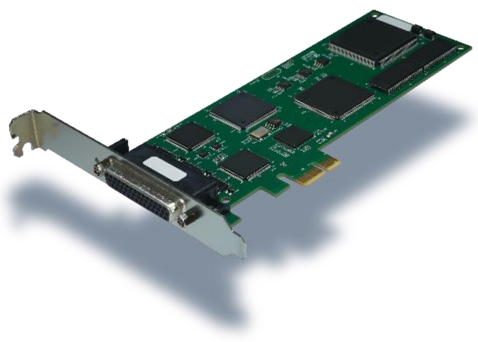
FarSync® BERT

User Guide



FarSync BERT PCIe

FarSync BERT HS PCIe

FarSync BERT USB

FarSync BERT HS USB

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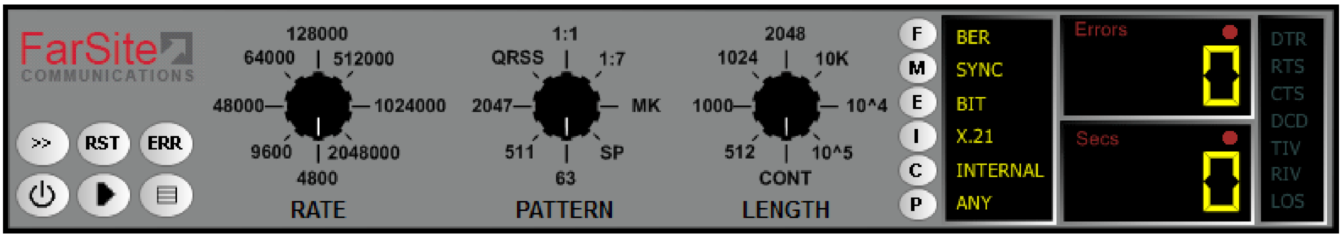
1 Getting Started

The FarSync Bit Error Rate Tester (BERT) is a Windows-based application that is used to test the quality of both synchronous and asynchronous lines. Industry-standard test patterns are used to identify bit error rates for the line under test. The results of the tests are collated and displayed as industry-standard metrics e.g. Errored Seconds (ES) etc.

In addition to the standard configuration, the FarSync BERT's Multi-Drop mode can be used to test the data paths of multiple nodes simultaneously on a Multi-Drop network using Industry-standard test patterns.

An additional Round Trip Delay mode enables the BERT to measure the Round Trip Delay of packets to a resolution of 1ms.

The FarSync BERT runs on Windows 11 and 10 as well as Windows Server 2025, 2022 and 2019. Its uses either a USB-attached, BERT-enabled FarSync Flex[1] device or a BERT-enabled FarSync K2Ee PCI Express card to connect to the line under test.

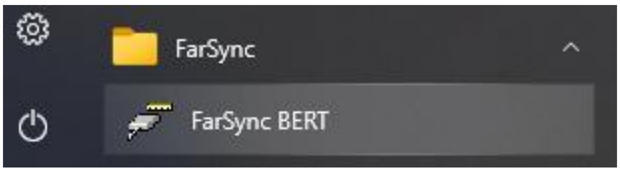


Using the FarSync BERT is quick and easy:

1) Ensure that either a BERT-enabled FarSync Flex is attached, or a BERT-enabled FarSync K2Ee card is physically installed in the machine. The device/card's drivers must then be installed - instructions for this are described in Section 2.1.

2) Ensure at the FarSync BERT application has been installed by running the **FarSyncBERTInstaller** executable (instructions are in Section 2.2).

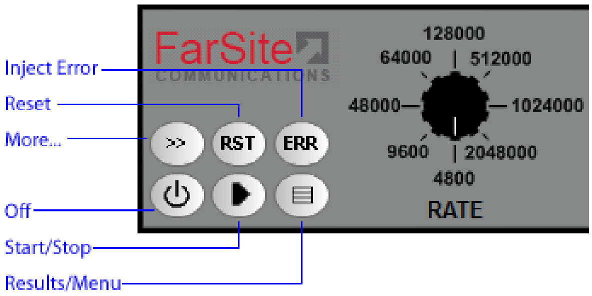
3) Run the FarSync BERT by clicking the **Start - FarSync - FarSync BERT** menu entry:



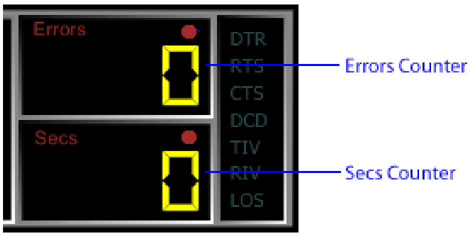
[1] Note that two variants of the FarSync BERT are available: Standard or HighSpeed. The former supports speeds up to 2Mbps. HighSpeed Flex-based BERTs support speeds up to 16Mps. BERT devices can be identified by a circular orange label on the device. This is marked with an 'H' if the device supports HighSpeed mode. Similarly, FarSync PCIe cards can be Standard [2Mbps] or HighSpeed [up to 20Mbps for the K2Ee (if one port is in use, otherwise 16Mbps)]

4) When the FarSync BERT display appears, configure the required **RATE**, **PATTERN** and **LENGTH** values along with the (I)nterface, INT/EXT clocking and Async/Sync interface (M)ode settings as required for the test.

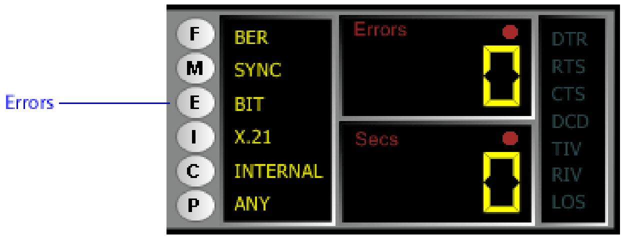
5) Then simply click the FarSync BERT's **Start** button (as shown in the diagram below)



