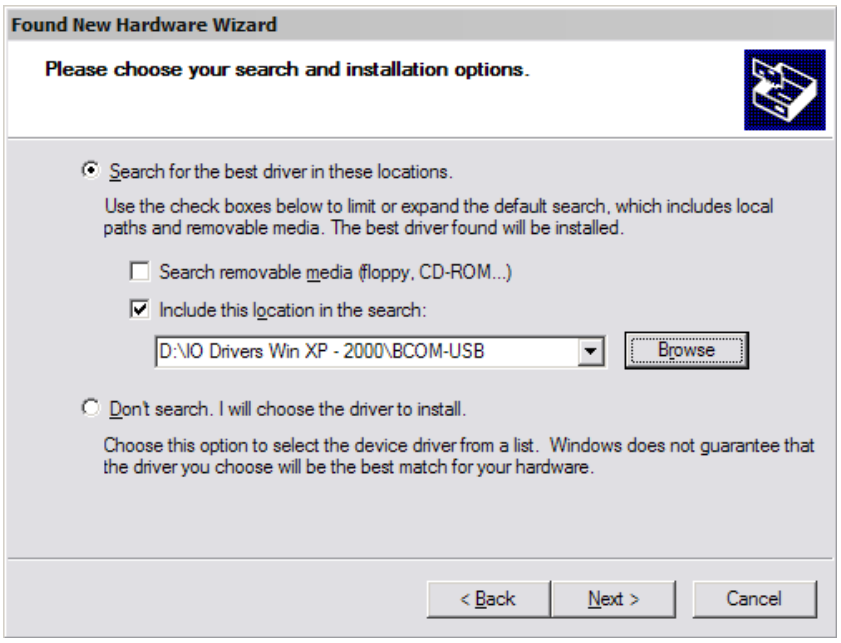


Figure 4

4. On some systems, Windows will issue several warning messages that the “Driver is Not Certified”. At each of these instances, select “Continue Anyway”.
5. When the “Next” button is selected, Windows will copy the driver files for the CDC Applied Systems enumerator.

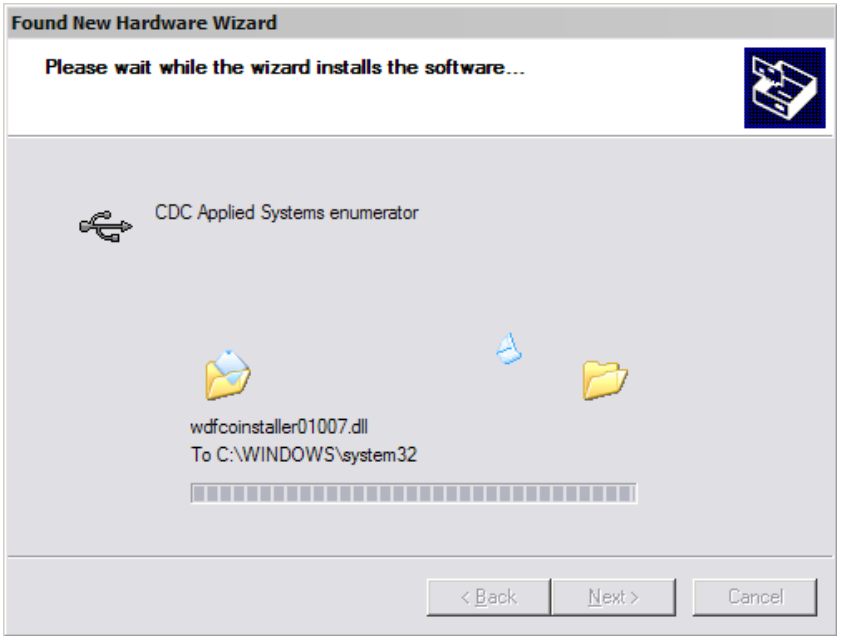


Figure 5

6. When the initial file copy has completed, the following screen will appear to indicate the “enumerator” driver for the first BCOM-USB port has completed.

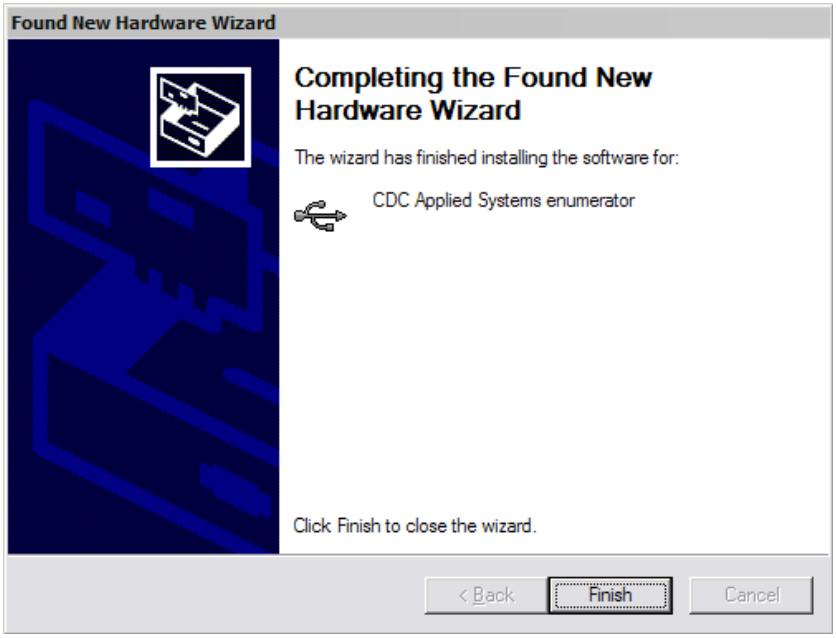


Figure 6

7. Select “Finish” to proceed with the next phase. The same sequence of steps as illustrated in Figure 2 through Figure 6 will be repeated to install the “enumerator” for the second BCOM-USB port.

8. When the “enumerator” for the second BCOM-USB port has completed, the same screen as shown in Figure 6 will be displayed.

9. Select “Finish” to proceed with installation of the BCOM-USB Comm Port portion of the procedure.

10. The following steps are virtually identical to the steps described previously but will be related to installing the second portion of the BCOM-USB driver files.

Figure 7

Note, the message is for installing the “usbcdcacm_6_12328……”

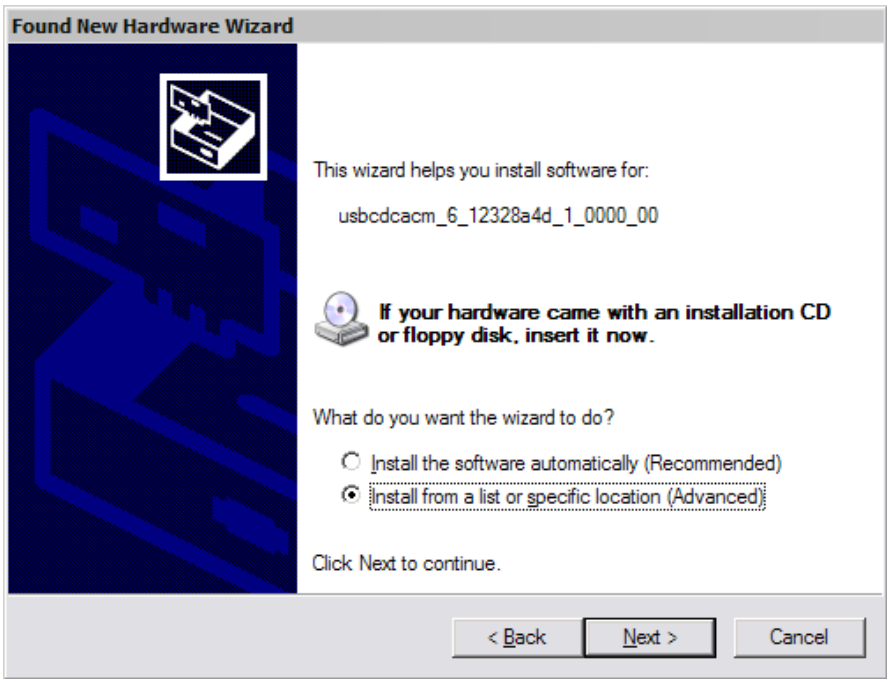


Figure 8

11. Please note, the files for installing the “ASE BCOM-USB Comm Port” are in the same location as for the “enumerator”.

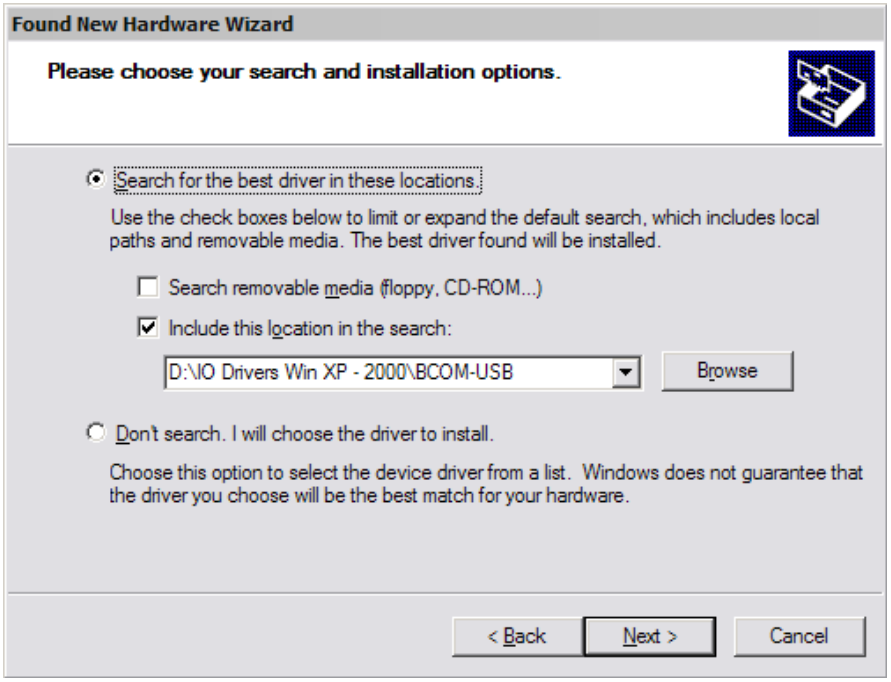


Figure 9

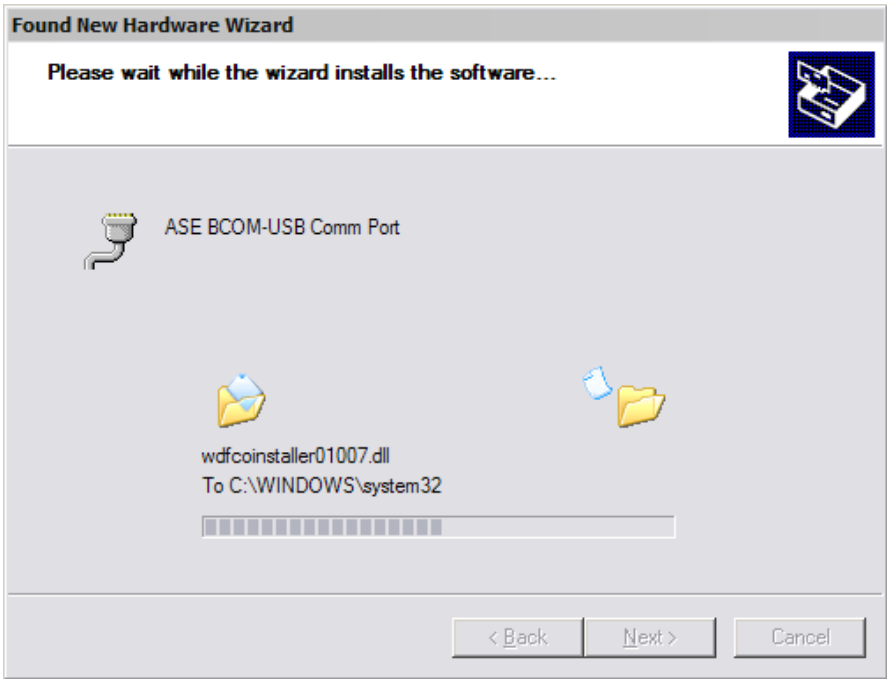


Figure 10

12. When the files for the first BCOM-USB Comm Port have been copied, the following screen will appear.

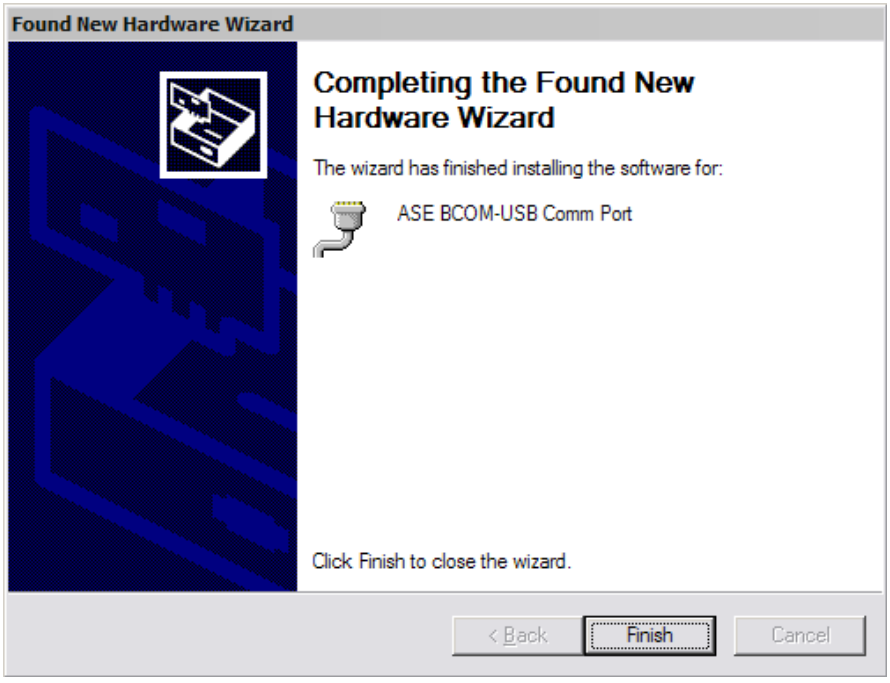


Figure 11

13. As with the “enumerator” installation, the steps illustrated in Figures 7 through Figure 11 will be repeated to install the second BCOM-USB Comm Port.

Following the completion of installation for the second BCOM-USB Comm Port, a message will appear in the lower right corner of the screen that:

Your New Hardware is installed and is ready to use

At this point, the driver installation is complete and the BCOM-USB is ready for use.

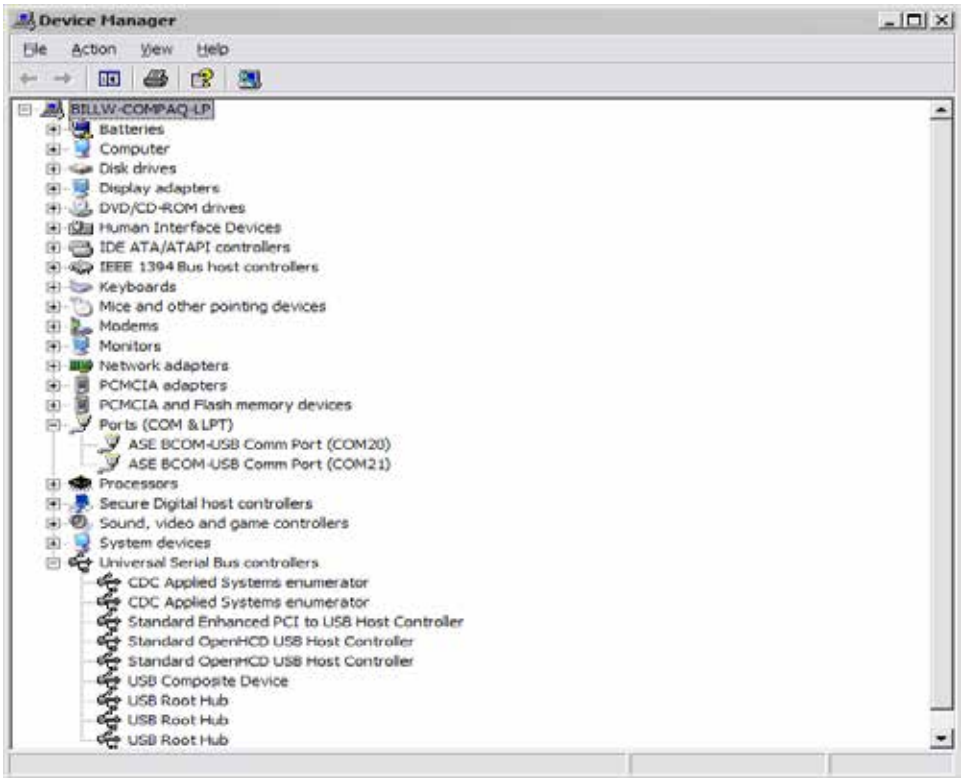
Following a successful driver installation, the Device Manager screen (Control Panel > System > Hardware tab) will show the devices:

- Ports (COM and LPT)
  ASE BCOM-USB Comm Port (COMxx)
  ASE BCOM-USB Comm Port (COMyy)

- Universal Serial Bus Controllers
  CDC Applied Systems enumerator
  CDC Applied Systems enumerator

USB Composite Device

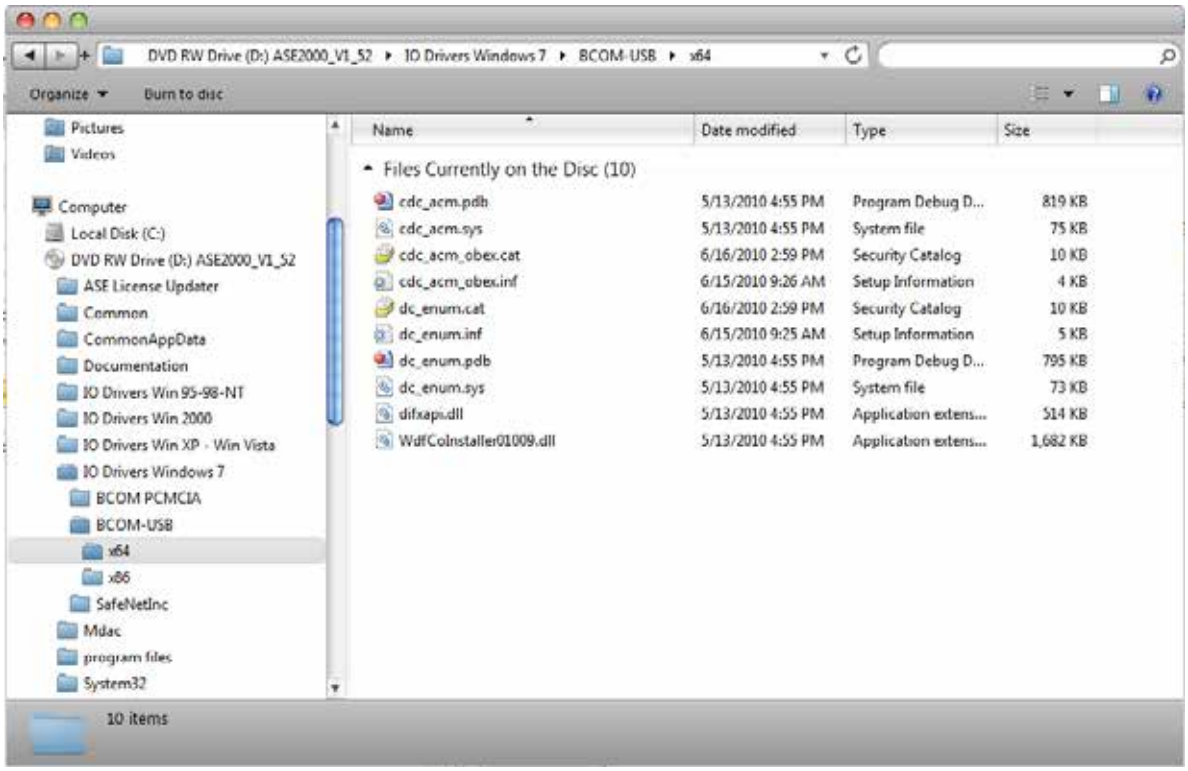
These entries are all associated with the BCOM-USB device. Also, since the BCOM-USB is a Plug-n-Play device, the entries will only appear when the device is connected.



21. BCOM-USB Windows 7 and Windows 8 I/O Driver Installation

> *Note: If you are installing the BCOM-USB I/O driver on a Windows 2000/XP/Vista system, go to the section "**Windows 2000/XP/Vista I/O Driver Installation**". These instructions also apply to Windows 8.*

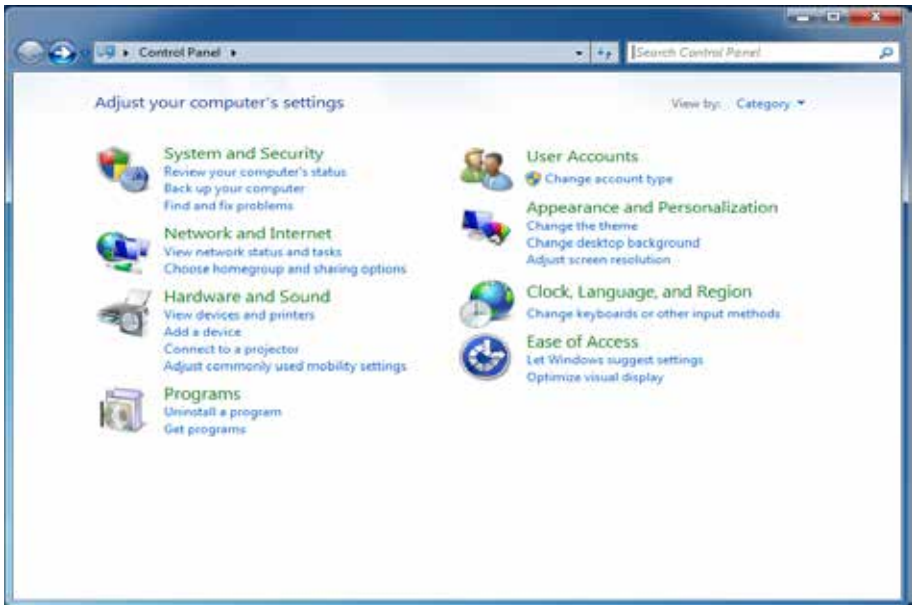
An example of the folder set on the ASE2000 Communication Test Set software distribution CD is shown below. For installing on a Windows 7/8/8.1 64-bit system, browse to the "IO Drivers Windows 7\BCOM-USB\x64 or \x86". The \x86 folder is used on 32-bit systems and \x64 on 64-bit systems. Once in the appropriate folder, the procedures are the same for 32 or 64 bit systems.



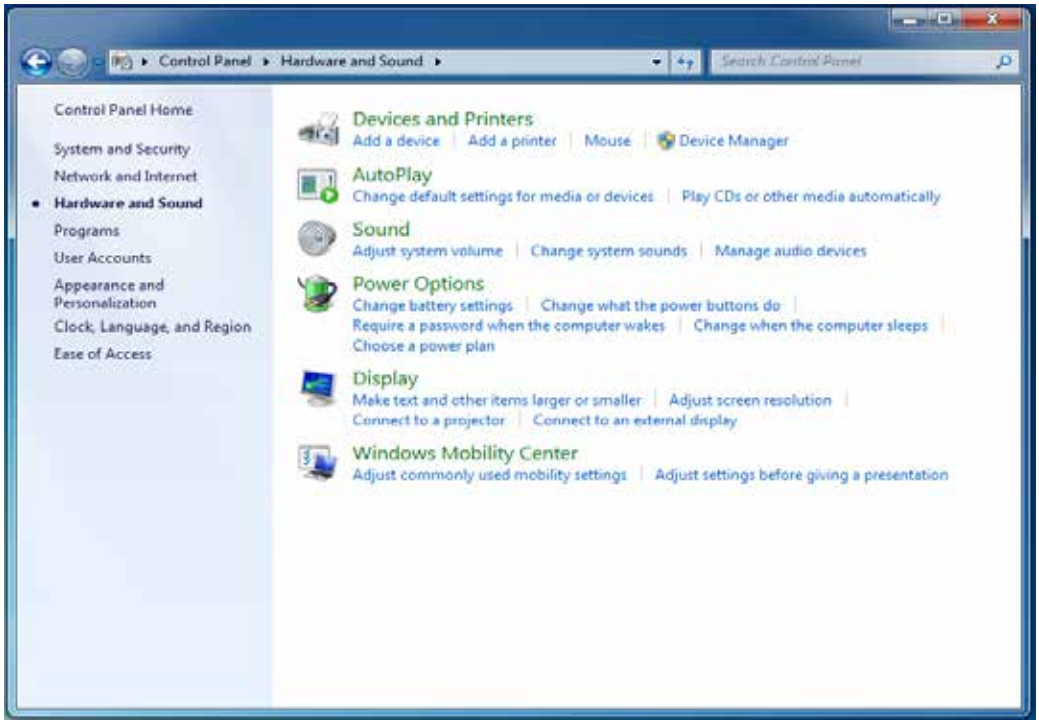
IMPORTANT! PLEASE NOTE: Windows 7/8/8.1 I/O driver installation is different from previous versions of Windows and it is extremely important that the following instructions be followed carefully to avoid an incorrect installation. The "automatic" driver installation feature of Windows 7 does not work with the BCOM-USB driver. It is necessary to use the manual installation procedure described below.

There are a number of steps involved for a complete installation of both COM ports for the BCOM-USB device. It is extremely important that the step-by-step procedures described below be followed completely.

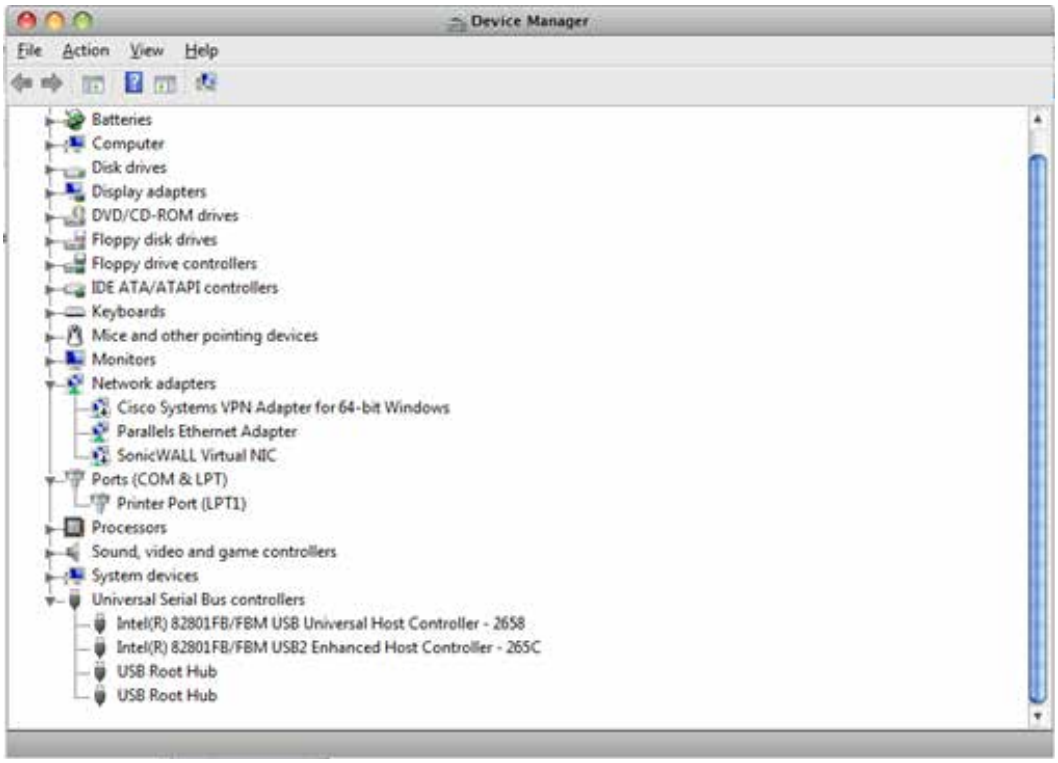
1. In order to initiate certain steps of the installation, it is necessary to use the Device Manager screen. From the Windows Start menu, select “Control Panel” and then select “Hardware and Sound”.

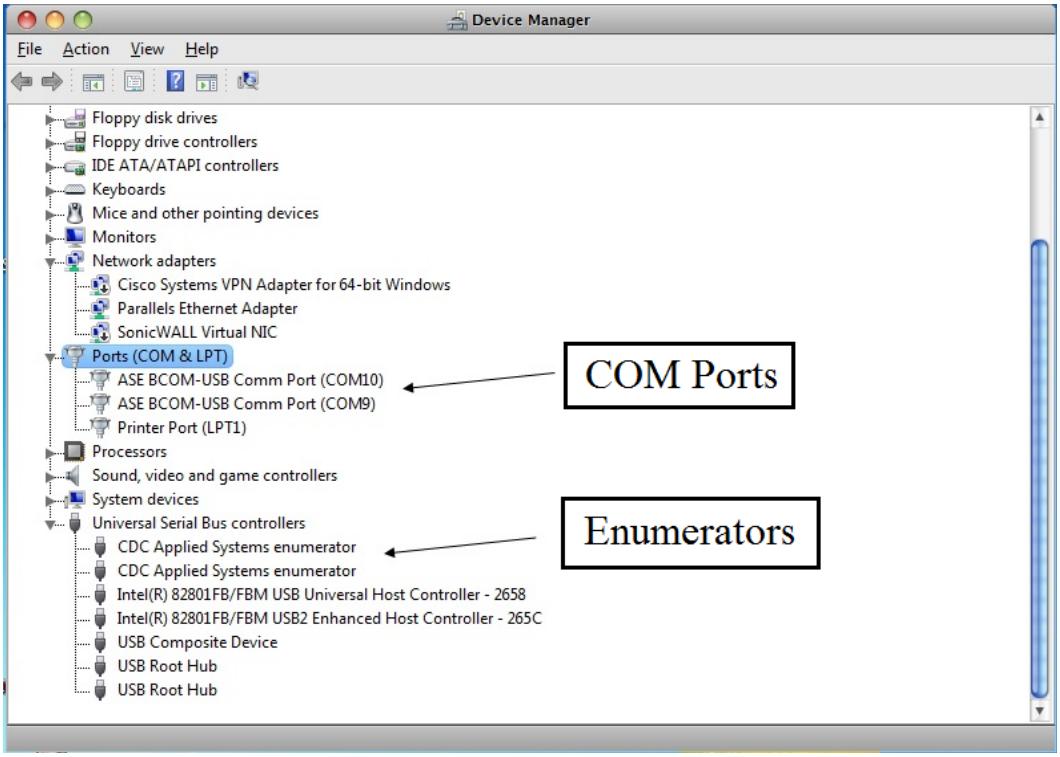


2. Select “Device Manager”



The screen shot below, Figure 16, is similar to one you should see on your system prior to installation of the BCOM-USB drivers. The Figure 17 screen shot illustrates the Device Manager screen following driver installation.

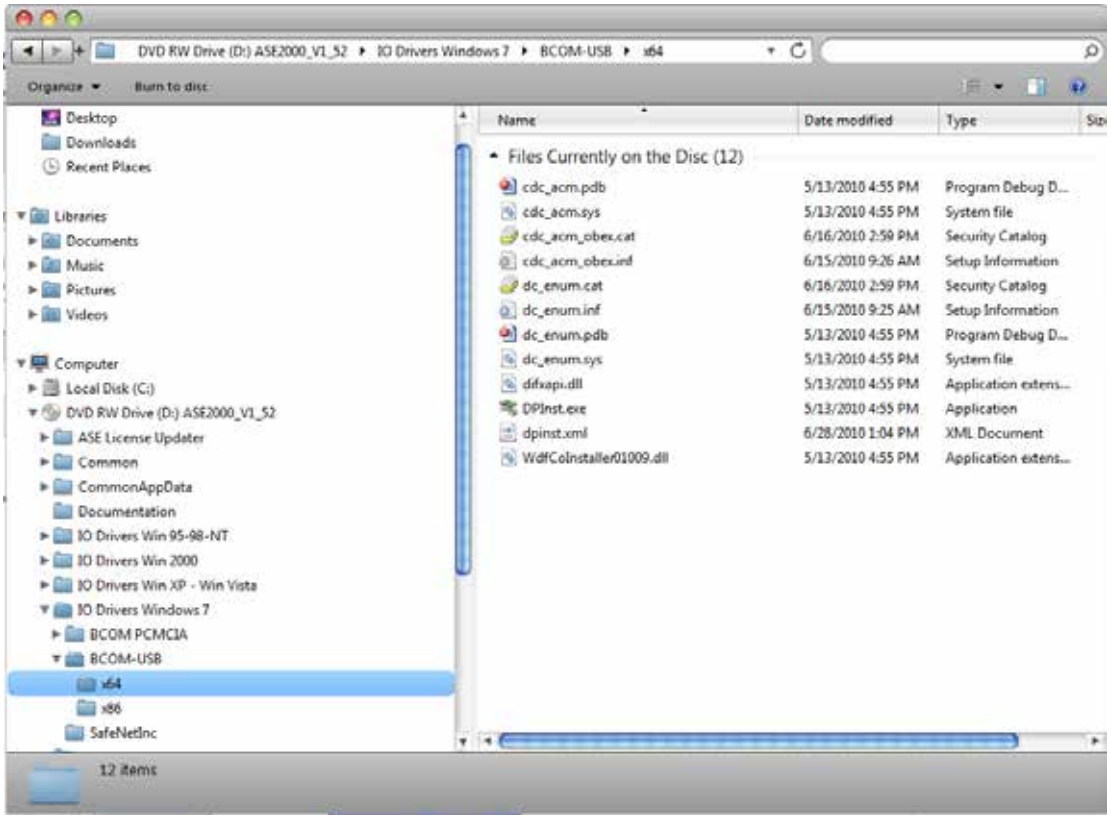




In the Post-Driver Installation screen shot, there are two new sets of entries. Under Ports (COM & LPT) the COM ports ASE-BCOM-USB Comm Port (COM9) and (COM10) have been added and under Universal Serial Bus controllers two CDC Applied Systems enumerator entries have been added, one for each BCOM-USB COM port.

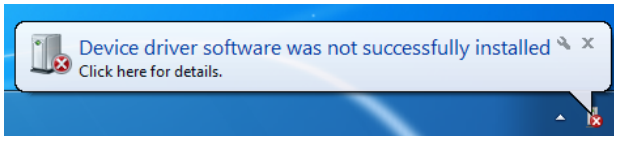
3. Identify the location containing the I/O Driver files to be used for the installation. In the steps below, it will be necessary to “point” the windows installer to this folder. The files can be obtained from the ASE2000 Communication Test Set installation CD or downloaded from the ASE web site at:

http://www.ase-systems.com/ASE2000-test-set/ase2000-downloads.asp



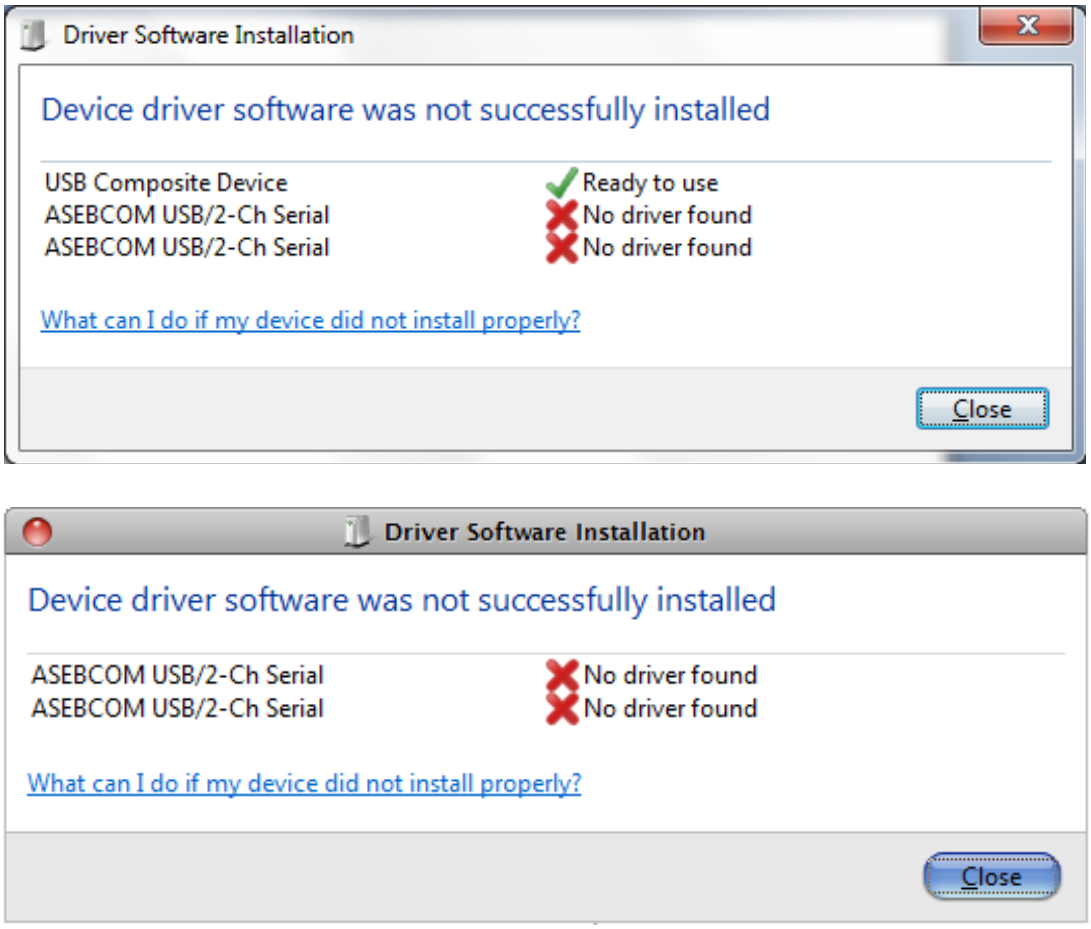
This section contains the step-by-step instructions for the actual driver installation. Please follow the steps carefully and verify the results of each step with the corresponding screen shots. Due to system variations, some information may be slightly different but the general content should be similar.

1. Connect the USB cable between the BCOM-USB device and the PC. Upon connection, Windows will read certain device information from the BCOM-USB device and attempt to locate a previously installed I/O driver for the device. Since no driver has been previously installed, Windows will be unsuccessful in locating the driver and will display the following screens. Initially, a small message block will be shown in the lower left corner of the screen indication the attempt to install the driver with a “Click Here” target to display details.



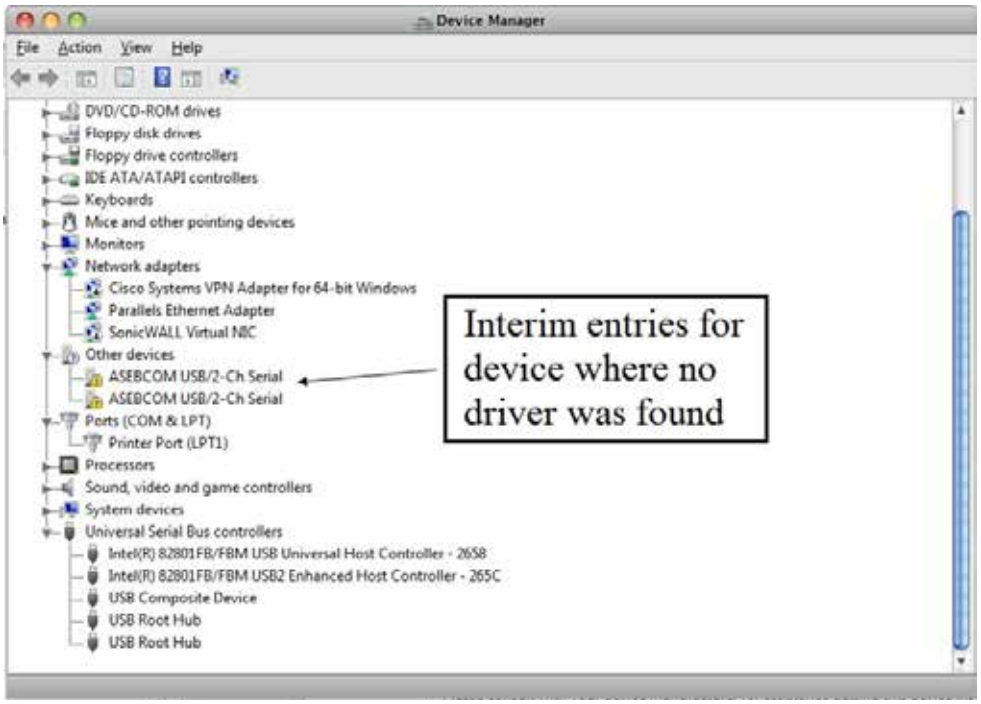
2. Click the indicated target to see the screen shown below. Depending on previous driver

installations, there are a couple of variations of screen content.

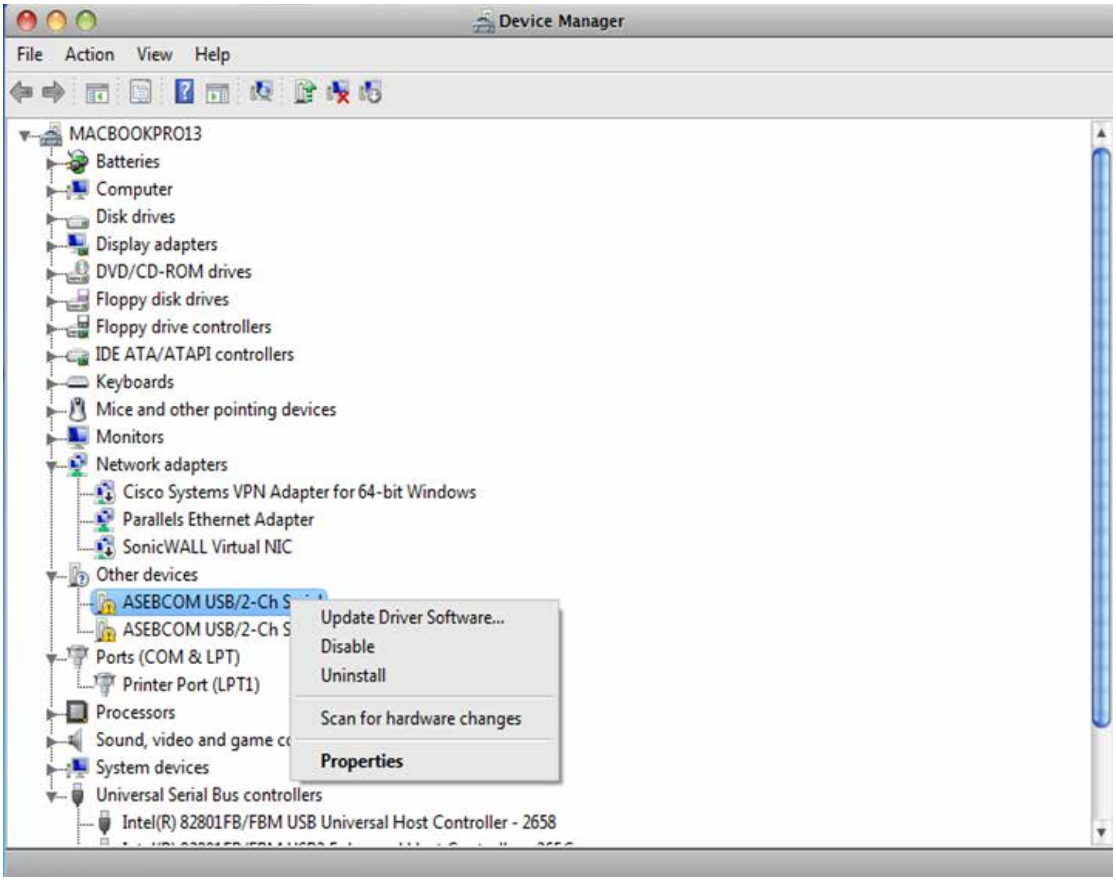


3. Since there are two COM ports, there will, in most cases, be two messages or two entries for each step. When status for each “ASEBCOM USB/2Ch Serial” shows “No driver found”, select “Close”

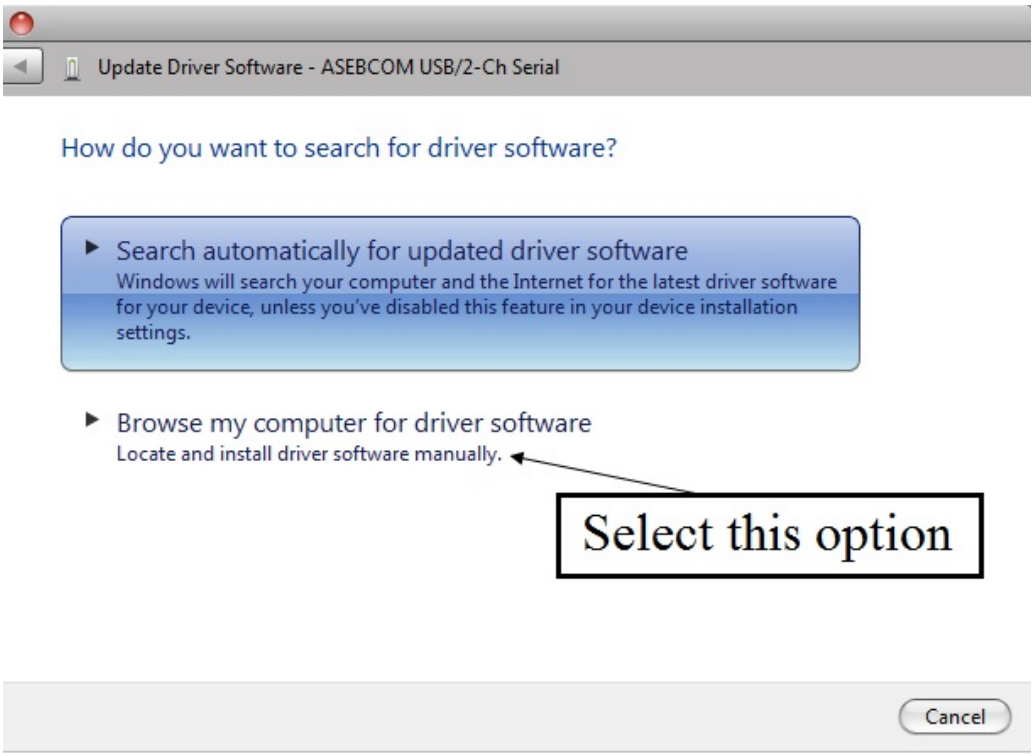
4. Refer to the Device Manager screen and there should be two new entries under Other devices for the “No driver Found” BCOM-USB ports.