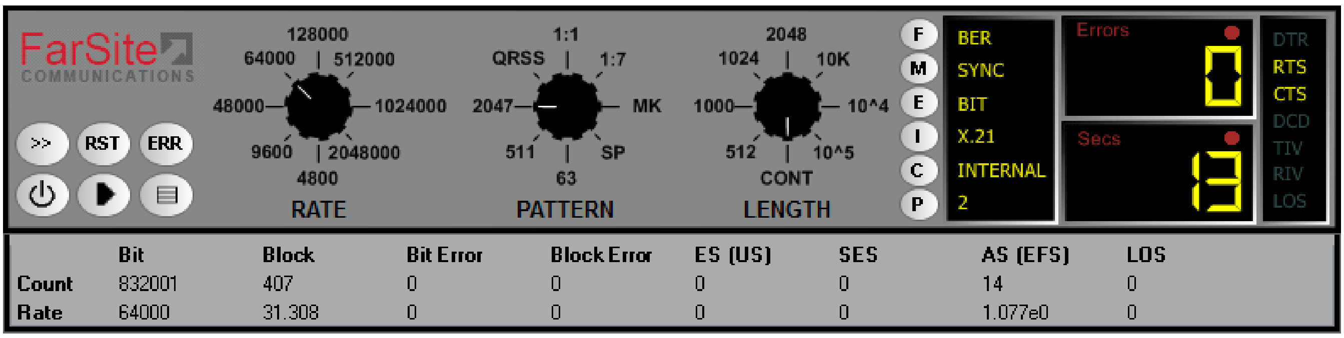
Whilst the test is running the **Errors** counter will display the number of Bit Errors, Block Errors, Errored Seconds, Parity Errors, Framing Errors or All Errors that have occurred during the test. The **Secs** counter displays the total number of seconds that the test has been running for.



Pressing the **Errors** button (as shown in the diagram below) causes the **Errors** counter to switch between **BIT**, **BLOCK, SECONDS, PARITY, FRAME** and **ALL** error counter values.



At any point the **Table** button can be used to display a table of statistics for the current (or most recent) test.



To return to the compact view (i.e. without the statistics table displayed) press the **Table** button once more.

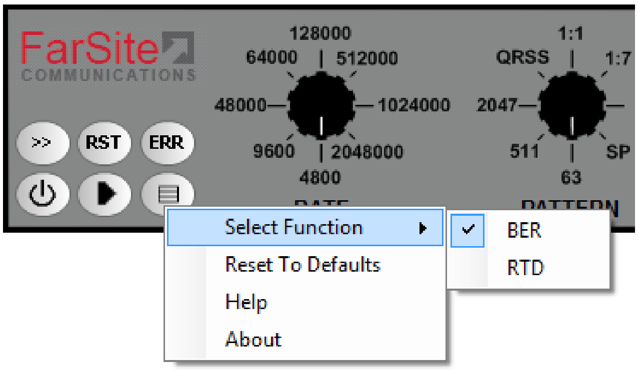
If the test is setup to run continuously (i.e. with **LENGTH** set to **CONT**) then use the **Stop** button to complete the test when required.

Test results are retained until either the test is restarted (by pressing the **Start** button) or the test is reset at any time (using the **Reset** button).

When the FarSync BERT is unable to synchronise with the incoming data (e.g. due to a physical break in the line, the wrong test pattern configured etc.) the Loss-of-Sync (**LOS**) indictor will be highlighted.

The interface signals states (DTE and DCE), as well as the RIV indicator, are updated in real-time in the Signals pane whilst the test running.

Note that right-clicking the Table/Menu button presents a context menu:



The **Reset To Defaults** menu option can be used to completely reset **all** the FarSync BERT's configuration parameters back to their factory default values.

See Section 3 for details of the FarSync BERT Test Functions.

2 Installation

2.1 FarSync Drivers Installation

The FarSync Drivers can be installed on Windows 11 and 10 as well as Windows Server 2025, 2022 and 2019.

Ensure that your FarSync devices/cards are physically installed in/attached to the target PC.

Download the drivers from www.farsite.com/download using the fulfilment code supplied with your product.

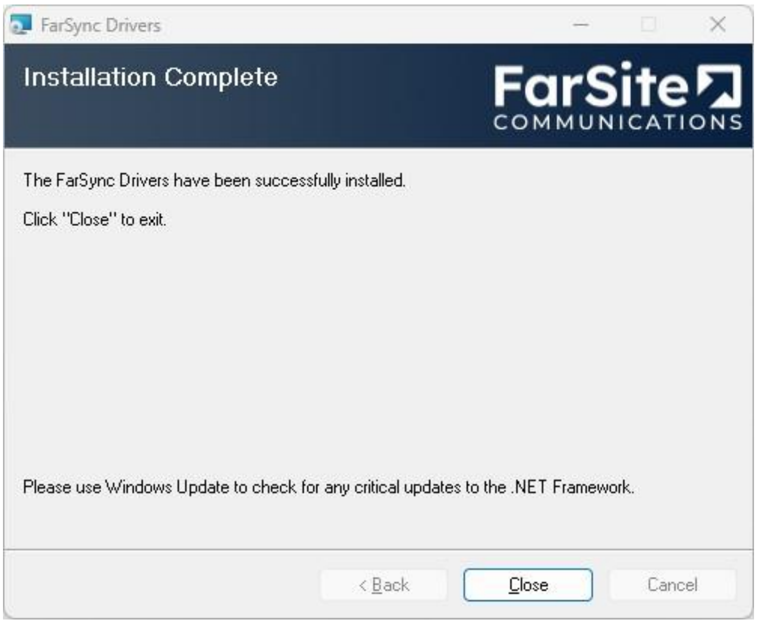
Run the **FarSyncDriversInstaller** executable that you have downloaded. The following screen should then be presented:

Press Next

Press Next

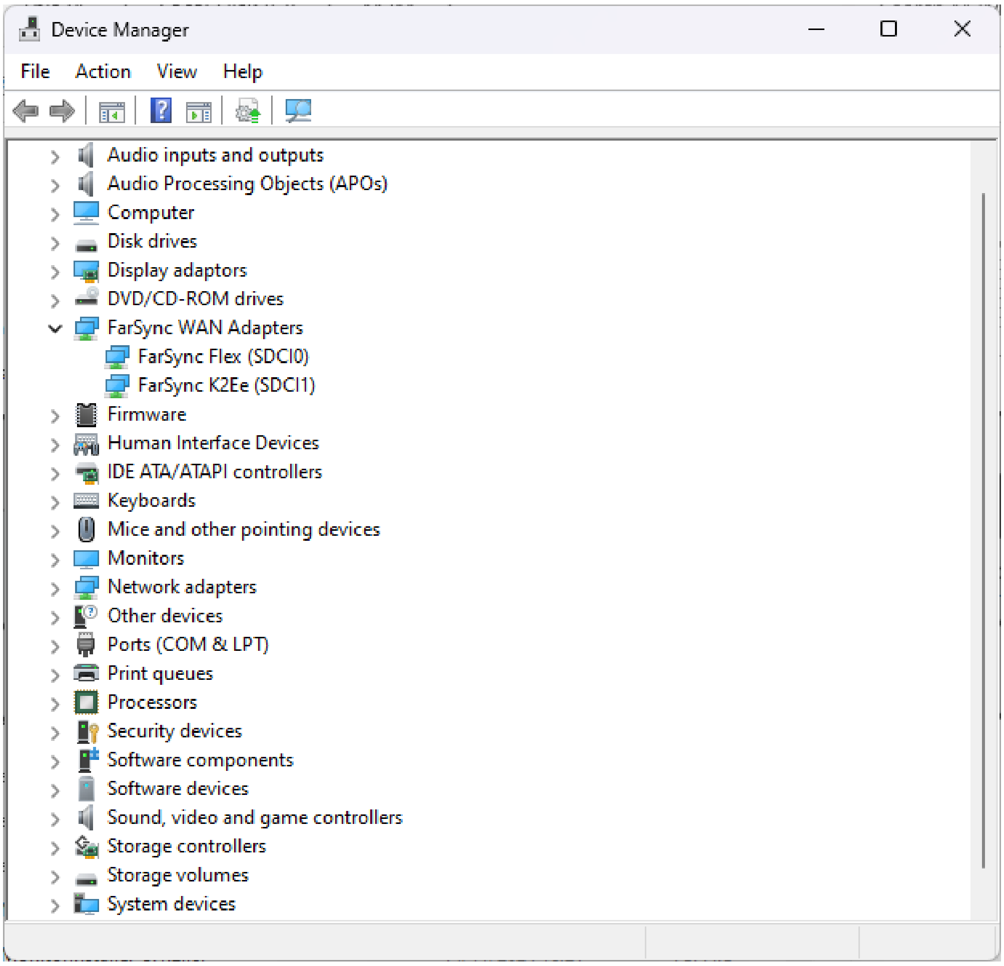
Press Next

If you accept the Licence Agreement, select I Agree and then press Next



Press Close

The installed devices can then be identified in Windows’ Device Manager list of devices. To see this, right click the Windows **Start** button and select **Device Manager**:



You should now proceed and install the FarSync BERT software (instructions are in Section 2.2).

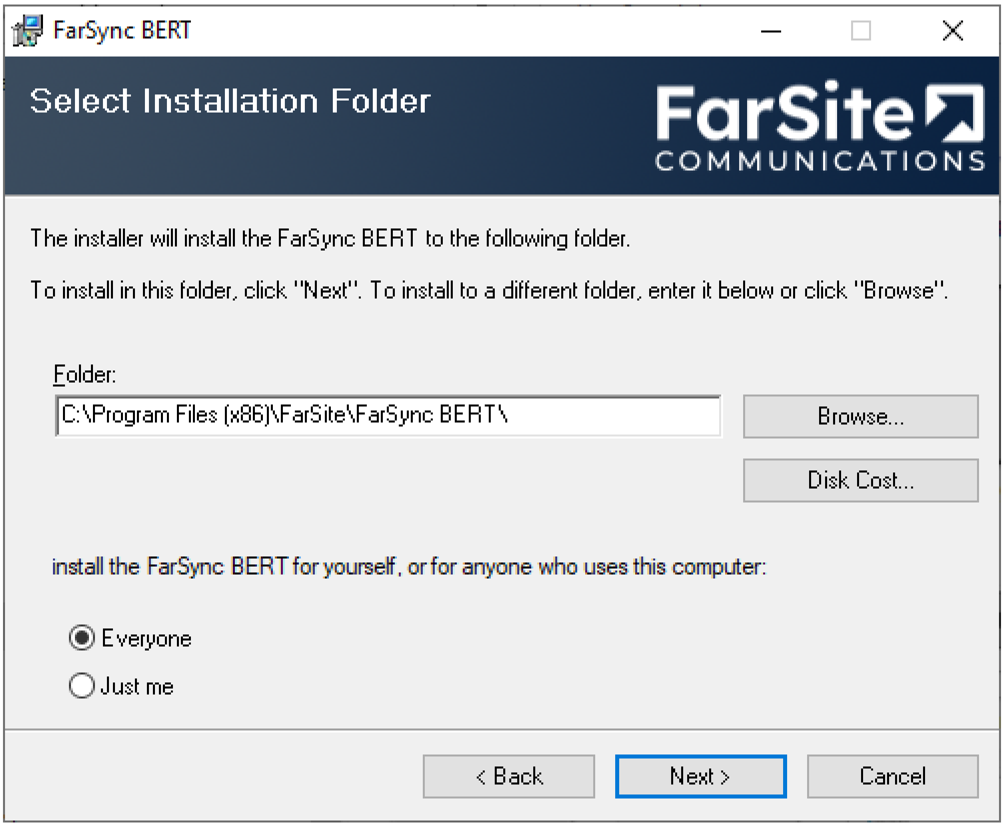
2.2 FarSync BERT Installation

Once the FarSync Flex (or FarSync K2Ee) device/driver has been installed, the FarSync BERT application itself should be installed.

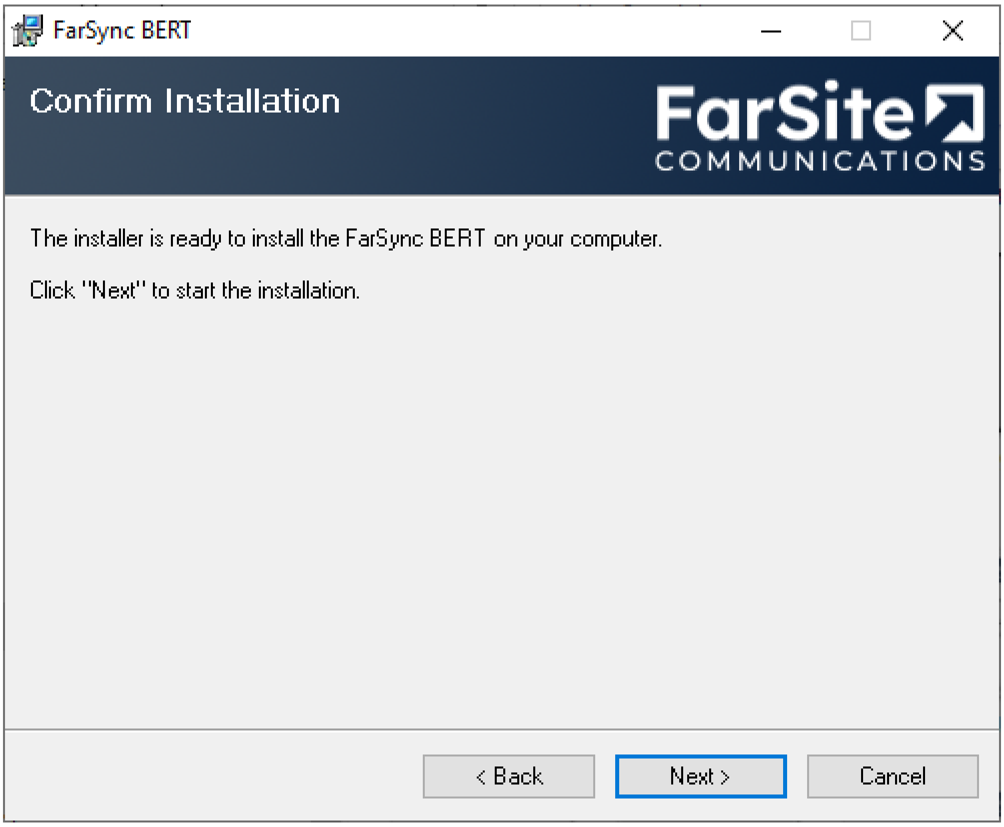
Download the FarSync BERT from www.farsite.com/download using the fulfilment code supplied with your product.