5. At this point, manually direct Windows to install the drivers. Under Other devices, right-click on the **first** “ASEBCOM USB/2-Ch Serial” entry and select “Update Driver Software”. **It is extremely important these entries are selected in the correct order so that the COM ports will be assigned to the BCOM-USB ports in the correct order**.

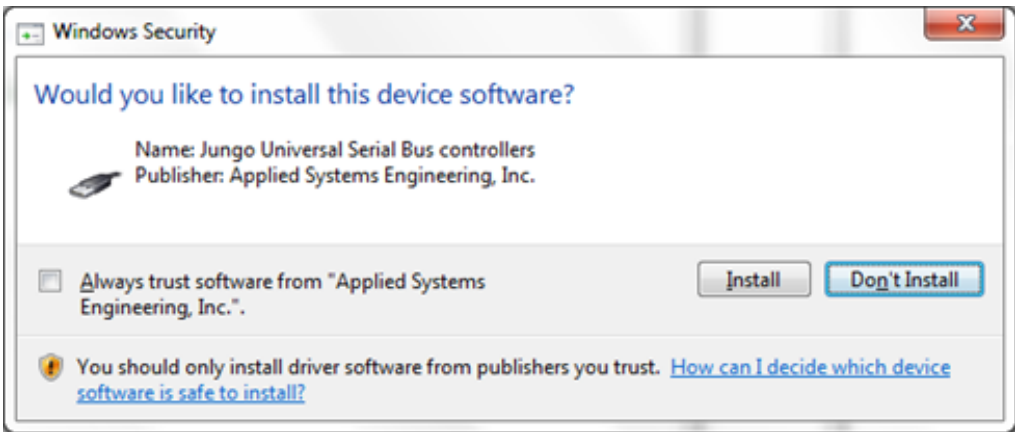


6. When the following screen appears, select the second option, “Browse my computer for driver software”.

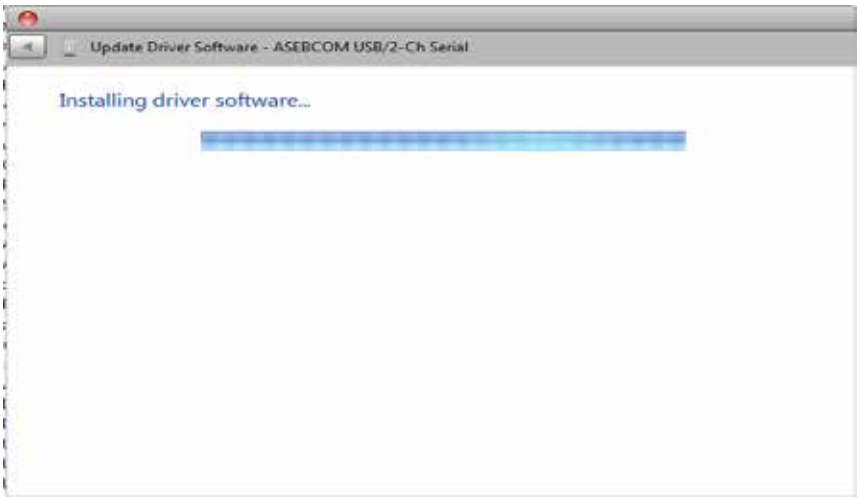


7. Select the Browse button and browse to the folder containing the driver files. In the example below, the system is a Windows 7/8/8.1 64-bit so the folder for the 64-bit version of the driver, “x64”, is selected. If you are installing on a Windows 7/8/8.1 32-bit system, select the “x86” folder. When the correct folder has been specified, select “Next”.

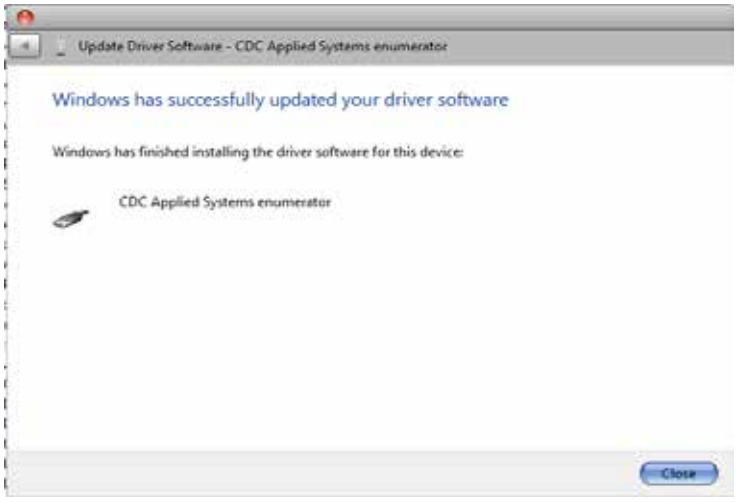
8. If digitally signed software from Applied Systems Engineering, Inc. has not previously been installed on the PC, the following screen will be displayed. If the check box <Always trust software from “Applied Systems Engineering, Inc.”> is checked before selecting the Install button, this message will not be displayed in the future. Otherwise, just select the Install button.



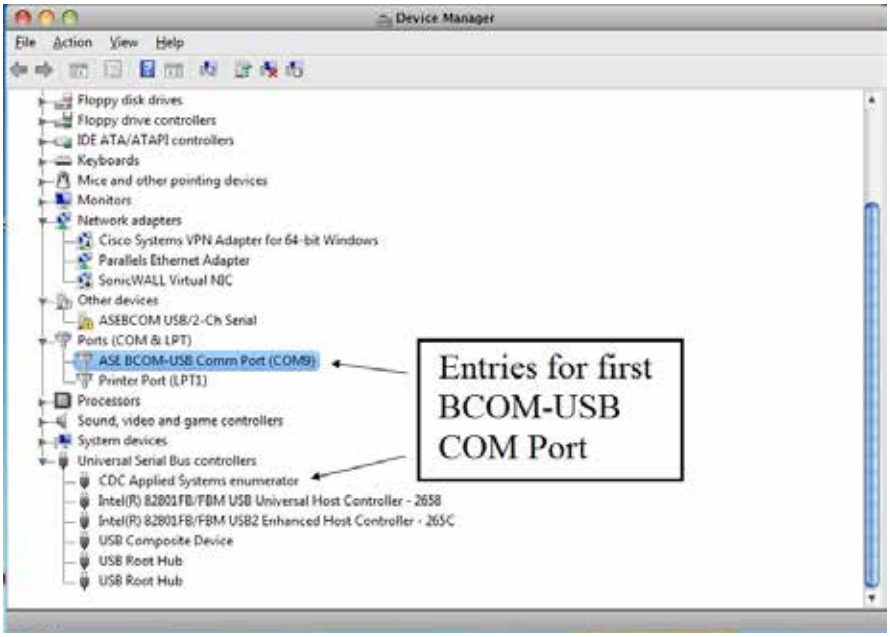
9. Windows will begin the driver file copy and install.



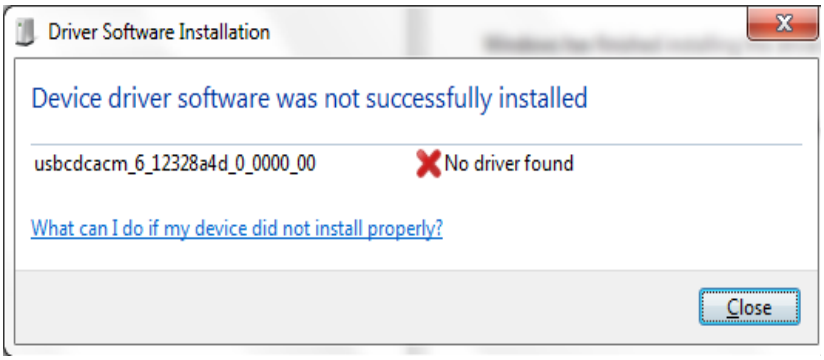
10. Upon completion of this phase, Windows will display the following screen. Do not select the “Close” button until the Device Manager screen updates showing the entry under Ports (COM & LPT) and entry under Universal Serial Bus controllers as shown in Figure 29 or until the screen shot shown in Figure 30 is displayed. Note: Actual COM port numbers will vary on different systems. If this screen is not displayed at this point, skip to Step 11 below for an alternative procedure.



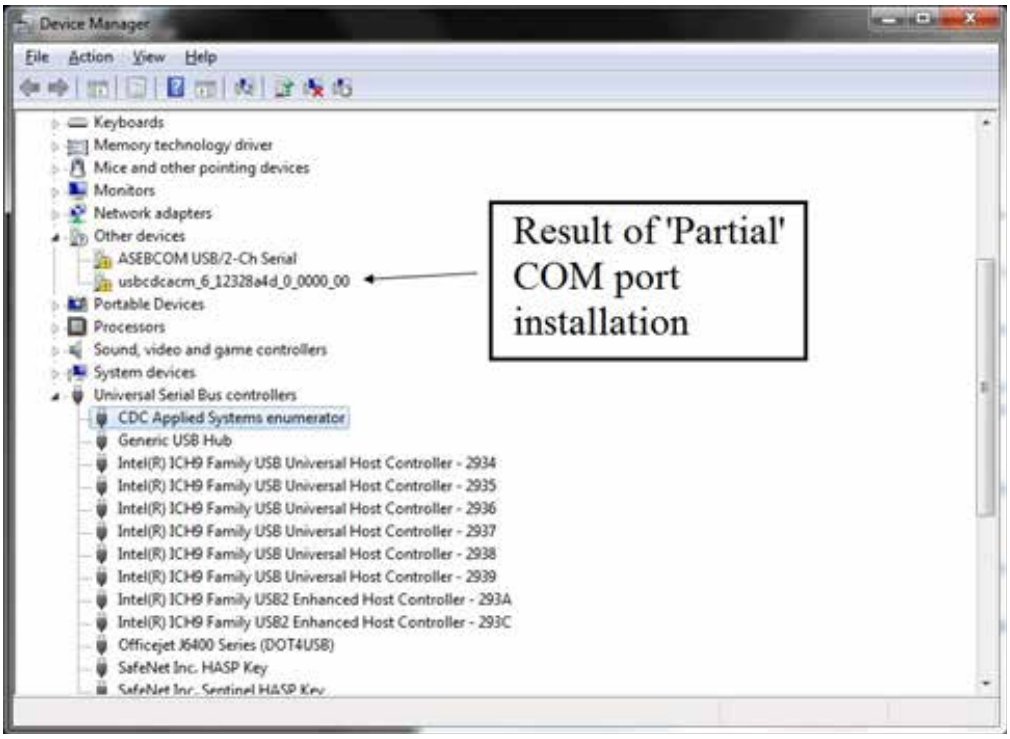
11. Upon completion of this installation phase, the Device Manager screen will be updated to indicate the first ASE BCOM-USB Comm Port and CDC Applied Systems enumerator have been installed.



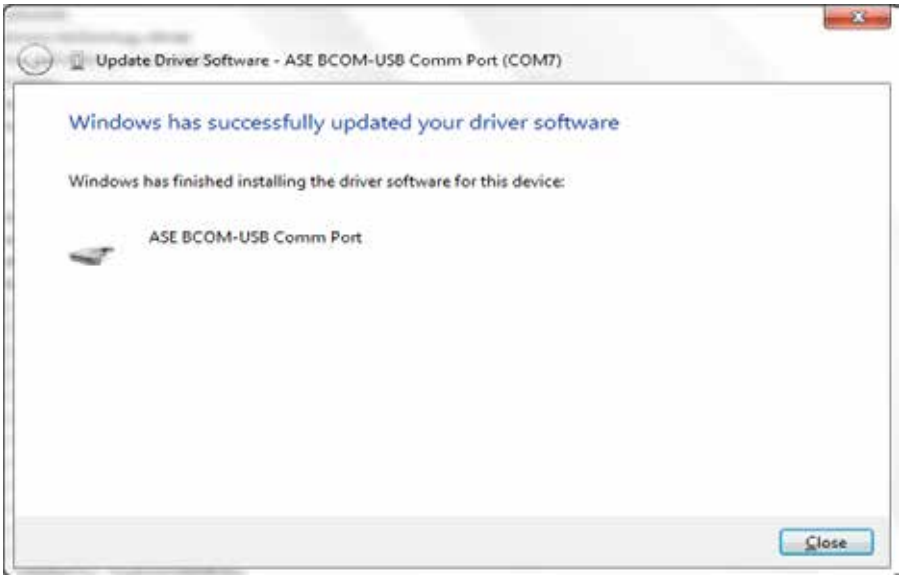
12. On some systems, Windows only performs a partial install in this phase and an additional manual step is required to complete installation of the first BCOM-USB COM port. If the following screen (or one similar) is displayed following Step 9.



13. To complete the COM port installation when this partial install occurs, right-click the line containing the entry “usbcdcacm_6_nnnnnnnnnn” and then select “Update Driver Software”.

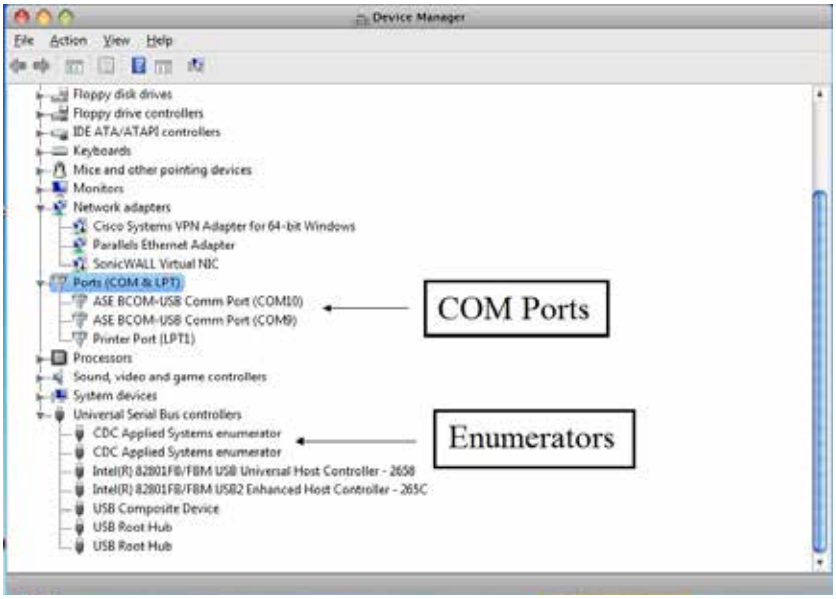


14. Windows will proceed with the COM port installation and will display the following message when complete and the first BCOM-USB COM port will have been installed and the Device Manager screen should appear as shown in Figure 29 above.



15. To install the second BCOM-USB COM port, select (Right-click) the remaining “ASEBCOM USB/2-Ch Serial” entry under Other devices then select “Update Driver Software” and follow Steps 5 – 8 above.

16. When both BCOM-USB ports have been installed, the Device Manager screen will appear as follows, the installation will be complete, and the BCOM-USB device ready for use.



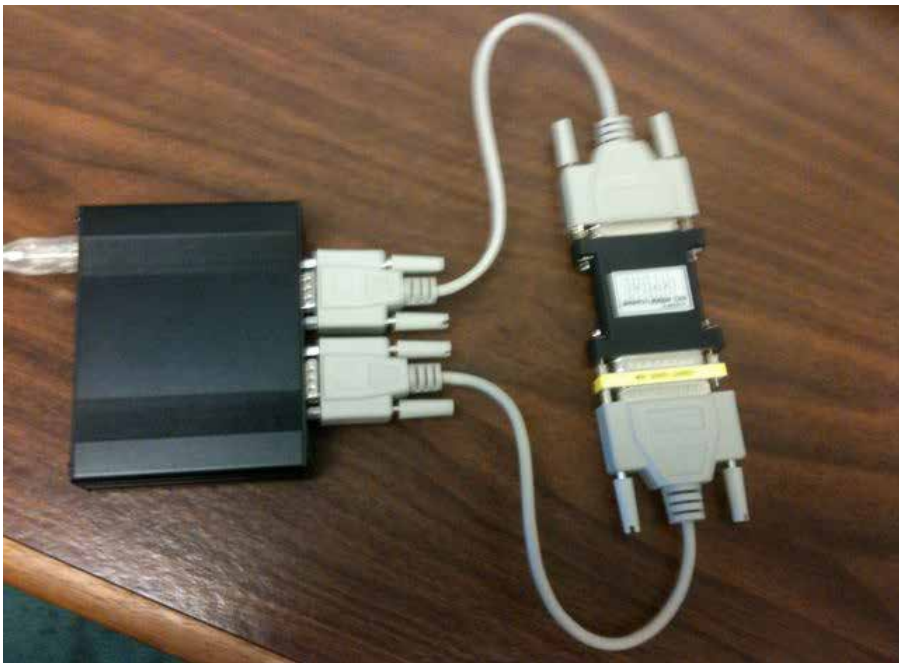
21.1. BCOM-USB device Troubleshooting

The most common requests for technical support relating to the BCOM-USB device are for I/O driver installation support or communication problems.

BCOM-USB I/O Driver Communication Problems

If the I/O drivers appear to be installed correctly but you are unable to communicate with the device you want to test, the first thing to do is verify that communications through the BCOM-USB device is working properly. To do this, the two BCOM-USB communication channels will be connected together and two copies of the ASE2000 software will be used to verify communications. One copy will simulate Master operation and the other will simulate RTU operation. Basically the ability to send and receive on both BCOM-USB ports will be tested.

1. Connect the “A” and “B” BCOM-USB channels together using the two RS-232 cables together with a NULL modem adaptor and gender changer.



2. Use the following link:

http://www.ase-downloads.com/downloads/BCOM-USB-Test.zip

To download the configuration file which will be used with the ASE2000 software to send/receive data. Save the BCOM-USB-Test.monx file in a folder on the local hard drive.

3. Launch the first copy (instance) of the ASE2000 test set by double-clicking on the BCOM-USB-Test.monx file name. Launch the second copy (instance) of the ASE2000 test set by double-clicking on the BCOM-USB-Test.monx file name.

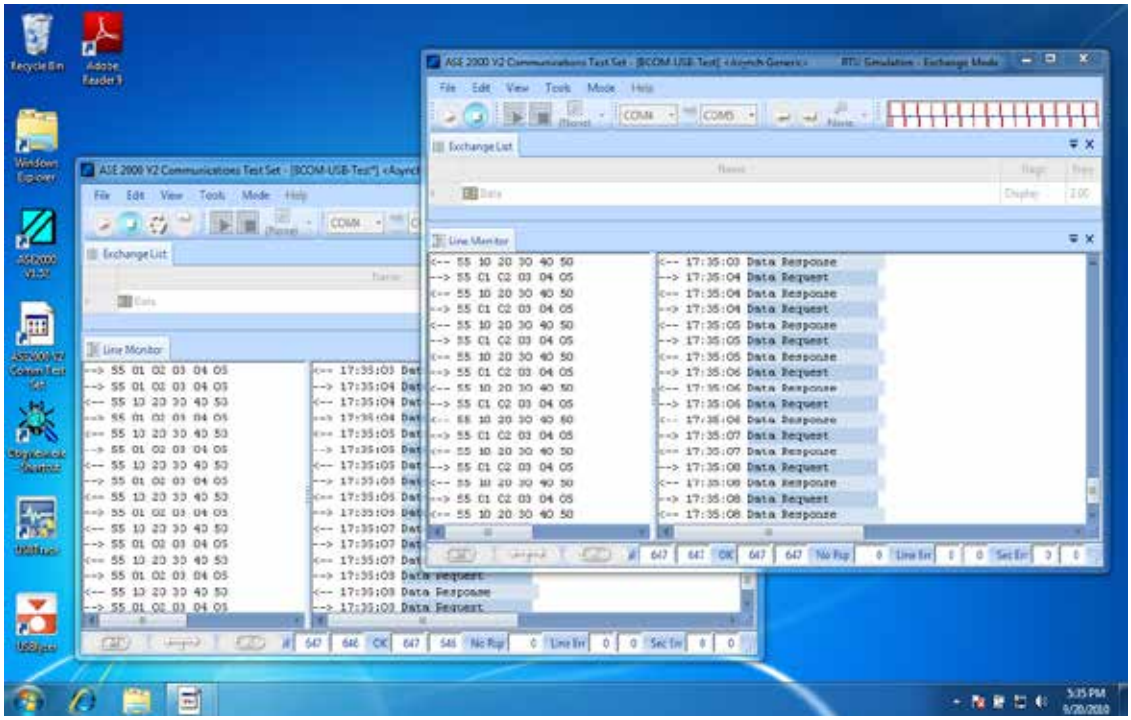
4. At this point, there should be two copies of the test set active but not communicating.

5. On one of the test copies, select “File > Simulate RTU” or select the “Simulate RTU” icon.

6. On the other test set copy, move the mouse pointer over the “Data” exchange name in the “Exchange List” view then select “File > Send Continuously” or select the “Send Continuously” icon.

7. At this point, if the BCOM-USB device is working properly, the screen should look similar to the example below. In the Line Monitor view for each test set window there should be a series of “Data request” and “Data Response” entries in the interpreted data section and the following data in the raw data section:

--> 55 01 02 03 04 05
<-- 55 10 20 30 40 50



8. If the test set screen looks similar to the above screen, the BCOM-USB device is most likely installed and functioning correctly.

22. ASE License/Firmware Updater

22.1. ASE License/Firmware Updater Overview

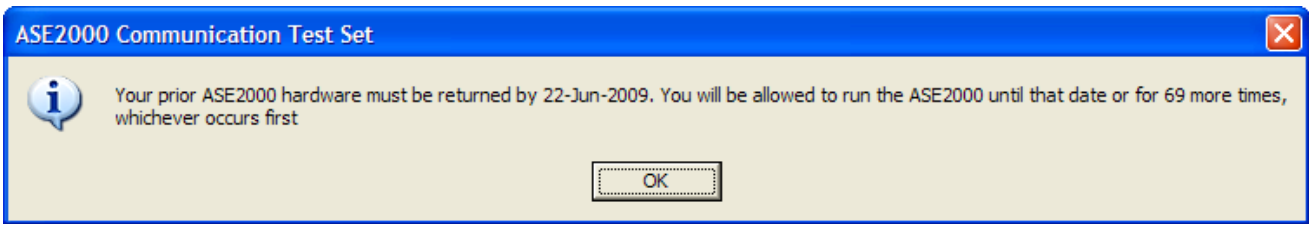
This ASE License/Firmware Updater program will be used whenever a new BCOM-USB device license or new device firmware must be installed.

The BCOM-USB device is the first ASE test set I/O device that utilizes on-board license information and field updatable firmware that utilizes an update program rather than firmware chip replacement.

Normally, the License will not need to be updated. However, for PCs running ASE2000 Version 1.47 or higher, where the BCOM-USB is replacing an ASE 2-Channel PCMCIA Card or Sentinel Security Plug (dongle) as part of a BCOM-USB Upgrade transaction, the BCOM-USB devices will be shipped with a 60 day license. The license will permit test set operation with the BCOM-USB device for up to 60 days (from the date of shipment) or 75 executions of the test set using the BCOM-USB device. When the original test set equipment (PCMCIA card or Sentinel Dongle) is returned to ASE, a new, unlimited, license file will be provided. If the unlimited license file is not installed, the BCOM-USB will stop functioning. The only way to re-activate is to install a new, unlimited, license.

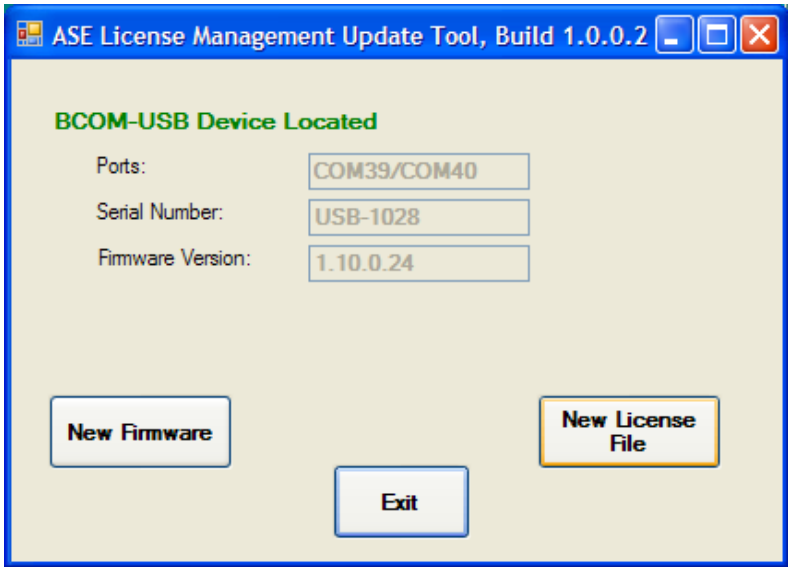
Where the BCOM-USB is provided with a new test set purchase, the BCOM-USB will be delivered with an unlimited license.

If the BCOM-USB has a Limited License, the following ASE2000 Test Set message will appear each time a request to start communication is made. The specific date and “allowed execution count” will depend on when the device was shipped and the number of times the test set applications has been run under the Limited License.



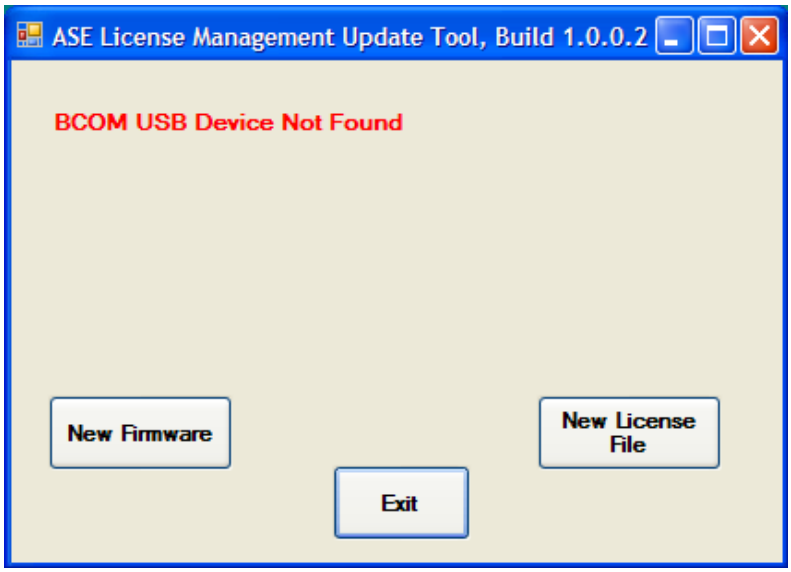
22.2. ASE License/Firmware Updater License/Firmware Updater Operation

Following installation, the application will automatically launch. If a BCOM-USB device is currently connected, the following screen will appear:



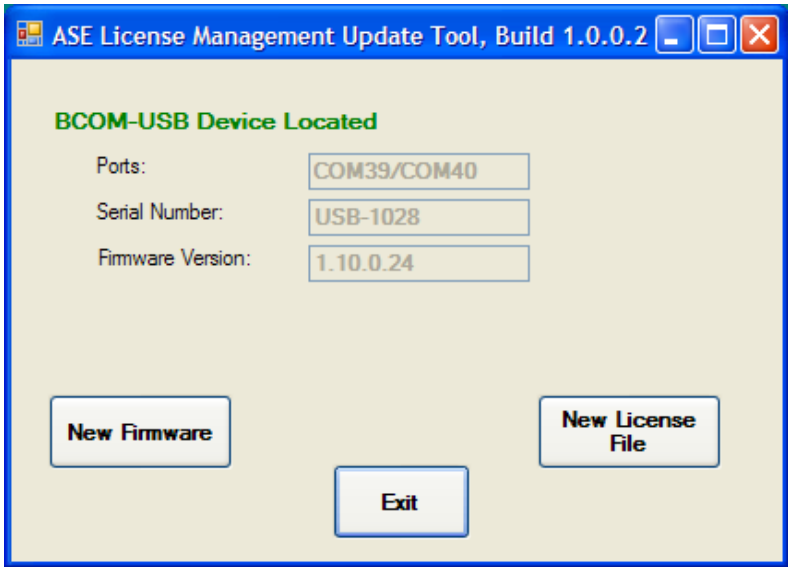
The values show in the boxes will be specific to the PC Com Port assignment, Serial Number of the BCOM-USB device, and current firmware version number.

When the License/Firmware Updater is launched, it will attempt to locate a BCOM-USB device. If one is not attached, the screen will look as follows:

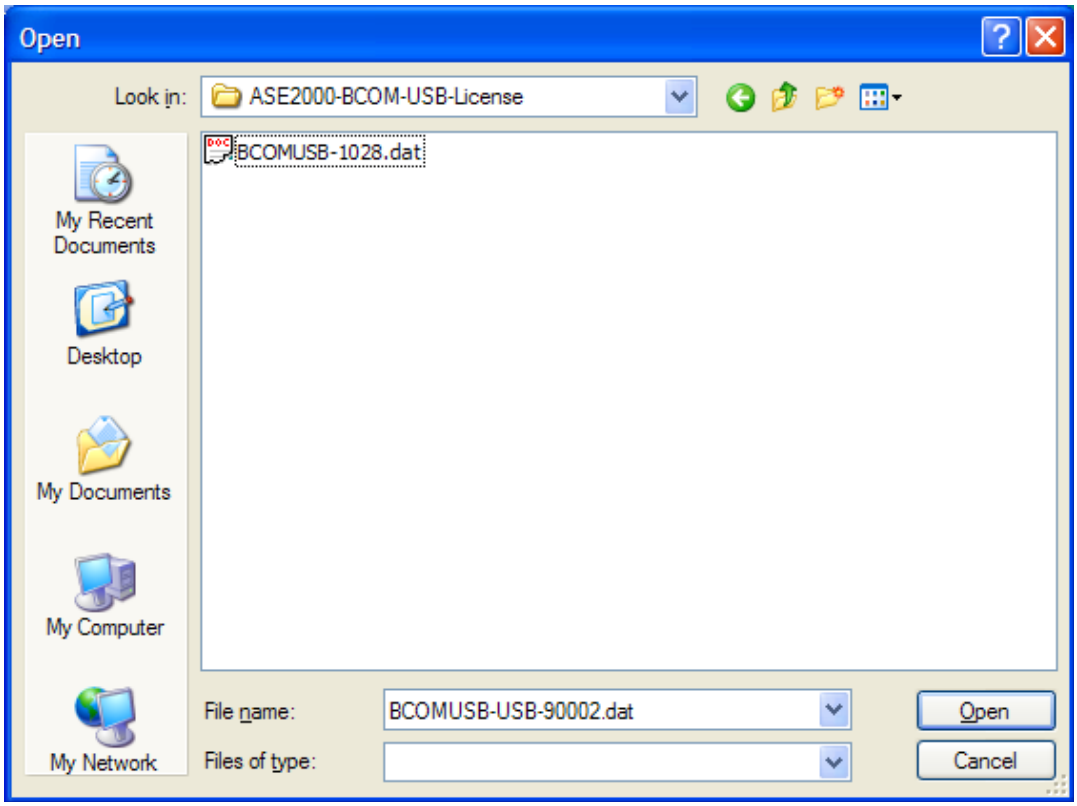


22.3. ASE License/Firmware Updater New License File Installation

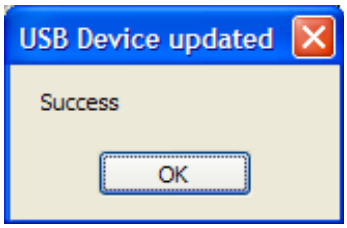
New License files will normally be distributed via e-mail. Save the new License file in a convenient place on the PC hard drive and start the ASE License/Firmware Updater program:



Select the “New License File” button and the contents of the default folder will appear. Browse to the folder containing the new license file and select the appropriate file. Note, the Device Serial Number is part of the file name.



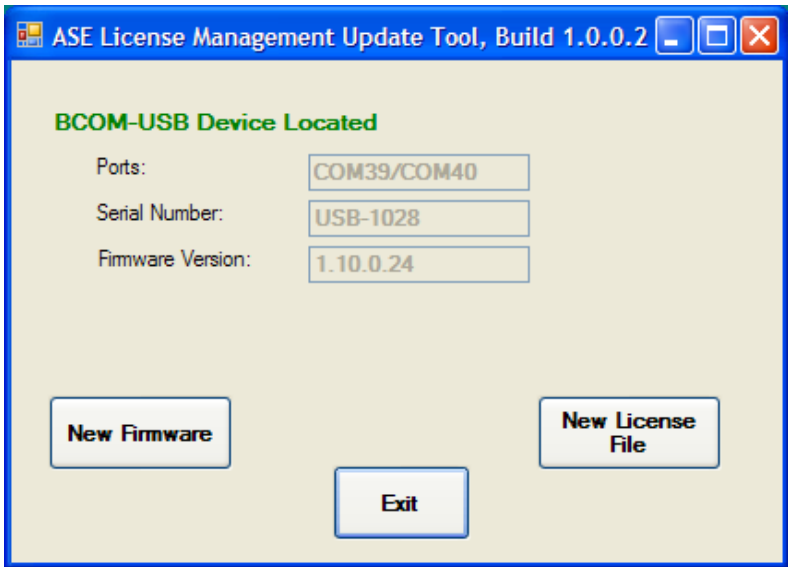
When you double-click on the file name or select “Open”, the program will write the new license file to the BCOM-USB device. If the update is successful, the following message will appear:



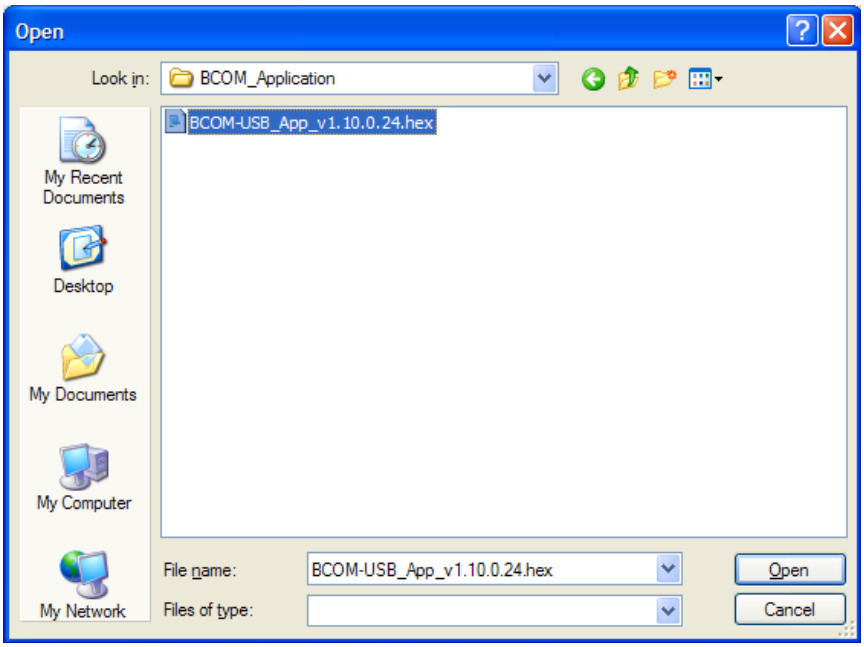
22.4. ASE License/Firmware Updater New Firmware Installation

The ASE License/Firmware Updater is also used to install new firmware in the BCOM-USB device. The BCOM-USB device was released in April 2009 and, although it underwent extensive testing prior to release, it is possible that new releases of the firmware will be necessary to correct problems found after shipment. Registered users will be notified by e-mail of new firmware releases and new release notices will also be posted and available for download from the ASE website at www.ase-systems.com.

Save the new Firmware file in a convenient place on the PC hard drive and start the ASE License/ Firmware Updater program:

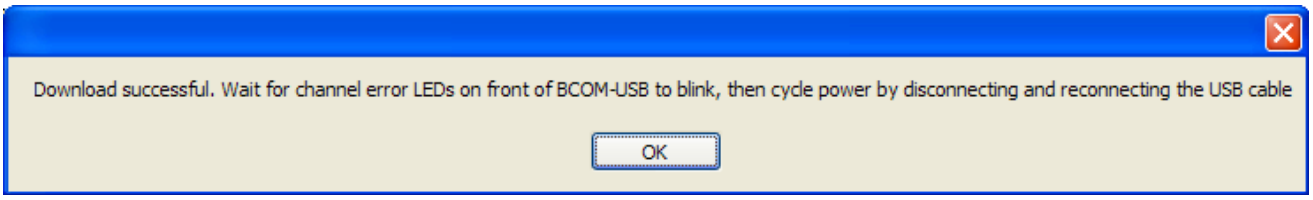


Select the “New Firmware” button and the contents of the default folder will appear. Browse to the folder containing the new firmware file and select the appropriate file. Note, the firmware release number is part of the file name.



When you double-click on the file name or select “Open”, the program will begin writing the new firmware to the BCOM-USB device and a progress bar will be shown on the program main screen.

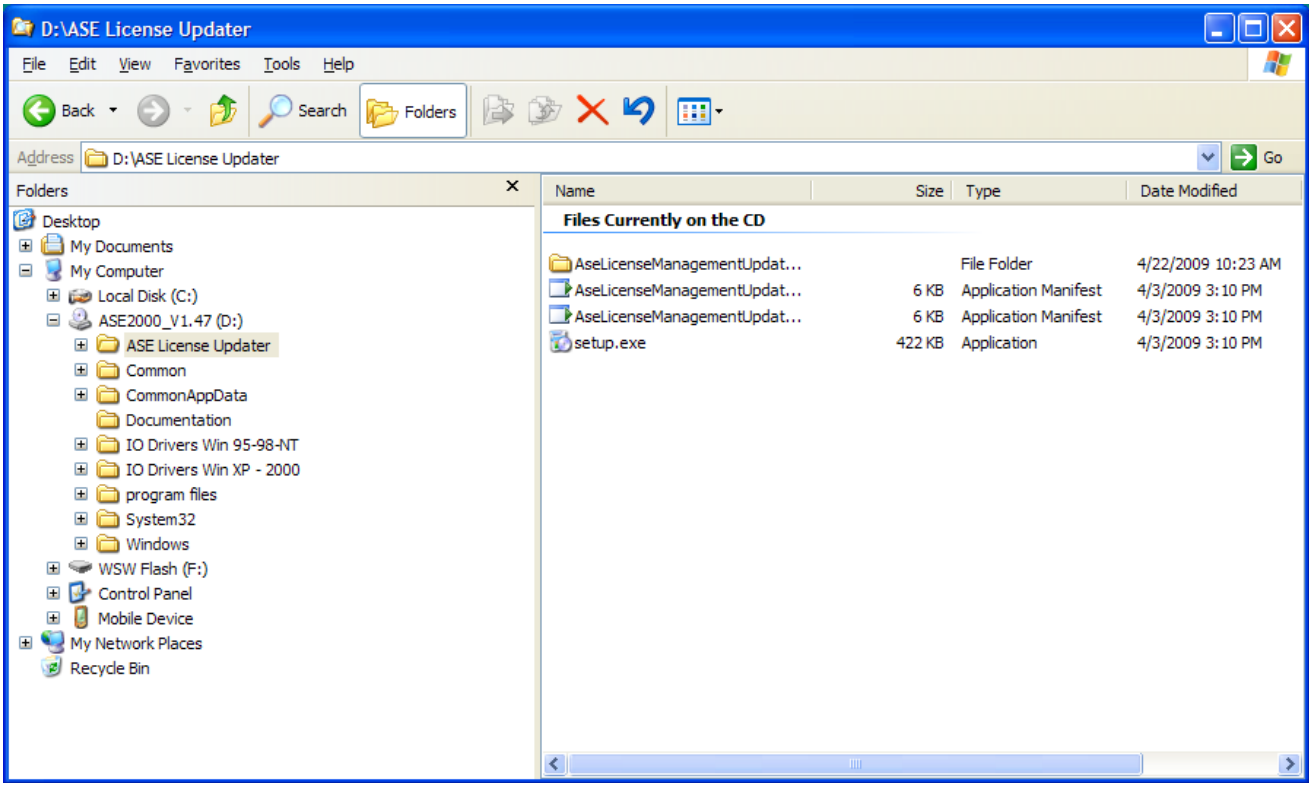
If the update is successful, the message:



Will be displayed. At this point, the “ERR” LEDs on the BCOM-USB device should be alternating on and off (ping-pong). To activate the new firmware, it is necessary to power-off and power-on the BCOM-USB device. This is accomplished by removing and re-connecting the USB cable. After the firmware update and re-start of the BCOPM-USB device, the current firmware version will be displayed on the ASE License/Firmware Updater main display page “Firmware Version:” section.

22.5. ASE License/Firmware Updater Program Installation

This section describes the steps necessary to install the ASE License/Firmware Updater. The Updater is distributed on the ASE2000 Installation CD as shown in Figure 43 below and may also be obtained from the ASE web site at www.ase-systems.com.



To initiate installation of the ASE License/Firmware Updater program, double click on the “setup. exe” file and follow the on-screen instructions.

23. CDC Type I – Protocol Specific

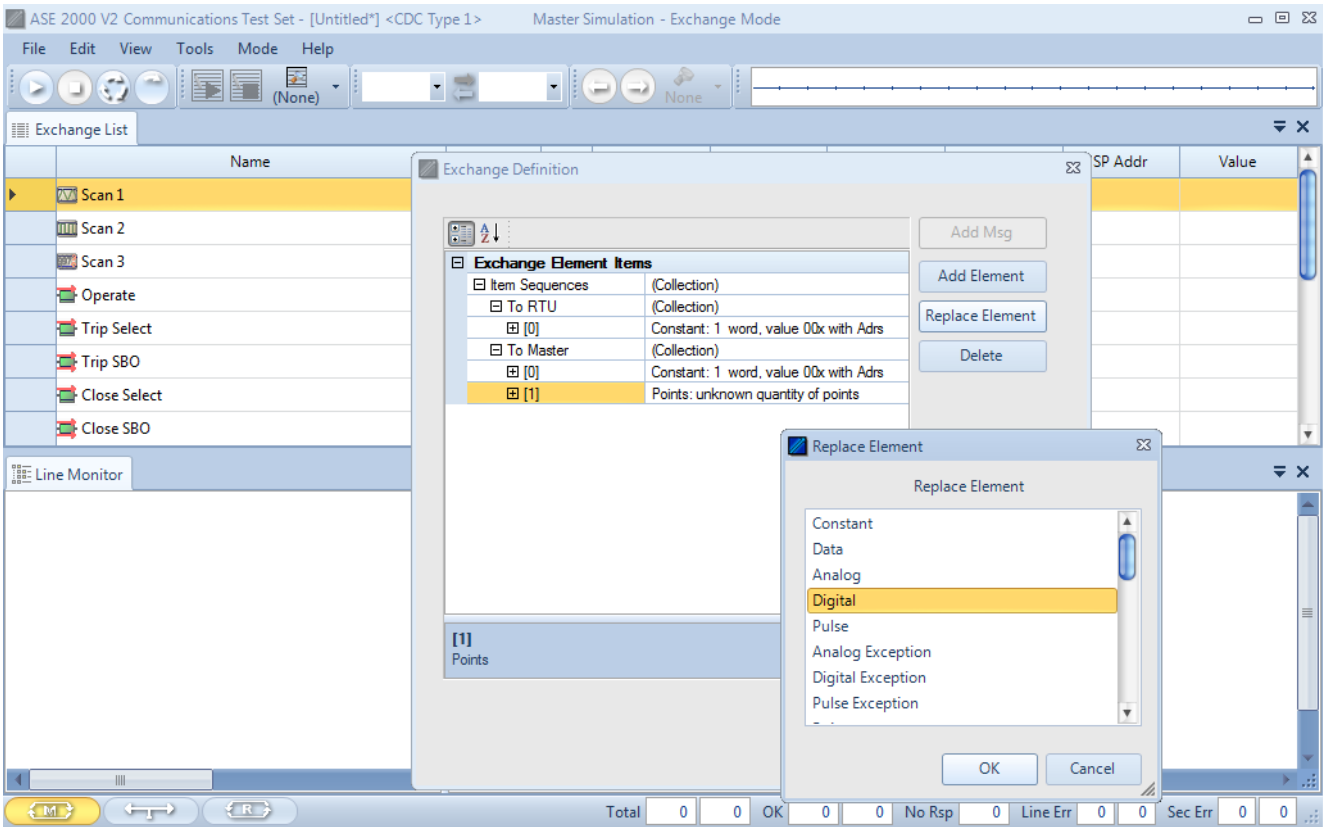
Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

23.1. CDC Type I – Exchange Mode

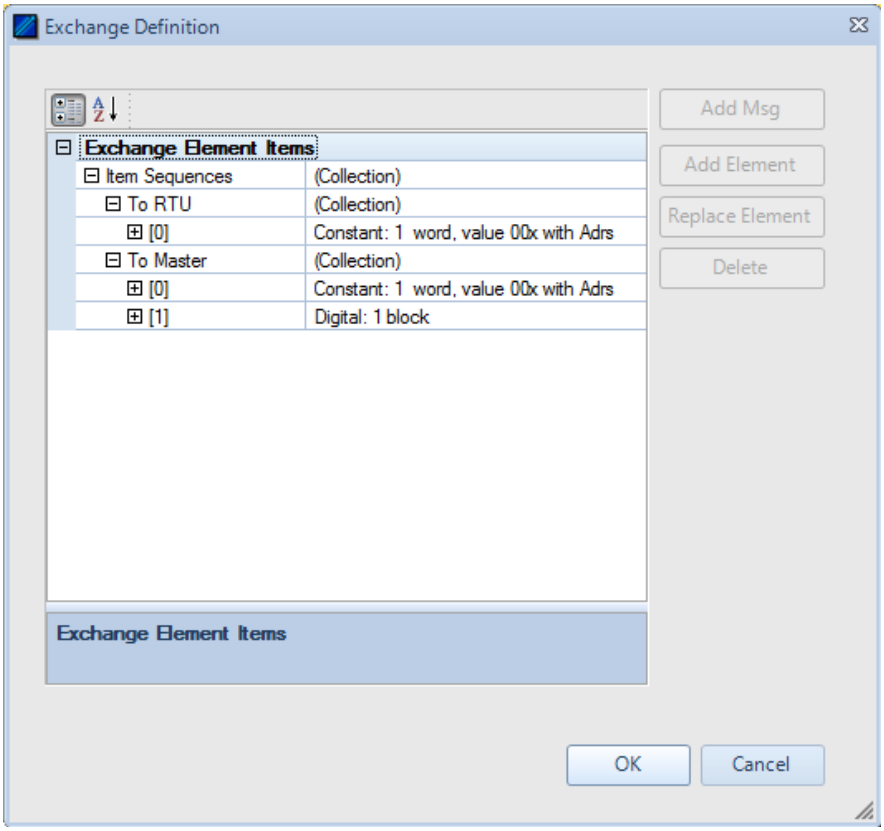
For Exchange Mode, protocol specific tasks are editing Exchange Definition and setting RTU address information.

23.1.1. CDC Type I – Edit Exchange Definition

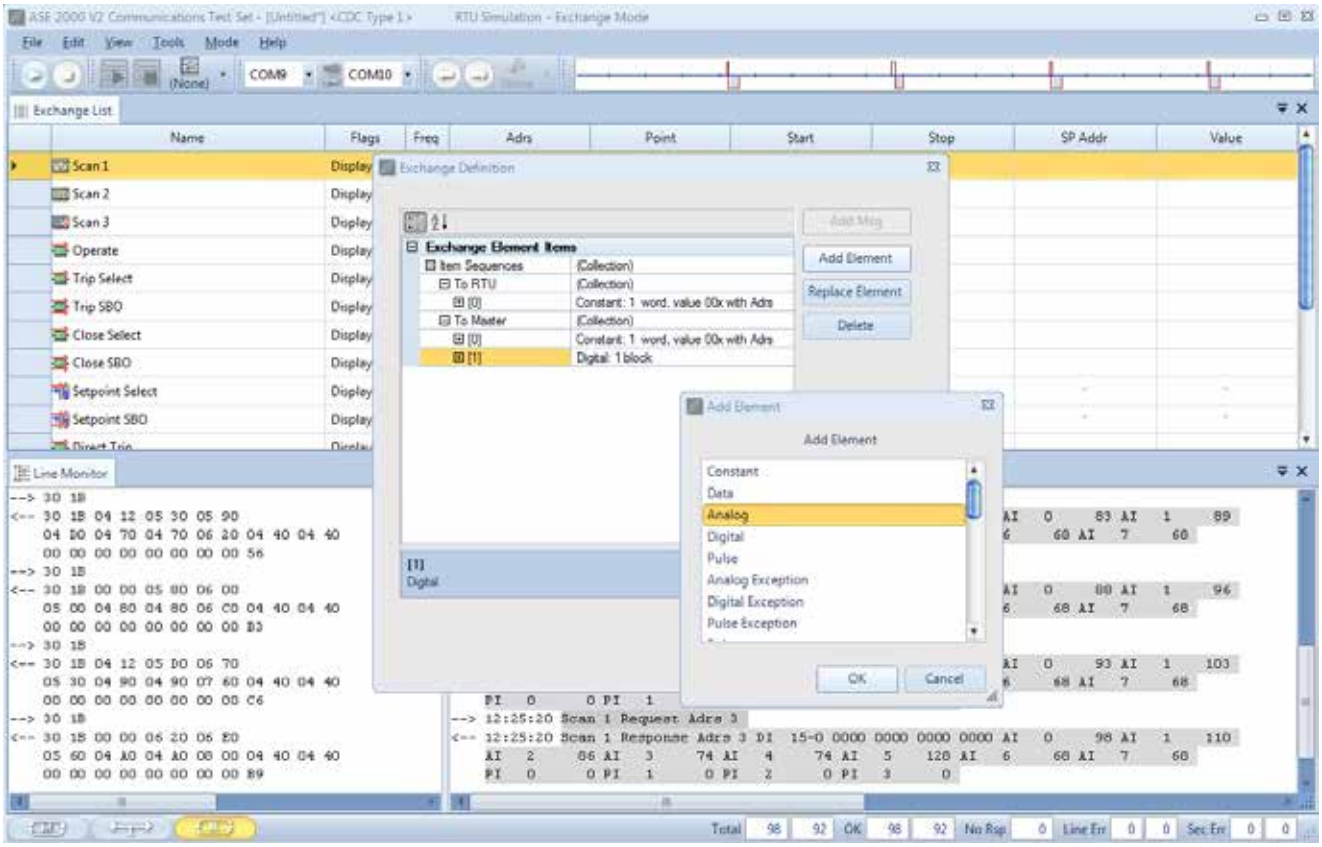
Configure one or more Scan exchanges (Scan 1, Scan 2, and Scan 3) with device point information. In the following example, the device configuration consists of 16 digital points and 8 Analog points, in that order. From the Exchange view, right-click on the line containing the Scan 1 exchange and select Edit Exchange Definition.



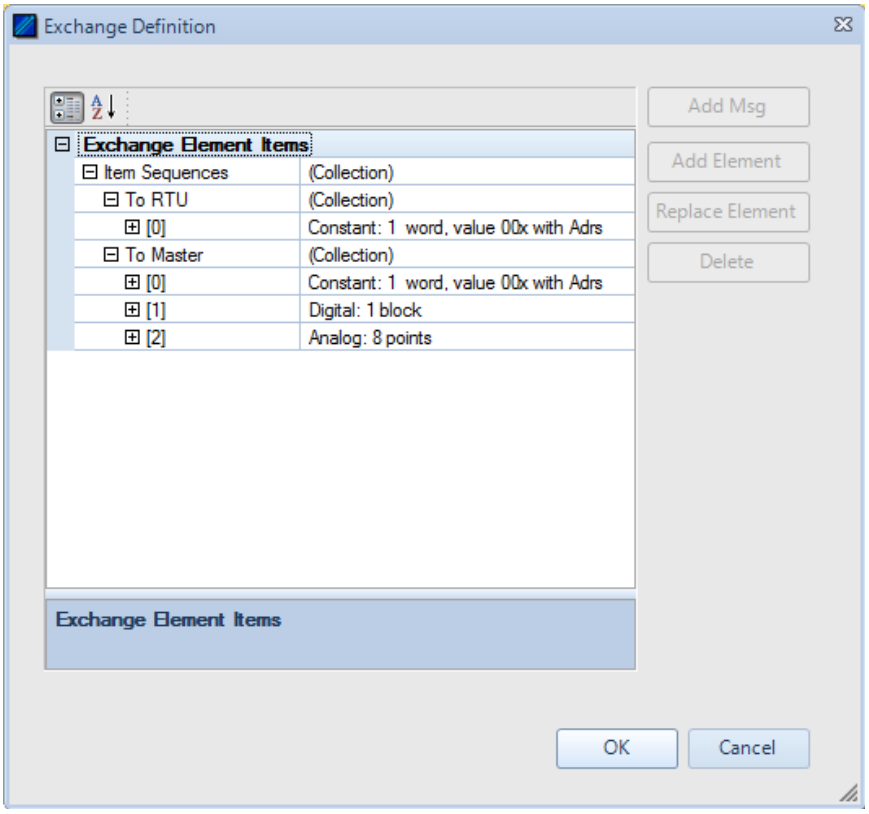
Under the “To Master” section, select the element “Points: unknown quantity of points”, select “Replace Element”, select “Digital”, then OK.



Expand the updated element and change the repeat count to 1. This indicates 1 “block” of 16 digital points. Click OK.



From the Exchange view, right-click on the line containing the Scan exchange and select Edit Exchange Definition. Under the “To Master” section, select the element “Points: Digital: 1 block”, select “Add Element”, select “Analog”, then OK. Expand the updated element and change the repeat count to 8. This indicates 8 “blocks” of Analog points, one point per block. Click OK.



The modified Exchange Definition for 16 Digital and 8 Analog points is shown above.

Since the Scan 2 command returns only digital points, only the digital point information would be configured in the Scan 2 Exchange Definition.

23.1.2. CDC Type I – Set RTU ID and Group

The RTU ID and Group number can be set for all exchanges from the Protocol > Properties display or individually on the Exchange List view.

23.1.3. CDC Type I – Exchange Mode Line Monitor

No additional setup is required. If cabling is correct Line Monitoring can be started by selecting the Start button.

23.1.4. CDC Type I – Exchange Mode Master Simulation

If the Communication Properties, Exchange Definition, RTU ID, and Group number have been configured, Master Simulation operations can be performed. No additional setup is required.

23.1.5. CDC Type I – Exchange Mode RTU Simulation

If the Communication Properties, Exchange Definition, RTU ID, and Group number have been configured, RTU Simulation operations can be performed. No additional setup is required.

23.2. CDC Type I – Task Mode

For all protocols, Task Mode setup starts by first configuring an RTU and RTU point configuration in the device data base or selection of an existing RTU definition. See the non-protocol specific section “Task Mode Device Selection and Configuration”. The steps described below for activating Line Monitor, Master Simulation, and RTU Simulation activities assume the correct RTU configuration has been selected.

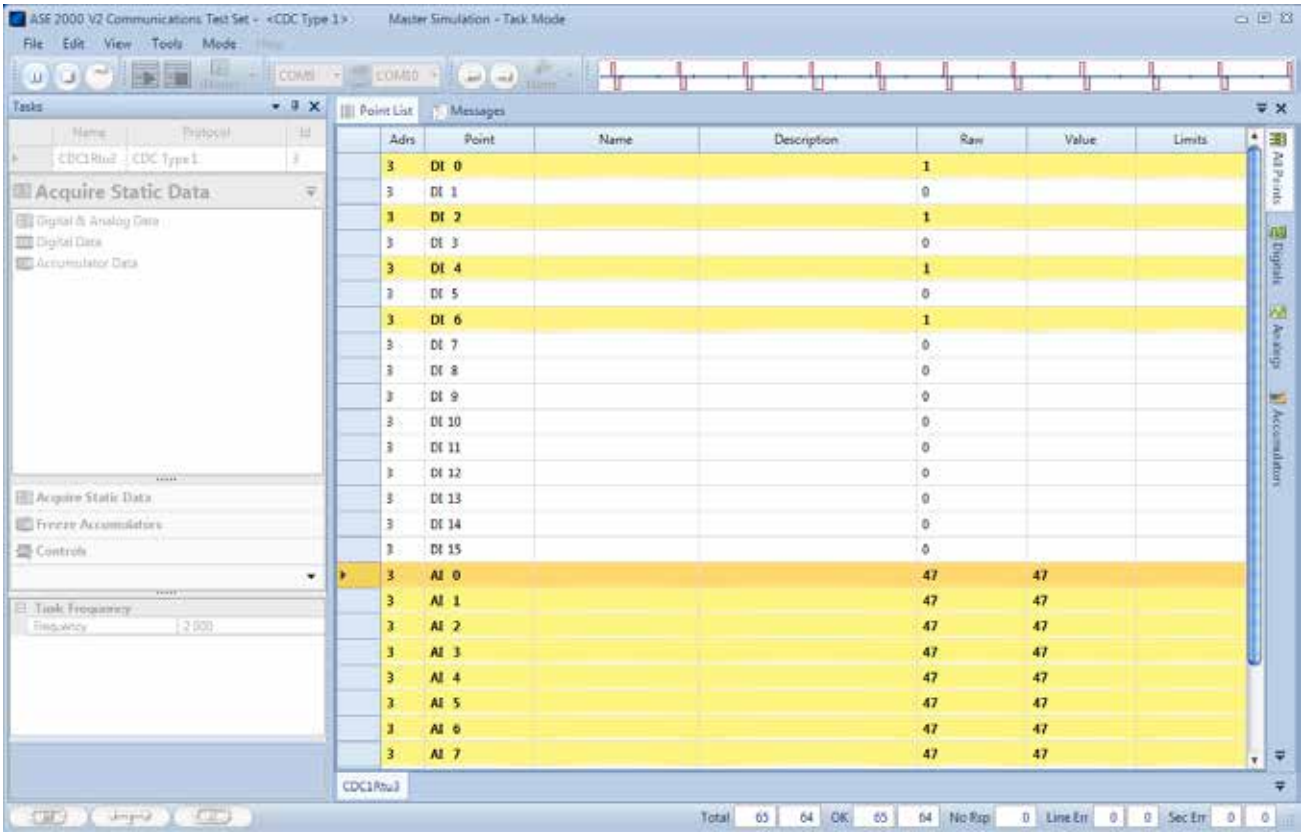
23.2.1. CDC Type I – Task Mode Line Monitor

No additional setup is required. If cabling is correct, Line Monitoring can be started by selecting the Line Monitor icon  on the bottom of the test set screen and then selecting the Start button. 

While it is best to accurately enter the RTU/point data base as described, it is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

23.2.2. CDC Type I – Task Mode Master Simulation

Master Simulation operation works by selecting a Task Group and then a Task Activity within that group.

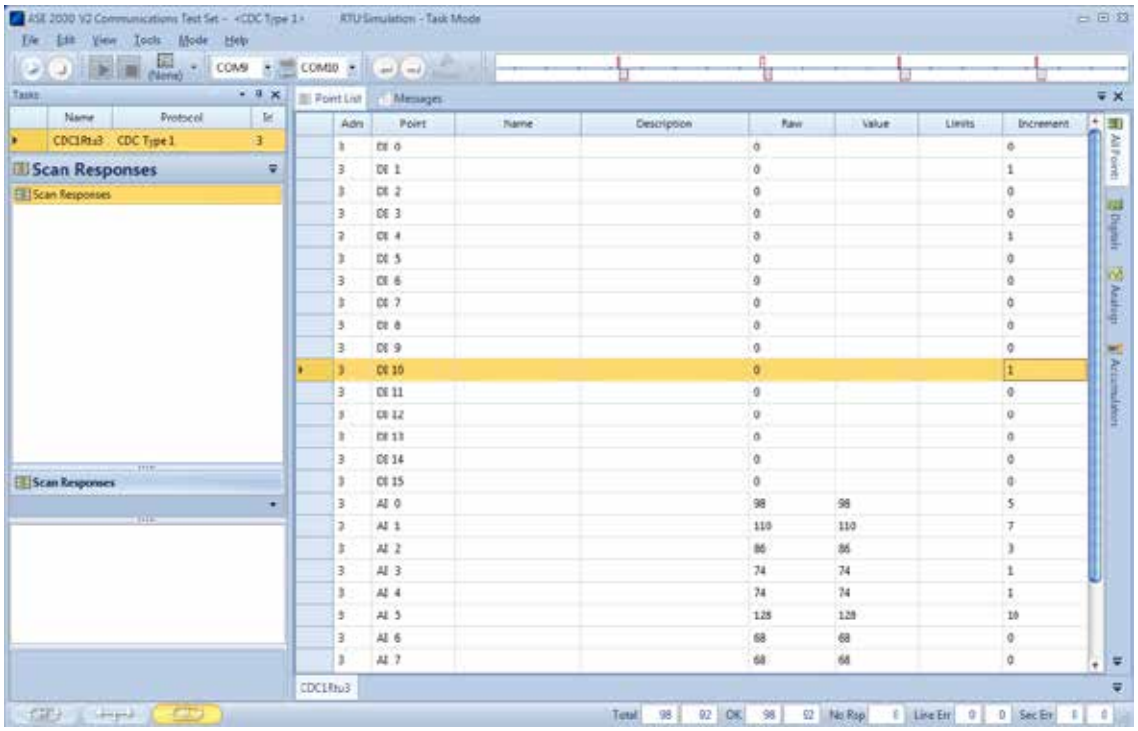


For CDC Type I, the Task Groups are Digital & Analog Data (Scan 1), Digital Data (Scan 2), and Accumulator Data (Scan 3).

With the desired Task Activity selected, execute the function one time using the Send Once icon or continuously by selecting the Start Button.

23.2.3. CDC Type I – Task Mode RTU Simulation

Task Mode RTU Simulation utilizes the RTU and Point Data previously configured for the device to generate responses to master commands for data values. When RTU Simulation mode is selected  , the Raw and Increment fields on the Point List view are enterable. This provides the capability of changing the simulation value for individual points and to control whether the value will change (Increment value) on successive scans.



24. CDC Type II – Protocol Specific

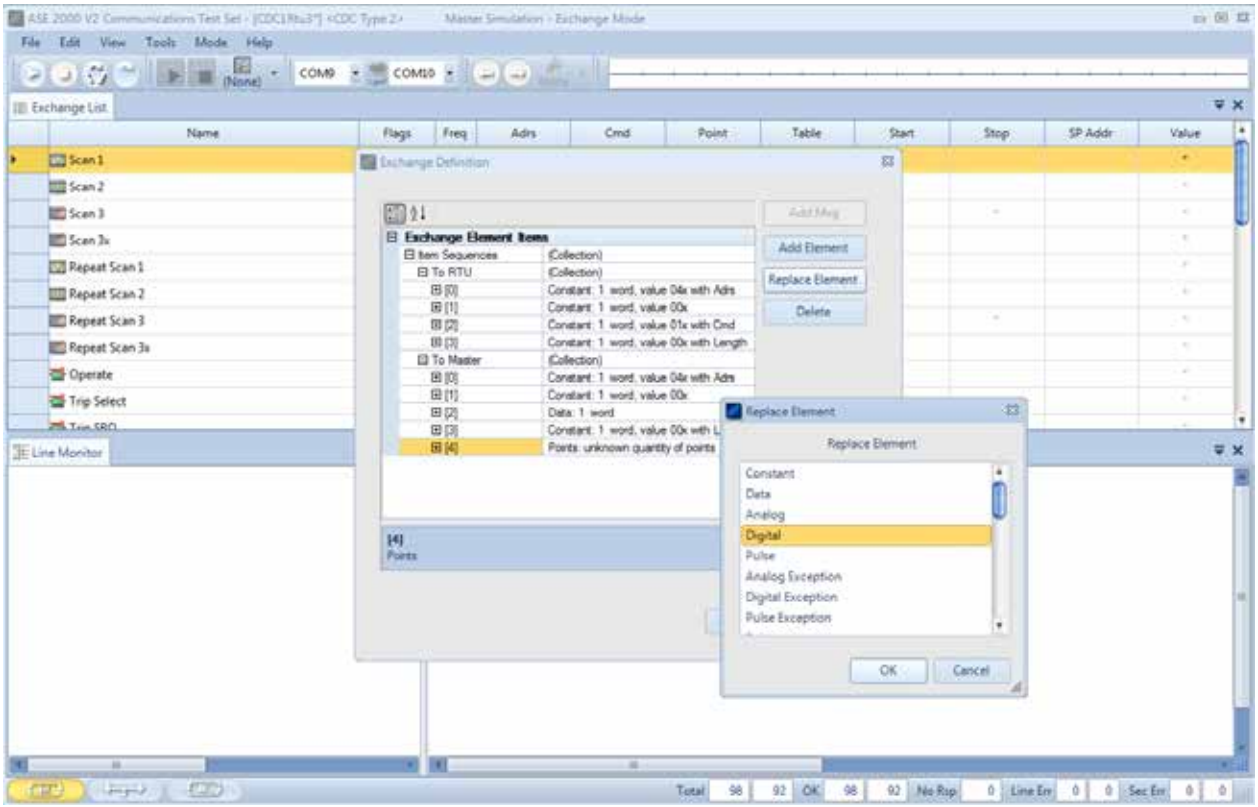
Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

24.1. CDC Type II – Exchange Mode

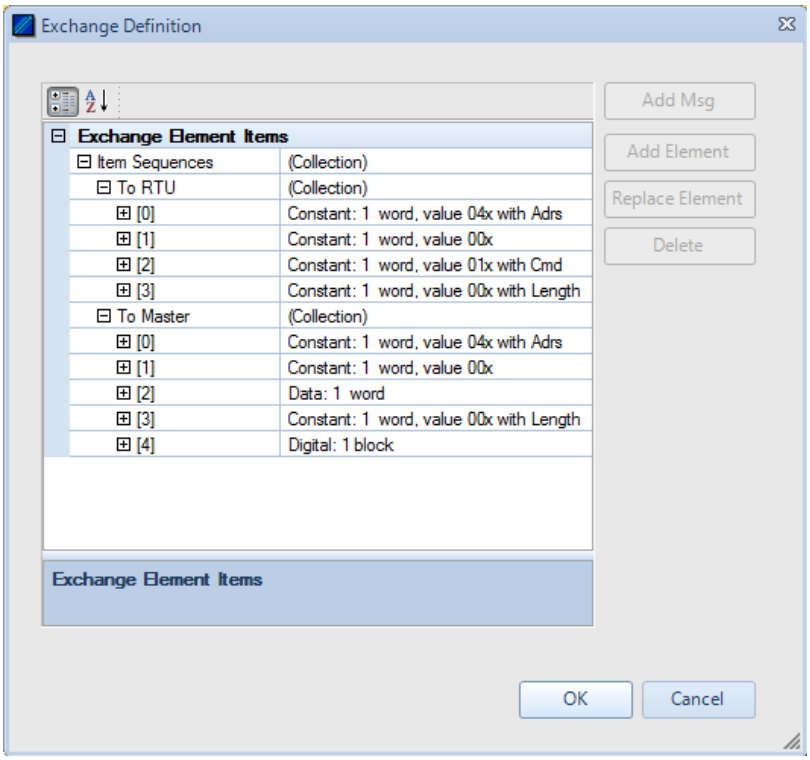
For Exchange Mode, protocol specific tasks are editing Exchange Definition and set RTU address information.

24.1.1. CDC Type II – Edit Exchange Definition

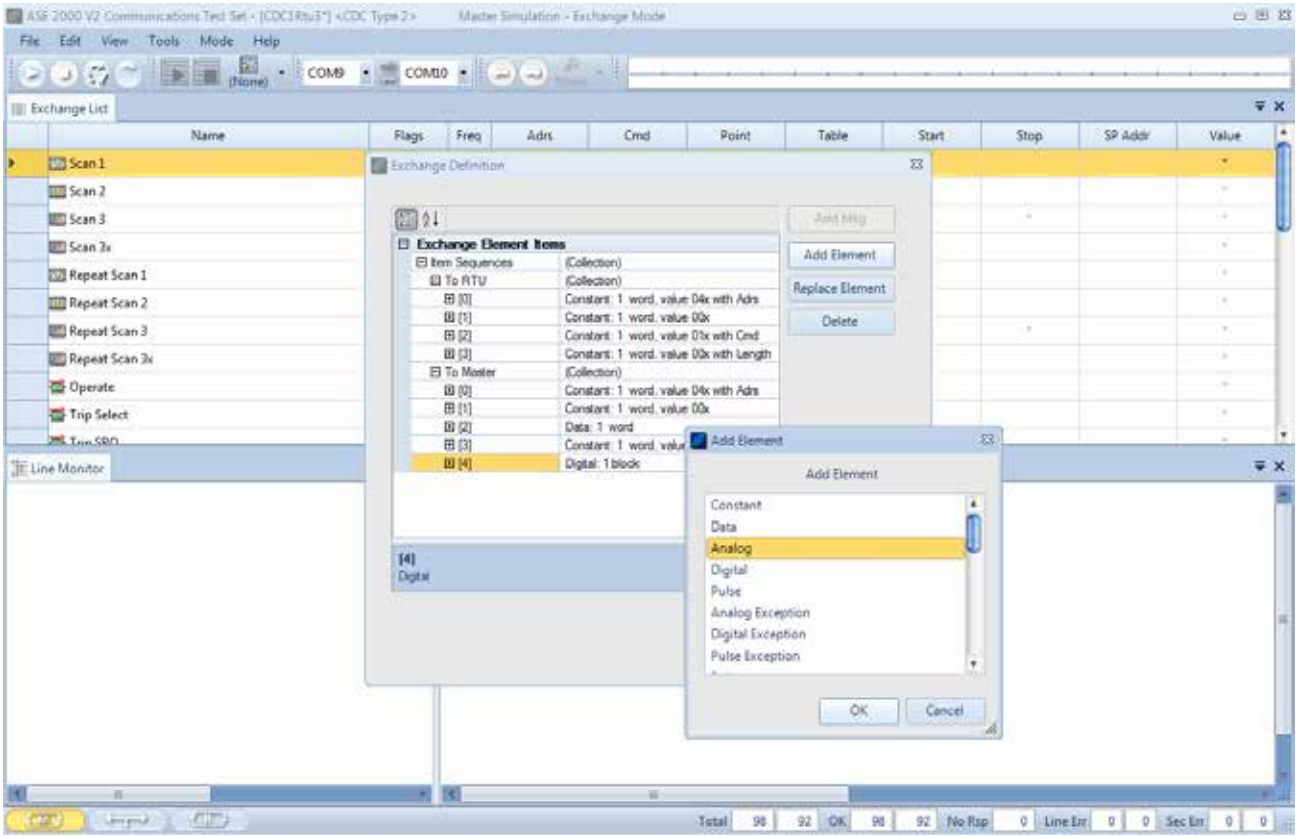
Configure one or more Scan exchanges (Scan 1, Scan 2, Scan 3) with device point information. In the following example, the configuration will contain 16 digital points and 8 Analog points, in that order. From the Exchange view, right-click on the line containing the Scan 1 exchange and select Edit Exchange Definition.



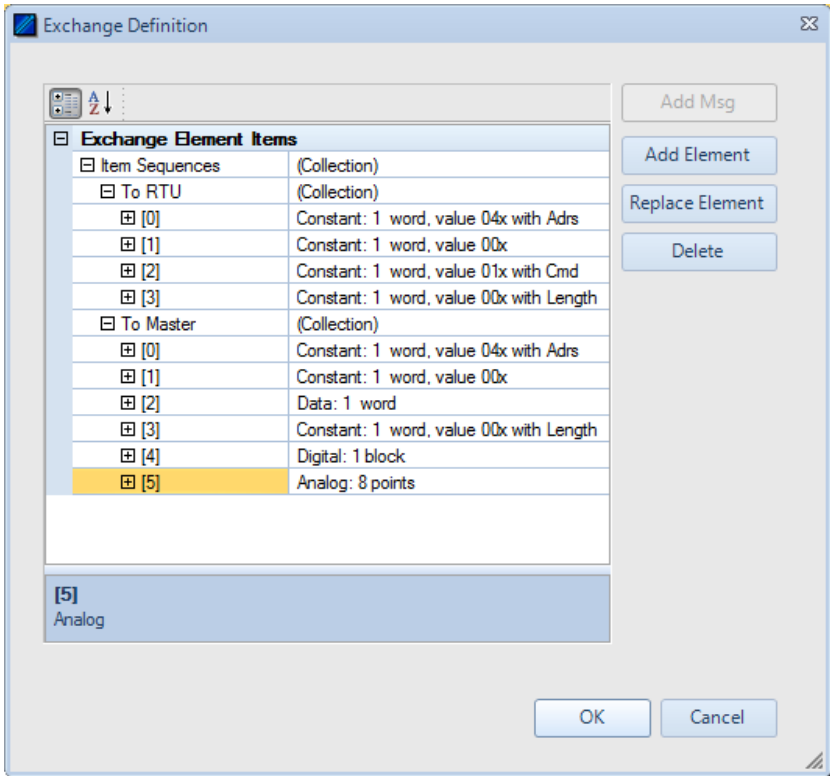
Under the “To Master” section, select the element “Points: unknown quantity of points”, select “Replace Element”, select “Digital”, then OK.



Expand the updated element and change the repeat count to 1. This indicates 1 “block” of 16 digital points. Click OK.



From the Exchange view, right-click on the line containing the Scan 1 exchange and select Edit Exchange Definition. Under the “To Master” section, select the element “Points: Digital: 1 block”, select “Add Element”, select “Analog”, then OK. Expand the updated element and change the repeat count to 8. This indicates 8 “blocks” of Analog points, one point per block. Click OK.



The modified Exchange Definition for 16 Digital and 8 Analog points is shown above.

24.1.2. CDC Type II – Set RTU ID

The RTU ID can be set for all exchanges from the Protocol > Properties display or individually on the Exchange List view.

24.1.3. CDC Type II – Exchange Mode Line Monitor

No additional setup is required. If cabling is correct Line Monitoring can be started by selecting the Start button.

24.1.4. CDC Type II – Exchange Mode Master Simulation

If the Communication Properties, Exchange Definition, and RTU ID have been configured, Master Simulation operations can be performed. No additional setup is required.

24.1.5. CDC Type II – Exchange Mode RTU Simulation

If the Communication Properties, Exchange Definition, and RTU ID, have been configured, RTU Simulation operations can be performed. No additional setup is required.

24.2. CDC Type II – Task Mode

For all protocols, Task Mode setup starts by first configuring an RTU and RTU point configuration in the device data base or selection of an existing RTU definition. See the non-protocol specific section “Task Mode Device Selection and Configuration”. The steps described below for activating Line Monitor, Master Simulation, and RTU Simulation activities assume the correct RTU configuration has been selected.

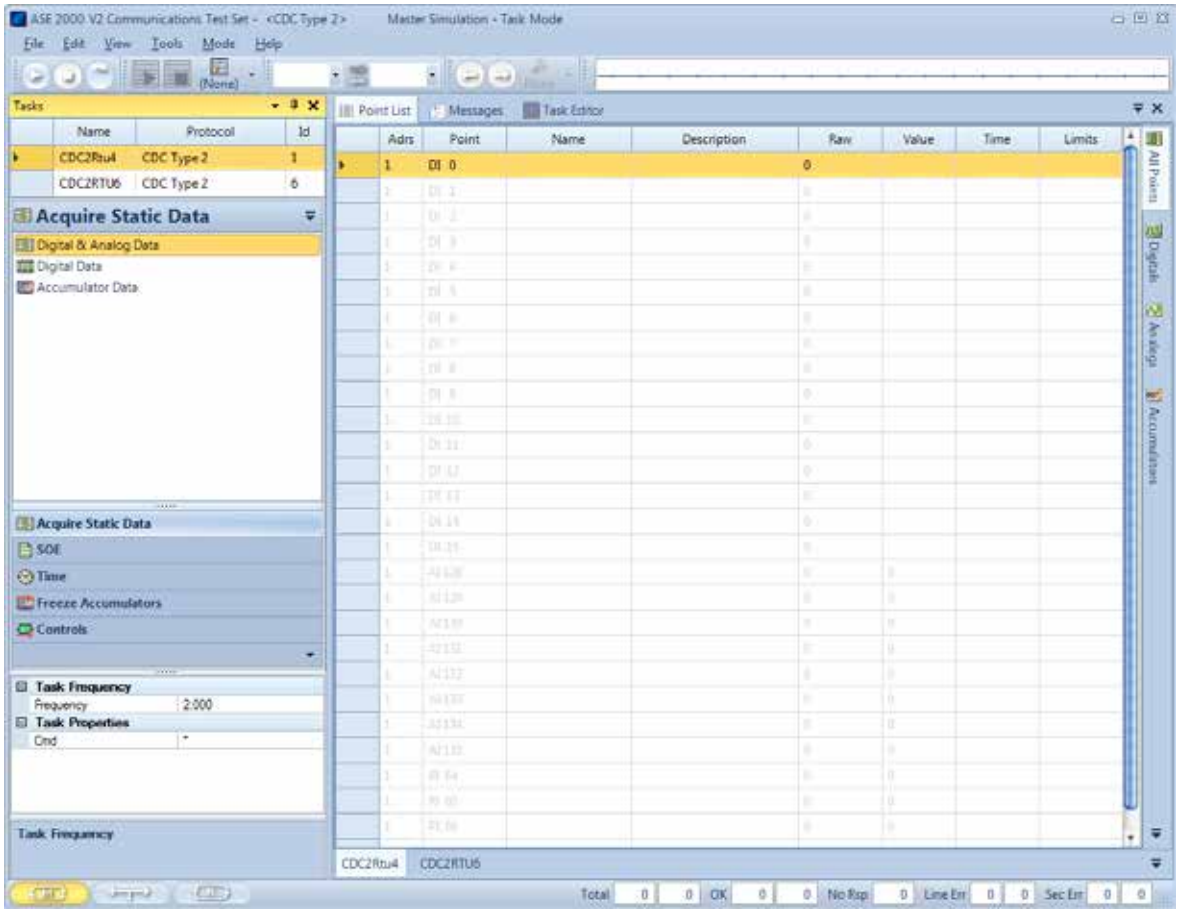
24.2.1. CDC Type II – Task Mode Line Monitor

No additional setup is required. If cabling is correct, and the RTU to be tested has been selected, Line Monitoring can be started by selecting the Line Monitor icon  on the bottom of the test set screen and then selecting the Start button  .

While it is best to accurately enter the RTU/point data base as described, it is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

24.2.2. CDC Type II – Task Mode Master Simulation

Master Simulation operation works by selecting a Task Group and then a Task Activity within that group.



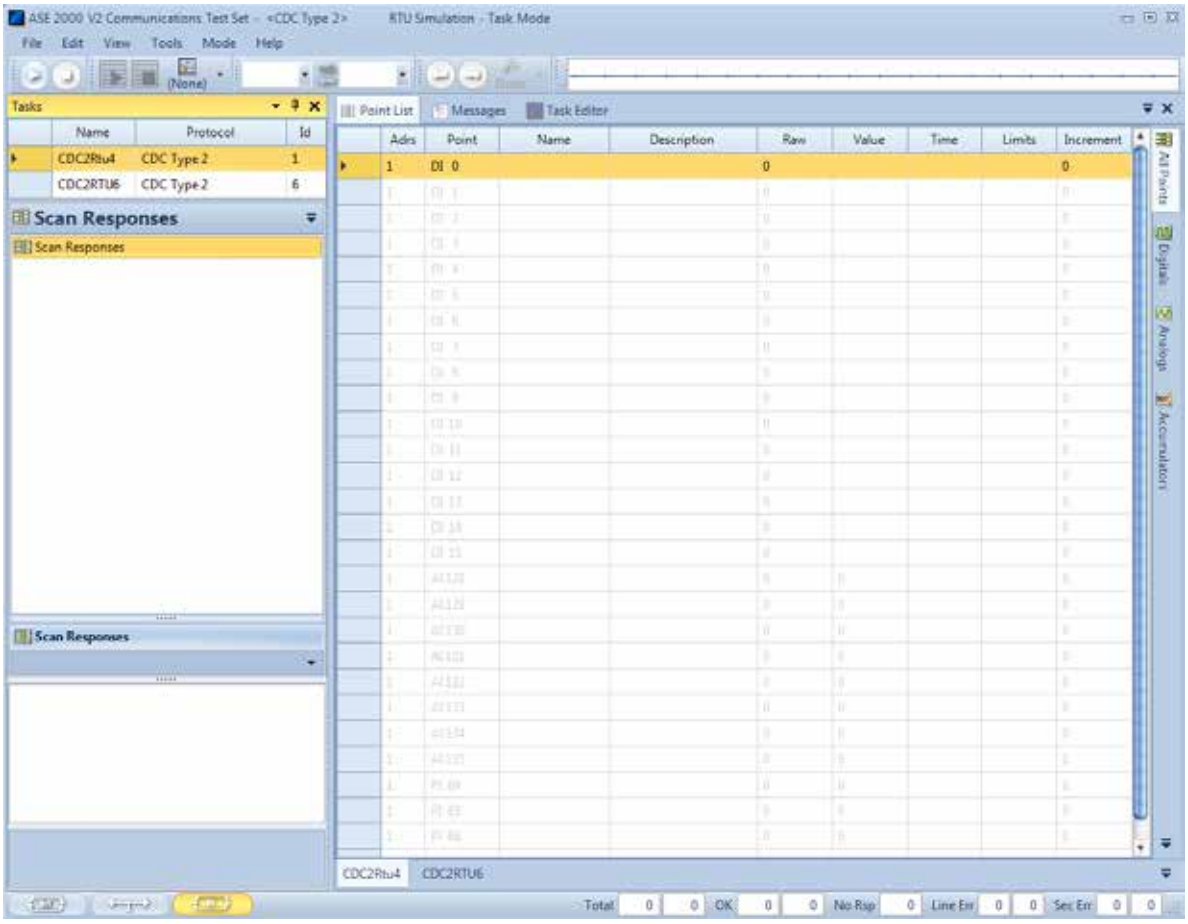
For CDC Type II, the Task Groups are Digital & Analog Data (Scan 1), Digital Data (Scan 2), and Accumulator Data (Scan 3).

With the desired Task Activity selected, execute the function one time using the Send Once icon or continuously by selecting the Start Button.

24.2.3. CDC Type II – Task Mode RTU Simulation

Task Mode RTU Simulation utilizes the RTU and Point Data previously configured for the device to generate responses to master commands for data values.

When RTU Simulation mode is selected  , the Raw and Increment fields on the Point List view are enterable. This provides the capability of changing the simulation value for individual points and to control whether the value will change (Increment value) on successive scans.



25. Conitel – Protocol Specific

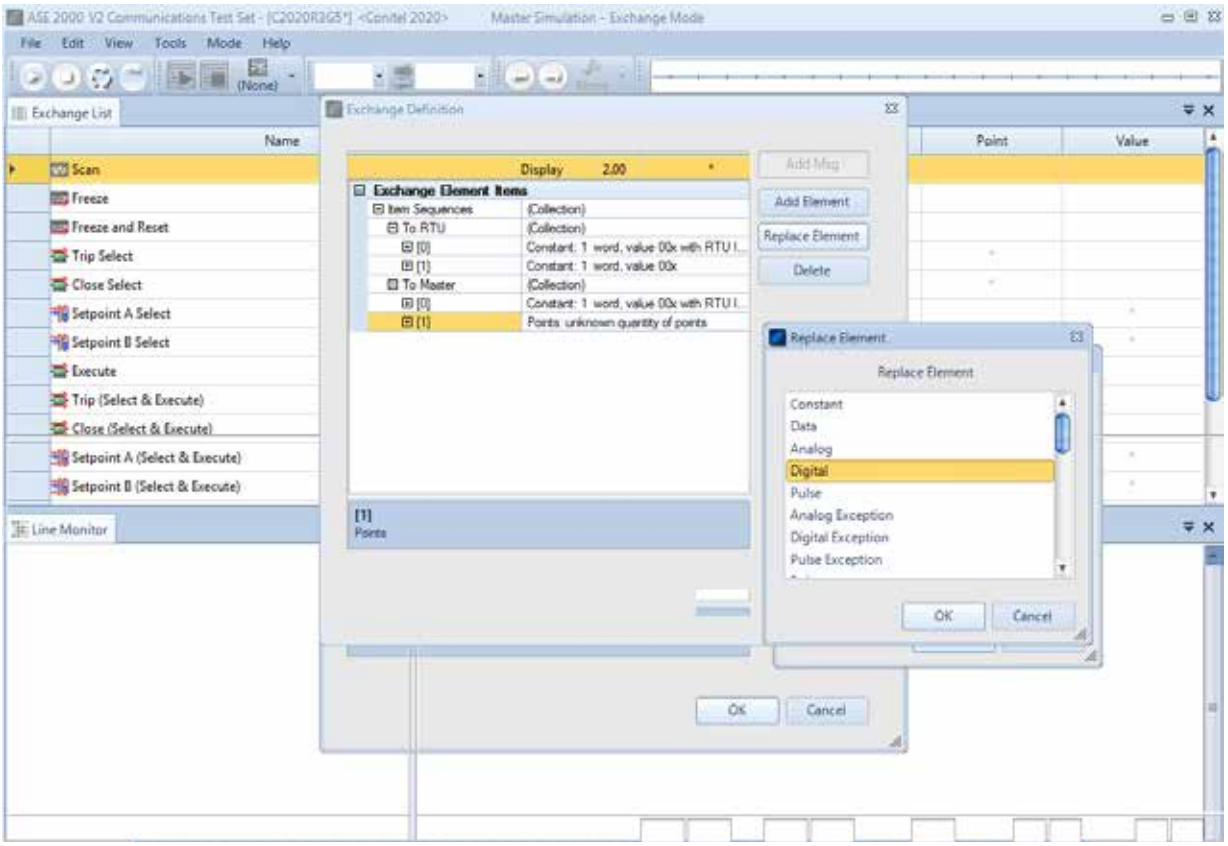
Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

25.1. Conitel – Exchange Mode

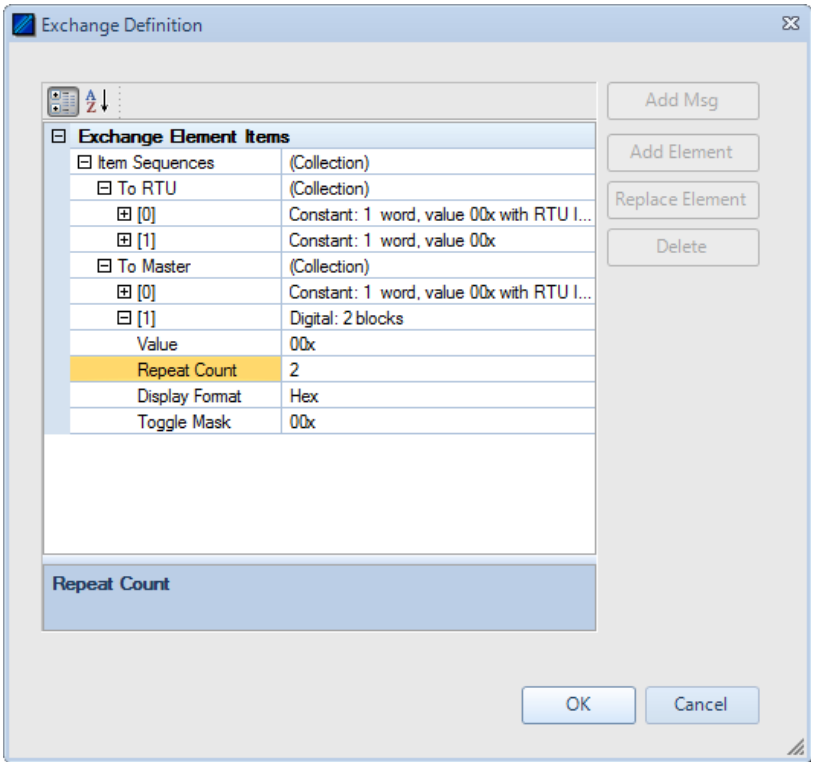
For Exchange Mode, protocol specific tasks are editing Exchange Definition and set RTU and Group address information.

25.1.1. Conitel – Edit Exchange Definition

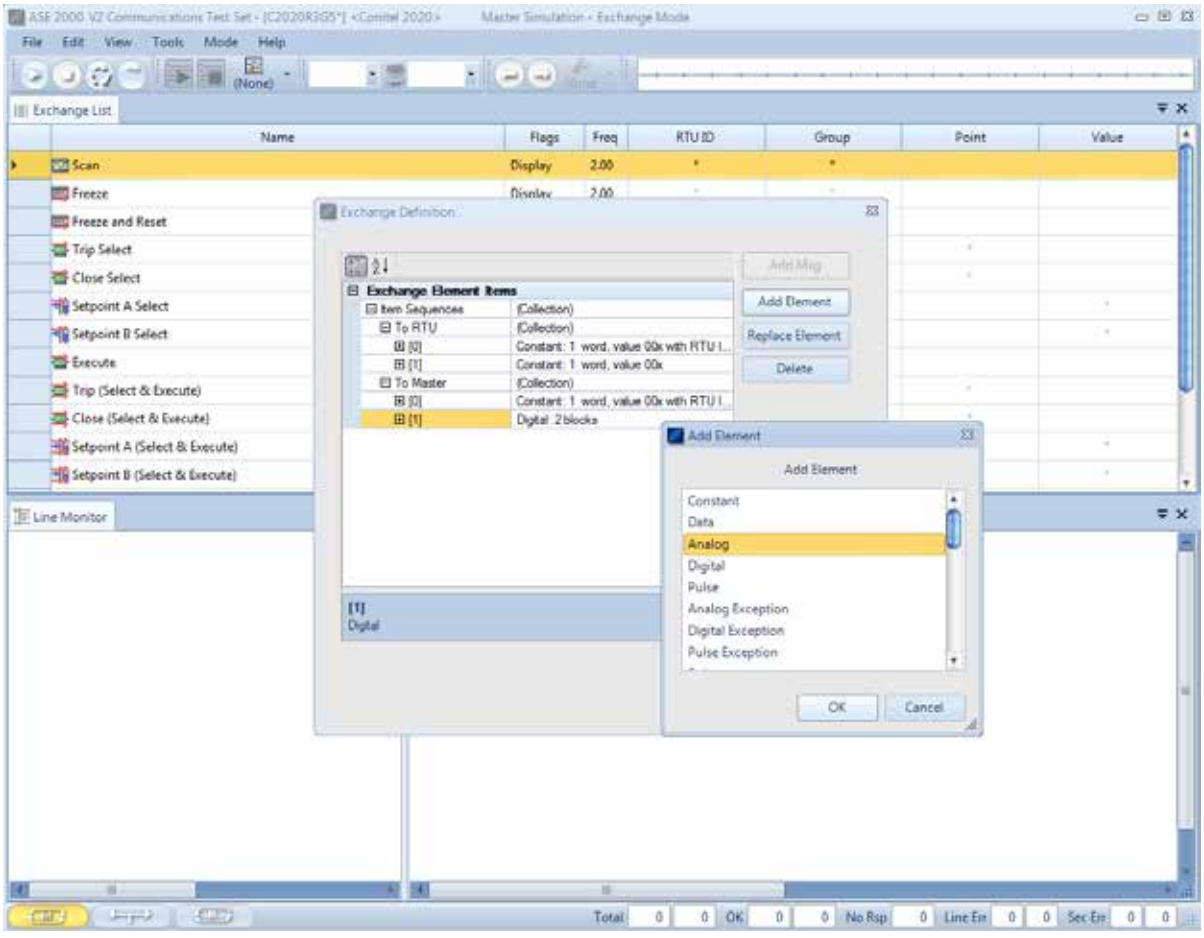
Configure one or more Scan exchanges with device point information. In the following example, the configuration will contain 24 digital points and 7 Analog points, in that order. From the Exchange view, right-click on the line containing the Scan exchange and select Edit Exchange Definition.