Run the **FarSyncBERTInstaller** executable that you have downloaded. The following screen should then be presented:

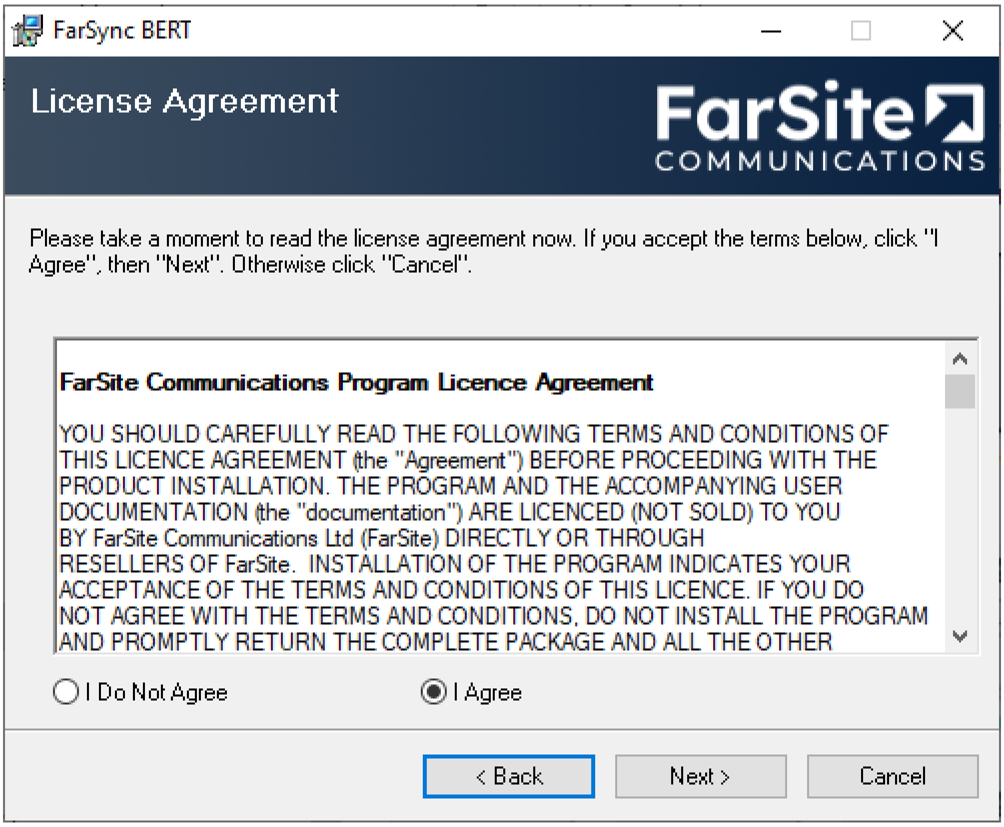
Press Next



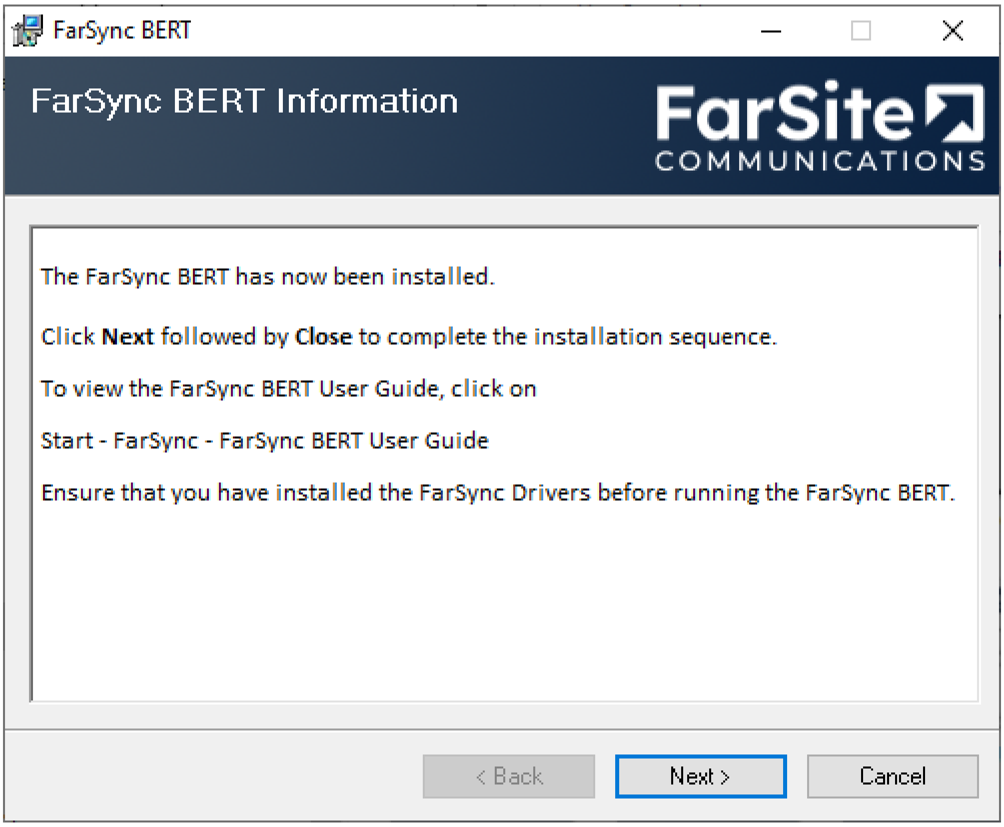
Press Next



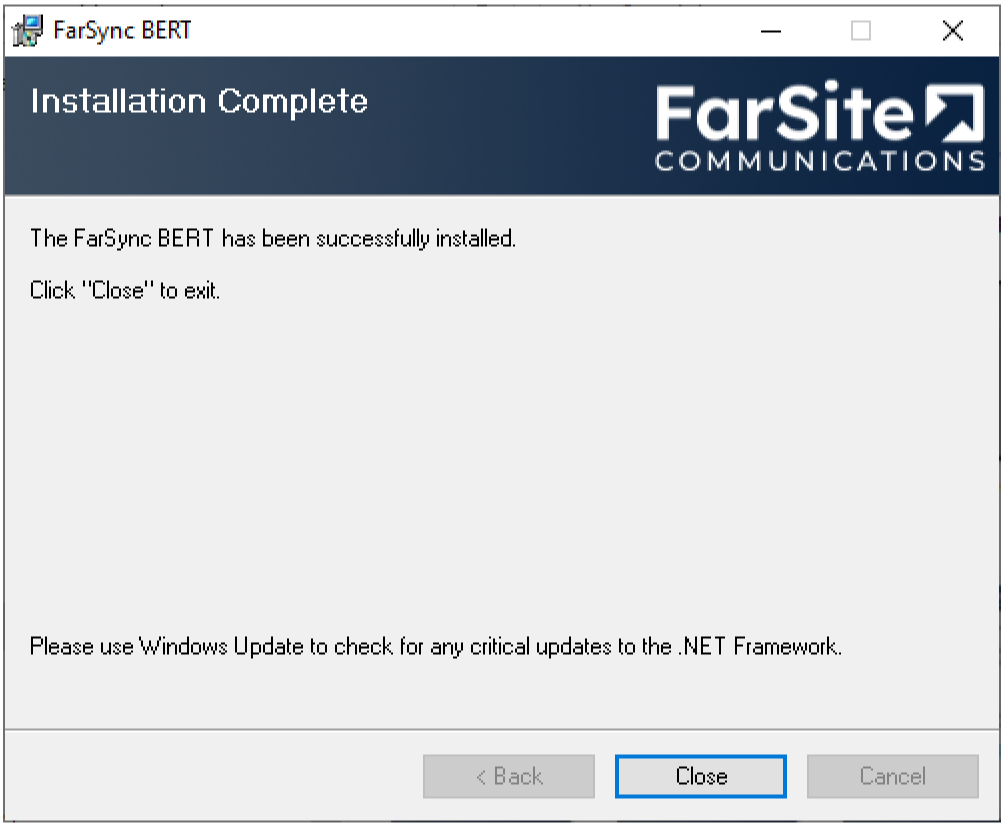
Press Next



If you accept the Licence Agreement, select **I Agree** and then press Next

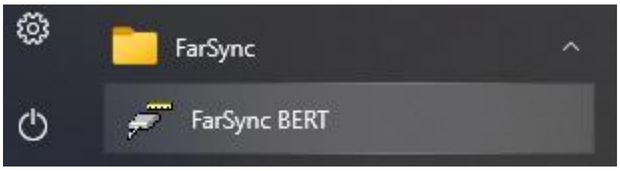


Press Next

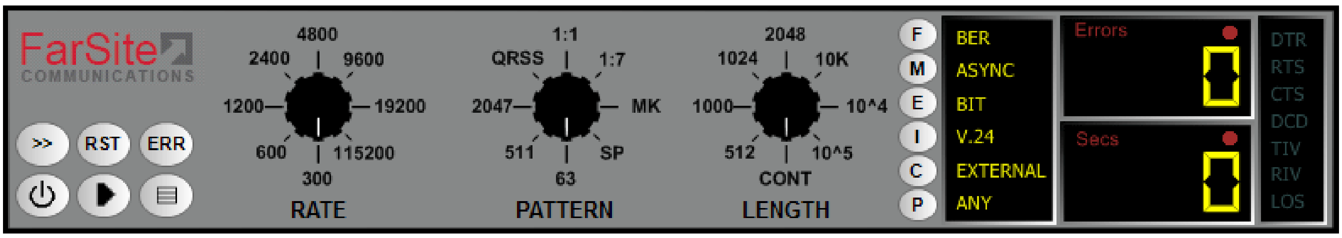


Press Close

The **FarSync BERT** can be then be started via the **Start - FarSync - FarSync BERT** menu entry:



The FarSync BERT's main display will then be presented:



Once the FarSync BERT is running, you can press the F1 key to display the help window.

Details of how to configure the FarSync BERT can be found in Section 4.

3 Test Functions

The FarSync BERT supports two test functions which are described below:

- BERT
- Round Trip Delay

3.1 BERT

This is the standard BERT configuration and is used to test the quality of both synchronous and asynchronous lines. Industry-standard test patterns are used to identify bit error rates for the line under test. The results of the tests are collated and displayed as industry-standard metrics e.g. Errored Seconds (ES) etc.

3.1.1 BERT Multi-Drop Mode

In addition to the standard configuration, the FarSync BERT can also be configured to test the data paths of multiple nodes simultaneously on a Multi-Drop network using Industry-standard test patterns.

The Multi-Drop test must always be run in software mode so it overrides the BERT Support setting on the General tab of the Additional Configuration Dialog.

The Multi-Drop test is between a **Master** node and one or more **Slave** nodes. Each slave node on the network has a unique **Slave Id** in the range of 1-247.

The master sends the data pattern to each configured slave and waits for the slave to echo the data pattern back. The master then checks the received data pattern for errors to determine the BER for that slave. The list of slaves to be sent packets is configured in the Slaves To Poll text box.

The data pattern is sent to each slave as the payload of a packet. The length of data pattern sent in each packet is configured by setting the Message Payload length.

The packet header contains the **Slave Id** of the slave to send the packet to. When the packet is transmitted, it is seen by all of the slaves on the network, but only the addressed slave can respond and echo back the message.

The packets are sent to each slave, one at a time, waiting for the echoed reply before sending the next packet to the next slave.