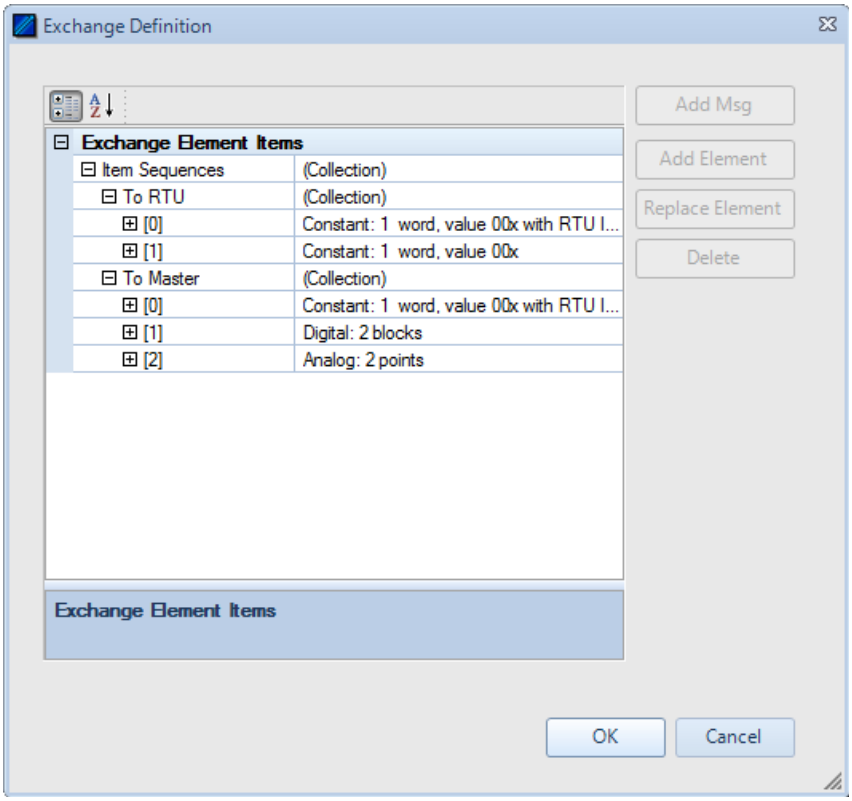
Under the “To Master” section, select the element “Points: unknown quantity of points”, select “Replace Element”, select “Digital”, then OK.



Expand the updated element and change the repeat count to 2. This indicates 2 “blocks” of 12 digital points each. Click OK.



From the Exchange view, right-click on the line containing the Scan exchange and select Edit Exchange Definition. Under the “To Master” section, select the element “Points: Digital: 2 blocks”, select “Add Element”, select “Analog”, then OK. Expand the updated element and change the repeat count to 7. This indicates 7 “blocks” of Analog points, one point per block. Conitel documetion refers these “blocks” as sections. Click OK.



The modified Exchange Definition for 24 Digital and 7 Analog points is shown above.

25.1.2. Conitel – Exchange Mode Set RTU ID and Group

The RTU ID and Group number can be set for all exchanges from the Protocol > Properties display or individually on the Exchange List view.

25.1.3. Conitel – Exchange Mode Line Monitor

No additional setup is required. If cabling is correct Line Monitoring can be started by selecting the Start button.

25.1.4. Conitel – Exchange Mode Master Simulation

If the Communication Properties, Exchange Definition, RTU ID, and Group number have been configured, Master Simulation operations can be performed. No additional setup is required.

25.1.5. Conitel – Exchange Mode RTU Simulation

If the Communication Properties, Exchange Definition, RTU ID, and Group number have been configured, RTU Simulation operations can be performed. No additional setup is required.

25.2. Conitel – Task Mode

For all protocols, Task Mode setup starts by first configuring an RTU and RTU point configuration in the device data base or selection of an existing RTU definition. See the non-protocol specific section “Task Mode Device Selection and Configuration”. The steps described below for activating Line Monitor, Master Simulation, and RTU Simulation activities assume the correct RTU configuration has been selected.

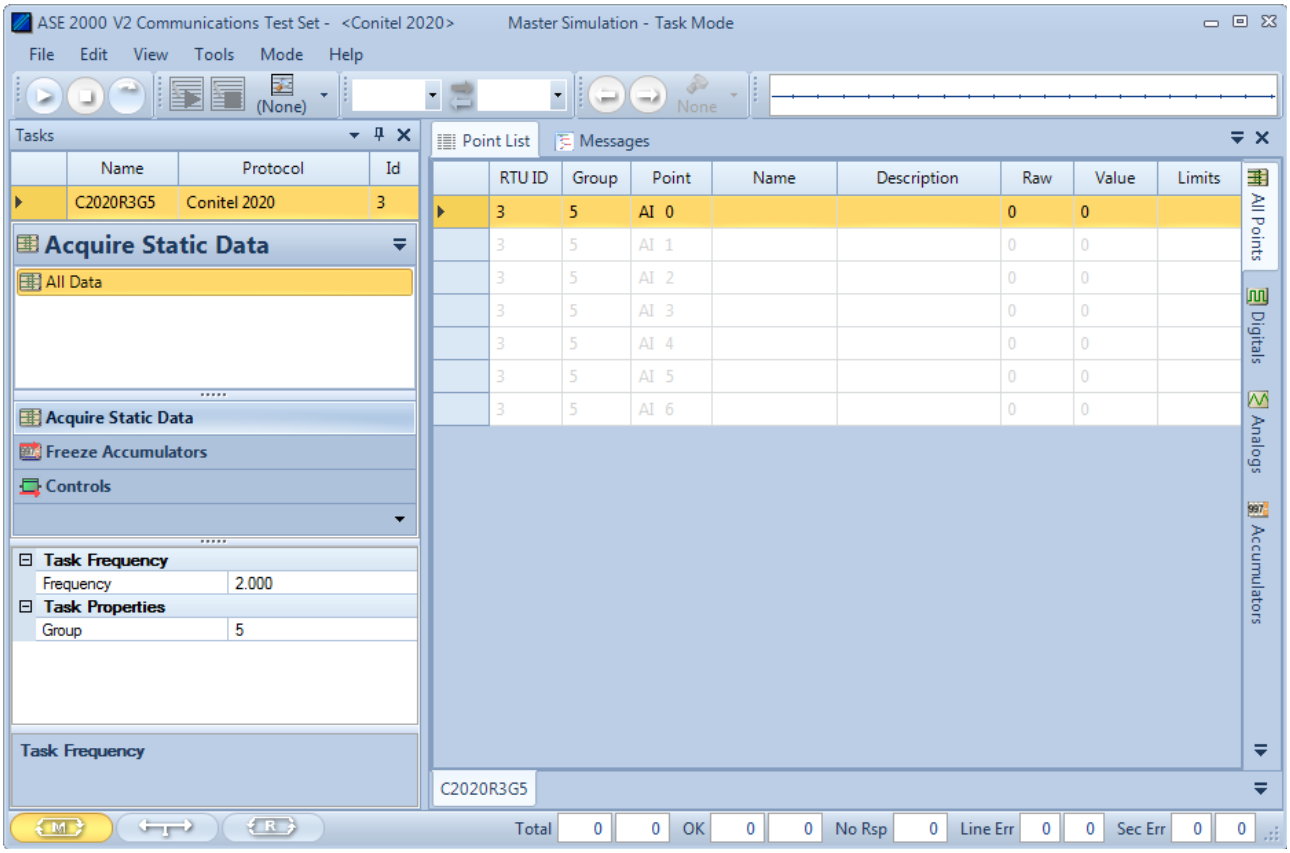
25.2.1. Conitel – Task Mode Line Monitor

No additional setup is required. If cabling is correct, Line Monitoring can be started by selecting the Line Monitor icon  on the bottom of the test set screen and then selecting the Start butto n  .

While it is best to accurately enter the RTU/point data base as described, it is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

25.2.2. Conitel – Task Mode Master Simulation

Master Simulation operation works by selecting a Task Group and then a Task Activity within that group.



For Conitel, the Task Groups are Acquire Static Data, Freeze Accumulators, and Controls.

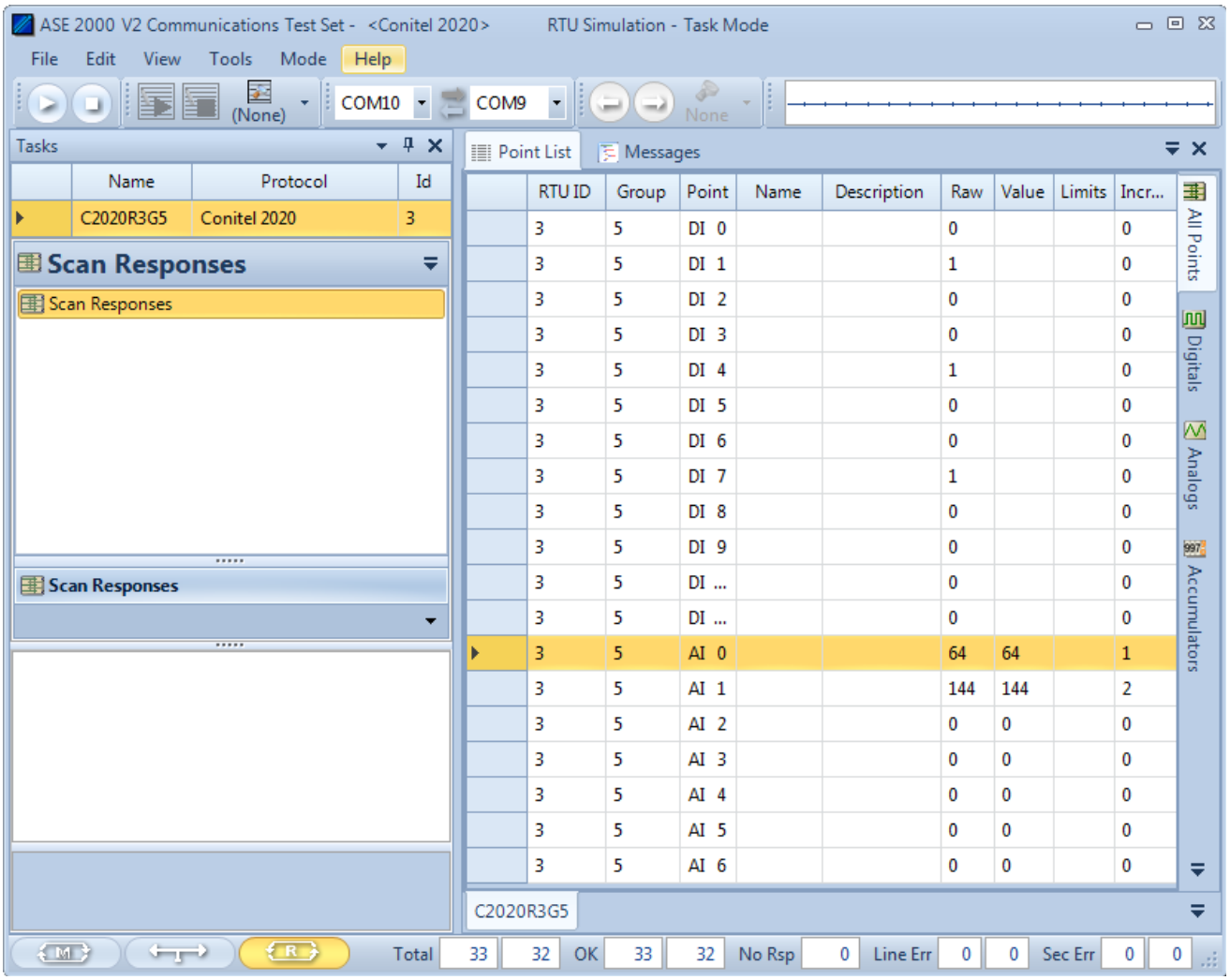
With the desired Task Activity selected, execute the function once using the Send Once icon or continuously by selecting the Start Button.

25.2.3. Conitel – Task Mode RTU Simulation

Task Mode RTU Simulation utilizes the RTU and Point Data previously configured for the device to generate responses to master commands for data values.

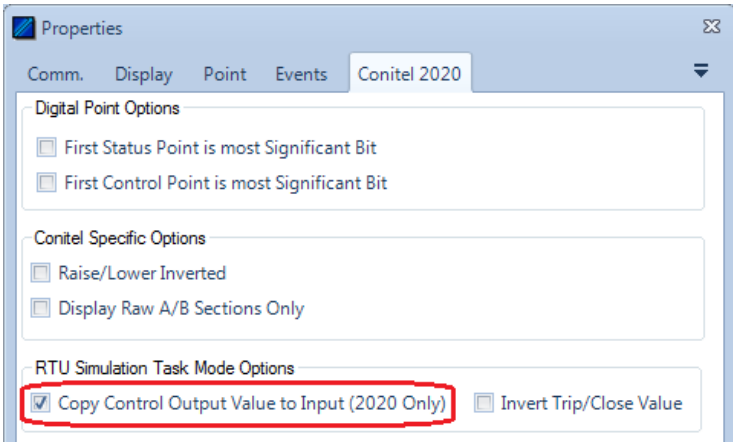
When RTU Simulation mode is selected  , the Raw and Increment fields on the Point List view are enterable. This provides the capability of changing the simulation value for individual points and to control whether the value will change (Increment value) on successive scans.

Another method to change simulation values for individual points is to send control commands from the Master as described in the next section.



25.2.4. Conitel – Mapping Output Controls to Change Input Point Values

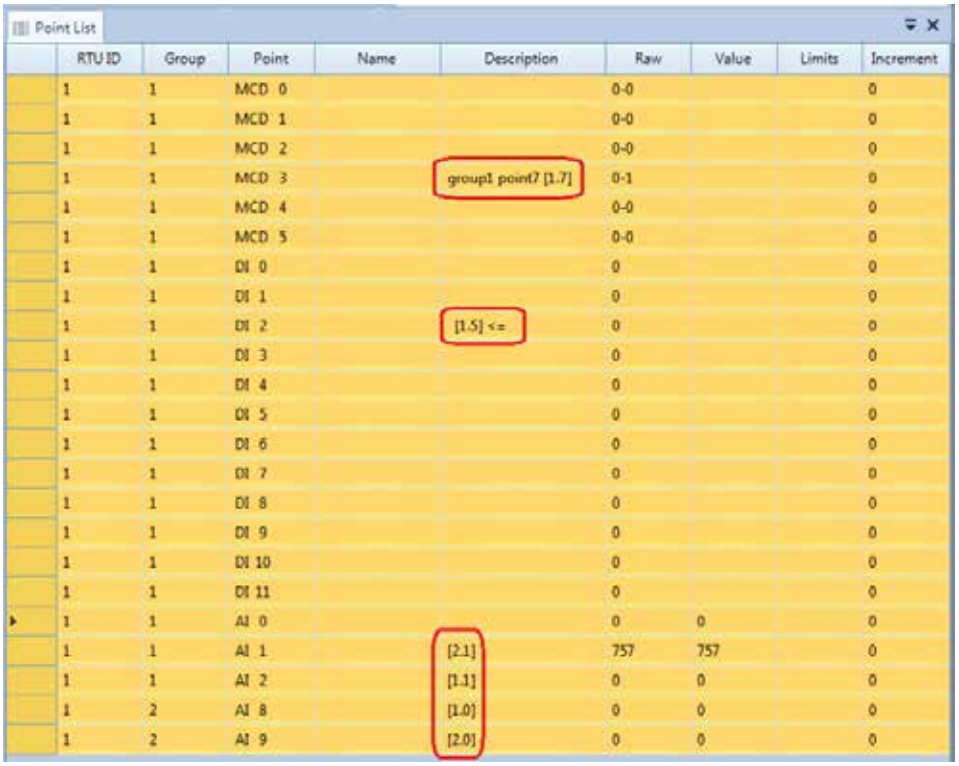
To modify values at the RTU by sending controls from the master station, select this feature from the Conitel tab in the Properties menu. (This feature is not available for all Conitel variations.) A Trip command defaults to a value of zero and a Close command defaults to one. To invert this interpretation, check the 'Invert Trip/Close Value' option.



Add the control point enclosed in square brackets to the description field of the input point to create a link. For Conitel, the point is referenced by group and point number, [Group.Point]. It is a one-way link. Individual points may be inverted by prefixing the point ID with an exclamation point such as [!2.3].

Binary link – [1.7] appears in the Description field for Point MCD 3: Write commands to point 7 in group 1 will change the value of MCD 3.

Analog link – [2.1] appears in the Description field for Point AI 1: A value written to point 1 in group 2 will be set as the value of AI 1 in group 1. Note that point numbers are relative to their position in the group. Point AI 9 represents point 1 in that group (point AI 8 is point 0 in group 2).



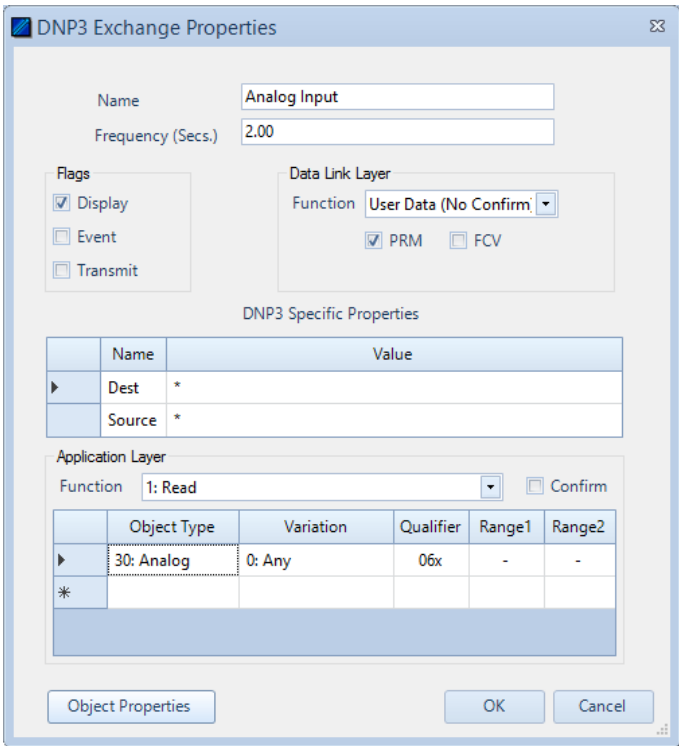
26. DNP3 – Protocol Specific

Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

26.1. DNP3 – Exchange Properties Menu

This Exchange Properties Menu is only available when in Exchange Mode and provides the ability to change message processing options. This menu is requested by selecting first an Exchange, then the Edit pull-down list, and Edit Exchange Properties option. It is also possible to request this menu by double-clicking on the rectangle at the left edge of the exchange.

Following is a sample Edit Properties Menu generated from either of these actions.



26.1.1. DNP3 – Fields

Name is used to identify the exchange on the Line Monitoring and Messages views. This field is normally not modified since default names reflect exchange functionality. The name is not used by ASE2000 internal processing.

Frequency defines how often a message is to be transmitted (in seconds). It is applicable in **Master Simulation** Mode when communication is started with the **Send Continuous** or **Start** button. In **RTU Simulation** Mode, it is used for unsolicited data reporting. It is not applicable in **Line Monitoring** Mode.

When **Send Continuous** is selected, the selected exchange message is sent immediately and, thereafter, at regular intervals specified by the Frequency.

When **Start** is selected in **Master Simulation** mode, each exchange with its **Transmit** flag set is transmitted at the associated frequency. The first transmission occurs at the frequency interval after **Start,** with subsequent transmissions periodically thereafter. For example, if two exchanges both have the **Transmit** flag set, one with a frequency of 2.0 seconds and another with 3.0 seconds, the first exchange is sent 2 seconds after **Start** is pressed and every 2 seconds thereafter. The second exchange is sent 3 seconds after **Start** is pressed and every 3 seconds thereafter.

A special frequency value of 0 seconds (along with setting the **Transmit** flag) causes the exchange to be sent once immediately after Start is pressed.

Note that frequency settings define the desired transmission rate. An exchange is never sent before processing of the prior exchange has terminated, either because the entire response has not yet been received or because no response has been received and the response timeout period has not yet expired.

For **RTU Simulation**, frequency defines how often an “unsolicited data reporting” message is transmitted. Frequency is not used if not operating in unsolicited data reporting mode.

Display and Event flags are as defined in the main ASE200 document. There is no special meaning for DNP protocols.

Transmit flag causes a message to be transmitted according to rules discussed for the frequency setting, above.

Data Link Layer Function is used to select the function code to transmit. Except for one case, this field is informational and should not be altered. The one case where it can be changed is to switch between **User Data (No Confirm)** and **User Data (Confirm)**. If the default function code is either of these, it can be safely modified to the other. The setting (Confirm or Not) is not used for processing incoming messages.

Data Link Layer PRM and FCV checkboxes define whether or not the PRM and FCV bits should be set in the function code byte. The ASE2000 always sets these fields correctly based on the Data Link function code. If modified, an incorrectly formatted message will be sent. The checkboxes are included in this menu only for that purpose, that is, to transmit an incorrectly formatted message to verify error handling by another DNP3 device.

Dest and Source define the exchange’s Destination and Source addresses. Either an ‘*’ or specific value can be entered. An ‘*’ instructs the ASE2000 to use the system default (see

Properties Tab and Protocol). If the system default is also '*', then, on reception, any address is considered valid. On transmission, 0 is used. If the value is not '*', then the entered value is used for both transmission and reception.

Dest and **Source** are always processed from the point of view of the master. That is, **Dest** is used as the Destination address in messages sent by the ASE2000 acting as a master, or received from an external master. For these messages, **Source** is the source address.

This is reversed in messages sent by the ASE2000 acting as a RTU, or received from an external RTU (outstation). In these cases, **Source** is used as the destination address and **Dest** is used as the source address.

Application Layer Function is the application layer function code. In most cases, this field is set correctly by the ASE2000 and should not be modified. The rare case where modification is warranted is for object groups that support both read and write functions. Available application layer function codes values are presented in a pull-down list generated by clicking in this field.

Application Layer Confirm checkbox requests messages to be sent with the application confirm bit set. This option has no impact on the ability of the ASE2000 to correctly process incoming messages.

26.1.2. DNP3 – Object List

The bottom portion of the DNP3 properties Menu presents a list of objects and associated qualifier codes. By default, the ASE2000 supplies one object corresponding to the Exchange type. For example, the Analog Input exchange contains one object, Object group 30: Analog Input. The Object List is empty in Data Link-only exchanges such as Reset Link.

The object list is used for three purposes:
1. To identify an incoming message
2. To allow the user to define variation and qualifier codes for RTU Simulation
3. To allow the user to define point values and modeling parameters for RTU Simulation

Each purpose is discussed in following sections.

26.1.3. DNP3 – Multiple Object Exchanges

▶ *This subsection provides instructions to configure messages that explicitly address multiple object groups, such as a single read for both analog and binary input data. It does not contain configuration information for Class Data scans or for read requests that address a single object group.*

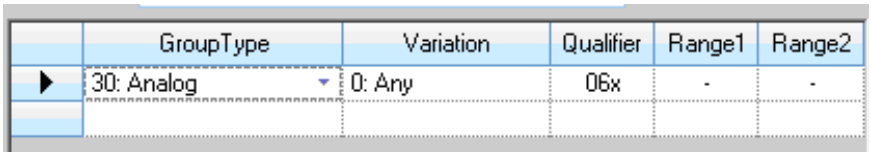
The ASE2000 identifies incoming messages by "best match" against the list of defined exchanges. The highest priority in the matching algorithm is the Data Link and Application layer function codes. The third level is the object list. Since most DNP3 messages are requests for data, which all use the same Data Link and Application layer function codes, the object list becomes significant in most matches.

All requests for data use a **User Data** (confirm or no confirm) data link layer function code and a **Read** application layer function code. These messages are distinguished by the object or list of objects they read. The ASE2000 default exchange list includes entries for all single object reads. For example, the default list includes a read of static analog data, a read of static binary data, and so on. The user may build new exchanges for multiple object reads, for example, a single request to read both analog and digital data.

When a request is received, the ASE2000 matches it against the closest defined exchange. A request for a single object only should match one of the default exchanges. A read for multiple objects will match a user configured exchange for the same objects, if one exists. If such an exchange is not configured, it will match a single object read for the last object in the list. For example, a read for static analog and digital data (in that order) will match an exchange configured with those two objects in the correct order. If such an exchange does not exist, it will match an exchange with only digital data.

The importance of matching a correct exchange is to:
- Identify the exchange in the line monitoring and messages views. The name is selected from the exchange matched
- In RTU Simulation mode, transmit the correct response. The response is generated from user entries made in the matched exchange

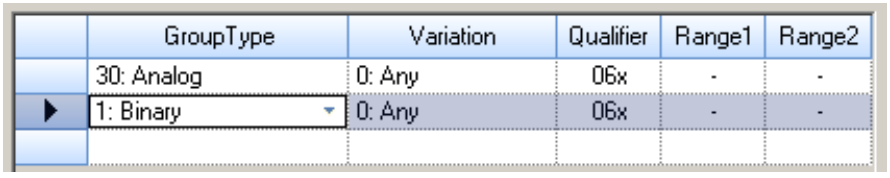
To create a multiple object exchange:
- Highlight a similar existing exchange, such as Analog input
- Make a copy by highlighting that exchange and selecting Edit/Copy and Edit/Paste. You now have two identical exchanges with the same name
- Highlight one of them and select Edit/Edit Exchange Properties. This generates the Exchange Properties menu (discussed previously). A portion of the menu for an analog read exchange is:



	GroupType	Variation	Qualifier	Range1	Range2
▶	30: Analog	0: Any	06x	-	-

In the case discussed, you want to modify this exchange to include both analog and binary input points.

- Select the line underneath **30: Analog** and, using the pull-down lists, create an entry for the Binary object



	GroupType	Variation	Qualifier	Range1	Range2
	30: Analog	0: Any	06x	-	-
▶	1: Binary	0: Any	06x	-	-

- Notice a third line is created, allowing entry of more objects as required
- When finished, change the exchange name from Analog Input to something more meaningful

The modified exchange will now match a read message requesting both analog and binary input data.

26.1.4. DNP3 – Variation and Qualifier Codes

The variation and qualifier code fields modify message transmission for Master and RTU Simulation modes. They are not used to identify an incoming message.

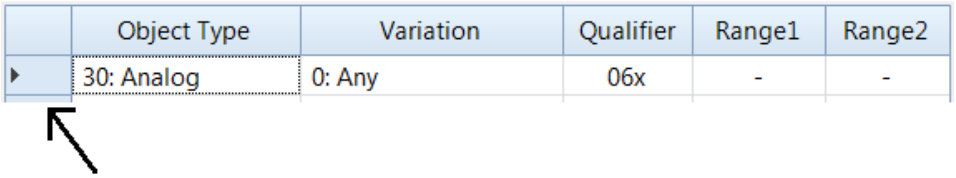
Variations

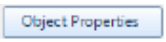
Object group variations can be changed from a pull-down generated by clicking in the Variation column for the correct object row. The variation pull-down list presents options for the corresponding object group.

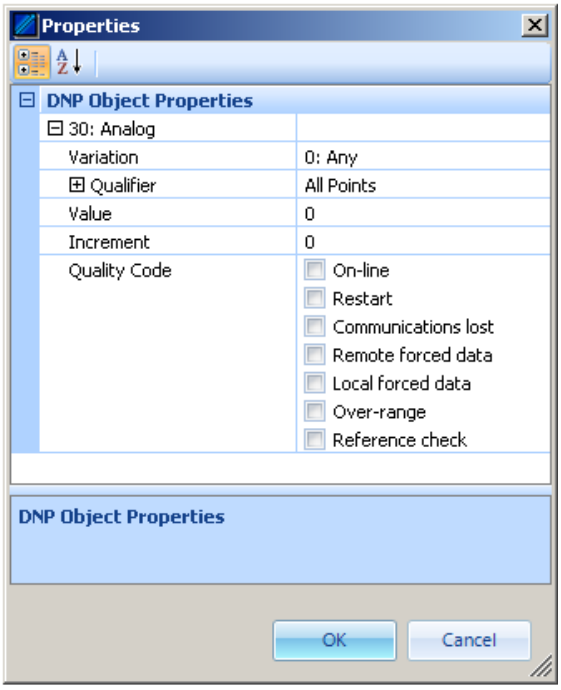
If not modified, the ASE2000 uses variation 0 in master request messages and variation 1 in RTU response messages.

Qualifier Codes

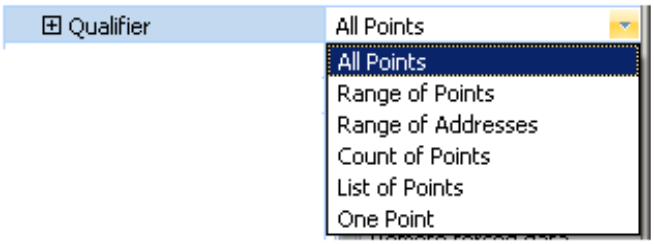
Qualifier codes are entered from the object's properties menu, displayed by double-clicking in the area at the far left of the object line.



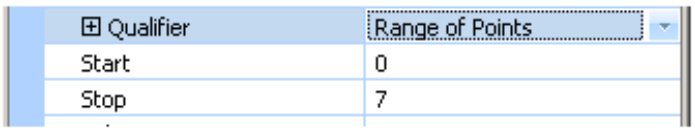
Selecting the object line and clicking the  button will also display the properties menu.



A qualifier setting is selected from a pull-down list generated by clicking in the qualifier entry area.



Click on the desired qualifier. When the selected qualifier requires additional parameter entry, such as for a Start/Stop address range, additional entry fields appear under the Qualifier code field. For example.

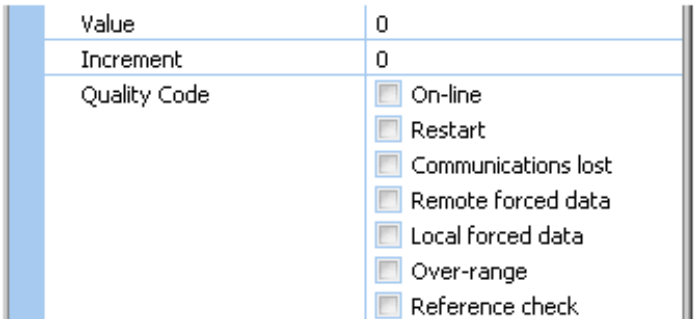


26.1.5. DNP3 – Point Value Simulation

When acting as a RTU Simulator, the ASE2000 responds to all master requests including those for analog, binary, or counter object values. This section provides instructions to define values and point modeling parameters for each input object type.

▶ *The procedures below are used only for Exchange Mode RTU Simulator. For Task mode, please refer to the Task Mode RTU Simulation section*

Point values and modeling parameters are entered from the Object's properties menu as described in the prior subsection. The appropriate fields from that menu are **Value**, **Increment** (replaced by **Mask** for Binary Points), and **Quality Code**.



Analog Parameters

The menu above shows value and modeling parameters for analog objects.

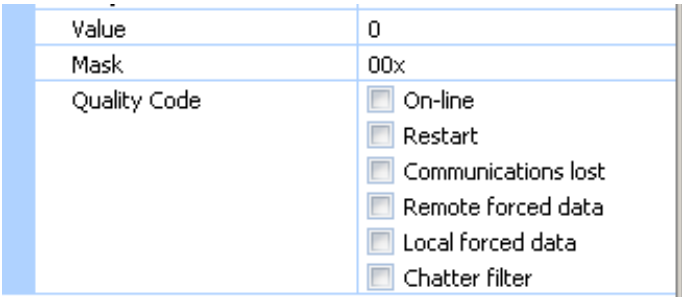
Value specifies the value to be sent in the next response. This is used for all analogs defined by the underlying object group definition. For example, if the definition specifies analog object indices 0 to 7, the same value is used for all 8 objects.

Increment specifies an amount to add to the value field after each response. Values are incremented to a maximum and then decremented by the same amount to a minimum. The cycle is repeated. Maximum and minimum values are set by the ASE2000; the defaults for DNP3 protocol are +32767 and -32768. They can be viewed and changed from the Properties dialog and Point tab.

Quality codes present all Analog object DNP3 quality codes. The message will be sent with all quality codes checked.

Binary Parameters

The following menu appears for binary input objects:

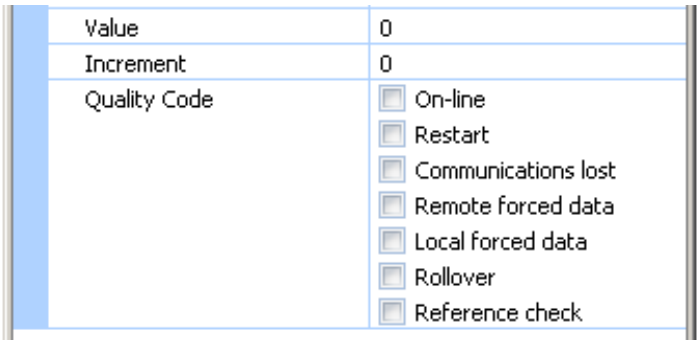


Value is an 8-bit octet containing states for each set of 8 points. The low bit defines the state of the first point in each set of 8. The high bit defines the state for last point in each set of 8. Note that this value can be entered in hex by specifying an 'x' suffix. For example, 81 is decimal and 81x is hex.

Mask specifies an 8-bit mask to exclusive-OR against the value field to create a value for the next response.

Quality codes present all DNP3 Binary object quality codes.

Counters
The following menu appears for counter input objects:



Value specifies the value to be sent in the next response. This is repeated for all counters contained in the underlying object definition.

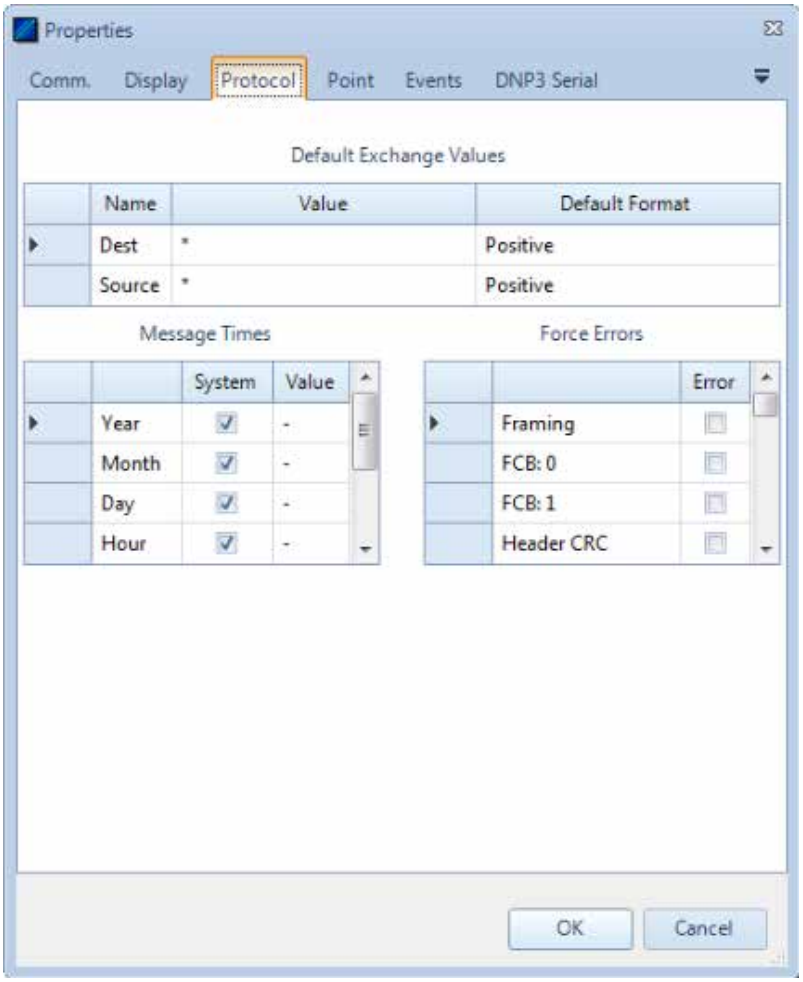
Increment specifies an amount to add the value field for the next response. Values wrap to 0 after exceeding a maximum. The maximum is set by the ASE2000 and can be viewed and changed from the Properties dialog and Point tab.

Quality codes present all DNP3 counter object quality codes.

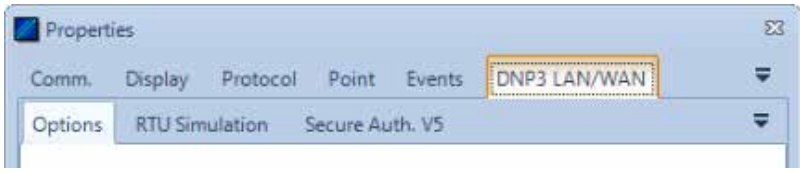
26.2. DNP3 – Properties Tabs

26.2.1. DNP3 – Protocol Tab (Exchange Mode - Serial and LAN/WAN)

Certain protocol specific properties can entered from the Protocol tab in the Properties menu. This menu is accessed by selecting the Tools pull-down list and the Properties option. Following is the menu that appears for DNP3 protocol in **Exchange Mode**.



Note: Some settings available from the Protocol tab in prior versions of the ASE2000 V2 have moved to a sub-tab accessible by first selecting the DNP3 Serial or DNP3 LAN/WAN tab from the Properties menu.



26.2.2. Default Exchange Values

Dest and Source specify default values to use for all exchanges where a specific value is not otherwise entered. As stated previously, Dest and Source are entered from the point of view of a master. When applied to messages sent from an Outstation (either the ASE2000 acting as a RTU or an external outstation), Dest and Source values are swapped.

System Time defines time values to use in all applicable messages sent by the ASE2000, both event time stamps and time synchronization messages. When the System time option is checked, time is extracted from the host PC. When unchecked, the user specified value is used.

Force Errors contains a list of error-generating instructions that can be followed in preparing a message for transmission. Options are:

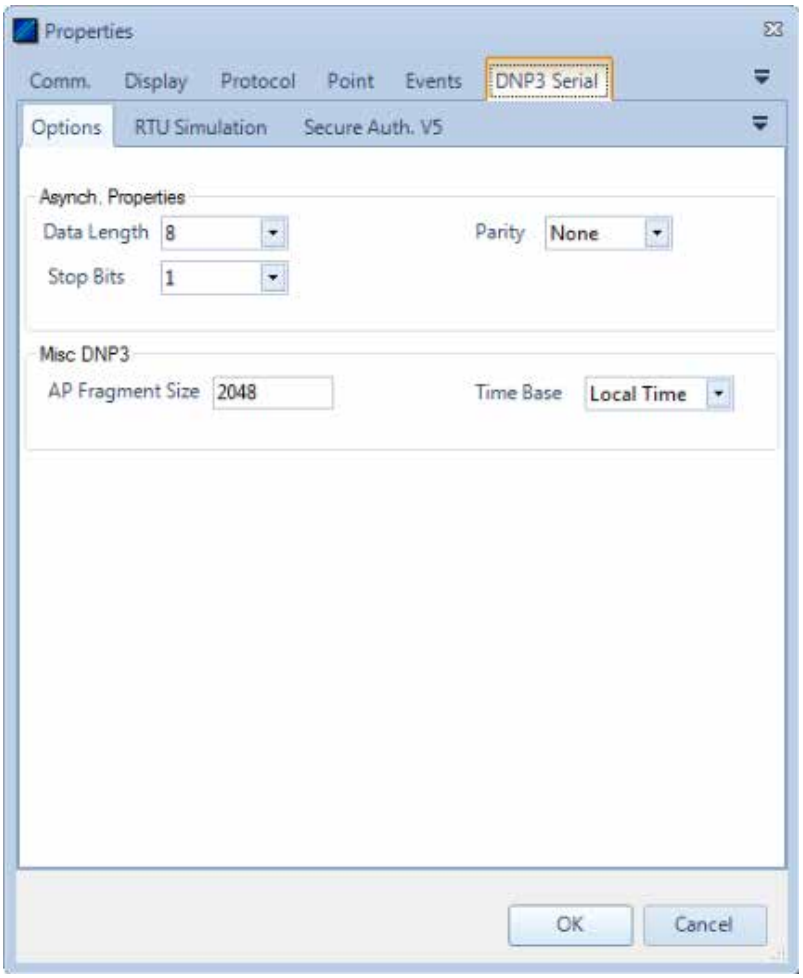
Framing	Generates a framing error near the start of the message by changing a stop bit from 1 to 0. This requires use of an ASE manufactured communication card. Also, the Communication properties *Native Asynch Mode* box must not be checked
FCB:0	Transmits the FCB bit state as 0
FCB:1	Transmits the FCB bit state as 1
Header CRC	Generates a CRC error in the Data Link header block
Data CRC	Generates a CRC error in the first data block following the data link header
NAK Messages	Where appropriate, sends a NAK in place of an ACK
Transport FIR	Sets the FIR bit in the transport header of all Data link frames
Transport FIN	Sets the FIN bit in the transport header of all Data link frames
Application FIR	Sets the FIR bit in all application fragment headers
Application FIN	Sets the FIN bit in all application fragment headers
Transport Seq	Sends incorrect transport header sequence numbers in all Data Link frames following the first
Appl Seq/Add 1	In Master Simulation mode, increments the application sequence number by 2 for each new request (instead of 1). In RTU Simulation mode, responds with an application sequence 1 more than in the corresponding request
Appl Seq/Do Not Increment	In Master Simulation mode, uses the same application sequence number in each request. In RTU Simulation mode, responds with an application sequence number 1 less than in the corresponding request
Appl Confirm Seq	Uses an application confirm message sequence number 1 less than in the message being confirmed
No Data Link Acks	Never sends Data link acknowledgement messages
No Application Confirms	Never send application layer confirmation messages
DL Start Error	Send a message with the first two octets other than 05 64
DFC:1	Transmits the DFC bit state as 1
No Nack Reset Link	Never send a NAK to initiate a Reset link resynchronization sequence
Randomly Select	Generate an occasional error by applying rules for one of the other Force Error options enabled. If this option is not checked, all enabled errors (where possible) are processed for every transmission

26.3. DNP3 Options Sub-Tab

Newer versions of ASE2000 V2 display DNP3 features in multiple sub-tabs appropriate to the current protocol (DNP3 Serial or DNP3 LAN/WAN) and operational mode (Exchange or Task mode). The following topics discuss the Options sub-tab settings. The Options sub-tab is accessible by first selecting the DNP3 Serial or DNP3 LAN/WAN tab in the Properties menu. (These settings were accessible from the Protocol tab in some earlier versions.)

26.3.1. DNP3 Serial – Options Sub-Tab (Exchange Mode)

Certain DNP3 Serial protocol specific properties can be entered from the Options sub-tab in the Properties menu below the DNP3 Serial tab. Following is the Options menu for DNP3 Serial in Exchange Mode.



Asynch. Properties

DNP3 Serial protocol octets are transmitted as 8 data bits, 1 stop bit, and no parity. The ASE2000 initializes these parameters as defined by the protocol, but allows them to be changed (primarily for device testing). Sending a message after any parameter is changed will cause a data reception error at any compliant device.

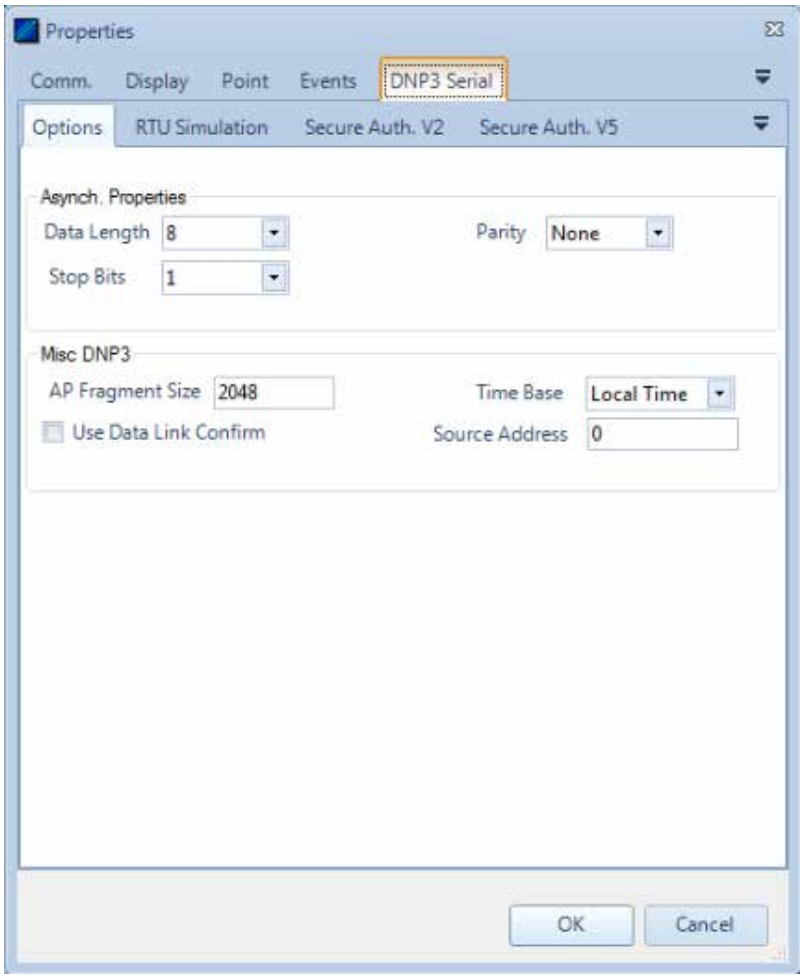
Misc DNP3

AP Fragment Size – DNP3 defines the maximum application fragment size to be 2048 octets. The ASE2000 can be configured to use a lesser size in messages it transmits. This field does not alter the ASE2000's ability to parse incoming messages.