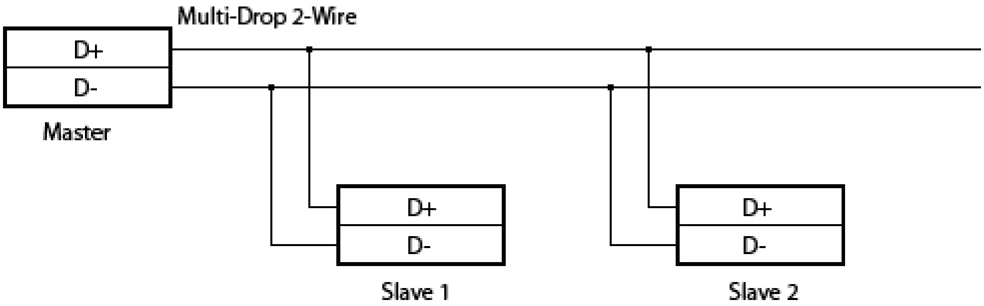
If the master fails to receive a packet from a slave, the slave is deemed to be Unresponsive. If the Poll Unresponsive Slaves checkbox has been ticked, the slave will remain in the list of slaves to poll and will be polled on its next turn. If the checkbox hasn't been ticked, the slave is removed from the list of slaves to poll and takes no further part in the current test. If all slaves are removed from the list of slaves to poll, the test is terminated.

Two interfaces can be used for the Multi-Drop test. RS485-2Wire and RS485-4Wire. In the 2-Wire interface the data is echoed back along the same data lines on which it was transmitted. In the 4-Wire interface the transmit and receive data lines are kept separate.

In the Multi-Drop mode, the auto-invert feature can be used to determine if the connection to a slave has been wired incorrectly.

To detect crossed wires Manchester Encoding signaling must be used.

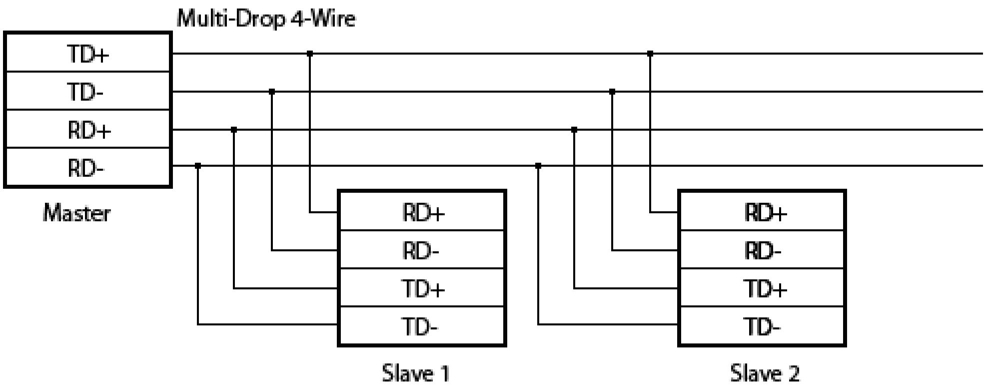
An additional Round Trip Delay mode enables the BERT to measure the Round Trip Delay of packets to a resolution of 1ms.



In the 2-Wire configuration, if a slave's D+ and D- wires have been incorrectly wired, the slave won't be able to detect and echo back packets which have been addressed to it and therefore won't be able to achieve sync.

If the slave fails to achieve sync (within 2 seconds worth of its time slice), the FarSync BERT inverts its TX and RX data. Whilst the TX and RX data are inverted, the inversion indicators **TIV** and **RIV** are displayed in the **Inverted** column in the **Multi-Drop Results** dialog.

- <nothing> Slave's D+ and D- wires have been wired correctly
- TIV/RIV Slave's D+ and D- wires have been swapped



In the 4-Wire configuration, if a slave's RD+ and RD- wires have been incorrectly wired, the slave won't be able to detect messages addressed to it. If a slave's TD+ and TD- wires have been incorrectly wired, it won't be able to echo the data back successfully.

If the slave fails to achieve sync (within 2 seconds worth of its time slice), the FarSync BERT inverts its TX and RX data. Whilst the TX and RX data are inverted, the inversion indicators **TIV** and **RIV** are displayed in the **Inverted** column in the **Multi-Drop Results** dialog.

If sync is achieved whilst one of the inversion indicators is displayed, it means:

- TIV The slave's RD+ and RD- wires have been swapped
- RIV The slave's TD+ and TD- wires have been swapped
- TIV/RIV Both the slave's RD+ and RD- wires and TD+ and TD- have been swapped

Note that the TIV and RIV indicators in the signals pane are not used whilst the FarSync BERT is in Multi-Drop mode.

Whilst the test is running, the results are shown in the Multi-Drop Results dialog. The results for each configured slave are shown along with a merged 'Total'.

3.2 Round Trip Delay

The Round Trip Delay test measures how long it takes for a packet to be received after it has been transmitted. The timestamps are taken at the hardware level and the measurements provide a resolution of one millisecond.

Packets are transmitted one at a time with each packet being transmitted as soon as the previous packet is received or after a configured Transmit Delay.

If a packet is transmitted but not received within the configured Receive Timeout, the packet is declared as lost.

The packet comprises a header and a payload. The payload length is configured by setting the Payload Length. The payload contains a fixed data pattern. The first byte of the payload is the sequence number and subsequent bytes contain an incrementing byte pattern.

3.2.1 RTD Measurement

The accuracy of the RTD measurement is subject to limitations imposed by the hardware. Whilst every effort has been made to compensate for the delays through the hardware, there is still a degree of error in the measurement which is dependent upon the line rate.

The error is due to the varying difference in time between taking the transmission timestamp and the actual point in time at which the packet starts to be transmitted.

The delay can be up to 8/R (where 8 is the number of bits and R is the line rate in bits per second).

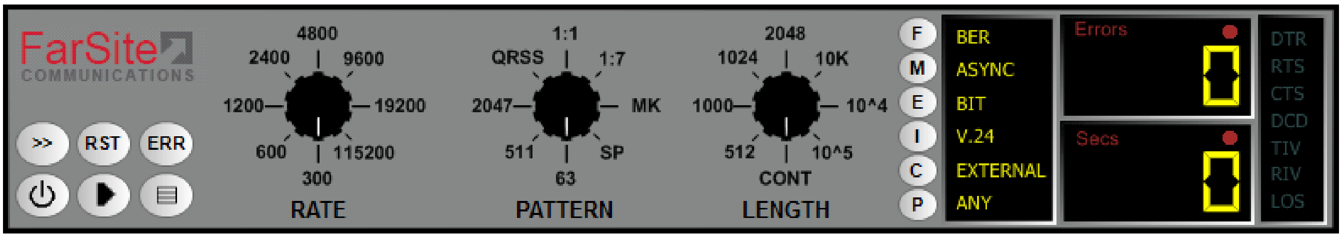
Some example line rates and their maximum measurement errors are shown below.

Line rate (bps)	Maximum possible 8/R error (in milliseconds)
300	26.6
2400	3.33
9600	0.83
64000	0.125
128000	0.0625

You should keep this in mind when selecting the line rate for any Round Trip Delay measurements.