Time Base – Time in messages generated by the ASE2000 can use either local time or UTC. UTC is the current DNP3 standard.

26.3.2. DNP3 Serial – Options Sub-Tab (Task Mode)

Additional DNP3 Serial protocol specific properties are added to the Options sub-tab in the Properties menu below the DNP3 Serial tab. Following is the Options menu for DNP3 Serial in Task Mode.



Use Data Link Confirm

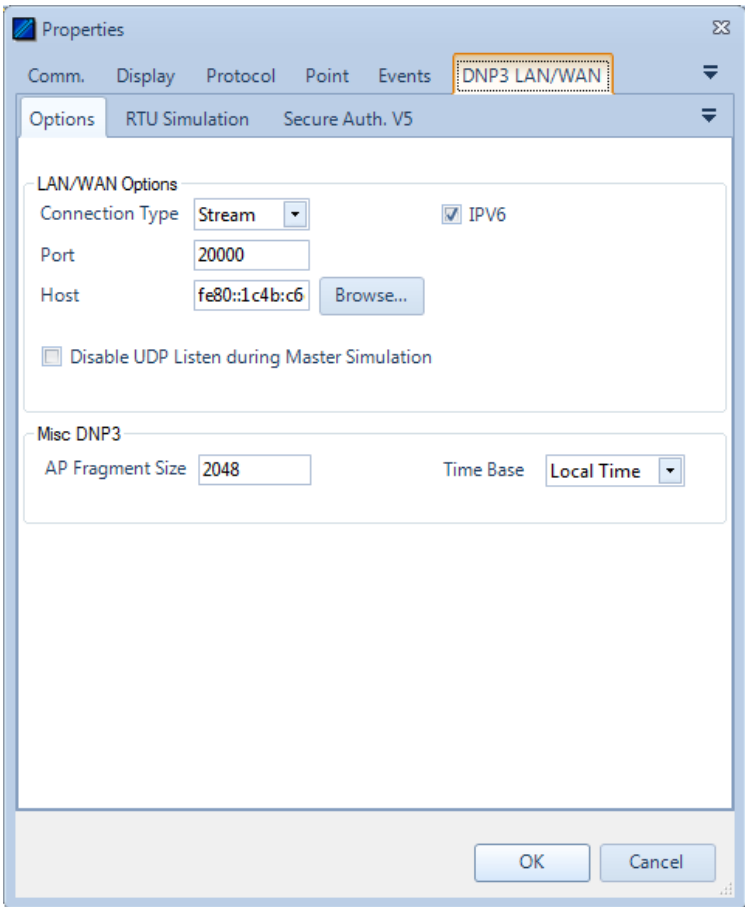
In Task mode, checking this box selects the function code to transmit **User Data (Confirm)** and leaving the box unchecked will transmit **User Data (Confirm)** when applicable. The setting (Confirm or Not) is not used for processing incoming messages.

Source Address

DNP3 messages in Task mode will transmit this value as the source address. This source address will be used for both Master and RTU simulation in Task mode only.

26.3.3. DNP3 LAN/WAN – Options Sub-Tab (Exchange Mode)

DNP3 LAN/WAN protocol specific properties can be entered from the Options sub-tab in the Properties menu below the DNP3 LAN/WAN tab. Following is the Options menu for DNP3 LAN/WAN in Exchange Mode.



LAN/WAN Options

Connection Type – Choices are Stream (TCP/IP) or Datagram (UDP/IP)

Port – DNP3 port, the default is 20000

Host – Host to which a connection should be issued. In Exchange Mode, this is used for Master Simulation mode only. Either a fixed IP address or remote node name can be entered. The Browse button may be used to scan the network for remote node names.

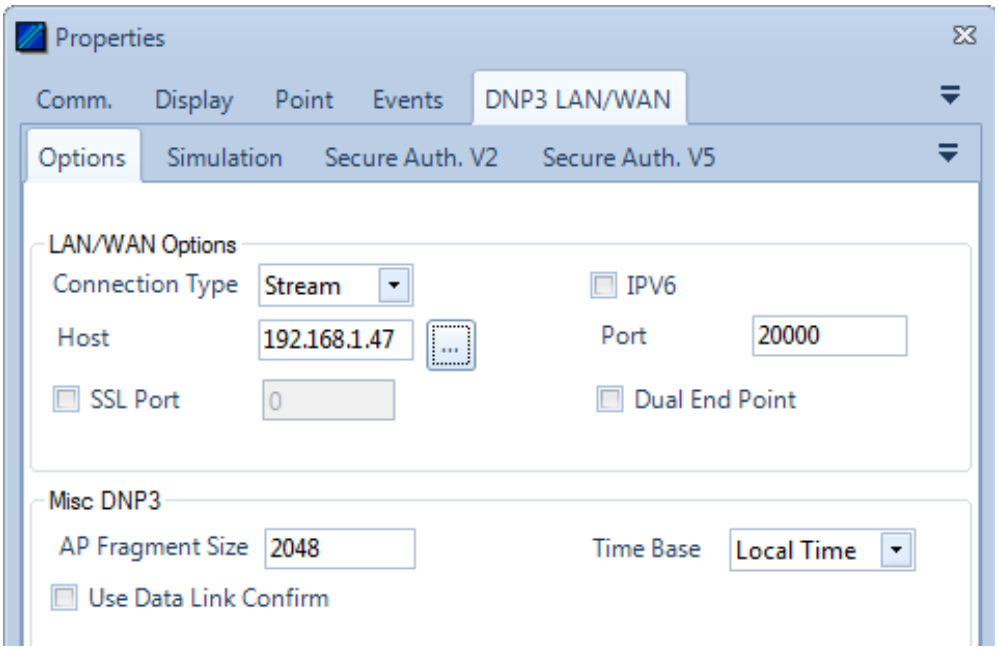
Disable UDP Listen during Master Simulation – This option is used only rarely when multiple copies of the Test Set are running on the same machine. When running in Master Simulation, the Test Set listens on the UDP port for unsolicited messages from the RTU. In RTU simulation, the Test Set also listens on the UDP port for incoming messages from the Master station. Since two copies of the application cannot both be listening to the port, the instance running in Master Simulation mode will not listen on the UDP port when this option is selected.

IPv6 – Select IPv6 when providing Host addresses using the broader IPv6 address space.

▶ *IPv4 is a 32-bit Internet Protocol addressing mechanism represented as four 8-bit decimal values separated by dots as in: “192.168.0.148”. With the explosion of the internet and devices using these addresses, IPv6 was introduced with a larger, 128-bit addressing mechanism in the form of eight 16-bit hexadecimal values separated by colons as in: “2013:08be:9ce8:0000:0000:0000:ff00:034d”.*

26.3.4. DNP3 LAN/WAN – Options Sub-Tab (Task Mode)

Following is the Options menu for DNP3 LAN/WAN protocol in Task Mode.



LAN/WAN Options

Connection Type – Choices are Stream (TCP/IP), SSL Stream (Secure TCP/IP), or Datagram (UDP/IP)

▶ *SSL certificates are obtained from the Windows Certificate Store. The user requests/ installs his certificates in the store and the ASE2000 Test Set accesses the certificates.*

- As a client the Test Set looks for a “user” certificate.
- As a server the Test Set looks for a “machine” certificate.

Port – DNP3 port, the default is 20000

Host – Host to which a connection should be issued. The host is used for Master Simulation mode (always) and RTU Simulation Mode (if dual End-Point is checked). Either a fixed IP address or remote node name can be entered.

IPv6 – Select IPv6 when providing Host addresses using the broader IPv6 address space.

▶ *IPv4 is a 32-bit Internet Protocol addressing mechanism represented as four 8-bit decimal values separated by dots as in: “192.168.0.148”. With the explosion of the internet and devices using these addresses, IPv6 was introduced with a larger, 128-bit addressing mechanism in the form of eight 16-bit hexadecimal values separated by colons as in: “2013:08be:9ce8:0000:0000:0000:ff00:034d”.*

Dual End Point (Task Mode Only) – Master Simulation Mode tasks always initiate a connection on startup. If this option is unchecked, any Master Simulation Mode task will fail if the connection is not accepted. If this option is checked, the task will wait until the initiated connection is accepted or until it detects an outstation initiated connection.

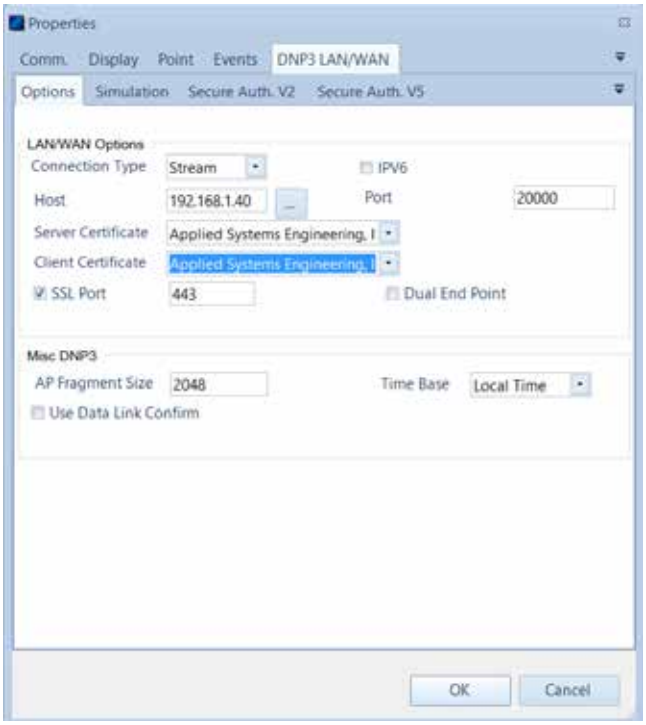
In RTU Simulation Mode, a task will initiate a connection on startup if this option is checked

SSL Port – Port to use in conjunction with a SSL Stream Connection Type

26.3.5. DNP3 LAN/WAN – Secured Sockets Layer (SSL)

When using SSL over DNP3 LAN/WAN, the DNP3 Secure Authentication Specification requires certificate validation for both sides. These certificates need to be obtained from a trusted Certificate Authority (CA). The CA trusted root certificate must also be installed into the appropriate certificate store.

- For client operations you must obtain and install into your certificate store a user certificate with user authentication.
- For server operations you must obtain and install into your local computer certificate store a server certificate.
- Beginning with 2.20, you can now pick the certificates that show up from the user store (Client) and local computer store (Server). The certificates are matched by serial number. Note: The certificate dropdowns will only show up/populate if you have certificates in your respective certificate stores.



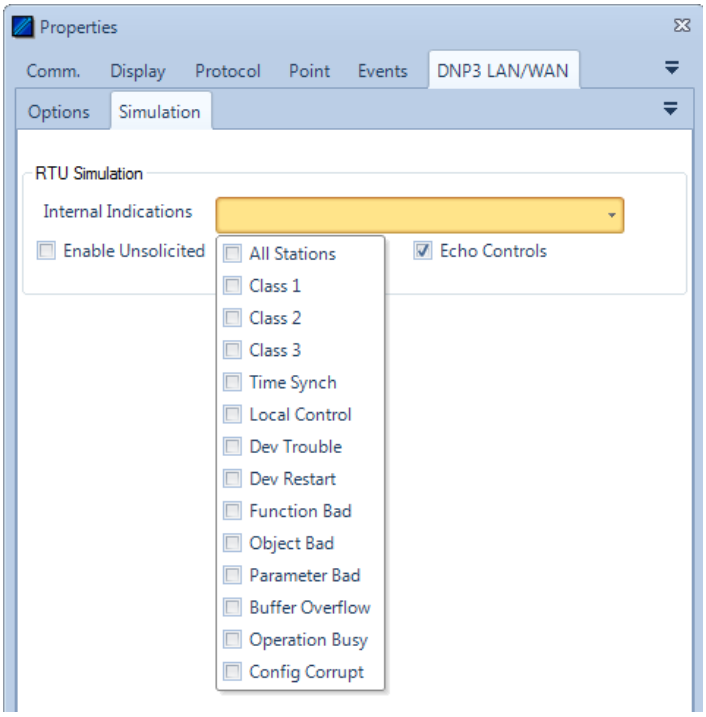
▶ *Under Windows 7 and Vista, the test set must be run “As Administrator” in order to use SSL in RTU Simulation mode*

26.4. DNP3 Simulation Sub-Tab

Newer versions of ASE2000 V2 display DNP3 features in multiple sub-tabs appropriate to the current protocol (DNP3 Serial or DNP3 LAN/WAN) and operational mode (Exchange or Task mode). The following topics discuss the RTU Simulation sub-tab settings. The RTU Simulation sub-tab is accessible by first selecting the DNP3 Serial or DNP3 LAN/WAN tab in the Properties menu. (These settings were accessible from the Protocol tab in some earlier versions.)

26.4.1. DNP3 – Simulation Sub-Tab (Exchange Mode – Serial and LAN/WAN)

Certain RTU Simulation properties can be entered from the RTU Simulation sub-tab in the Properties menu below the DNP3 Serial or DNP3 LAN/WAN tab. Following is the RTU Simulation menu for DNP3 in Exchange Mode.



RTU Simulation

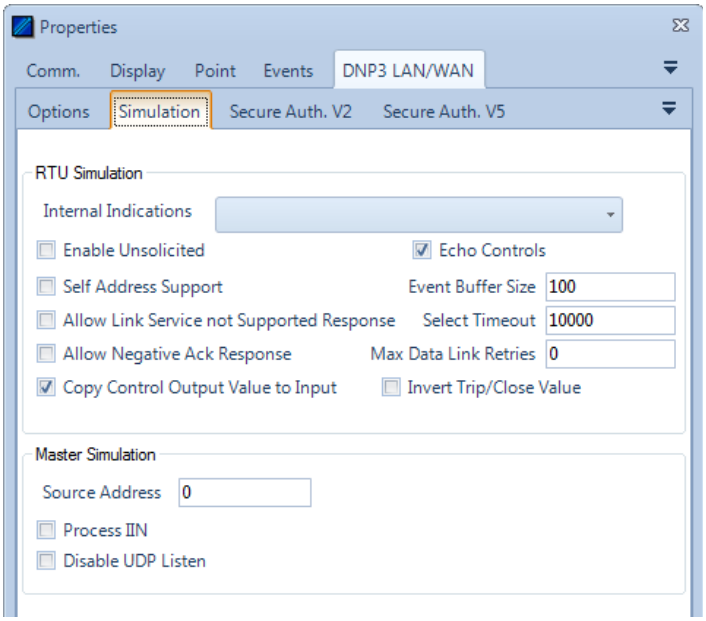
Internal Indications – Defines Internal Indication flags to be set in messages transmitted by the ASE2000. Clicking in the Internal Indications field generates a pull-down list of all internal indications (see above). Note that the Need Time (Time Synch) and Device Restart flags are maintained by the ASE2000. Both are set at startup and cleared upon reception of appropriate master station commands

Enable Unsolicited – Enables unsolicited data reporting in RTU Simulation mode. When enabled, all input object messages with the Transmit flag checked are transmitted at the configured frequency

Echo Controls – When selected, responses to select and operate commands are constructed as echoes of the incoming request. When unchecked, values to be used in Select and Operate responses must be manually entered into the corresponding exchange(s)

26.4.2. DNP3 – Simulation Sub-Tab (Task Mode – Serial and LAN/WAN)

Both RTU and Master Simulation options are shown in the following Simulation sub-tab menu for DNP3 protocols in Task Mode.



RTU Simulation

Self Address Support – Respond to requests for RTU transmission of its address

Allow Link Service not Supported Response – Allows Link Service not Supported Response, otherwise NAK is set

Allow Negative Ack Response – Enables unsolicited data reporting in RTU Simulation mode. When enabled, all input object messages with the **Transmit** flag checked are transmitted at the configured frequency

Event Buffer Size – Configure the number of events stored in the event buffer

Select Timeout – Time in milliseconds before RTU reports a timeout

Max Data Link Retries – Number of data link retries before terminating

Copy Control Output Value to Input – When enabled, control operation data values received from the master station are copied to their mapped input points. This feature assists testing of master station reaction to different RTU input data without reconfiguring the RTU points list (see below for mapping instructions)

Invert Trip/Close Value – This option inverts the value for Copy Control Output mappings such that Trip ⇔ Close are reversed (see below for mapping instructions)

Master Simulation
Source Address – The source address selects a specific RTU Id for processing Internal Indication flags (see below)

Process IIN – If enabled, this feature will send messages to the RTU Id selected above in response to Internal Indications flags appearing in responses from the RTU. In the example below, the RTU response to a Binary Input Request contains IIN flags for Need Time and Restart. The ASE2000 first forms a Clear Restart Request and sends it to the RTU. In the Clear Restart Response, the Restart indication has been cleared. This will be followed by a sequence to measure the response delay and write a synchronized date & time to the RTU (not shown).

```
--> [14:47:49.256] Binary Input Request Data Link Header
    User Data (No Confirm) [DIR:1,PRM:1,FCV:0] Length 11 Dest 5 Source 0
    Transport Header [FIN:1,FIR:1,Seq:0]
    Application Data Read [FIR:1,FIN:1,CON:0,UNS:0,Seq:0] Binary Input (Object 1) Var 0
    Qualifier 06x
<-- 19 msec-- [14:47:49.303] Binary Input Response Data Link Header
    User Data (No Confirm) [DIR:0,PRM:1,FCV:0] Length 18 Dest 0 Source 5
    Transport Header [FIN:1,FIR:1,Seq:2]
    Application Data Response [FIR:1,FIN:1,CON:0,UNS:0,Seq:0] [Need Time,Restart]
    Binary Input (Object 1) Var 1 Qualifier 01x Start 0 Stop 7 DI   7-0 0000 0000
--> [14:47:49.356] Clear Restart Request Data Link Header
    User Data (No Confirm) [DIR:1,PRM:1,FCV:0] Length 14 Dest 5 Source 0
    Transport Header [FIN:1,FIR:1,Seq:1]
    Application Data Write [FIR:1,FIN:1,CON:0,UNS:0,Seq:1] Internal Indications (Object 80)
    Var 1 Qualifier 00x Start 7 Stop 7  00x
<-- 18 msec-- [14:47:49.405] Clear Restart Response Data Link Header
    User Data (No Confirm) [DIR:0,PRM:1,FCV:0] Length 10 Dest 0 Source 5
    Transport Header [FIN:1,FIR:1,Seq:3]
    Application Data Response [FIR:1,FIN:1,CON:0,UNS:0,Seq:1] [Need Time]
```

Disable UDP Listen during Master Simulation – This option is only needed when multiple copies of the Test Set are running on the same machine. When running in Master Simulation, the Test Set listens on the UDP port for unsolicited messages from the RTU. In RTU simulation, the Test Set also listens on the UDP port for incoming messages from the Master station. Since two copies of the application cannot both be listening to the same port, the instance running in Master Simulation mode will not listen on the UDP port when this option is selected.

26.4.3. DNP3 – Mapping Output Controls to Change Input Point Values

To modify values at the RTU by sending controls from the master station, select this feature from the RTU Simulation sub-tab in the Properties menu. A Trip command defaults to a value of zero and a Close command defaults to one. To invert this interpretation, select the 'Invert Trip/Close Value' check box.

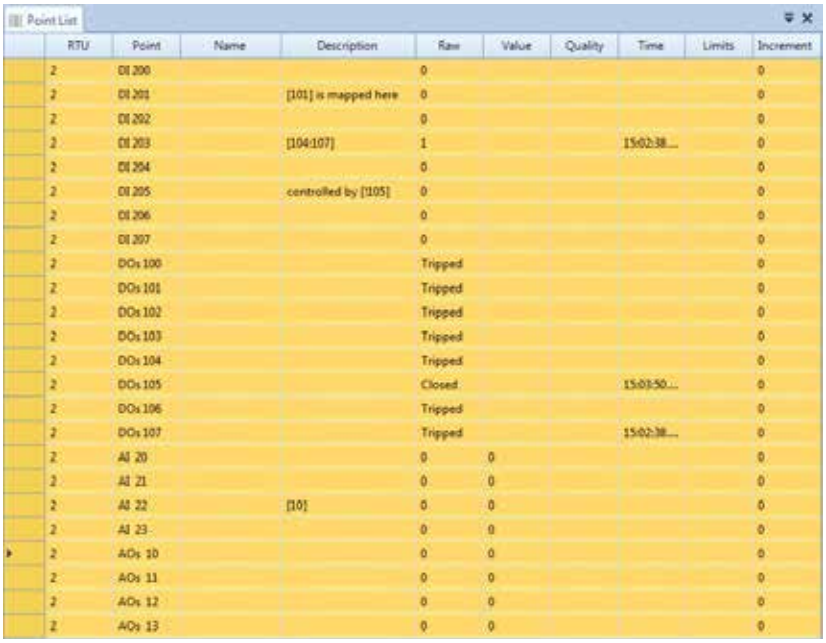
Add the control point Id enclosed in square brackets to the description field of the input point to create the link. The mapping value may appear anywhere in the description field. It is a one-way link. Individual points may be inverted by prefixing the point ID with an exclamation point such as [!23]. To change digitals using two controls, specify both controls separated by a colon as [zero:one]. For example, [3:5], which will set the point value to 0 when operating control point 3 and set the value to 1 when any control operation to control point 5 is received.

Binary link – [101] appears in the Description field for Point DI 201: Write commands to point DOs 101 change the value of DI 201

Dual control binary link – [104:107] for Point DI 203: Write zero to DI 203 when operates to DOs 104 are received; write one to DI 203 when operates to DOs 107

Negated binary link – [!105] appears in the Description field for Point DI 205: Write commands to DOs 105 change the value of DI 205 to the opposite value

Analog link – [10] appears in the Description field for Point AI 22: A value written to point AOs 10 will be set as the value of AI 22



26.4.4. DNP3 Secure Authentication Sub-Tabs

The ASE2000 V2 supports DNP3 Secure Authentication Version 2 (SAv2) and Version 5 (SAv5) in **Task Mode**. Only Secure Authentication Version 5 is supported in **Exchange Mode**. DNP3 Secure Authentication can be enabled for all tasks in both Master and RTU simulation modes. Messages can then be protected with Challenge or Aggressive Mode challenges.

▶ *See implementation notes on SAv5 for additional technical details.*

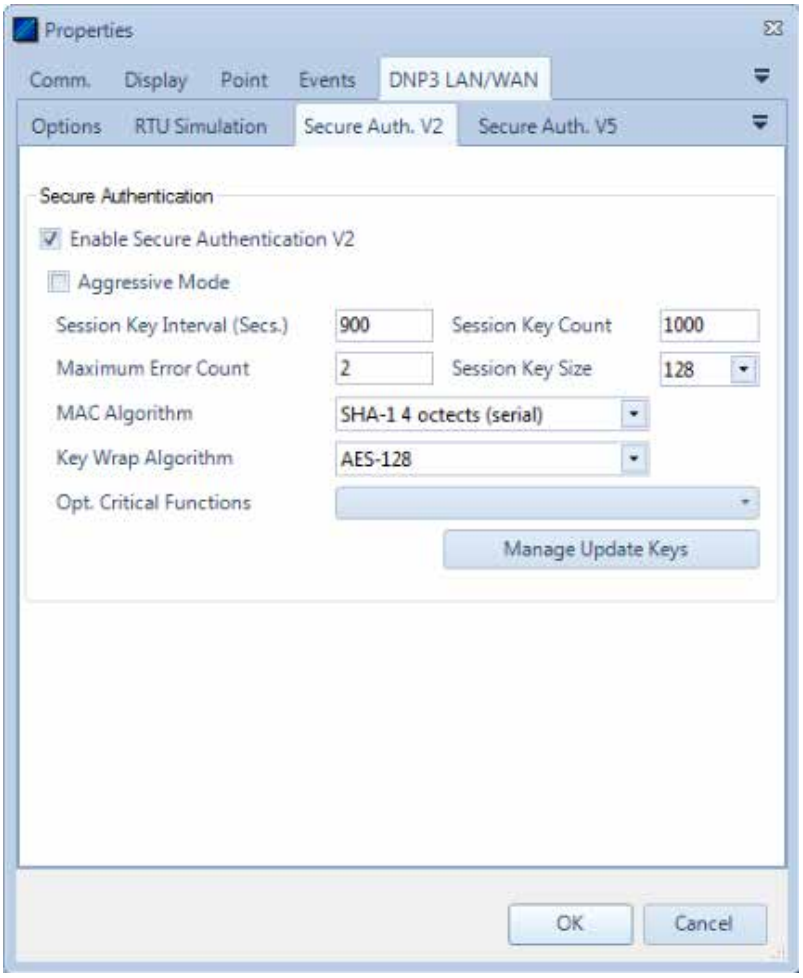
A few additional tasks, such as Session Key Exchange, are provided to support specific Secure Authentication functions.

In **Exchange Mode**, only Secure Authentication message parsing is supported, allowing messages with Secure Authentication functions and objects to be displayed.

26.4.5. DNP3 – Secure Auth. V2 Sub-Tab (Task Mode – Serial and LAN/WAN)

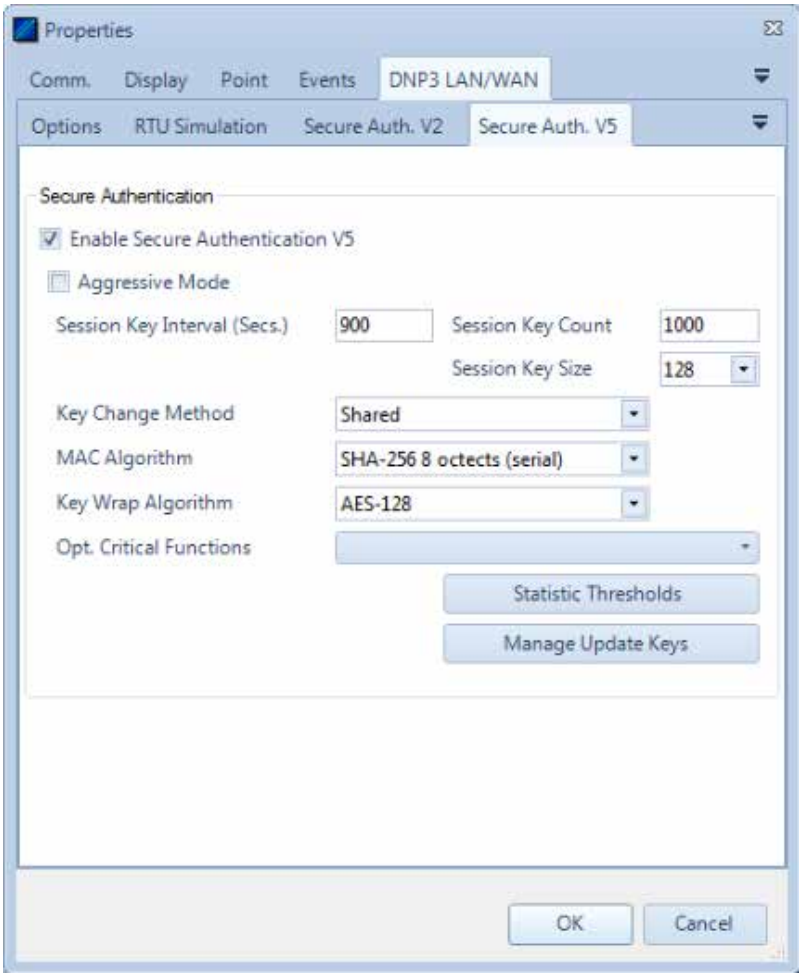
The Secure Authentication V2 sub-tab is accessible in **Task Mode** by first selecting the DNP3 Serial or DNP3 LAN/WAN tab in the Properties menu. (These settings were accessible from the Protocol tab in some earlier versions.)

Support for Secure Authentication Version 2 is available only when operating in **Task Mode**. In **Task Mode**, messages can be sent with correct Secure Authentication values, and security of incoming messages can be validated. Secure Authentication is discussed in detail in the section: **DNP3 - Secure Authentication**.



26.4.6. DNP3 – Secure Auth. V5 Sub-Tab (Serial and LAN/WAN)

Full support for Secure Authentication Version 5 is available only when operating in Task Mode. In Task Mode, messages can be sent with correct Secure Authentication values, and security of incoming messages can be validated. In Exchange Mode, only Secure Authentication message parsing is supported, allowing messages with Secure Authentication functions and objects to be displayed. Secure Authentication is discussed in detail in the section: DNP3 - Secure Authentication Setup.



26.5. DNP3 – Secure Authentication Setup

26.5.1. DNP3 – Enabling Secure Authentication

Secure Authentication is activated by checking the **Enable Secure Authentication** checkbox from the Secure Auth. sub-tab menu as shown in the prior section.

When **Enable Secure Authentication** is checked, tasks are processed according to general DNP3 Secure Authentication rules and other options selected from this menu.

It is highly recommended that users be familiar with DNP3 Secure Authentication specifications.

26.5.2. DNP3 – ASE2000 Protection

Secure Authentication processing includes solicitation and storage of an Update Key or Keys, required for protecting communication messages.

▶ *In keeping with standard security procedures, Update Keys are encrypted when stored on disk.*

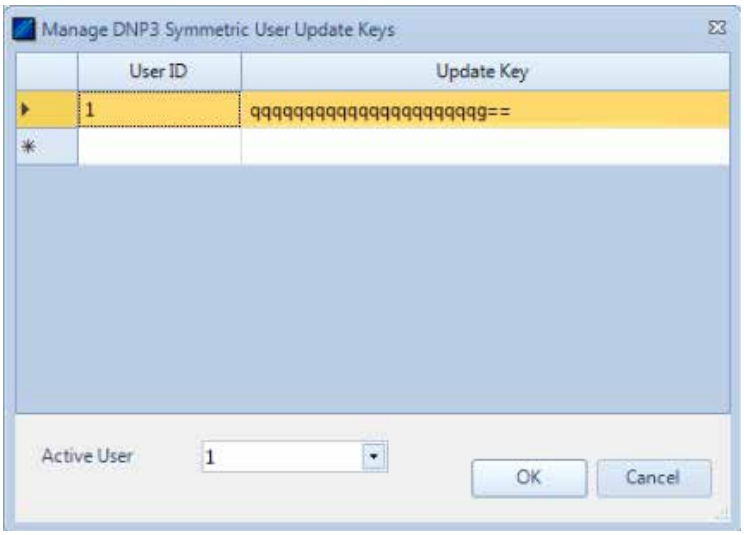
Ultimately, the ASE2000 relies on the Windows logon mechanisms for the protection of the Update Keys storage. That is, if someone has access to your Windows account, then they will have access to any Update Keys you have stored in your account.

26.5.3. DNP3 – Update Keys Overview

Central to DNP3 Secure Authentication is the concept of a pre-shared key called the Update Key. The Update Key is used to encrypt dynamically created and exchanged Session Keys. Session Keys are temporary in that new Session Keys are created and exchanged under various circumstances dictated by the DNP3 Secure Authentication Specification. The specification does not define a mechanism for the creation and exchange of the Update Key.

The Update Key is the key that must be guarded carefully; knowledge of this key gives you complete access to DNP3 Secure Authentication. Each organization has procedures and policies regarding the creation of exchange the Update Keys.

A menu for Update key information entry is accessed by selecting the **Manage Update Keys** option from the DNP3 SAv2 or SAv5 sub-tab menu.



The specification defines three types of Update Keys, identified by a non-zero User ID. Only one key need be entered to use Secure Authentication, but this key must be the same as used by the device to which the ASE2000 communicates. The three types, identified by User ID, are:

Master Key – is a single update key used that can be used for all communication and is entered in the Update Key field with a User ID of one (1).

RTU Key – is a key used for communication to a given RTU. The RTU Key is entered in the Update Key field with a User ID of two (2).

User Key – is a separate key assigned to a given user (master station). On entry, both the User ID and associated Key must be provided. A User Key has a User ID of three (3) or higher.

26.5.4. DNP3 – Update Key Entry

The keys themselves are binary, but are displayed in ASCII using a Base64 format, the standard format for key display. As the name implies this is a base 64 representation of the key value.

- A production update key generated from a external source (not the ASE2000) is best entered using normal copy and paste operations
- A test update key can be generated by selecting the Key target from the DNP3 Key Entry menu. This allows testing of the Secure Authentication functions without the need to acquire a key through normal company procedures. The test key must also be provided to the device being tested. Obviously, a test key should not be used in a production environment.

Once the key or keys are specified, from menu fields shown above, select which **Active User** to use: (1) Master, (2) RTU, or (other) User.

26.5.5. DNP3 – Other Secure Authentication Properties

Other global parameters that impact ASE2000 Secure Authentication are:

Aggressive Mode, if checked, enables Aggressive Mode for applicable exchanges. Please refer to the Secure Authentication specification for more information.

Session Key Interval defines the maximum time interval, in seconds, between session key exchanges

Session Key Count defines the maximum number of application data messages protected by Secure Authentication that can occur before a session key update

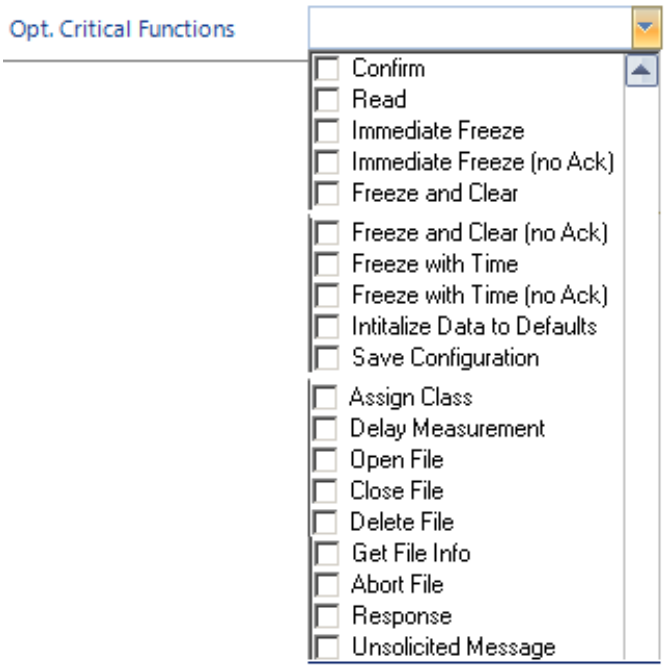
Maximum Error Count defines the maximum number of Secure Authentication errors that can occur before a session key update **(SAv2 only)**

Session Key Size defines the key size. Use the default, 128, unless instructed otherwise by your organization.

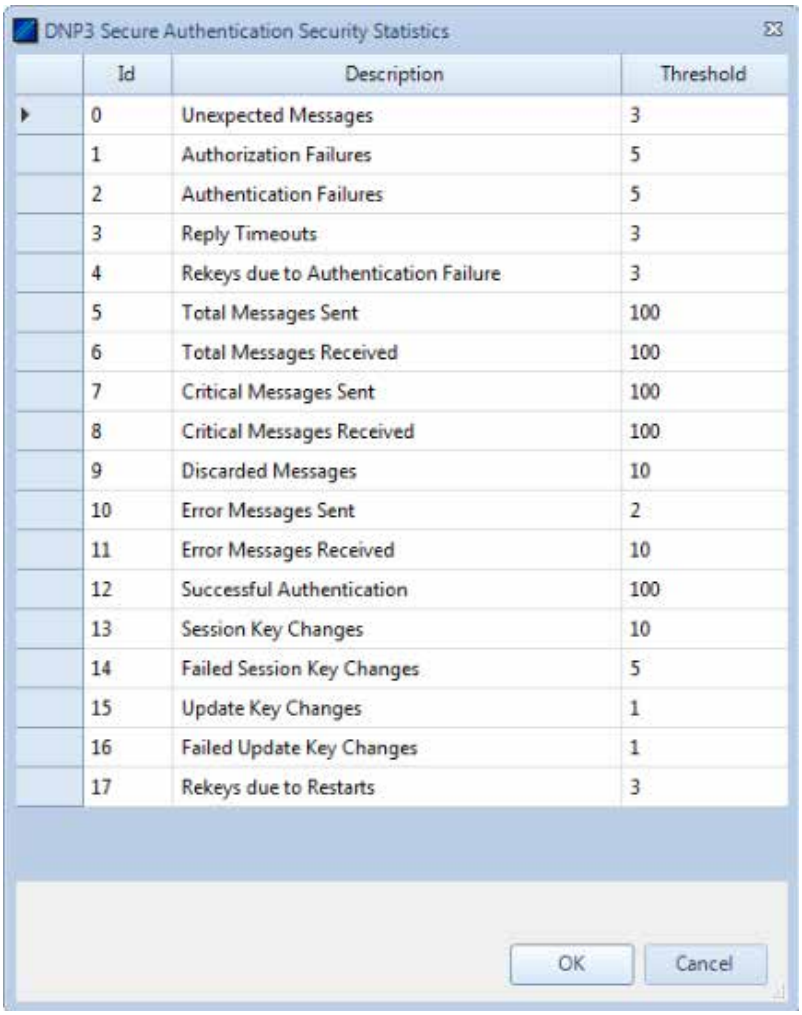
Key Change Method selects the mechanism used when key change is made **(SAv5 only)**

MAC Algorithm selects the SHA (Secure Hash Algorithm) or AES (Advanced Encryption Standard) and number of octets (AES is only available for **SAv5**)

Key Wrap Algorithm selects the AES key wrap algorithm to use
Opt. Critical Functions The DNP Specification defines functions that must be protected by Secure Authentication, such as Relay Controls, and functions that may optionally be protected. Those optional functions are shown by a pull-down list that occurs after clicking in the **Opt. Critical Functions**. Functions checked in this pull-down list are included in protection processing



Statistic Thresholds is used to set thresholds for each security category **(SAv5 only)**



Id	Description	Threshold
0	Unexpected Messages	3
1	Authorization Failures	5
2	Authentication Failures	5
3	Reply Timeouts	3
4	Rekeys due to Authentication Failure	3
5	Total Messages Sent	100
6	Total Messages Received	100
7	Critical Messages Sent	100
8	Critical Messages Received	100
9	Discarded Messages	10
10	Error Messages Sent	2
11	Error Messages Received	10
12	Successful Authentication	100
13	Session Key Changes	10
14	Failed Session Key Changes	5
15	Update Key Changes	1
16	Failed Update Key Changes	1
17	Rekeys due to Restarts	3

Additional implementation information on Secure Authentication Version 5 (SAv5) is contained in the section: **Secure Authentication V5 Implementation Notes**.

26.6. DNP3 – Exchange Mode

26.6.1. DNP3 – Exchange Mode Line Monitor

No additional setup is required. If cabling is correct and Interoperability settings entered, Line Monitoring can be started by selecting the Start button.

26.6.2. DNP3 – Exchange Mode Master Simulation

Master Simulation operation works best if the Destination and Source addresses are entered globally, from Properties and the Protocol tab.

Name	Value	Default Format
Dest	*	Binary
Source	*	Binary

Data can then be obtained by transmitting the **Class 1/2/3/0** exchange.

26.6.3. DNP3 – Exchange Mode RTU Simulation

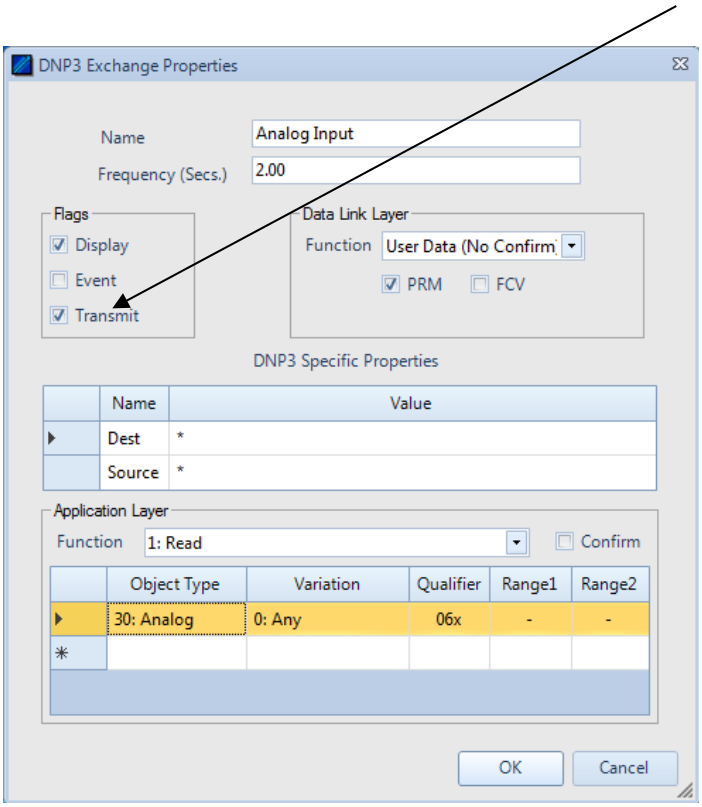
Most DNP3 masters acquire data from an Outstation using Class Data scans. Each response to a Class Data scan includes a set of one or more DNP3 data objects appropriate to the class being requested.

- Class 0 is the static class and contains all static object groups, those that report the current values of analog, binary, and counter input points
- Classes 1, 2, and 3 are event classes and contain all event/data change object groups. The ASE2000 does not differentiate between classes 1, 2, and 3. A request for any or all event classes will cause the ASE2000 to respond with all enabled event object group data

To configure a response to a Class 0 data scan, the static object groups that can be included in a Class 0 scan response must be configured with point information, discussed in the **Exchange Properties Menu** section. To configure a response to a Class 1/2/3 data scan, the change event object groups that can be included in a Class 1/2/3 scan response must be configured. Applicable object groups for both static and event data are shown below.

Static Class Objects		**Event Class Objects**	
Object Group	**Description**	**Object Group**	**Description**
1	Binary Input (1-bit)	2	Binary Input Change (1-bit)
3	Binary Input (2-bit)	4	Binary Input Change (2-bit)
10	Binary Output Status		
20	Binary Counter	21	Binary Counter Change
22	Frozen Counter	23	Frozen Counter Change
30	Analog Input	31	Analog Change Event
32	Frozen Analog Input	33	Frozen Analog Event
40	Analog Output Status		

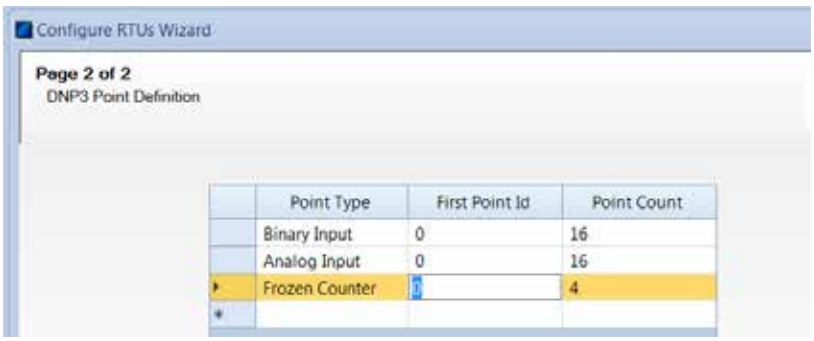
By following instructions in the **Exchange Properties Menu** section and **Object List Subsection**, each exchange is configured with the correct number of points and point simulation parameters. A configured exchange can be included in a Class Data response, simply set the Exchange's **Transmit flag**.



In RTU Simulation mode, after receiving a request for Class 0, 1, 2, or 3 data, the ASE2000 generates a response message from all enabled and properly configured exchanges in the requested class or classes.

26.7. DNP3 – Task Mode

Virtually all Task Mode setup starts by first configuring points/objects in the RTU data base. For example:



The configuration shown above creates 16 Binary Inputs, 16 Analog Inputs, and 4 Frozen Counters.

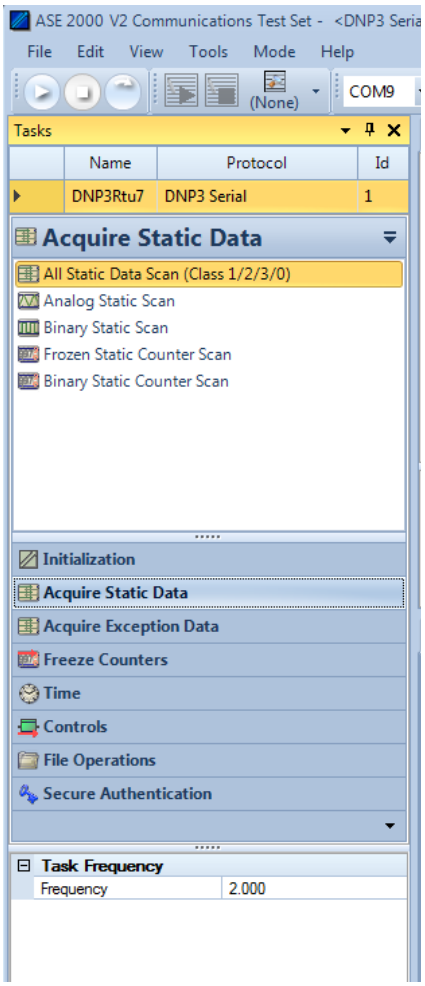
26.7.1. DNP3 – Task Mode Line Monitor

No additional setup is required. If cabling is correct, Line Monitoring can be started by selecting the Start button.