4 Configuration

When the FarSync BERT is run for the first time it will default to the following setup:



In this case, when the test is run it will use

- Interface = V.24 Async
- Rate = 300bps
- the 63-bit pseudorandom test pattern

also

- the **Errors** display will indicate the number of **bit** errors that have occurred since the start of the test
- the test will terminate when the **Stop** button is pressed (since **LENGTH** is set to **CONT**)

Note that whenever the FarSync BERT is started it will default to the configuration that was used when it was previously run.

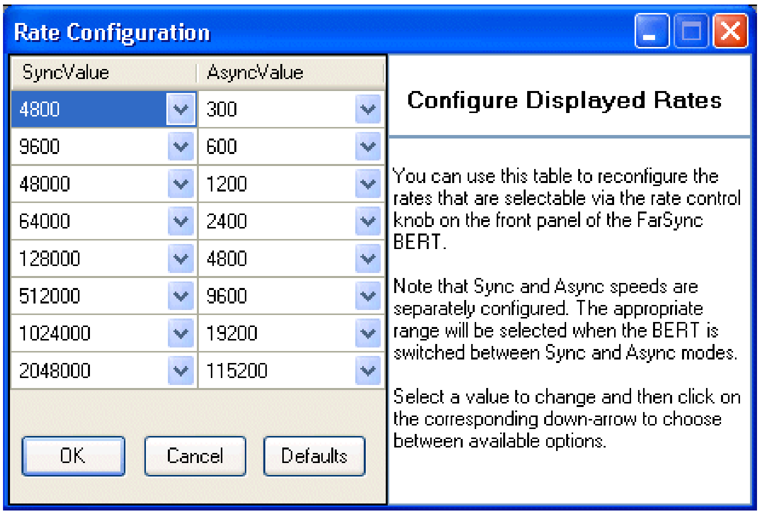
Changing any of the configuration options during a test will cause the test to stop. Simply press the **Start** button (shown above) to start a new test using the new settings.

Details of the available configuration options are listed below.

4.1 Rate

The line rate to be used for the test is selected using the **RATE** control. The range of 8 selectable values that are displayed is dependent on the configured Interface Mode (**ASYNC** or **SYNC**) and the labels will change accordingly as and when the Interface Mode button is pressed.

If required, the values available in this range can be modified by double-clicking the **RATE** control to display the Rate Configuration dialog:



Select the required rate values from the dropdown lists and press OK to update the selectable values. Alternatively a custom value can be entered into any of the 8 locations. Only use custom values if you are sure that the FarSync hardware that you are using does support the customised rate. In the case that the actual configured rate is not supported by the FarSync hardware, the device will choose the closest rate available to it.

Please refer to the FarSync FAQ for details of the rates natively supported by the particular FarSync device that you are using.

Note that the rate need only **exactly** match the required rate if the BERT is generating the clock itself in SYNC mode, or if the Interface Mode is set to **ASYNC** - otherwise simply choose the closest available rate.

If you are experiencing unexpected errors or failure to synchronise whilst running a BERT test, check the **Bit Rate** value that is reported in the Statistics/Results Table and ensure that it is close to the Rate value that you have configured. If it is not, then you may have configured an unsupported rate. Reconfigure the rate value accordingly and rerun the test.

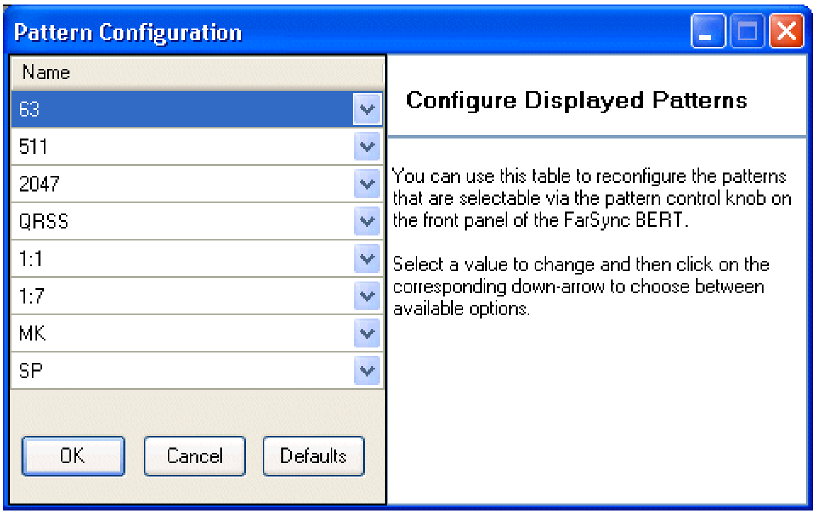
Refer to the Interface Type options for details of the maximum supported rate for each type.

Where the BERT is sourcing clocking (i.e. is configured for **Internal** (INT) Clocking) at rates in excess of 1.5Mbps, the use of Terminal Timing is recommended. Where Terminal Timing is not available, the use of Invert Rx Clock should be considered as an alternative.

4.2 Pattern

The test pattern to be used for the test is selected using the **PATTERN** control. This enables you to select a value from a range of 8 predefined patterns or 8 user-defined patterns.

If required, this range can be modified by double-clicking the **PATTERN** control to display the Pattern Configuration dialog:



Select the required pattern values from the dropdown list and press OK to update the selectable values.

The currently supported patterns are detailed below.

4.2.1 Synchronous Line Patterns

The following *pseudorandom* patterns can be used to test synchronous lines:

- 63: 2^6 -1 including a max of 5 sequential zeros and 6 sequential ones
- 511: 2^9 -1 including a m of 8 sequential zeros and 9 sequential ones (see ITU recommendation O.150/153 for definition)
- 2047: 2^{11} -1 including a max of 10 sequential zeros and 11 sequential ones (see ITU recommendation O.150/152/153 for definition)
- 2^{15} -1 including a max of 14 sequential zeros a 15 sequential ones (see ITU recommendation O.150/151 for definition)
- 2^{20} -1 including a max of 19 sequential zeros and 20 sequential ones (see ITU recommendation O.150/151/153 for definition)
- 2^{23} -1 including a max of 22 sequential zeros and 23 sequential ones (see ITU recommendation O.150/153 for definition)
- QRSS: 2^{20} -1 modified to transmit a maximum of 14 sequential zeros

The following *fixed* patterns can be used to test synchronous lines:

- 1:7 (1/8, 1-in-8) - 1 mark followed by 7 spaces (see ITU recommendation O.153 for definition)
- 1/16 (1:15, 1-in-16) - 1 mark followed by 15 spaces
- 2/8 (2:6 2-in-8) - 2 marks in 8 bits (0100 0010...)
- 3/24, 3-in-24 - 3 marks in 24 bits (0010 0010 0010 0000 0000 0000...)
- MK - all 1s (see ITU recommendation O.153 or definition)
- SP - all 0s (see ITU recommendation O.153 for definition)
- 1:1 - alternating 1s and 0s (see ITU recommendation O.153 for definition)
- FOX (see ITU recommendation R. for definition)

Note that the use of MK and SP patterns is not recommended if you are using Manchester (MAN) encoding.