While it is best to accurately enter the RTU/point data base as described, completeness is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

26.7.2. DNP3 – Task Mode Master Simulation

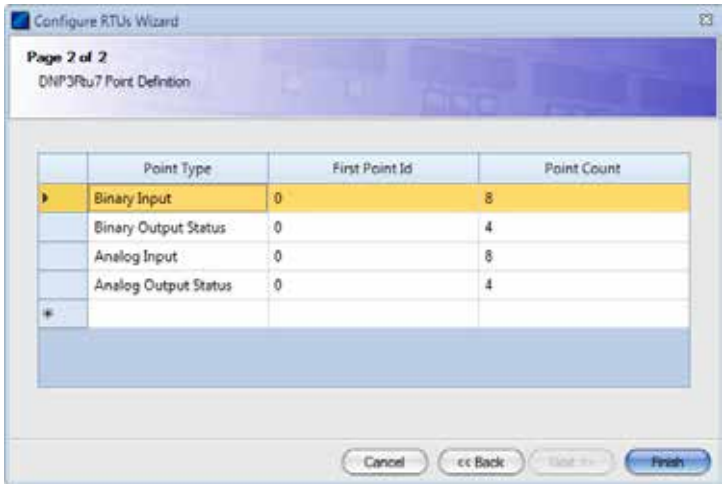
Master Simulation operation works by selecting a task group (Acquire Static Data in the example below) in the ***Tasks View*** and an individual task within that group. The best way to obtain DNP3 input data is to continuously transmit the ***All Static Data Scan*** task.



To issue supervisory controls in Task Mode Master Simulation, select the Controls task group and provide the desired values as shown below.

26.7.3. DNP3 – Task Mode RTU Simulation

Task mode RTU Simulation is mostly automatic. Task Mode starts by selecting a pre-configured device, with point object types and indices, such as shown below, already defined. The ASE2000 automatically generates scan responses consistent with data in this table. There is no need to modify any exchanges. **NOTE**: If Binary or Analog control points are to be simulated, the points must be defined in the device configuration. For Binary points this would be Binary Input Status points. For Analog controls, this would be Analog Input Status points as shown below.



The following rules explain how responses are generated from the table below. Point modeling is the ability to specify point value changes and is supported by performing data entry in the **Raw** and **Increment** columns.

- Static objects are always sent with a variation that includes flag (quality code) information
- Event objects are always sent with time
- The **Raw** column contains the last value sent for the corresponding point/object. A value shown in normal video has already been transmitted. A new value can be entered. It appears dim until sent, after which it is redisplayed in normal video
- For Binary points, an event is generated on the scan following entry of a new **Raw** value
- Binary points can be configured to change in every scan response by entering a 1 in the **Increment** column. Each response will then include an event with a state different from the prior response
- Analog points can be configured to change in every scan response by entering a non-zero value in the **Increment** column. Each response will then include a value that will differ from the previously transmitted value by the increment amount. Over time, values will ramp up and down between high and low limits. A new analog value generated due to a non-zero increment is reported as an analog change event

Point List | Messages

RTU	Point	Name	Description	Raw	Value	Quality	Time	Limits	Increment
1	DI 0			0		On-line			0
1	DI 1			1		On-line			0
1	DI 2			0		On-line			0
1	DI 3			0		On-line			0
1	DI 4			0		On-line			0
1	DI 5			1		On-line			1
1	DI 6			0		On-line			0
1	DI 7			0		On-line			0
1	AI 0			45	45	On-line			0
1	AI 1			0	0	On-line			0
1	AI 2			56	56	On-line			0
1	AI 3			56	56	On-line			7
1	AI 4			0	0	On-line			0
1	AI 5			0	0	On-line			0
1	AI 6			0	0	On-line			0
1	AI 7			0	0	On-line			0

26.8. DNP3 – Certification Tests

For a complete description of the procedure to run the DNP3 Certification Tests, refer to the Help section “DNP3 Certification Test Procedures” or the document “*ASE2000 Version 2 DNP3 Certification Procedures*”.

26.9. Secure Authentication Version 5 Implementation Notes

Important! Applied Systems Engineering recommends that the Test Set’s Secure Authentication implementation should be limited to a lab environment. Use of Test Sets in a production environment could lead to security violation issues.

SAv5 introduces the concept of a Certificate Authority. The Certificate Authority is basically the keeper of all secrets, and its interface to a master is not defined by the specification. As a lab tool the test set incorporates the Certificate Authority functionality into the test set, as the test set needs to know these secrets.

Storage of production secrets in the Test Set could constitute a security violation issue. Please consult your organization’s security professionals for advice regarding your particular situation.

26.9.1. General

- SAv5 adds three more tasks.
  - User Status Change. This allows the addition, deletion and modification of user status.
  - User Certificate. This allows the addition, deletion and modification of user certificates.
  - Update Key Change. This performs an update key change sequence as defined by the update key change method option.
- A predefined user “Common” is created as user one.
- SAv5 requires quite a bit of state to be maintained. If is highly advised that the Test Set’s “connect” functionality be utilized when tasks are sent individually. It probably won’t work as expected otherwise.
- SAv5 provides three basic modes of update key management as described below.
- To exercise SAV5 you need to perform the following tasks:
  - Select the desired update key management.
  - Distribute and install the appropriate keys.
  - “Connect” to the device.
  - Issue the “Update Key Change” task. This will establish the update key.
  - Continue normal operation, which will establish session keys…

26.9.2. Shared Update Keys

- Fully supported. This is basically the V2 mode of operation with regards to update key management. Update keys for each user are persisted.

26.9.3. Symmetric Update Key Change

- Fully supported. Key change methods 3, 4 and 5 are supported. A symmetric key is shared between the Test Set and the device. The symmetric key is persisted.

26.9.4. Asymmetric Update Key Change

- This implementation requires Windows Vista SP1 or better. Key Sizes greater than 1024 require Windows 8 or better. The Key Change Method selection will not display these options for the incorrect Windows version.
- Each RTU requires a RSA key pair, the RTU uses the private key and the master needs the public key.

- Each user requires a DSA key pair, the master uses the private key and each RTU needs the public key.
- The test set requires the appropriate private or public RSA and DSA keys depending on the test set operation mode. If the appropriate keys are not available to the test set, the messages will be flagged as an error.
  – Master mode: User private key and outstation public key.
  – RTU mode: Outstation private key and user public key.
  – Monitor mode: Outstation private key and user public key.
- In general asymmetric key pairs are created by a third party certificate authority which may be imported by the test set. However the test set does provide some rudimentary key management that may be useful in a lab environment only.
- New Private /Public key pairs may be created by the test set.
- Private /Public key pairs may be imported.
  – PKCS#12 certificate files using the PFX or P12 format.
  – XML file according to RFC 3275.
- Public keys may be imported.
  – X509 certificate files using the CRT/CER/DER/PEM format.
  – PKCS#7 data files using the P7S/P7M/P7B format.
  – XML file according to RFC 3275.
- Public key of a private/public key pair may be exported. This is a self-signed certificate.
  – X509 certificate files using the CRT/CER/DER/PEM format.
  – PKCS#7 data files using the P7S/P7M/P7B format.
  – XML file according to RFC 3275.
- Private keys may not be exported.
- Please note that the following discussion regarding AES-GMAC also pertains to asymmetric update key methods that utilize AES-GMAC.

26.9.5. AES-GMAC MAC Algorithm

AES-GMAC is a new optional MAC algorithm for SAv5. This implementation requires Windows Vista SP1 or better. The MAC Algorithm selection will not display these options for the incorrect Windows version.

However GMAC use comes with some caveats. These caveats are probably not unique to the Test Set; you will probably find them in any implementation.

AES-GMAC requires a dynamic initialization vector. This means that the values used for this vector may change each time a MAC calculation is performed. Supposedly the master and outstation are in agreement on these values at all times. This is mostly true, but not always. The problem components are identified here.

- User Number. The value for the user number is not generally known for the User Status Change variation. It may be best not to use GMAC if users need to be dynamically maintained. The Test Set makes the following assumptions based on the operation.
  – Delete – the user number test set option.
  – Change – the user number test set option.
  – Add – zero
- Key Change Sequence Number. If GMAC is used the specification requires that the KSQ number is persistent. The Test Set doesn't do this, but in any case the specification provides no mechanism to synchronize the KSQ explicitly. However the KSQ number can be synchronized if the master performs a Key Status Request, the response will contain the outstation's KSQ.
- Challenge Sequence Number. Basically the same problem, the specification provides no explicit mechanism to synchronize the CSQ number on startup or whenever they get out of

synchronization for any reason. If a connection protocol (LAN/WAN) is used the CSQ should be reset to zero during a new connection, but there is no requirement for this. For a connectionless protocol (Serial or UDP) the outstation will probably need to be reset each time the master restarts. If for some reason the CSQ get out of synchronization, a TCP/IP connection can be reset, otherwise both the master and the outstation will need to be reset.

27. Harris 5k/6k – Protocol Specific

Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

27.1. Harris 5k/6k – Exchange Mode

For Exchange Mode, protocol specific tasks are editing Exchange Definition and setting RTU address information. To ensure that ASE2000 correctly transmits and processes responses from Harris 5000/6000 Data Dump and Status Dump exchanges modify the corresponding exchange definitions to match the I/O port configuration of the RTU. The following information is required to properly modify the exchange definitions for the Data Dump and Status Dump exchange templates:

- The number of applicable data ports contained in the RTU. For Data Dump, the total number of analog and pulse accumulator input ports. For Status Dump, the total number of Status input ports.
- For each port, the type and number of points to request

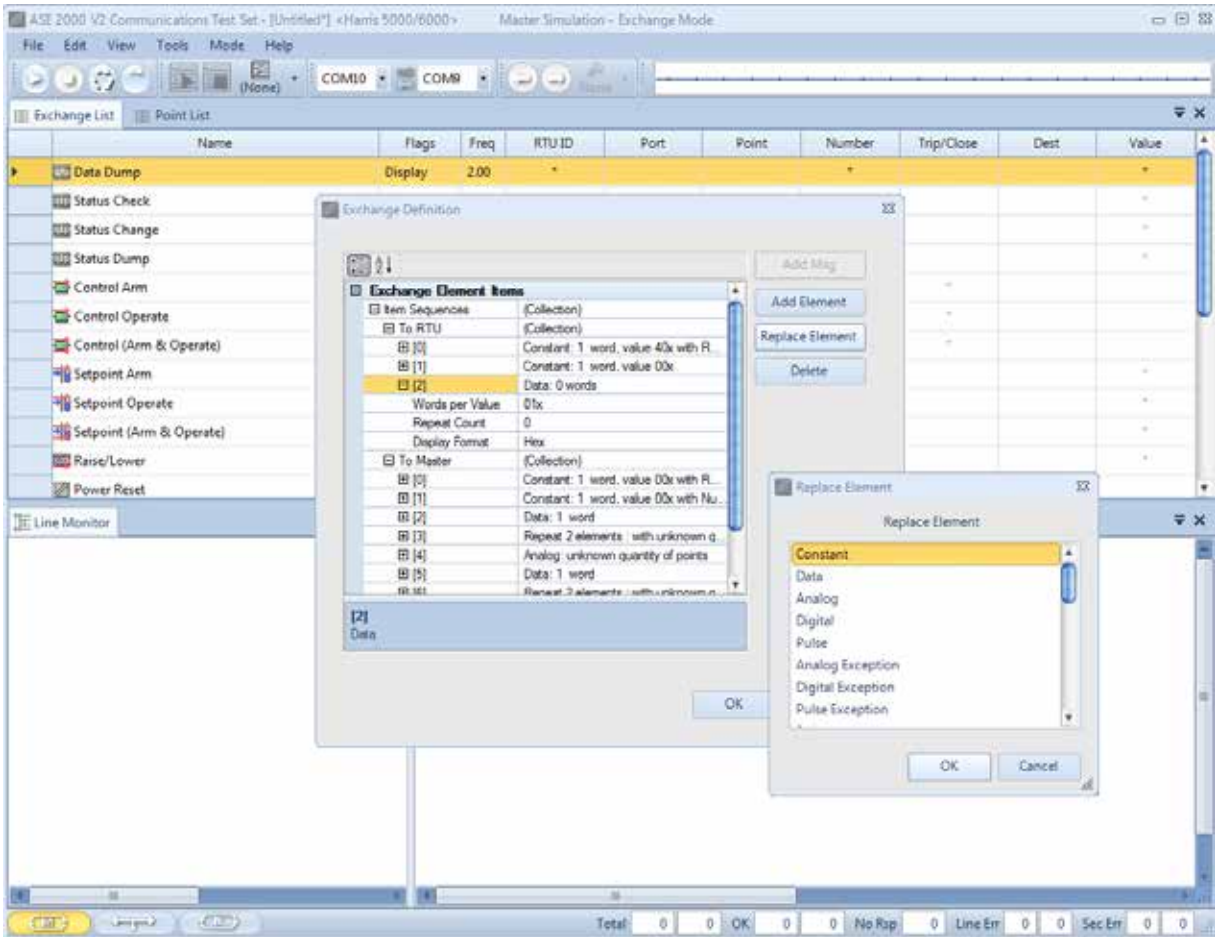
Note: A Data Dump request reads all analog and pulse accumulator ports. A Status Dump request reads status (digital) ports.

One unusual requirement in configuring an exchange definition for Harris 5k/6k is that in addition to editing the “To Master” section of the exchange definition which is a requirement for most protocols, it is also necessary to edit the “To RTU” portion of the exchange definition.

27.1.1. Harris 5k/6k – Edit Exchange Definition for Data Dump

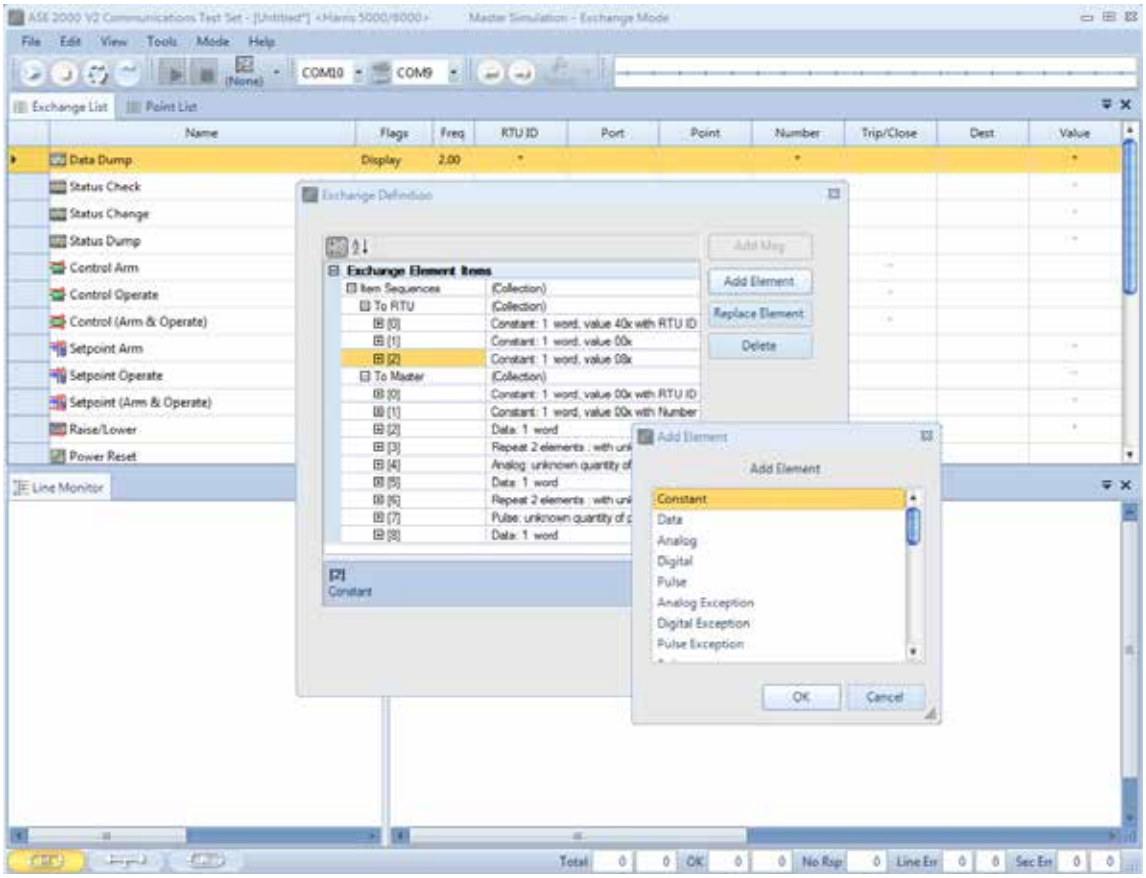
The following example illustrates configuring a Data Dump exchange definition for 8 analog and 4 accumulator points.

Right-click the Data Dump exchange in the Exchange List view and select Edit Exchange Definition. In the “To RTU” section, select the 3rd entry in the list (Data: 0 Words), select Replace Element, select Constant, then OK.

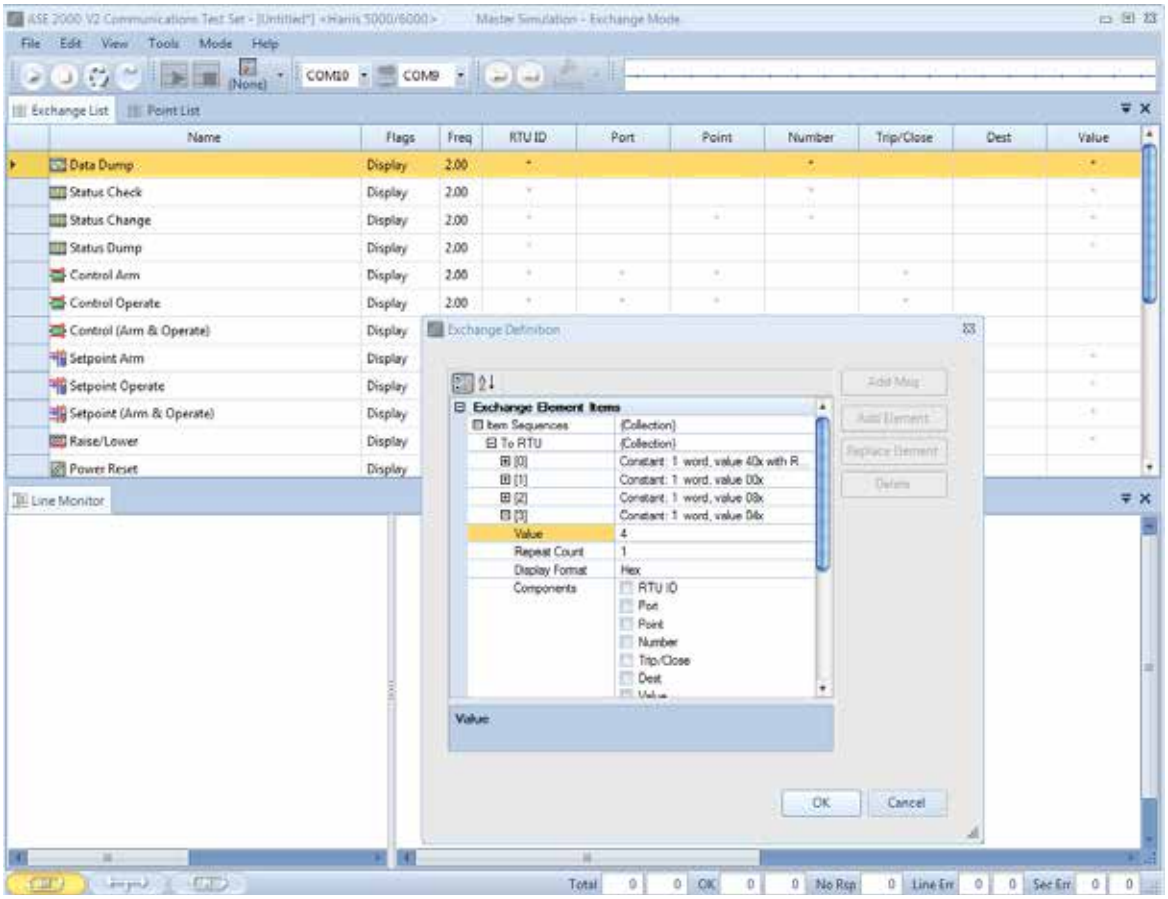


Expand that element (Constant: 1 word, value 00x) and set the Value to 8.

Add another port specifier entry by selecting the 3rd element in the list under “To RTU” then select Add Element, select Constant, then OK.

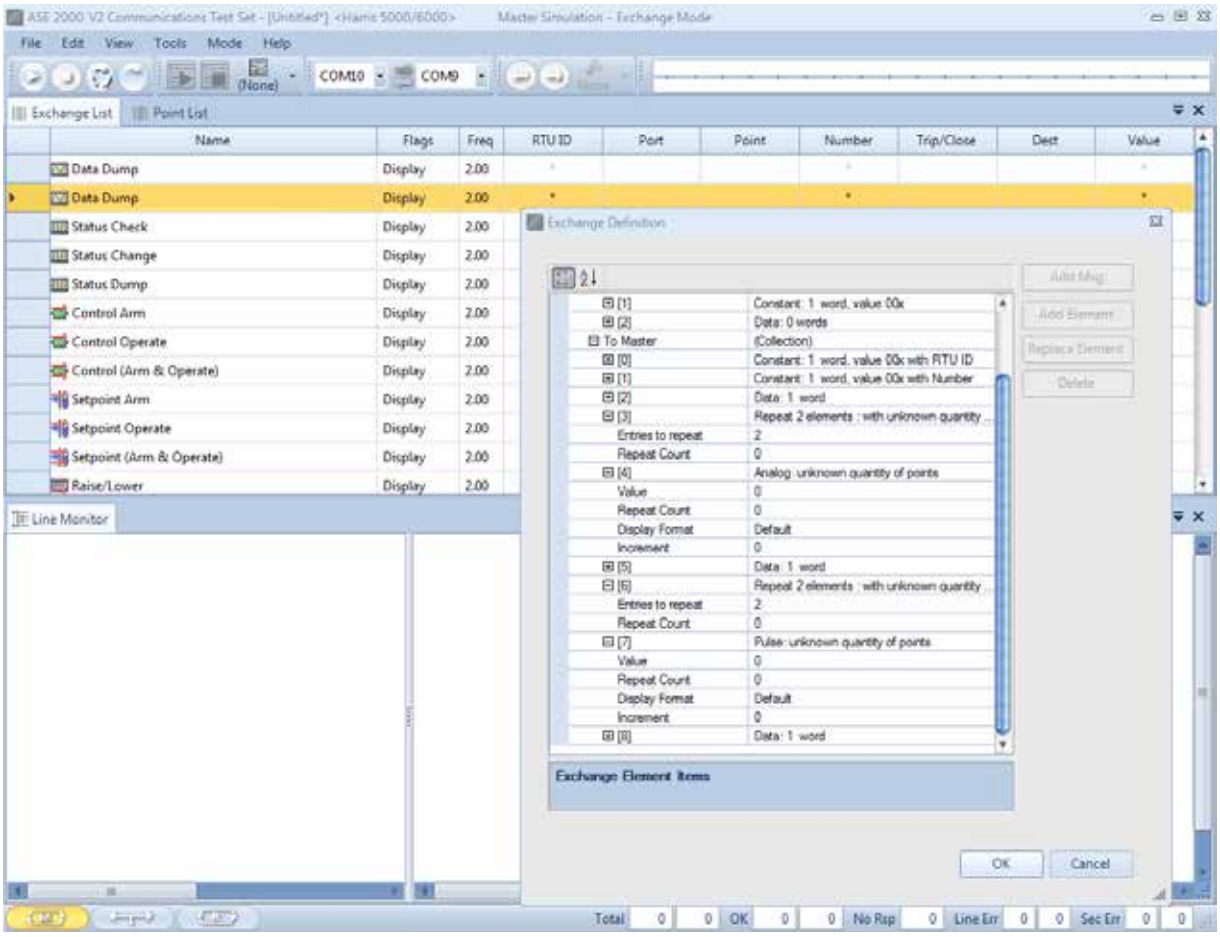


Expand the newly added element and set Value to 4 then OK

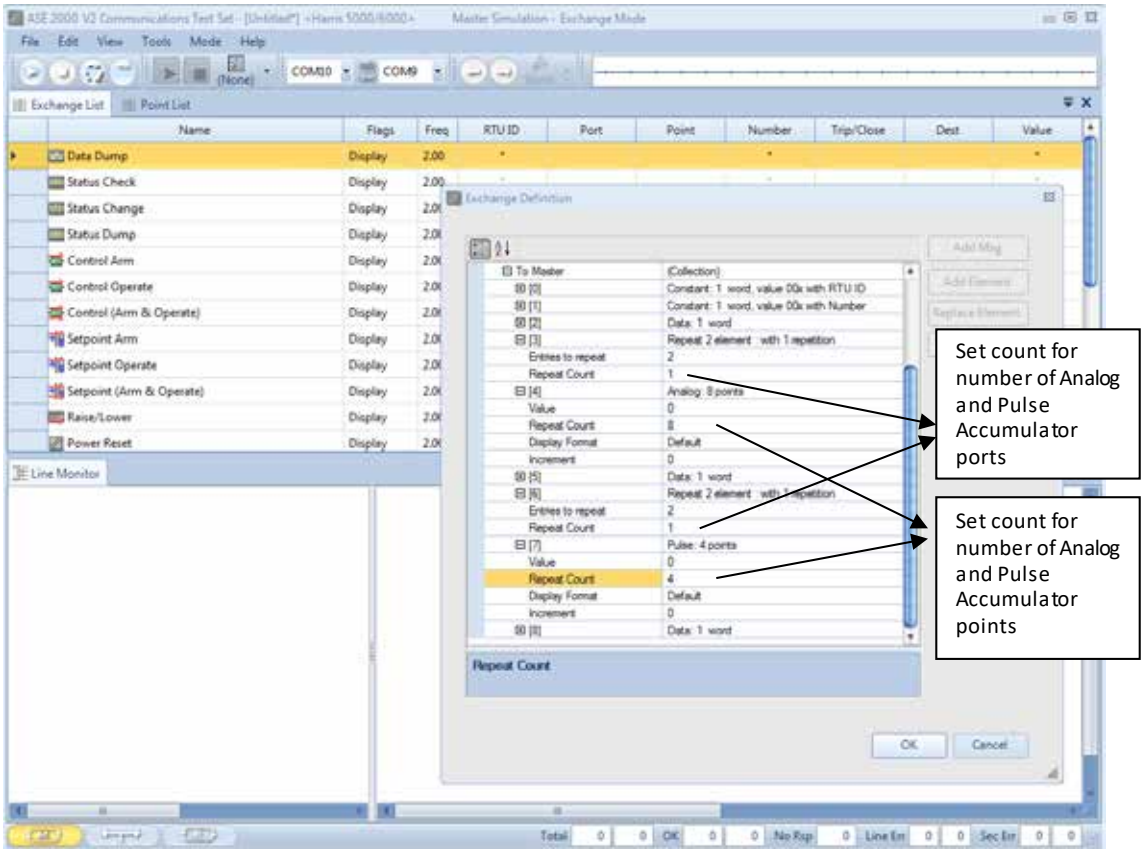


The “To RTU” section has now been modified to request 8 points (Analogs) from the 1st Data Dump port and 4 points (Accumulator) from the 2nd Data Dump port.

Edit the “From RTU” portion of the Data Dump exchange to specify the number and type of points to be returned from each port. One of the confusing aspects of the Harris 5000/6000 protocol is that there is port status information intermixed with the data returned from the RTU. So, for each port, the RTU response message contains data values followed by port status for that port followed by data values and port status for the next port. For the Data Dump response, this is repeated for each port. The screen shot below shows the default exchange definition which is one analog port and one pulse accumulator port.



Edit the entries as shown on the following screen shot to specify one analog port with 8 points and one pulse accumulator with 4 points.



27.1.2. Harris 5k/6k – Set RTU ID and Group

The RTU ID and Group number can be set for all exchanges from the Tools>Properties>Protocol tab or individually on the Exchange List view.

27.1.3. Harris 5k/6k – Exchange Mode Line Monitor

No additional setup is required. If cabling is correct Line Monitoring can be started by selecting the Start button.

27.1.4. Harris 5k/6k – Exchange Mode Master Simulation

If the Communication Properties, Exchange Definition, and RTU ID have been configured, Master Simulation operations can be performed. No additional setup is required.

27.1.5. Harris 5k/6k – Exchange Mode RTU Simulation

If the Communication Properties, Exchange Definition, and RTU ID have been configured, Master Simulation operations can be performed. No additional setup is required. Note, if the RTU ID is set to * the test set will respond to any RTU ID.

27.2. Harris 5k/6k – Task Mode

For all protocols, Task Mode setup starts by first configuring an RTU and RTU point configuration in the device data base or selection of an existing RTU definition. See the non-protocol specific section “Task Mode Device Selection and Configuration”. Note, when configuring the points for a Harris 5k/6k device, it is necessary to specify the point type for each port.

Group Type	Command	Point Type
Analog	Data Dump	Analog
Pulse (Accumulator)	Data Dump	Pulse Accumulator
Digital	Status Dump	Digital

The steps described below for activating Line Monitor, Master Simulation, and RTU Simulation activities assume the correct RTU configuration has been selected.

27.2.1. Harris 5k/6k – Task Mode Line Monitor

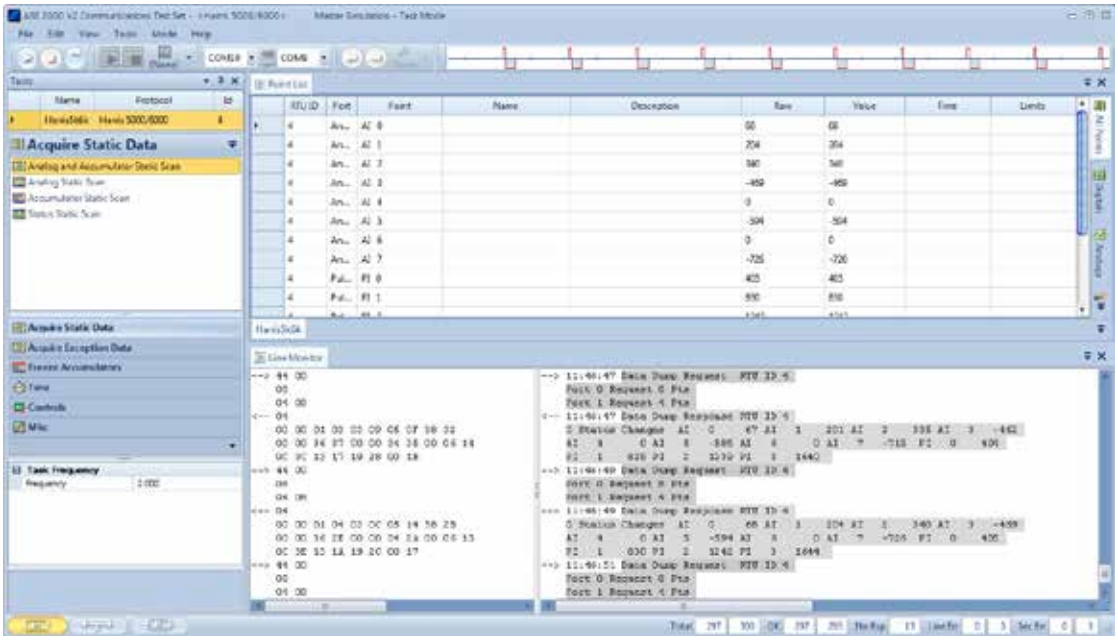
No additional setup is required. If cabling is correct, Line Monitoring can be started by selecting the Line Monitor icon  on the bottom of the test set screen and then selecting the Start button. 

While it is best to accurately enter the RTU/point data base as described, it is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

27.2.2. Harris 5k/6k – Task Mode Master Simulation

Master Simulation operation works by selecting a Task Group and then a Task Activity within that group.

With the desired Task Activity selected, execute the function one time using the Send Once icon or continuously by selecting the Start Button.



27.2.3. For Harris 5k/6k, the Task Activities are:

- Analog and Accumulator Static Scan (Uses Data Dump command)
- Analog Static Scan (Uses Data Dump command)
- Accumulator Static Scan (Uses Data Dump command)
- Status Static Scan (Uses Status Dump command)

27.2.4. Harris 5k/6k – Task Mode RTU Simulation

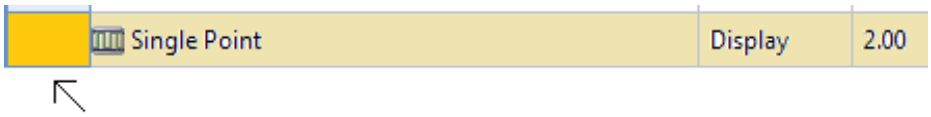
Task Mode RTU Simulation utilizes the RTU and Point Data previously configured for the device to generate responses to master commands for data values. When RTU Simulation mode is selected, the Raw and Increment fields on the Point List view are enterable. This provides the capability of changing the simulation value for individual points and to control whether the value will change (Increment value) on successive scans.

28. IEC 60870-5 – Protocol Specific

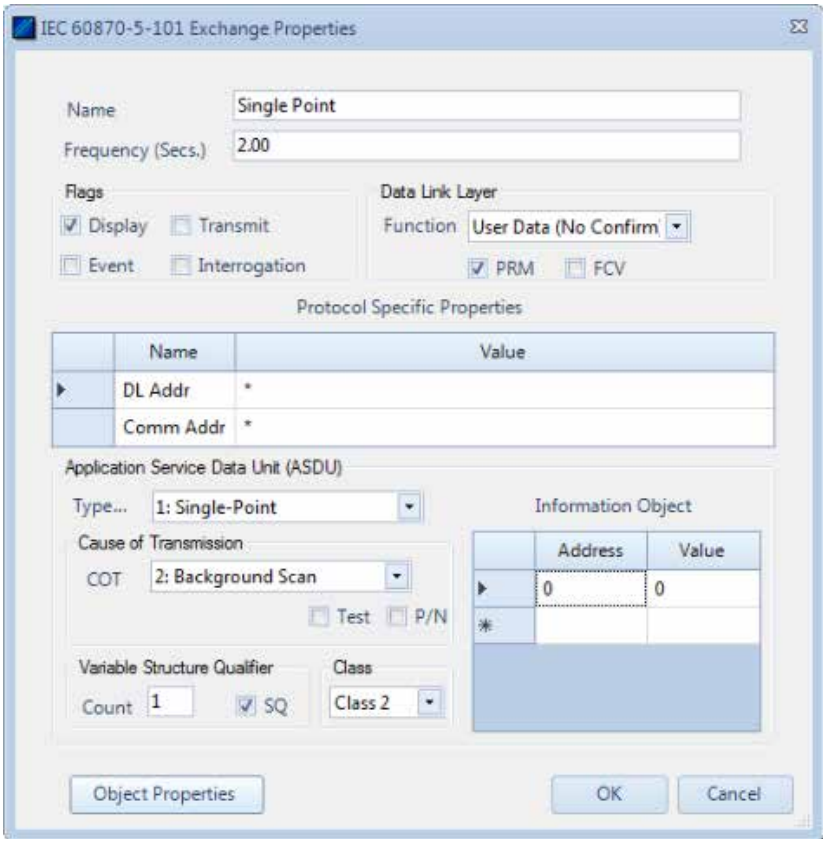
Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

28.1. IEC 60870-5 – Exchange Properties Menu

This Exchange Properties Menu is only available when in Exchange Mode and provides the ability to change message processing options. This menu is requested by selecting first an Exchange, then the Edit pull-down list, and Edit Exchange Properties option. It is also possible to request this menu by double-clicking on the rectangle at the left edge of the exchange.



Following is a sample Edit Properties Menu generated from either of these actions.



28.2. IEC 60870-5 – Fields

Name is used to identify the exchange on the Line Monitoring and Messages views. This field is normally not modified since default names reflect exchange functionality. In some cases, a user may create two similar exchanges, in which case the name can be changed for differentiation. For example, one Single Point exchange may be used for points 100 to 109, while a second might be for points 110 to 119, in which case names such as **Single Point 100-109** and **Single Point 110-119** might be meaningful. The name is not used by ASE2000 internal processing.

Frequency defines how often a message is to be transmitted (in seconds). It is applicable in **Master Simulation** Mode when communication is started with the **Send Continuous** or **Start** button, and in **RTU Simulation** Mode. It is not applicable in **Line Monitoring** Mode.

When **Send Continuous** is selected, the selected exchange message is sent immediately and, thereafter, at regular intervals specified by the Frequency.

When **Start** is selected in **Master Simulation** mode, each exchange with its Transmit flag set is transmitted at the associated frequency. The first transmission occurs at the frequency interval after **Start**, with subsequent transmissions periodically thereafter. For example, if two exchanges both have the **Transmit** flag set, one with a frequency of 2.0 seconds and another with 3.0 seconds, the first exchange is sent 2 seconds after **Start** is pressed and every 2 seconds thereafter. The second exchange is sent 3 seconds after **Start** is pressed and every 3 seconds thereafter.

A special frequency value of 0 seconds (along with setting the **Transmit** flag) causes the exchange to be sent once immediately after Start is pressed. This is typically used with the **STARTDT ACT** exchange for IEC 60870-5-104 protocol, and also commonly used with the **Interrogation** exchange for both IEC 60870-5-101 and IEC 60870-5-104.

Note that frequency settings define the desired transmission rate. An exchange is never sent before processing of the prior exchange has terminated, either because the entire response has not yet been received or because no response has been received and the response timeout period has not yet expired.

▶ *For IEC 60870-5-101 protocol in master simulation mode, the ASE2000 normally sends Class 1 and Class 2 requests in addition to the exchanges manually configured for transmission. These exchanges do not have to be explicitly enabled. Please see the Properties tab section for more discussion.*

In **RTU Simulation mode,** frequency defines how often information objects are queued for transmission. For example, if a Single Point exchange is configured for transmission[2] with a 10 second frequency, then it is inserted into the Class 2 response queue every 10 seconds. After insertion, it is sent based on its queue position.

Display and Event flags are as defined in the main ASE200 document. There is no special meaning for IEC protocols.

Transmit flag causes a message to be transmitted according to rules discussed for the frequency setting, above. For Master Simulation for IEC 60870-5-104 protocol, it is important that the STARTDT message be enabled for transmission at a 0.0 second frequency.

2 For 101, in response to Class 1 and Class 2 requests; for 104, automatically.

Interrogation flag is unique to IEC protocol and applies when operating in RTU Simulation and Exchange modes. When enabled for a Monitor-Direction Process-Information ASDU (IEC terminology for input points), it causes that ASDU to be queued for transmission after receipt of an Interrogation request. Integrated Total ASDUs are queued in response to Counter Interrogation requests. Other applicable ASDUs are queued in response to General Interrogation requests. There is no special processing for Group Interrogations.

Data Link Layer Function (IEC 60870-5-101 only) is used to select the Data Link function code for transmission. Except for one case, this field is informational and should not be altered. The one case where it can be changed is to switch between **User Data (No Confirm)** and **User Data (Confirm)**. If the default function code is either of these, it can be safely modified to the other. The setting (Confirm or Not) is not used for processing incoming messages.

Data Link Layer PRM and FCV checkboxes define whether or not the PRM and FCV bits should be set in the function code byte. The ASE2000 always sets there fields correctly based on the Data Link function code. If modified, an incorrectly formatted message will be sent. The checkboxes are included in this menu only for that purpose, that is, to transmit an incorrectly formatted message to verify error handling by another IEC device.

DL Addr (IEC 60870-5-101 only) defines the exchange's data link address. Either an '*' or specific value can be entered. An '*' instructs the ASE2000 to use the system default (see *Properties Tab* and *Protocol*).

If the system default is also '*', then, on reception, any address is considered valid. On transmission in Master Simulation mode, 0 is used. On transmission in RTU Simulation mode, the data link address extracted from the corresponding request message is used.

If the value is not '*', then the entered value is used for both transmission and reception. In this case, a message received with any other address is considered invalid.

Comm Addr defines the exchange's common address of ASDU. Either an '*' or specific value can be entered. An '*' instructs the ASE2000 to use the system default (see Properties Tab and Protocol).

If the system default is also '*', then, on reception, any address is considered valid. On transmission in Master or RTU Simulation mode, 0 is used.

If the value is not '*', then the entered value is used for both transmission and reception. In this case, a message received with any other address is considered invalid.

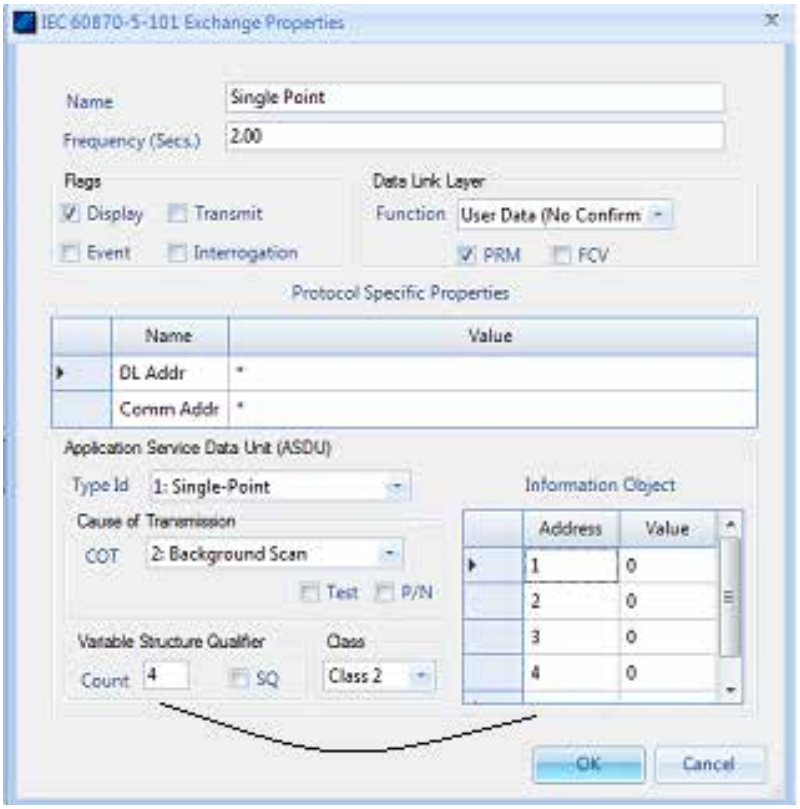
ASDU Type ID defines the exchange's application data type, such as *Single Point* or *Measured Value*. While this field can be changed from the associated pull-down list, there should be no reason to do so since the ASE2000 provides one exchange for every ASDU Type. The Type and the exchange name should coincide as it would be confusing to change one without also changing the other.

Cause Of Transmission, in general, should not be modified except for Process Information ASDUs in the Monitor Direction, and then only when operating in Exchange and RTU Simulation modes. For these Exchanges, the Cause Of Transmission defines the value used in all messages sent except Interrogation responses (in which case, the cause is changed to "Interrogated"). The ASE2000 assigns one of the many acceptable settings when the exchange is created.

Test, when checked, sets the Test Flag in the cause of transmission octet in messages transmitted by the ASE2000. This field has no impact on the ability of the ASE2000 to identify incoming messages.

P/N, when checked, sets the P/N Flag in the cause of transmission octet in messages transmitted by the ASE2000. This field has no impact on the ability of the ASE2000 to identify incoming messages.

Variable Structure Qualifier/Count defines the number of Information Objects to include when transmitting this message. It has no impact on message reception. It should only be modified for ASDU Types that support multiple objects, such as most Process Information ASDUs in the Monitor Direction. The number of entries in the Information Object table adjusts to the entered count.



SQ sets the exchanges SQ (sequential) flag. When SQ is set, an information object address can only be entered only for the first object. Addresses for other objects are assumed to be sequential ascending from the first. When SQ is clear, information object addresses can and should be entered for all objects.

Object Class is used in RTU Simulation mode. Two transmission queues are maintained: one for class 1 and one for class 2.

Information Object Table supports object information entry for use in RTU Simulation mode. The value of each object can be entered directly into this table. Other information such as quality codes and point modeling parameters can be entered from the object properties menu, accessed by double clicking on the target at the left of the object line.

The number of objects in each exchange is defined by the value in the **Count** filed (discussed above).

Different properties can be entered for each object. However, when a new object is created, its initial properties are copied from the object above where the new objects were created. The easiest way to create multiple objects with the same property setting is to start with one object, enter its properties, and then set the count to the desired number of objects. This last action creates the new objects with duplicate settings to the first.

Properties for the various information objects are described in the following section.

28.3. IEC 60870-5 – Information Object Properties

Information in this section is used in RTU Simulation (and Exchange) modes. It defines information to be sent to the controlling station for each object.

Data can be entered either from the ***Edit Exchange Properties*** menu or from a menu specific to each Information Object.

28.3.1. IEC 60870-5 – Enterable from the Edit Exchange Properties Menu

Information common to all ASDU types is shown on the ***Edit Exchange Properties*** menu. Specific Information Object menus are displayed when double-clicking on a single Information Object or by clicking on the **Object Properties** button. These include:

Address – the information object address. When the SQ flag is set, the address can be set for the first object only. When SQ is cleared, it can be set for all objects

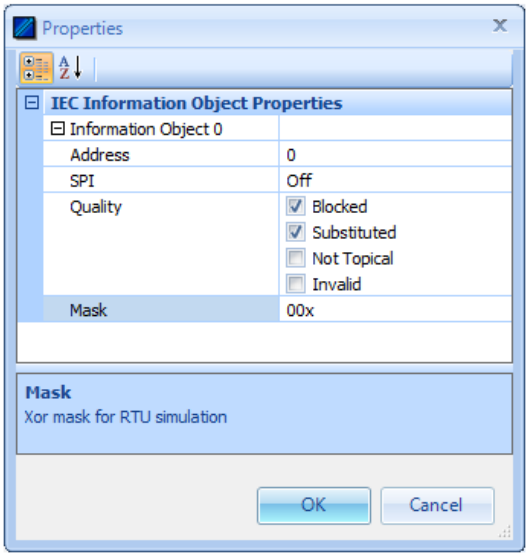
Value – the object (point) value

28.3.2. IEC 60870-5 – Enterable from the Information Object Properties Menu

Time Fields

Objects that include Time (event objects) allow setting of the ***Time Qualifier*** properties.

Single Point



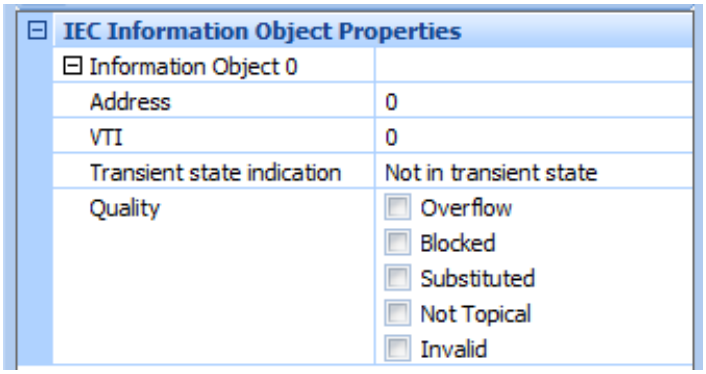
SPI is the object value (state), either On or Off

Quality shows quality codes applicable to this ASDU type
Mask, if 1, instructs the ASE2000 to toggle the value of this object each time it is sent. If 0, the value is not toggled

Double Point

Double and single point information is the same except that the single point's **SPI** field is replaced with **DPI** for a double point.

Step Position

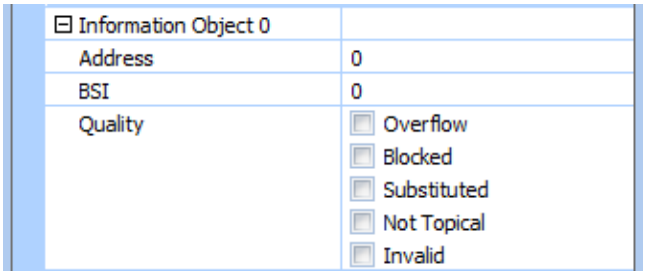


VTI is the object value

Quality shows quality codes applicable to this ASDU type

Transient State is an additional flag to indicate transient or non-transient status

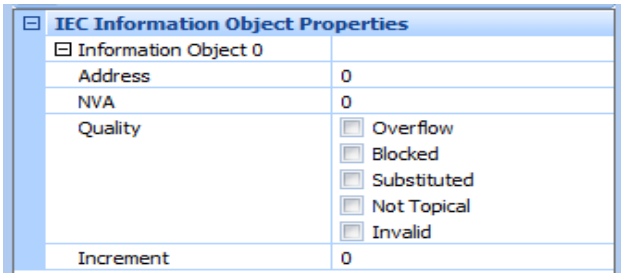
Bitstring



BSI is the object value

Quality shows quality codes applicable to this ASDU type

Measured Values

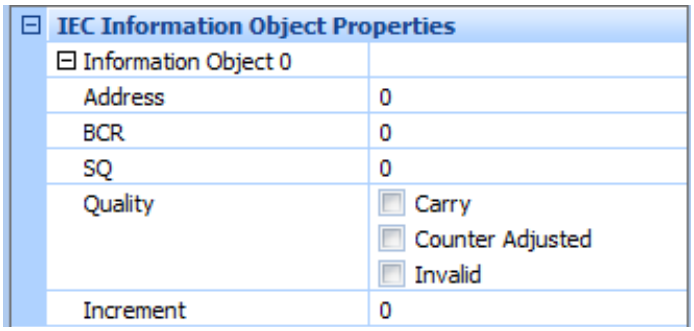


NVA is the name of the object value used for Normalized objects. **SVA** is used for scaled objects and **FVA** for floating point object

Quality shows quality codes applicable to this ASDU type

Increment specifies an amount to add to the value after each ASE2000-generated response. The new value is used in the next response. Values are incremented to a maximum, then decremented by the same amount to a minimum. The cycle is repeated. Maximum and minimum values are set by the ASE2000. They can be viewed and changed from the Properties dialog and Point tab

Totals

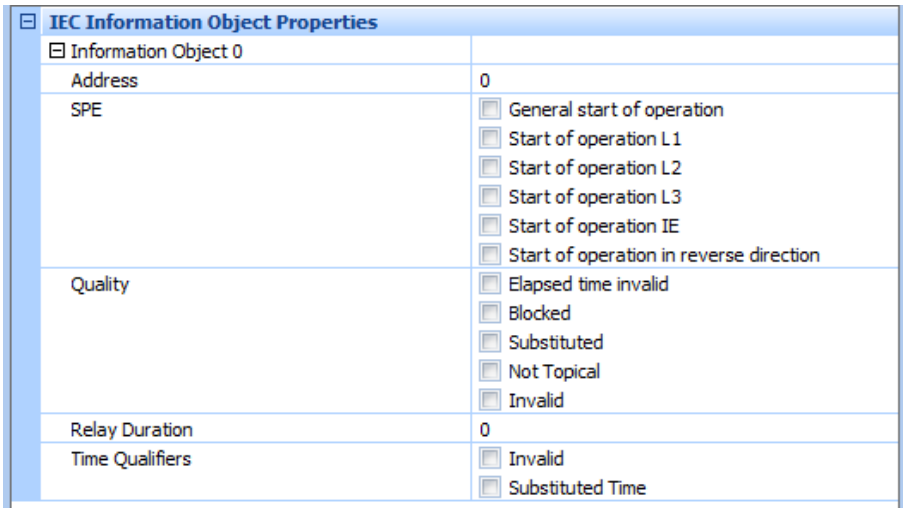


BCR is the point value

Quality shows quality codes applicable to this ASDU type

Increment specifies an amount to add to the value after each ASE2000-generated response. The new value is used in the next response. Values wrap to 0 after exceeding a maximum. The maximum is set by the ASE2000 and can be observed and changed from the Properties dialog and Point tab

Protection Events



SPE identifies the type of event

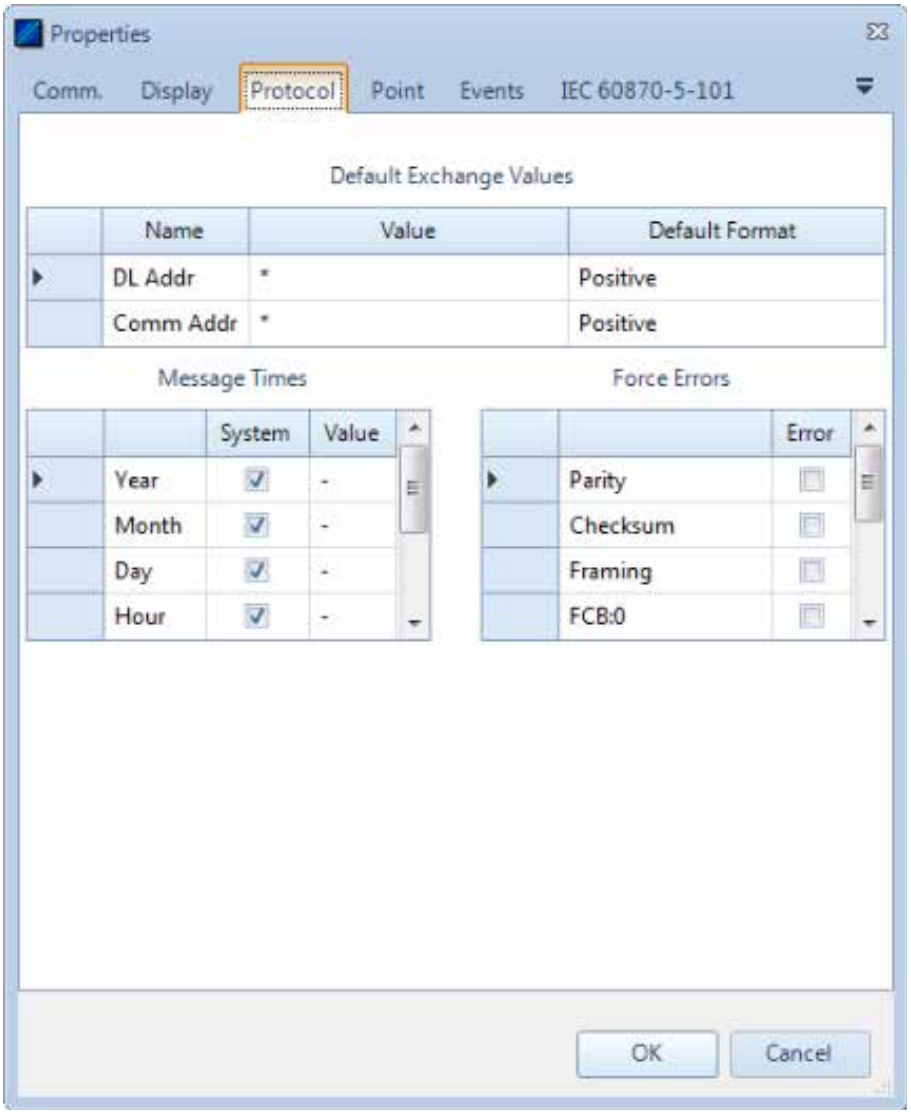
Quality shows quality codes applicable to this ASDU type

28.4. IEC 60870-5 – Protocol Tab

Certain protocol specific properties can entered from the ***Protocol Tab*** in the ***Properties*** menu. This menu is accessed by selecting the Tools pull-down list and the properties option.

28.4.1. IEC 60870-5-101 Protocol Tab

The IEC 60870-5-101 Protocol Menu is shown below.



DL Addr is the Data Link address, as discussed in the Exchange Properties Menu section

Comm Addr is the Common address of ASDU, as discussed in the Exchange Properties Menu section

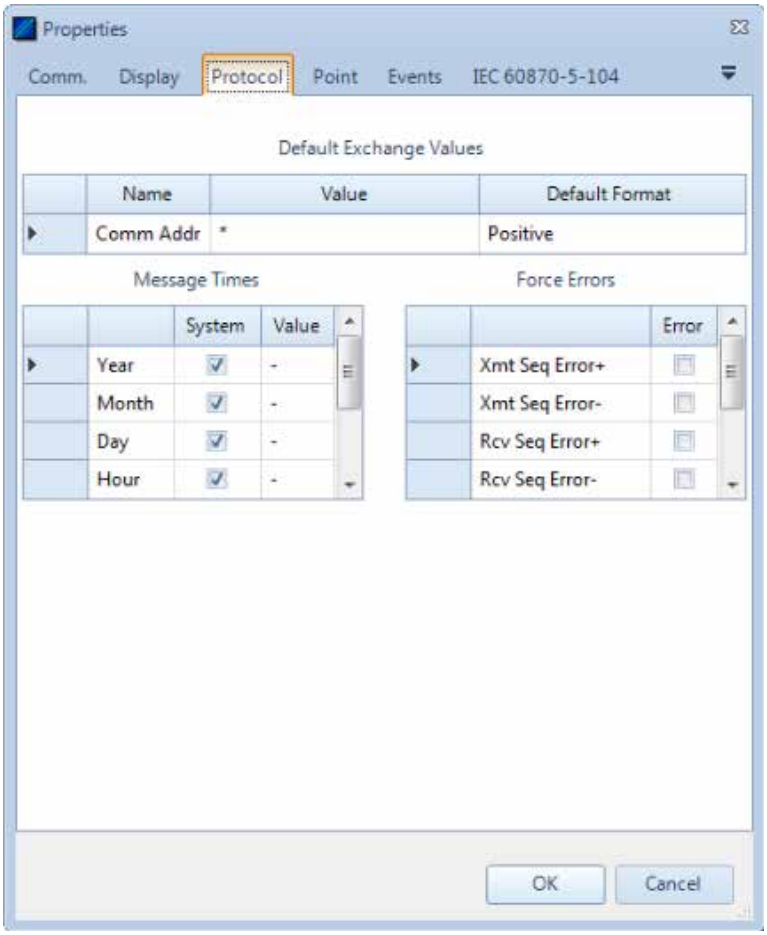
System Time defines time values to use in all applicable messages sent by the ASE2000, both event time stamps and time synchronization messages. When the System time option is checked, time is extracted from the host PC. When unchecked, the user specified value is used.

Force Errors contains a list of error-generating instructions that can be followed in preparing a message for transmission. Options are:

Parity	Generates a parity error in the first octet. IEC 60870-5-101 uses even parity. This selection requires an ASE manufactured communication card, and also requires that the *Native Asynch Mode* box on the Communication properties tab is not checked
Checksum	Generates a checksum error
Framing	Generates a framing error near the start of the message by changing a stop bit from 1 to 0 This selection requires an ASE manufactured communication card, and also requires that the *Native Asynch Mode* box on the Communication properties tab must is not checked
FCB:0	Transmits the FCB bit state as 0
FCB:1	Transmits the FCB bit state as 1
NAK Messages	Where appropriate, sends a NAK in place of an ACK
No Data Link Acks	Never sends Data link acknowledgement messages
Randomly Select	Generate an occasional error by applying rules for one of the other Force Error options enabled. If this option is not checked, all enabled errors (where possible) are processed for every transmission

28.4.2. IEC 60870-5-104 Protocol Tab

The IEC 60870-5-104 Protocol Menu is shown below.

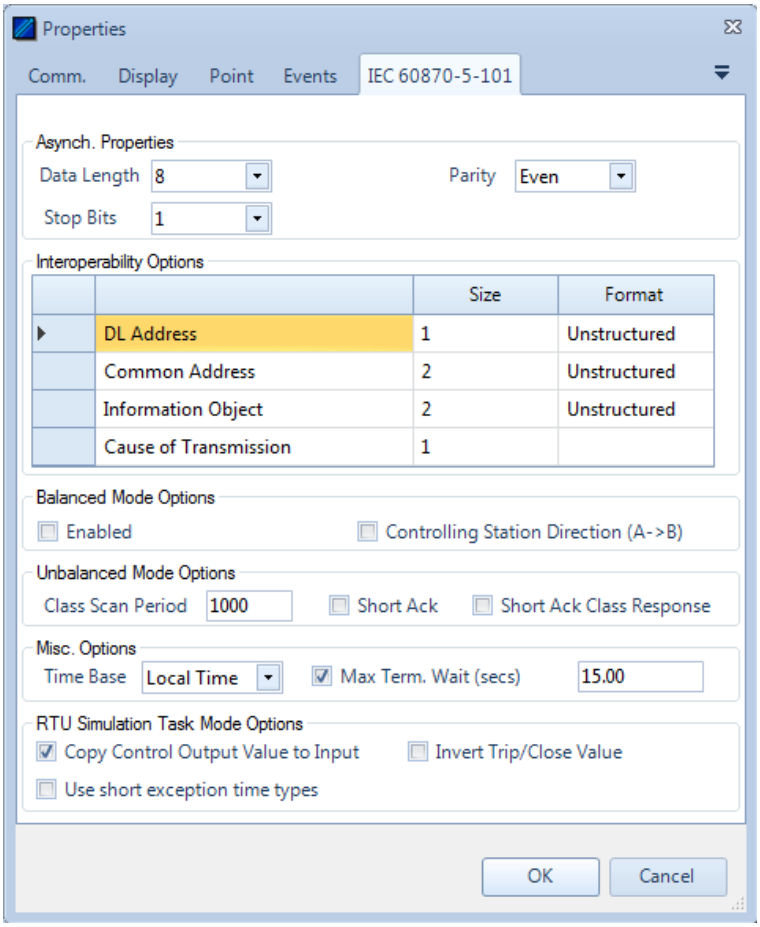


Comm Addr is as explained for IEC 60870-5-101
System Time is as explained for IEC 60870-5-101
Force Errors contains a list of error-generating instructions that can be followed in preparing a message for transmission. Options are:

Xmt Seq Error +	Increases the Xmit sequence number one more than normal
Xmt Seq Error -	Increases the Xmit sequence number one less than normal
Rec Seq Error +	Increases the Receive sequence number one more than normal
Rec Seq Error -	Increases the Receive sequence number one less than normal
No Supervisory Functions	Never transmits a supervisory message
No unnumbered function confirm	Does not confirm reception of unnumbered functions (primarily TESTFR)
Randomly Select	Generate an occasional error by applying rules for one of the other Force Error options enabled. If this option is not checked, all enabled errors (where possible) are processed for every transmission
Randomly Select	Generate an occasional error by applying rules for one of the other Force Error options enabled. If this option is not checked, all enabled errors (where possible) are processed for every transmission

28.5. IEC 60870-5-101 Tab

This section discusses options available from the IEC 60870-5-101 Properties page, accessed by selecting the Tools pull-down menu and the Properties tab.



Asynch Properties

IEC 60870-5-101 protocol octets are transmitted as 8 data bits, 1 stop bit, and even parity. As for all serial protocols, the ASE2000 sets these parameters as defined by the protocol but allows them to be changed (primarily for device consistency testing). Sending a message after any parameter is changed will cause a data reception error at any compliant device

Interoperability Options

There are three addressing components, the Data Link (DL) address, Common address of ASDU, and Information Object address. The protocol allows the size of these fields to vary from system to system, although they must be the same for all devices in a given system.

Also, each address can be structured or not. A structured address implies that the total address size, for example 2 octets (16 bits), is logically structured into two subfields of, for example, 8 bits each. This is purely an interpretation convention. For example, assume the value of a 2-octet Common Address is 513. This is hex 0x201. If interpreted as an unstructured number, the value is 513. If interpreted as a structured number composed of two 8-bit subfields, the value could be displayed as 2.1 (the high 8-bit value is 2 and the low 8-bit value is 1).

The IEC 60870-5-101 menu allows specification of both the address sizes, whether they should be interpreted as structured or unstructured values, and how structured values should be displayed.

1-octet addresses can only be unstructured

2-octet addresses can be unstructured, or structured with an address format of 8.8. This displays the 2-octet, 16-bit field, as two 8-bit values

3-octet addresses can be can be unstructured, or structured with an address format of:

- 8.8.8 - three 8-bit values,
- 16.8 - a 16-bit value followed by an 8-bit value, or
- 8.16 – an 8-bit value followed by a 16-bit value

DL Address is the data link address size, 0, 1, or 2 octets. 0 octets is allowed only for balanced mode

Common Address is the common address of ASDU size, 1 or 2 octets
Information Object is the information object address size, 1, 2, or 3 octets
Cause of Transmission is the size of the cause of transmission field, 1 or 2 octets. For 2 octets, the first is the cause and the second contains an origination address

Balanced Mode Options

Enabled is *set* to enable balanced mode, *clear* for unbalanced mode
Controlling Station Direction (A -> B) For balanced mode, indicates that the DIR bit is set in messages originating from the Controlling station. If not selected, the DIR bit is set in messages originating from the controlled station. Not used inn unbalanced mode

Unbalanced Mode Options

Class Scan Period is only used when operating as a master (controlling station) in unbalanced mode. In addition to exchanges that are explicitly enabled for transmission, this option instructs the ASE2000 how often to issue a Class 1 or Class 2 request

Short Ack is set to transmit the 1-octet Short Ack code when applicable. If not set, then the multi-octet Data Link acknowledgement message is sent

Short Ack Class Response is set when RTU is to send a Short Ack code when no data is available instead of a negative response code

Misc. Options

Time Base – Select Local time or UTC time

Max Term. Wait (secs) – When a termination code is expected but not received, selecting this option will end polling after the specified number of seconds

RTU Simulation Options

Copy Control Output Value to Input – When enabled, control operation data values received from the master station are copied to their mapped input points. Writing 'Off' to a control is represented by a value of zero and 'On' defaults to one. To invert this interpretation, select the 'Invert Trip/Close Value' check box.

Add the control output point number enclosed in square brackets, [X], to the description field of the input point to create a link. Only points of the same type may be linked. It is a one-way link. Individual points may be inverted by prefixing the point ID with an exclamation point such as [!23].

Binary link – [20] appears in the Description field for Point DI 12: Digital Input point 12 and Digital Input point 20 are linked and control operations (Single Command) to DI 20 will change the value of DI 12

Negated binary link – [!21] appears in the Description field for Point DI 10: Write commands to DI 21 change the value of DI 10 to the opposite value

Analog link – [201] appears in the Description field for Point AI 103: A value set (Set Point Command) to AI 201 will be set as the value of AI 103

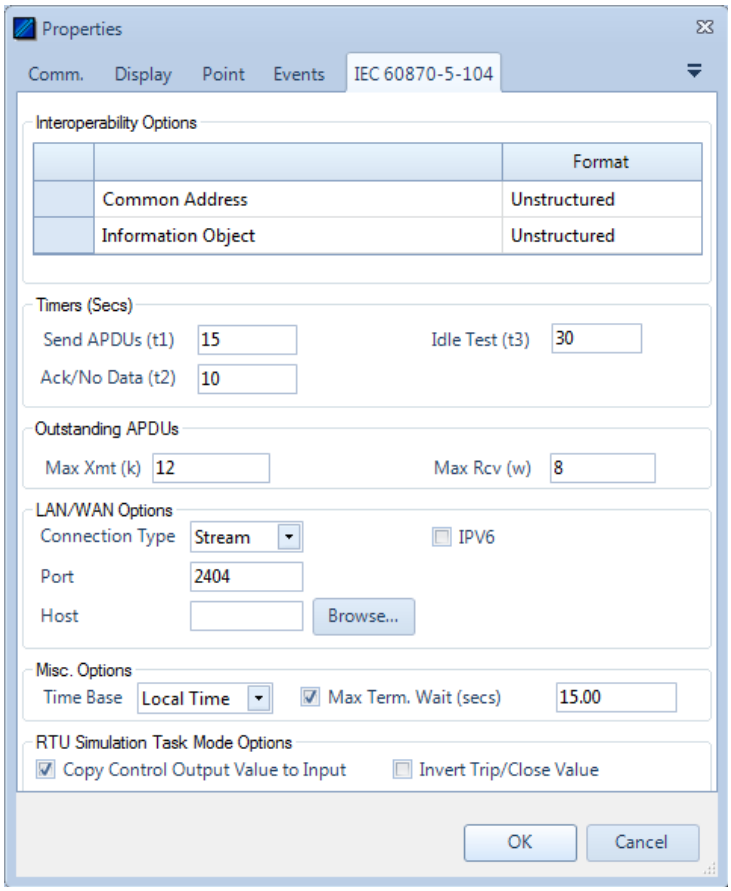
Point List | Line Monitor

	Comm Addr	Object	Name	Description	Raw	Value	Quality	Time	Limits	Increment
	1	DI 10		inverse of [!21]	0		Valid			0
	1	DI 11			0		Valid			0
	1	DI 12		12 controlled by [20]	1			16:28:43....		0
	1	DI 13			0		Valid			0
	1	DI 20			0		Valid			0
	1	DI 21			0		Valid			0
	1	AI 100			0	0	Valid			0
	1	AI 101			0	0	Valid			0
	1	AI 102			0	0	Valid			0
	1	AI 103		value set by [201]	123	123		16:27:43....		0
	1	AI 104			0	0	Valid			0
▶	1	AI 200			0	0	Valid			0
	1	AI 201			0	0	Valid			0
	1	AI 202			0	0	Valid			0

Use short exception time types – Send time information in three octets (milliseconds, seconds, & minutes) instead of seven octets

28.6. IEC 60870-5-104 Tab

This section discusses options available from the IEC 60870-5-104 Properties page, accessed by selecting the Tools pull-down menu and the Properties tab.



Interoperability Options

Common Address is the common address of ASDU size, 1 or 2 octets
Information Object - The IEC 60870-5-104 address component is 3-octets in length. It can be displayed as a structured or unstructured value. Please refer to the prior IEC 60870-5-101 section for more information

Timers (Secs)

These timers are defined by the IEC 60870-5-104 specification. They are used in master and RTU simulation modes, but not in Monitoring Mode. All values are in seconds.

Send APDUs (t1) – Maximum amount of time between transmission of a message and reception of an acknowledgement
Ack/No Data (t2) – Maximum amount of time between reception of a message and transmission of a corresponding acknowledgement
Idle Test (t3) – Maximum time period for no message activity, after which a Test message is sent

Outstanding APDUs

Max Xmt (k) Maximum number of APDU messages that will be sent before waiting for an acknowledgement
Max Rcv (w) Maximum number of APDU messages that will be received before sending an acknowledgement

LAN/WAN Options

Connection Type – Currently, IEC 60870-5-104 only allows stream
Port – The default is 2404
Host – Host to which a connection should be issued; used for Master Simulation mode only. Either a fixed IP address or remote node name can be entered

Misc. Options

Time Base – Select Local time or UTC time
Max Term. Wait (secs) – When a termination code is expected but not received, selecting this option will end polling after the specified number of seconds

RTU Simulation Options

Copy Control Output Value to Input – When enabled, control operation data values received from the master station are copied to their mapped input points. Writing 'Off' to a control is represented by a value of zero and 'On' defaults to one. To invert this interpretation, select the 'Invert Trip/Close Value' check box.

Add the control output point number enclosed in square brackets, [X], to the description field of the input point to create a link. Only points of the same type may be linked. It is a one-way link. Individual points may be inverted by prefixing the point ID with an exclamation point such as [!23].

Binary link – [20] appears in the Description field for Point DI 12: Digital Input point 12 and Digital Input point 20 are linked and control operations (Single Command) to DI 20 will change the value of DI 12

Negated binary link – [!21] appears in the Description field for Point DI 10: Write commands to DI 21 change the value of DI 10 to the opposite value

Analog link – [201] appears in the Description field for Point AI 103: A value set (Set Point Command) to AI 201 will be set as the value of AI 103

Point List | Line Monitor

Comm Addr	Object	Name	Description	Raw	Value	Quality	Time	Limits	Increment
1	DI 10		inverse of [!21]	0		Valid			0
1	DI 11			0		Valid			0
1	DI 12		12 controlled by [20]	1			16:28:43....		0
1	DI 13			0		Valid			0
1	DI 20			0		Valid			0
1	DI 21			0		Valid			0
1	AI 100			0	0	Valid			0
1	AI 101			0	0	Valid			0
1	AI 102			0	0	Valid			0
1	AI 103		value set by [201]	123	123		16:27:43....		0
1	AI 104			0	0	Valid			0
1	AI 200			0	0	Valid			0
1	AI 201			0	0	Valid			0
1	AI 202			0	0	Valid			0

Quick-Start IEC 60870-5-101 / IEC 60870-5-104

This section presents the quickest way to start ASE2000 communication for an IEC protocol. There are separate requirements for Line Monitor, Master Simulation, and RTU Simulation operation, and for Task and Exchange modes.

28.7. IEC 60870-5 – All Modes and Operational Types

For IEC 60870-5-101, all Interoperability sizes must be entered from the IEC 60870-5-101 properties menu. This is not required for IEC 60870-5-104.

Interoperability Options

		Size	Format
▸	DL Address	1	Unstructured
	Common Address	2	Unstructured
	Information Object	2	Unstructured
	Cause of Transmission	1	

28.8. IEC 60870-5 – Exchange Mode

28.8.1. IEC 60870-5 – Exchange Mode Line Monitor

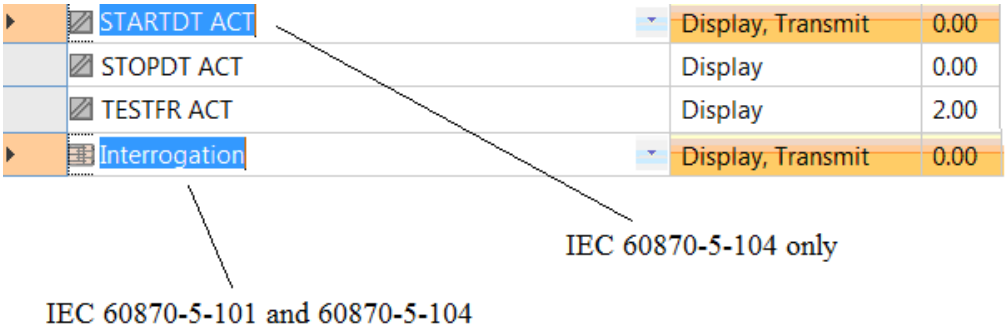
No additional setup is required. If cabling is correct and Interoperability settings entered, Line Monitoring can be started by selecting the Start [communications] button.

28.8.2. IEC 60870-5 – Exchange Mode Master Simulation

Master Simulation operation requires entry of the Common Address of ASDU and, for 101 only, the Data Link address. Entry is made from Properties and the Protocol tab.

	Name	Value
▸	DL Addr	*
	Comm Addr	*

To obtain initial data for all points, the **Interrogation** exchange should be enabled with a transmission frequency of 0.0 seconds, causing it to be sent once at startup. For IEC 60870-5-104, the **STARTDT** exchange must be similarly enabled.



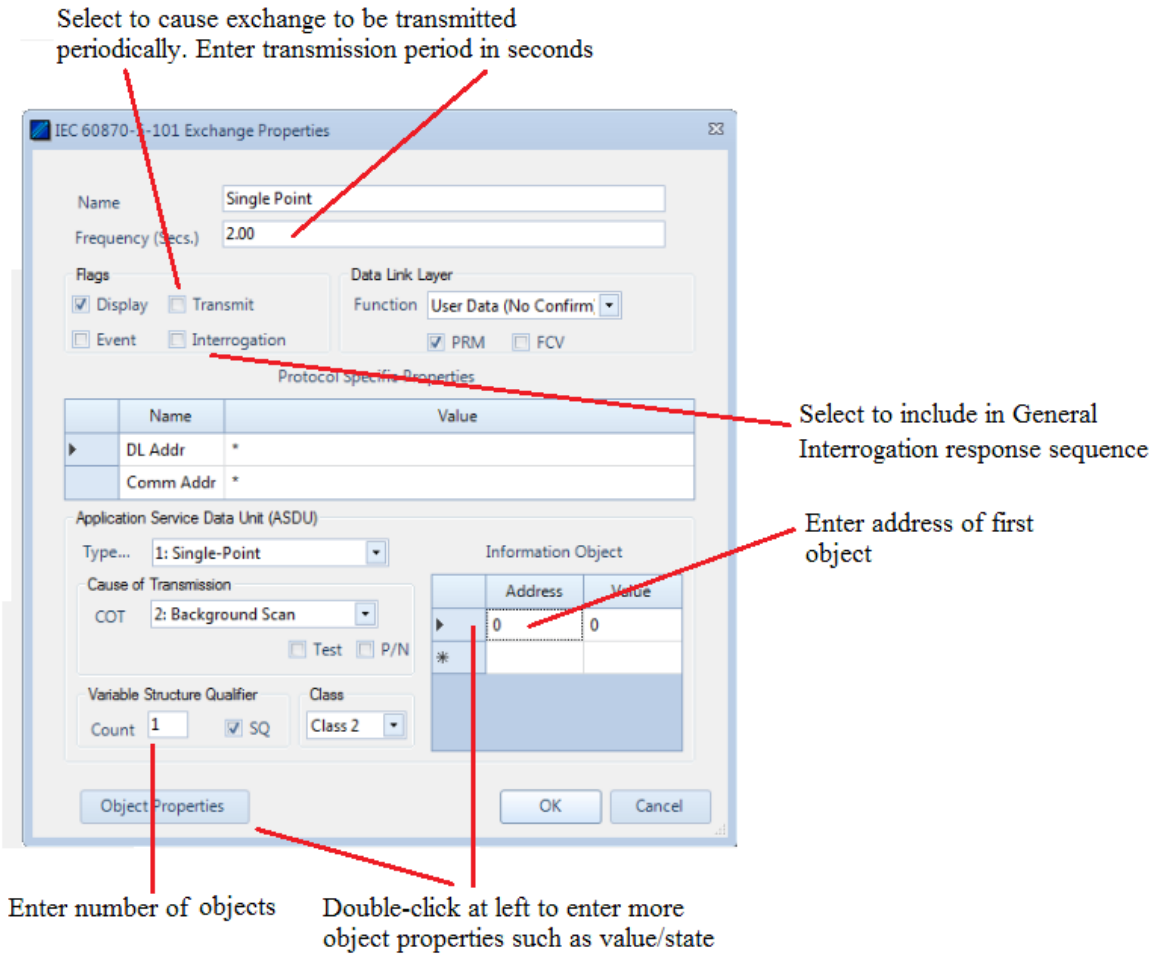
No further setup is required. Select Start.

28.8.3. IEC 60870-5 – Exchange Mode RTU Simulation

RTU simulation requires entry of the Common Address of ASDU. The Data Link address may be entered, but is not required. If the default setting of '*' is unmodified, the ASE2000 transmits every response message using the Data Link address contained in the associated request. (Remember that Data Link address is sued for IEC 60870-5-101, but not IEC 60870-5-104).

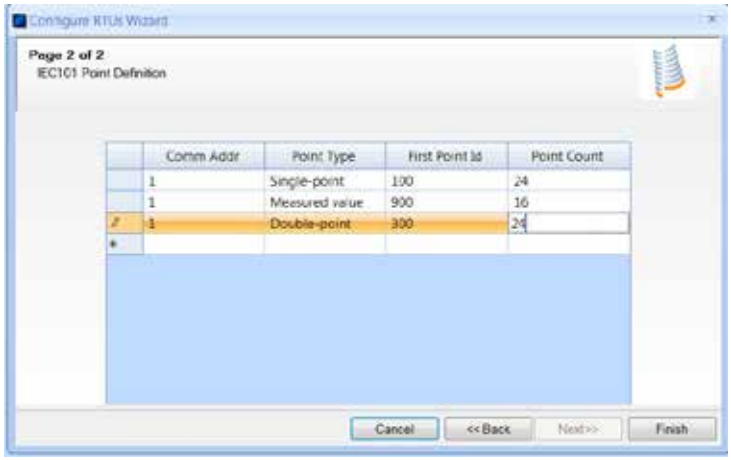
The major additional setup step is to configure input point data ASDUs. (No setup is required for analog or digital control outputs.) For each Process Information ASDU in the Monitor direction to

be sent to the master, edit transmission information from the Exchange Proprieties menu. The example presented below is for Single Points. While other properties than those shown can be entered, a basic RTU simulation configuration requires entry only of those shown.



28.9. IEC 60870-5 – Task Mode

Virtually all Task Mode setup starts by first configuring points/objects in the RTU data base. For example:



The configuration shown above creates 24 Single Points, 16 Measured Values, and 24 Double Points with consecutive Information Object address starting at the address contained under the ***First Point ID*** column.

28.9.1. IEC 60870-5 – Task Mode Line Monitor

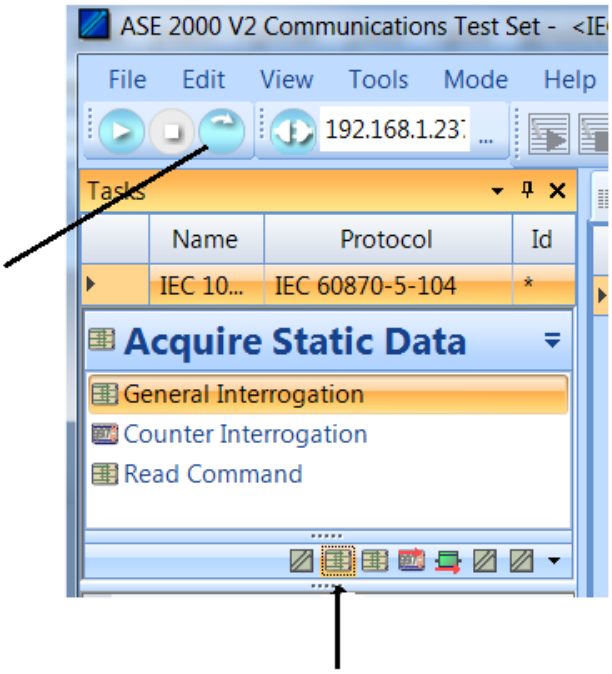
No additional setup is required. If cabling is correct and Interoperability settings entered, Line Monitoring can be started by selecting the Start button.

While it is best to accurately enter the RTU/point data base as described, completeness is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

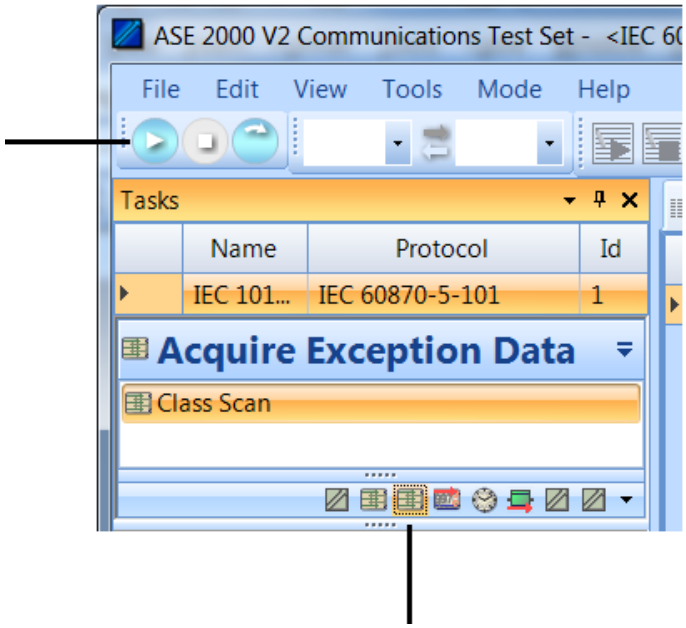
28.9.2. IEC 60870-5-101 Task Mode Master Simulation

Master Simulation operation works by selecting a task group in the middle of the ***Tasks View*** and an individual task within that group. The best way to obtain process (input) data from an IEC 60870-5-101 Controlled Device (RTU) is to:

- Select and send once the ***General Interrogation*** task from within the A***cquire Static Data*** grouping

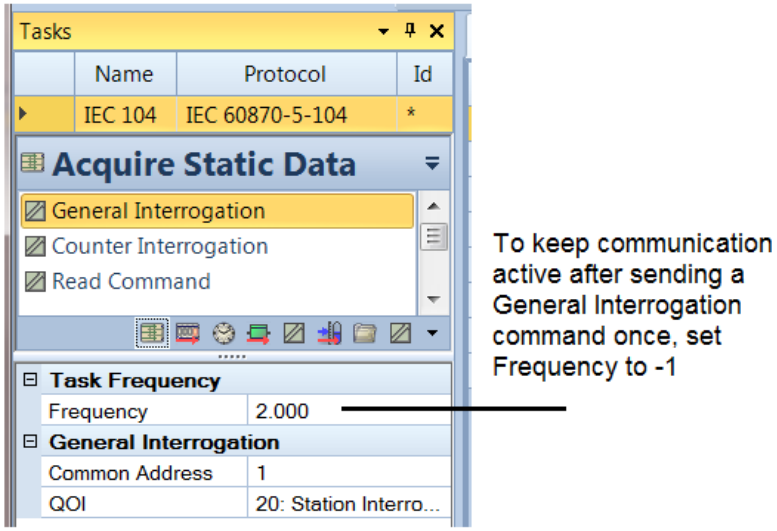


- Select and play continuously the ***Class Scan*** task from within the ***Acquire Exception Data*** grouping



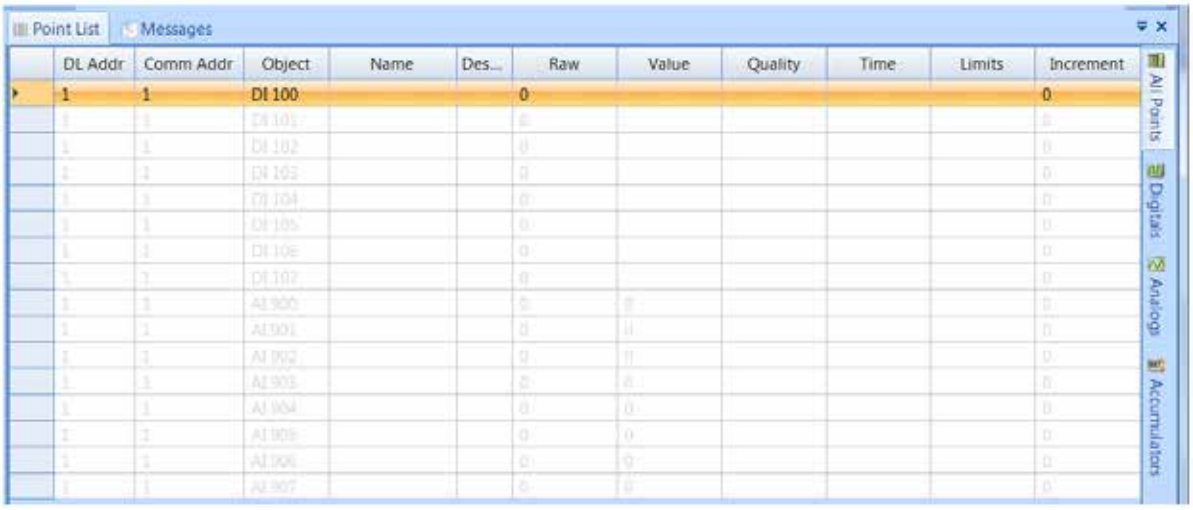
28.9.3. IEC 60870-5-104 Task Mode Master Simulation

IEC 60870-5-104 does not have a Class Scan function since the Controlled Station sends point data independently of requests from the Controlling Station. Whether the ASE2000 sends a General Interrogation message periodically or only once is controlled by the *Frequency* property. The default value, 2.000 seconds, causes a General Interrogation to be sent once every 2 seconds. A *Frequency* setting of -1 causes a General Interrogation to be sent only once when the task is started, while keeping communication open until stopped by the user. This is different from the *Send Once* option, which causes a General Interrogation to be sent once when the task is started, but then stops communication when the General Interrogation completes.



28.9.4. IEC 60870-5 – Task Mode RTU Simulation

No additional setup is required. While RTU Simulation is active, input point values and states can be entered from the Point Values view.

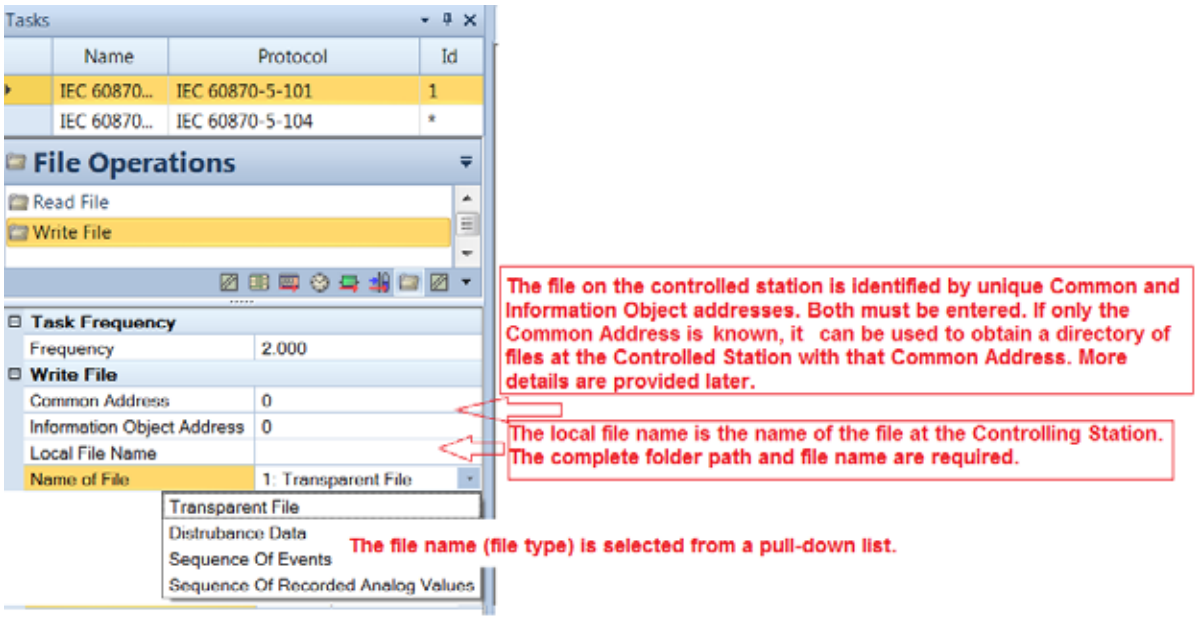


Raw values entered are transmitted at the next opportunity. Other use of this view is described in the main ASE2000 Version 2 document.

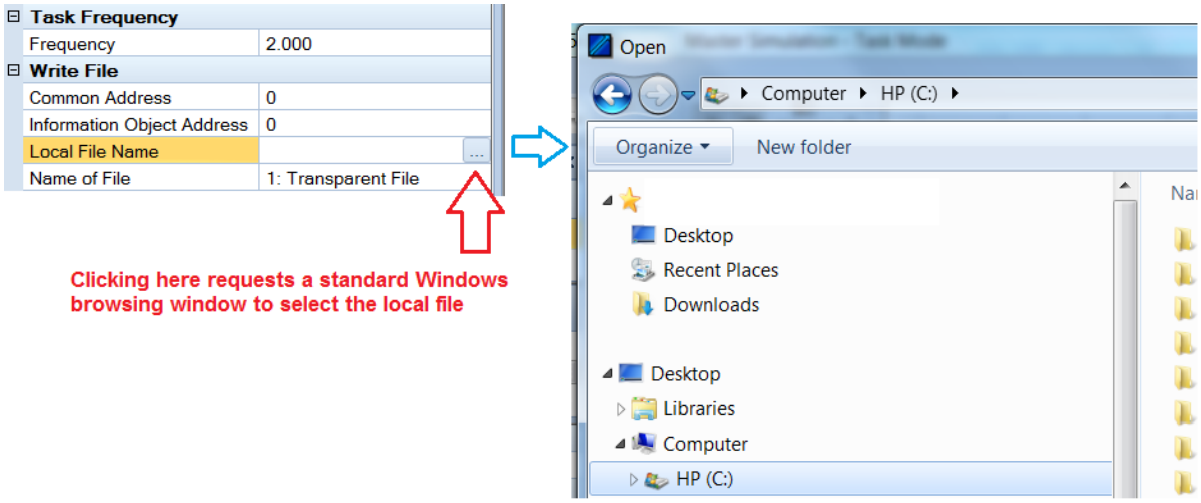
28.9.5. IEC 60870-5 – Task Mode File Transfer

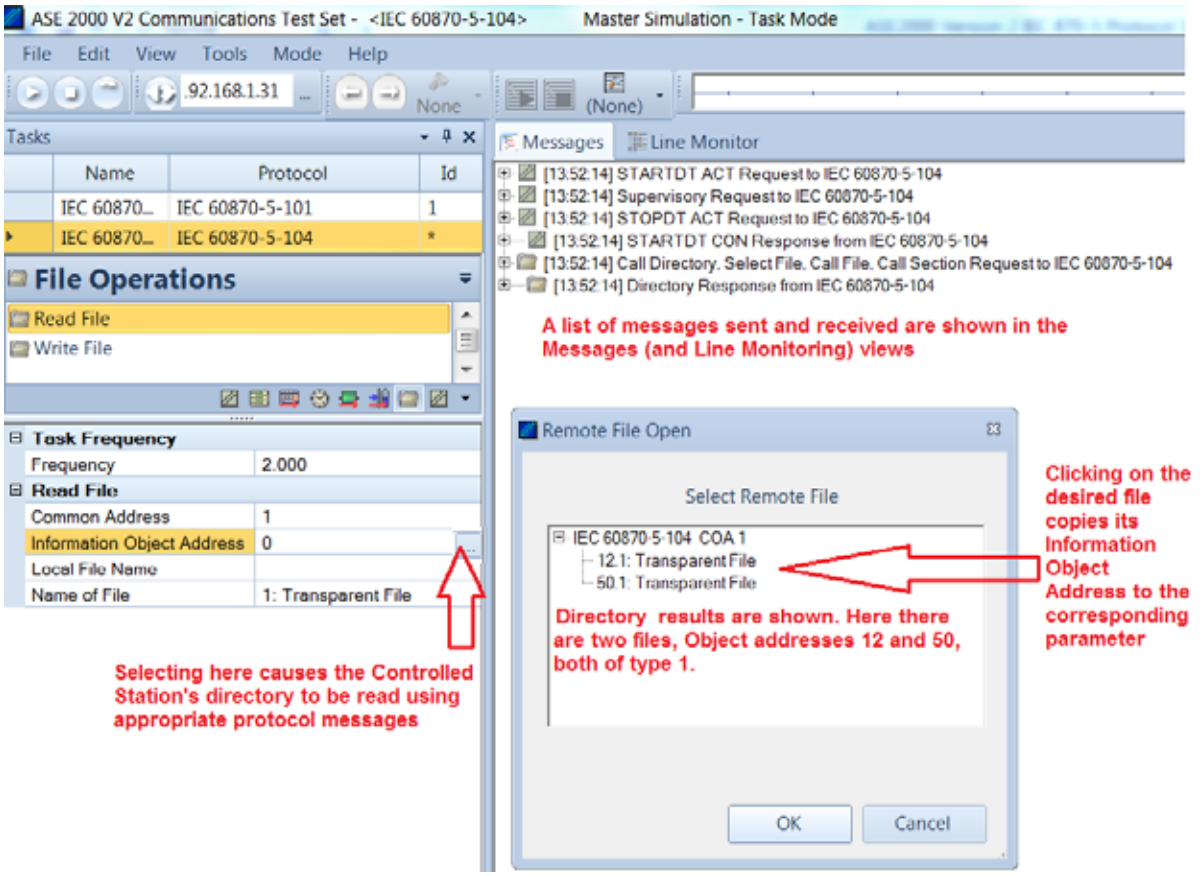
This section provides details on use of the Task Mode file transfer capabilities. These procedures are the same for IEC 60870-5-101 and IEC 60870-5-104.

The File Operations task group has two tasks: Read File and Write File. Prior to starting either operation, values for four properties must be entered.

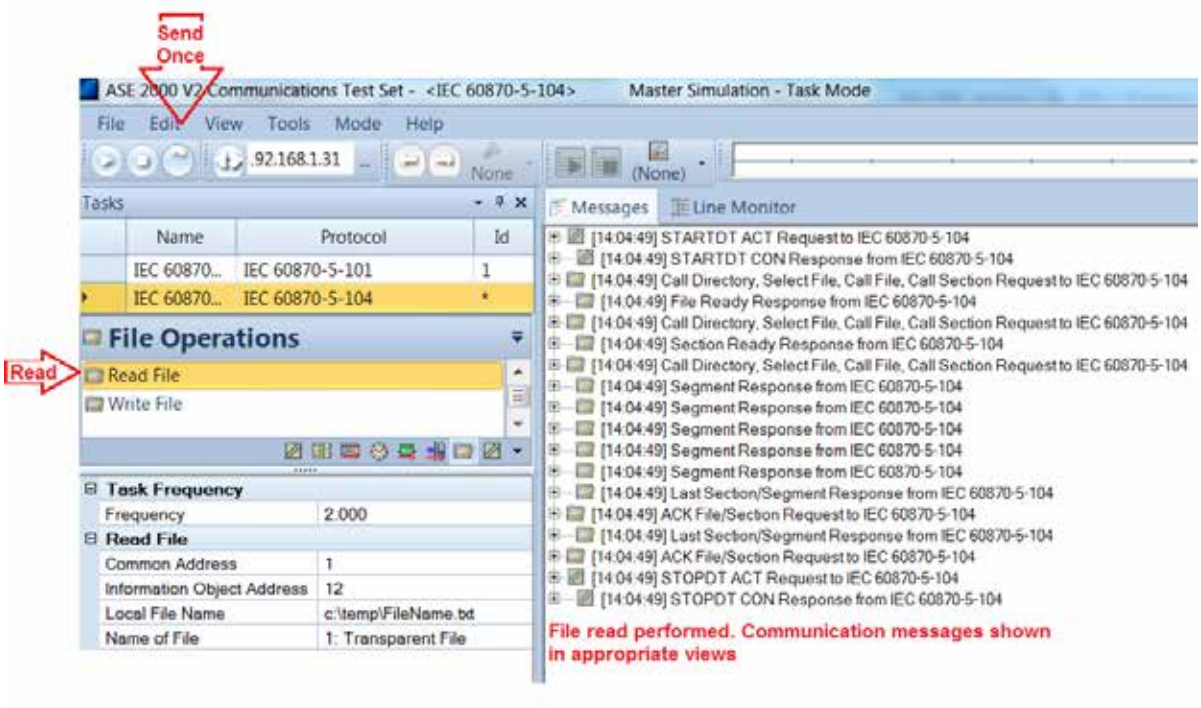


To help locate and enter both the local file (Controlling Station file on disk) and remote file (Controlled Station Common Address/Information Object Address), browse functions are supported by clicking the right edge of either the *Local File Name* or *Information Object Address* fields.





Once all parameters are entered, select the desired operation (Read or Write) and the Send Once target to initiate the file action.



29. Modbus – Protocol Specific

Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

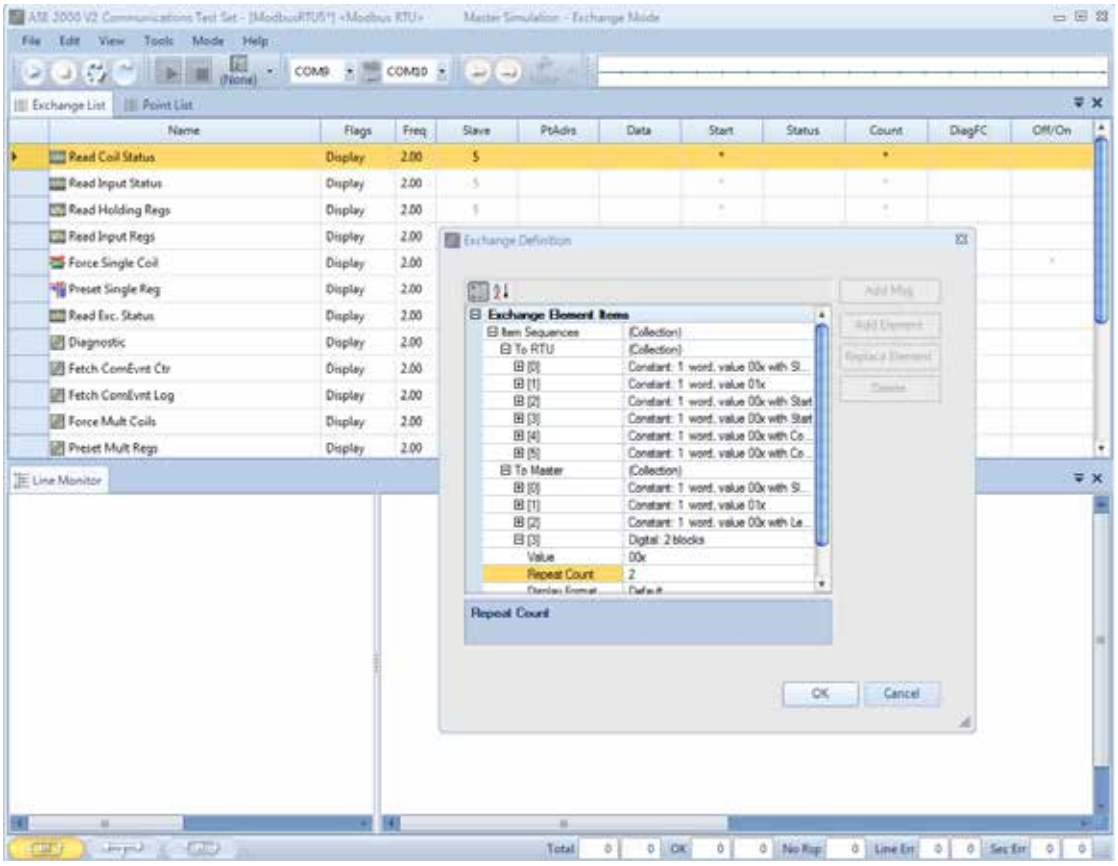
29.1. Modbus – Exchange Mode

For Exchange Mode, protocol specific tasks are editing Exchange Definition and setting RTU address information.

29.1.1. Modbus – Edit Exchange Definition

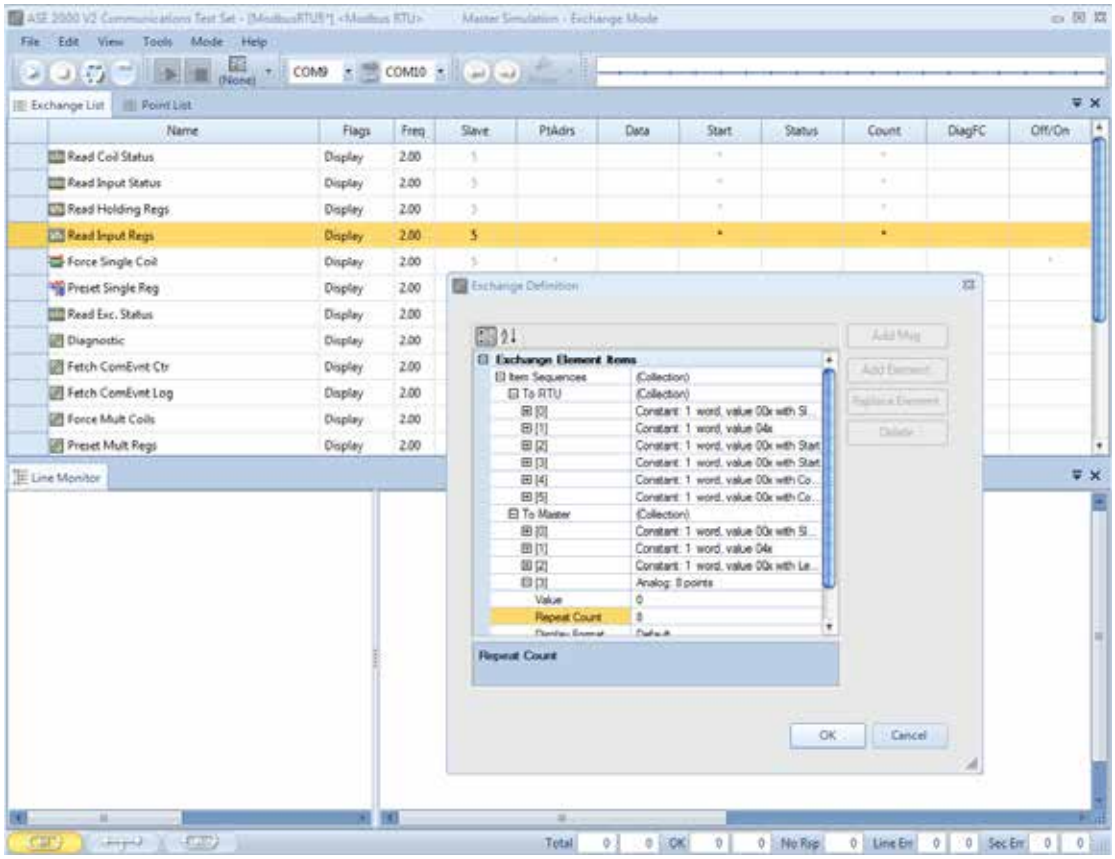
Configure one or more Read exchanges (Read Coil Status, Read Input Status, Read Holding Reg, Read Input Regs) with device point information. The specific Read exchange(s) to configure is a function of how points are configured in the device. In the following example, the device configuration consists of 16 Input Coil points and 8 Analog points in Input Registers.

From the Exchange view, right-click on the line containing the Read Coil Status exchange and select Edit Exchange Definition.



Under the “To Master” section, expand the element “Digital: unknown quantity of blocks”, set “Repeat Count” to 2 (8 digital points per block), then OK.

From the Exchange view, right-click on the line containing the Read Input Regs exchange and select Edit Exchange Definition.



Under the “To Master” section, expand the element “Analog: unknown quantity of blocks”, set “Repeat Count” to 8 (1 analog point per count), then OK.

29.1.2. Modbus – Set RTU ID and Group

The RTU ID and Group number can be set for all exchanges from the Protocol > Properties display or individually on the Exchange List view.

29.1.3. Modbus – Exchange Mode Line Monitor

No additional setup is required. If cabling is correct Line Monitoring can be started by selecting the Start button.

29.1.4. Modbus – Exchange Mode Master Simulation

If the Communication Properties, Exchange Definition, and Slave device number have been configured, Master Simulation operations can be performed. No additional setup is required.

29.1.5. Modbus – Exchange Mode RTU Simulation

If the Communication Properties, Exchange Definition, and Slave device number have been configured, Master Simulation operations can be performed. No additional setup is required

29.1.6. Modbus – Task Mode

For all protocols, Task Mode setup starts by first configuring an RTU and RTU point configuration in the device data base or selection of an existing RTU definition. See the non-protocol specific section “Task Mode Device Selection and Configuration”. Note, when configuring the points for a Modbus device, it is necessary to specify the type of digital and analog points. This is done in the “Group Type” as follows:

Group Type	Definition	Point Type
CS	Coil Status	Digital
IS	Input Status	Digital
HR	Holding Register	Analog
IR	Input Register	Analog

The steps described below for activating Line Monitor, Master Simulation, and RTU Simulation activities assume the correct RTU configuration has been selected.

29.1.7. Modbus – Task Mode Line Monitor

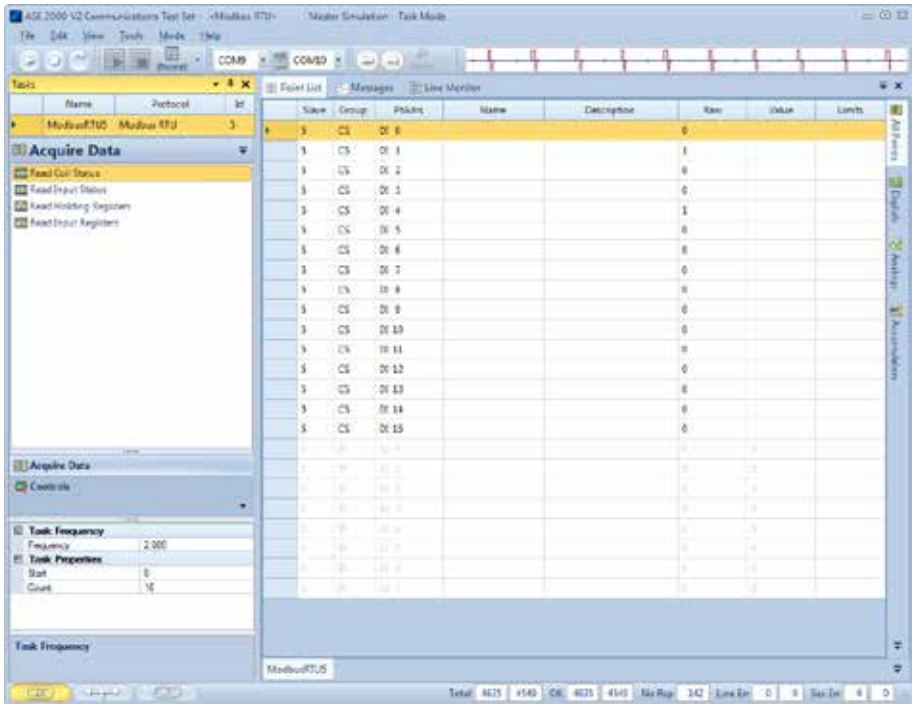
No additional setup is required. If cabling is correct, Line Monitoring can be started by selecting the Line Monitor icon  on the bottom of the test set screen and then selecting the Start button. 

While it is best to accurately enter the RTU/point data base as described, it is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

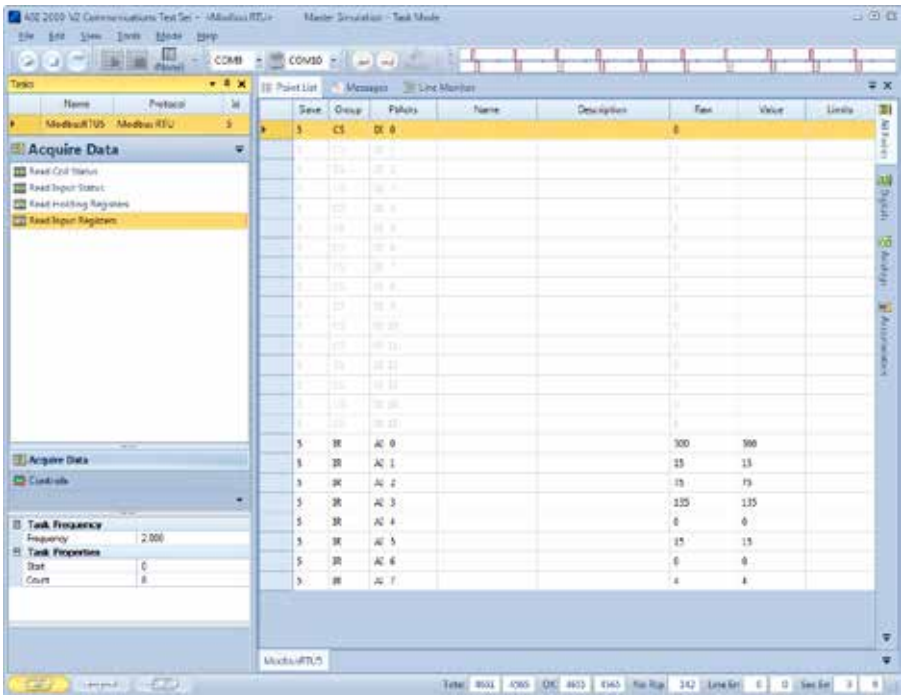
29.1.8. Modbus – Task Mode Master Simulation

Master Simulation operation works by selecting a Task Group and then a Task Activity within that group.

With the desired Task Activity selected, execute the function one time using the Send Once icon or continuously by selecting the Start Button.



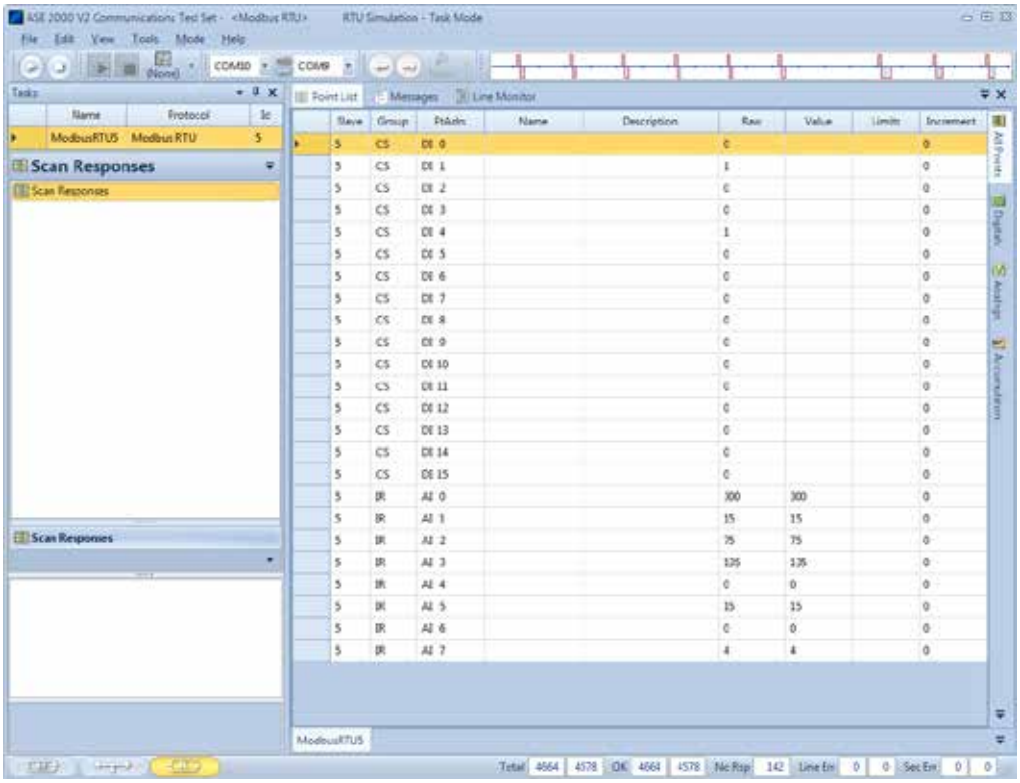
For Modbus, the Task Groups are Acquire Data and Controls. The Acquire Data task Activities are Read Coil Status, Read Input Status, Read Holding Regs, and Read Input Regs. The above display illustrates Read Coil Status and the display below illustrates the Read Input Regs activity.



29.1.9. Modbus – Task Mode RTU Simulation

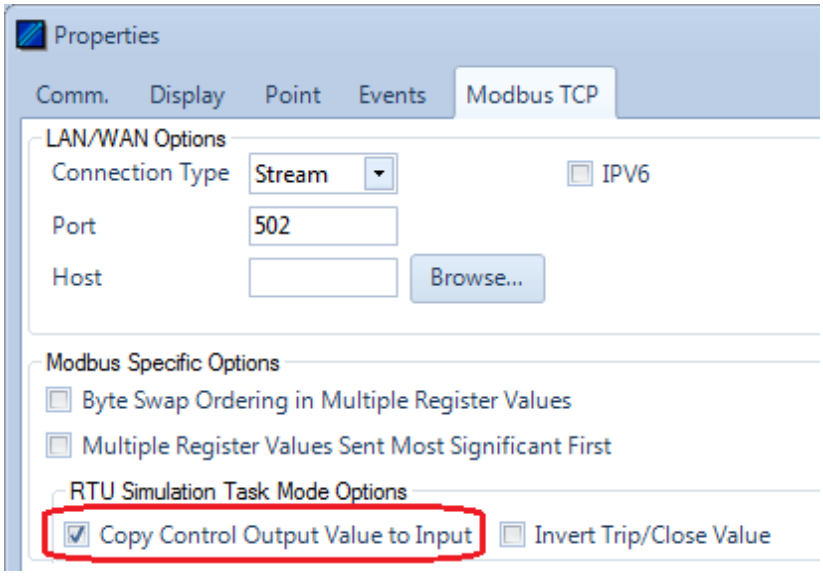
Task Mode RTU Simulation utilizes the RTU and Point Data previously configured for the device to generate responses to master commands for data values. When RTU Simulation mode is selected  , the Raw and Increment fields on the Point List view are enterable. This provides the capability of changing the simulation value for individual points and to control whether the value will change (Increment value) on successive scans.

Another method to change simulation values for individual points is to send control commands from the Master as described in the next section.



29.1.10. Modbus – Configuring Output Controls to Change Input Point Values

To modify Coil Status and Holding Register values at the RTU by sending controls from the master station, select the “Copy Control Output Value to Input” feature from the Modbus tab in the Properties menu. Writing “Off” to a coil causes ‘0’ to be written to the Input Coil; “On” is ‘1’. To invert this interpretation, select the “Invert Trip/Close Value” check box.



When enabled, states written to output coil index ‘n’ will cause a change in the state of input coil ‘n’, and similarly for writes to Output registers and values of Holding Registers.

30. Telegyr 8979 – Protocol Specific

Most test set operations are independent of the specific protocol being used and are described in the non-protocol specific topics. The most common protocol specific activity is defining the message structure for a particular RTU. This involves defining the number and types of points (analog, digital, and accumulator) configured in the device (RTU, IED) under test. This information enables the test set to issue the proper data scan request and to parse and correctly display information in data response messages. The following sections will describe the protocol specific considerations, if any, for Task and Exchange operational modes and, within those modes, any communication mode (Line Monitor, Master Simulation, and RTU Simulation) protocol specific considerations.

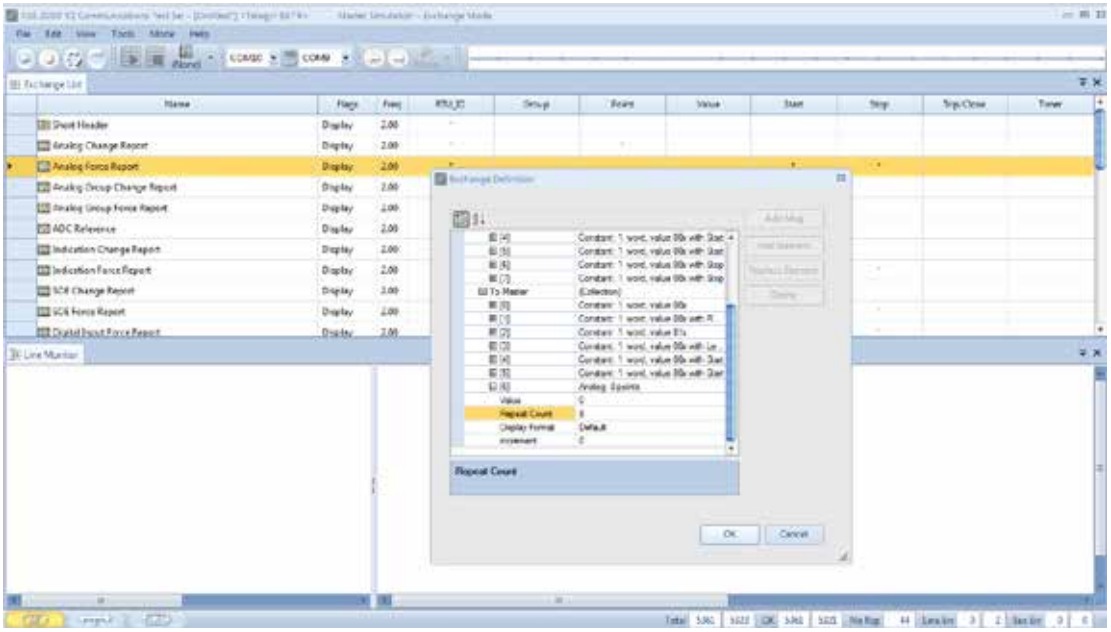
30.1. Telegyr 8979 – Exchange Mode

For Exchange Mode, protocol specific tasks are editing Exchange Definition and setting RTU address information.

30.1.1. Telegyr 8979 – Edit Exchange Definition

Configure one or more Read exchanges (Analog Force Report, Analog Group Force Report, Indication Force Report) with device point information. The specific Read exchange(s) to configure is a function of how points are configured in the device. In the following example, the device configuration consists of 16 Indication and 8 Analog points.

From the Exchange view, right-click on the line containing the Analog Force Report exchange and select Edit Exchange Definition.



Under the “To Master” section, expand the element “Analog: unknown quantity of blocks”, set “Repeat Count” to 8 (1 analog point per block), then OK.

From the Exchange view, right-click on the line containing the Indication Force Report exchange and select Edit Exchange Definition.

Under the “To Master” section, expand the element “MCD: unknown quantity of blocks”, set “Repeat Count” to 2 (8 Indication points per count), then OK.

30.1.2. Telegyr 8979 – Set RTU ID and Group

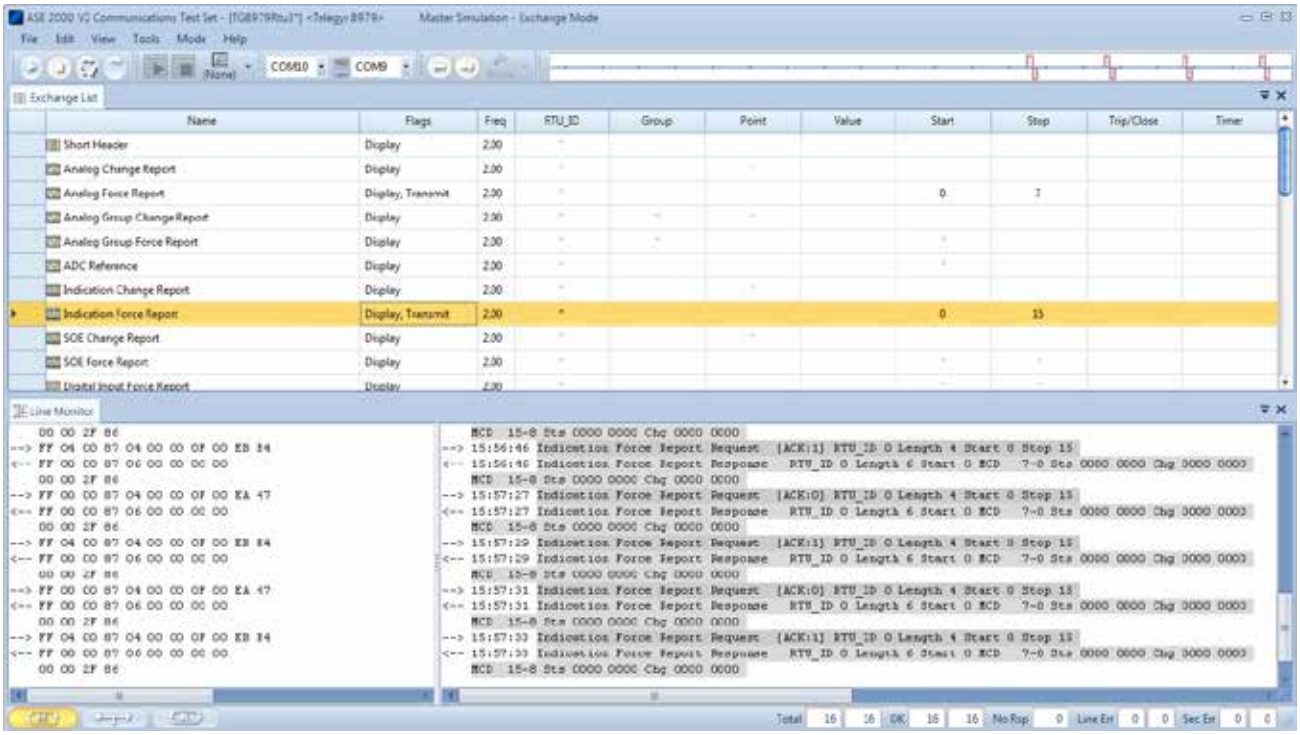
The RTU ID can be set for all exchanges from the Tools>Properties>Protocol tab display or individually on the Exchange List view.

30.1.3. Telegyr 8979 – Exchange Mode Line Monitor

No additional setup is required. If cabling is correct Line Monitoring can be started by selecting the Start button.

30.1.4. Telegyr 8979 – Exchange Mode Master Simulation

If the Communication Properties, Exchange Definition, and RTU ID have been configured, set the Start and Stop point numbers for the Analog Force Report and Indication Force Report on the Exchange Properties display or on the Exchange List display. Bring up the associated Exchange Properties display by double-clicking on the exchange name on the Exchange List display. In the following example, Start/Stop have been configured for 8 analog and 16 MCD points.



30.1.5. Telegyr 8979 – Exchange Mode RTU Simulation

If the Communication Properties, Exchange Definition, and RTU ID have been configured, Master Simulation operations can be performed. No additional setup is required. RTU ID can be set to * (wild card) to respond to any RTU ID.

30.2. Telegyr 8979 – Task Mode

For all protocols, Task Mode setup starts by first configuring an RTU and RTU point configuration in the device data base or selection of an existing RTU definition. See the non-protocol specific section “Task Mode Device Selection and Configuration”. Note, when configuring the points for a Telegyr 8979 device, it is necessary to specify a Group Type for digital and analog points. This group information is used by the test set to determine which command to use when polling for data. This is done in the “Group Type” as follows:

Group Type	Definition	Point Type
ANG	Analog related commands	Analog
ADC	Reference Analog Points	Analog
IND	Indication Points	Digital (MCD)
SOE	Sequence of Event (SOE)	Digital
DIG	Digital Input commands	Digital
ACC	Accumulator commands	Pulse Accumulator

The steps described below for activating Line Monitor, Master Simulation, and RTU Simulation activities assume the correct RTU configuration has been selected.

30.2.1. Telegyr 8979 – Task Mode Line Monitor

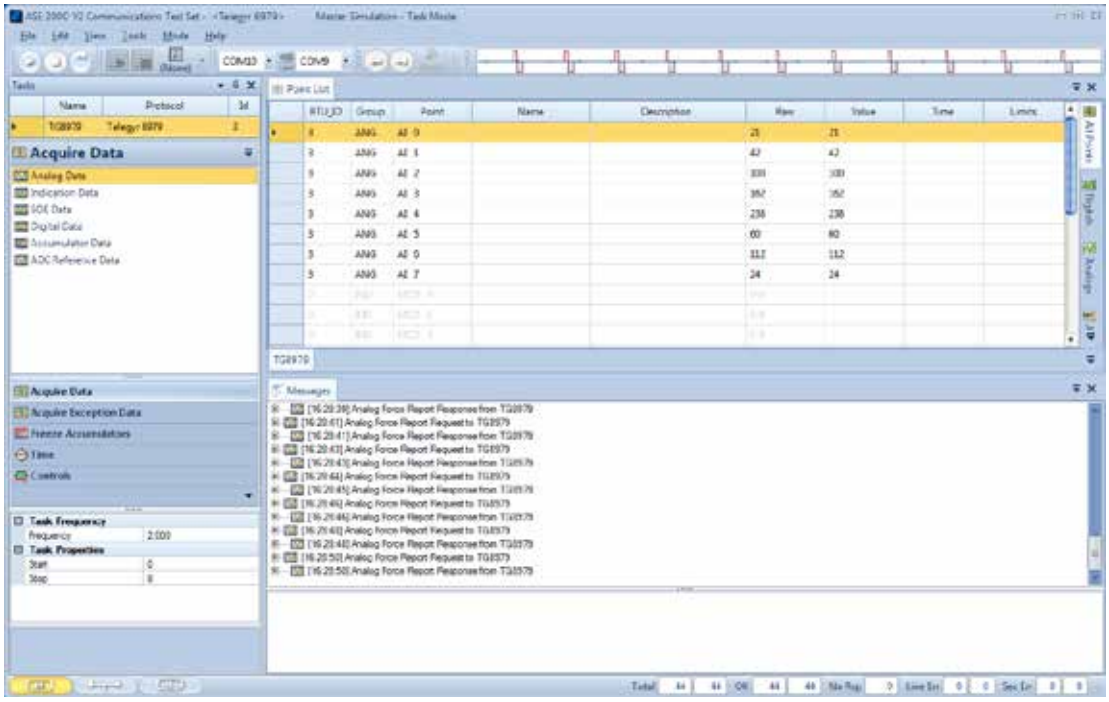
No additional setup is required. If cabling is correct, Line Monitoring can be started by selecting the Line Monitor icon  on the bottom of the test set screen and then selecting the Start button. 

While it is best to accurately enter the RTU/point data base as described, it is not required for Line Monitor operations. An undefined input point is automatically added to the data base when detected.

30.2.2. Telegyr 8979 – Task Mode Master Simulation

Master Simulation operation works by selecting a Task Group and then a Task Activity within that group.

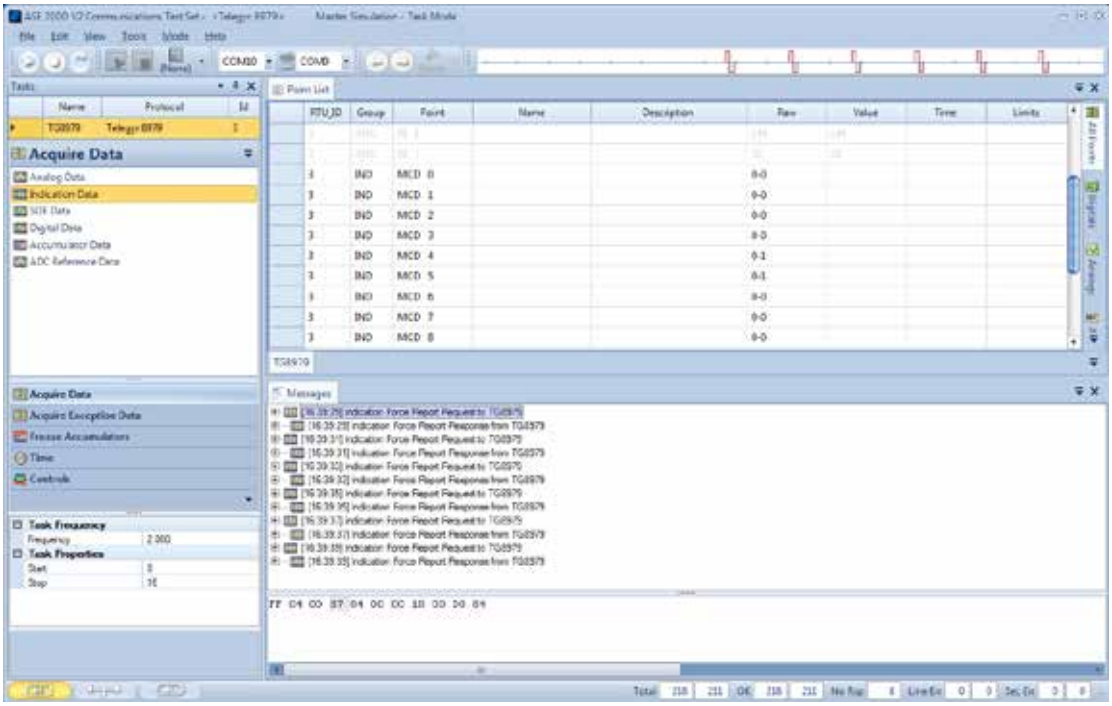
With the desired Task Activity selected, execute the function one time using the Send Once icon or continuously by selecting the Start Button.



For Telegyr 8979, the Task Groups are:

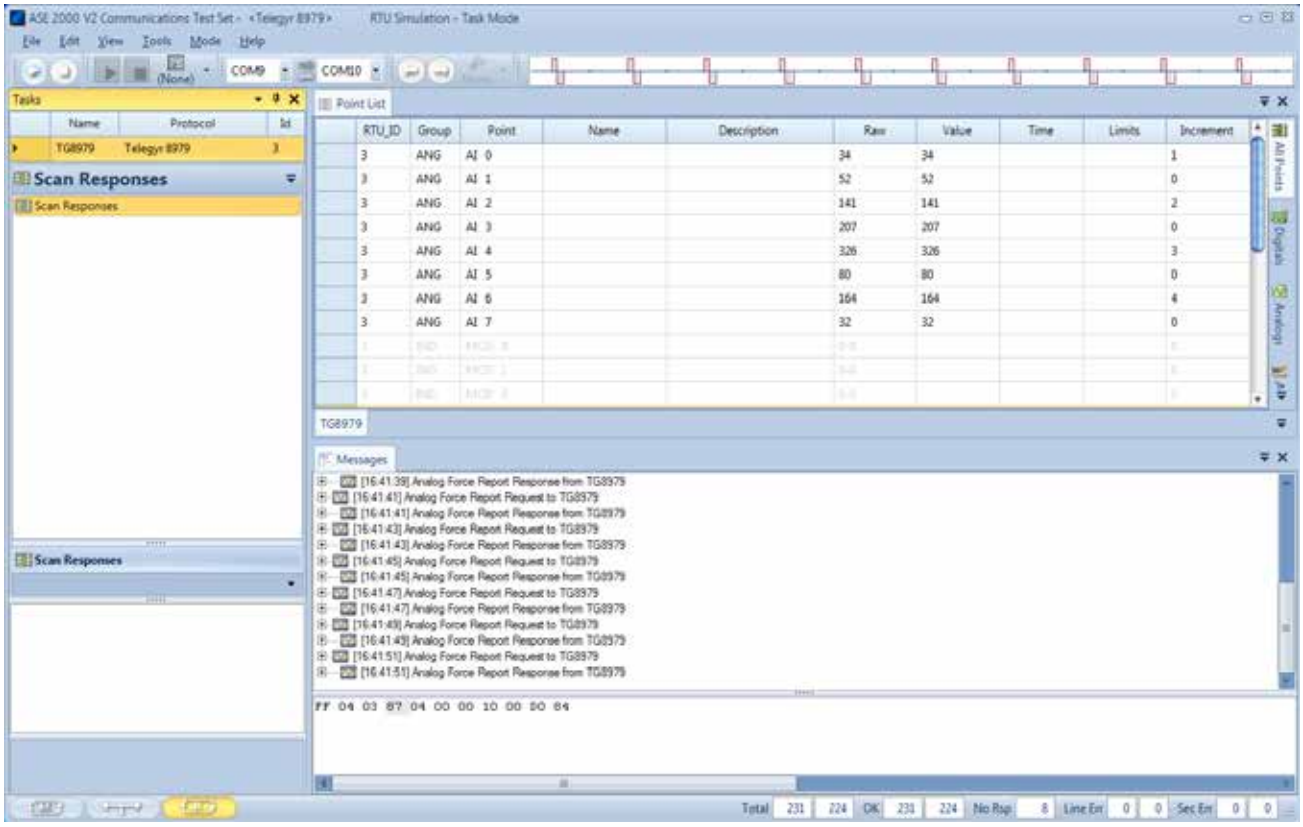
- Analog Data
- Indication Data
- SOE Data
- Digital Data
- Accumulator Data
- ADC Reference Data

The above display illustrates Analog Data (Analog Force Report) and the display below illustrates activity.



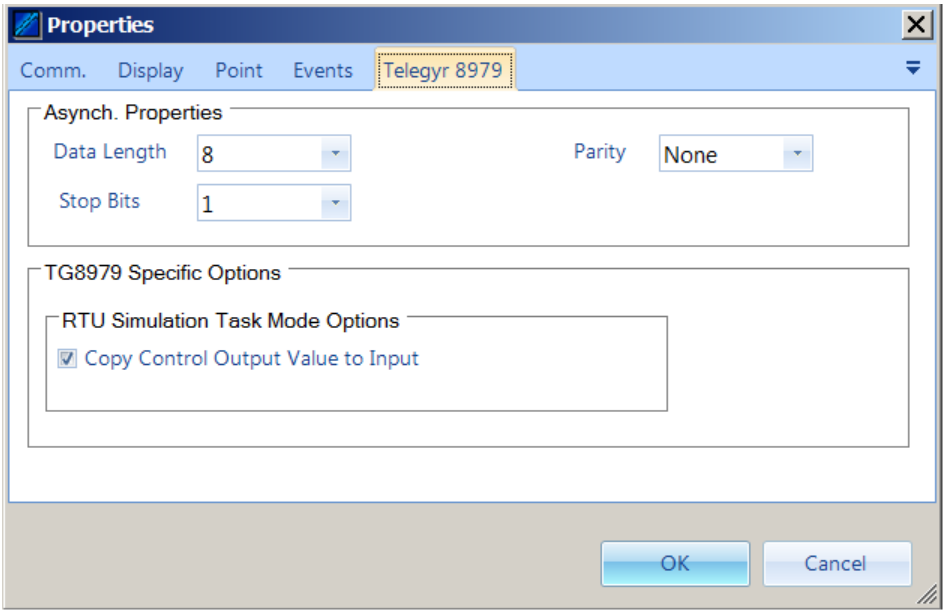
30.2.3. Telegyr 8979 – Task Mode RTU Simulation

Task Mode RTU Simulation utilizes the RTU and Point Data previously configured for the device to generate responses to master commands for data values. When RTU Simulation mode is selected  , the Raw and Increment fields on the Point List view are enterable. This provides the capability of changing the simulation value for individual points and to control whether the value will change (Increment value) on successive scans.



30.2.4. Telegyr 8979 – Mapping Output Controls to Change Input Point Values

To modify values at the RTU by sending controls from the master station, select the “Copy Control Output Value to Input” feature from the Telegyr 8979 tab in the Properties menu.



Add the control point index enclosed in square brackets to the description field of the input point to create a link between that input point and an output point index, as shown in the screen shot below. The number within the square brackets defines the index of an output point. When a command is issued to that point, the state/value of the corresponding input point is changed.

Analog output values are copied directly to an analog input point. For digital controls, a Trip command defaults to a value of zero and a Close command defaults to one.

Control commands to a trip/close point
Binary link – [1] appears in the Description field for IND point 1: Controls to point 1 will change the state of indication point 1.

Analog link – [6] appears in the Description field for AI point AI 2: A value written to analog output point 6 will change the value AI 2.

Point List

	RTU_ID	Group	Point	Name	Description	
▸	1	ANG	AI 0			0
	1	ANG	AI 1			0
	1	ANG	AI 2		[6]	0
	1	ANG	AI 3			0
	1	ANG	AI 4			0
	1	ANG	AI 5			0
	1	ANG	AI 6			0
	1	ANG	AI 7			0
	1	IND	DI 0			0
	1	IND	DI 1		[1]	0
	1	IND	DI 2			0
	1	IND	DI 3			0
	1	IND	DI 4			0
	1	IND	DI 5			0
	1	IND	DI 6			0
	1	IND	DI 7			0

As stated, the default for control outputs is to associate trip with 0 and close with 1. To invert this option, place a ‘!’ symbol before the point index. For example:

- [1] maps a trip to point 1 to ‘0’, and a close to point 1 to ‘1’
- [!1] maps a trip to point 1 to ‘1’, and a close to point 1 to ‘0’
- Comment text can be placed in the description field outside of the square brackets