4.2.2 Asynchronous Line Patterns

The following patterns are recommended for general use on asynchronous lines (see above for definitions):

- 63: 2^6-1

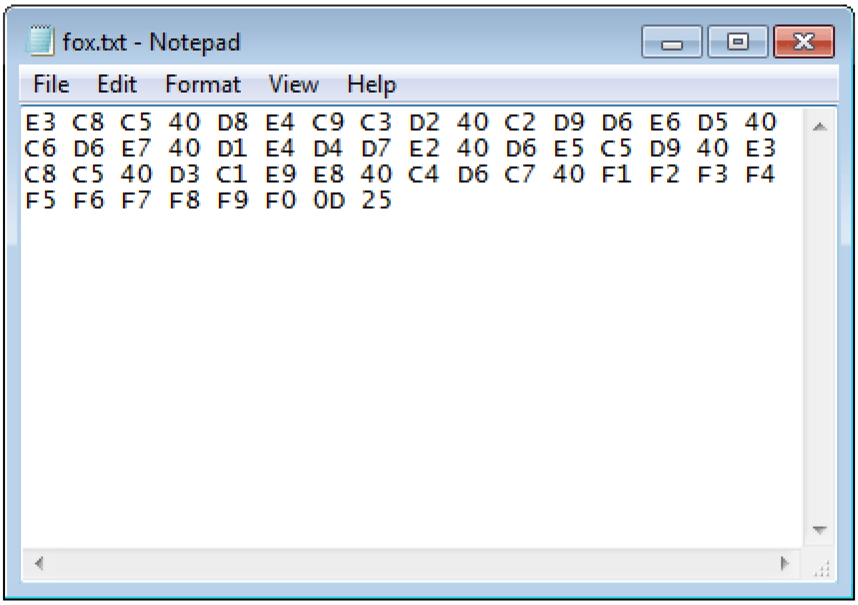
- 511: 2^9-1
- 2047: 2^{11}-1
- FOX

The ITU specifications for some of these industry standard patterns can found at the ITU web-site, https://www.itu.int/en/ITU-T/publications/Pages/recs.aspx.

4.2.3 User Patterns

In addition to the pseudorandom and fixed patterns provided, up to 8 of your own patterns may be selected. To add a user pattern, go to the **Additional Configuration** - **User Patterns** tab and provide the filename and filetype of the file which contains your pattern. The provided files can be in either a binary file format or a text file format (with the data stored as hexadecimal values as shown below).

The pattern length is the number of bytes of data. In the example shown below, this would be 56 bytes (448 bits).



Once you have selected a valid filename, the pattern will be made available in the Pattern Configuration Dialog with one of the default User Pattern Names **USR1** – **USR8**, unless of course, you have changed it. Simply select the pattern to make it available on the **PATTERN** control.

Note that User Patterns can only be used in software mode.

4.3 Test Length

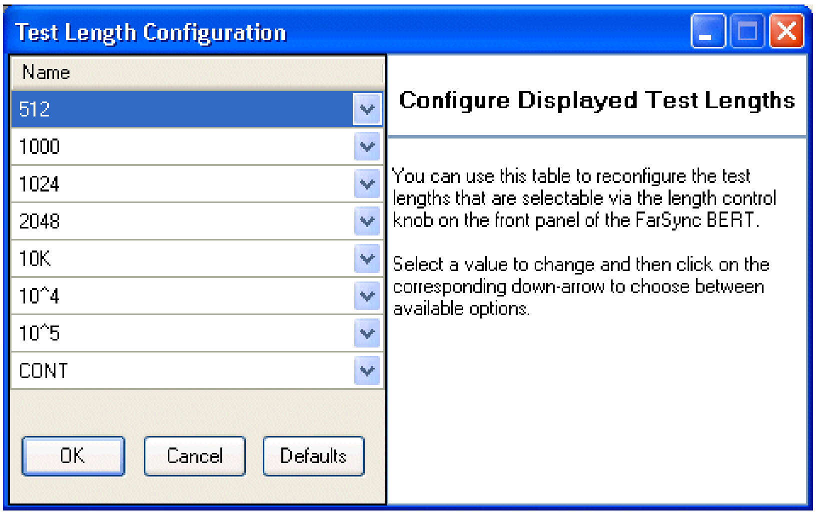
The length of the test is specified using either **LENGTH** or **TIME**. In the time mode, the elapsed time doesn't commence until initial synchronisation is achieved and thus to handle the case where synchronisation never occurs, a timeout is set using **SYNC TIME**.

To cycle between the different modes, double-click on the label beneath the Test Length Dial. For the **TIME** and **SYNC TIME** modes, a clock display appears above the dial showing hours, minutes and seconds in an **HH:MM:SS** format. The three test length modes are shown below:

4.3.1 Length

The length of the test is selected using the **LENGTH** control to choose from the range of 8 selectable values. This length value determines how any bits to test in the received datastream before completing the test. Note that the count does not start until initial synchronisation is achieved.

If required, the values available in this range can be modified by double-clicking the **LENGTH** control to display the Test Length Configuration dialog:



Select the required length values from the dropdown lists and press OK to update the selectable values.

4.3.2 Time

The duration of the test is selected using the **TIME** control. To change the duration, click and drag the **TIME** control in a circular motion. As the control is dragged, the green HH:MM:SS values in the Time Display will increase using a clockwise motion and decrease using an anti-clockwise motion.

The default mode for the **TIME** control is **H:M:S**, whereby the time is updated one second at a time. Alternatively, each of the hours, minutes and seconds values can be set separately by either clicking on the desired value in the Time Display and then clicking and dragging the control or by typing the value in from the keyboard. The currently selected value is highlighted in the Time Display along with the appropriate HOURS, MINS, SECS label which is shown beneath the **TIME** control.

The maximum test duration that can be set is 99 hours, 59 minutes and 59 seconds.

4.3.3 Sync Time

The Synchronisation Time sets the timeout to wait for synchronisation to occur. If synchronisation doesn't occur within the specified time, the test is stopped.

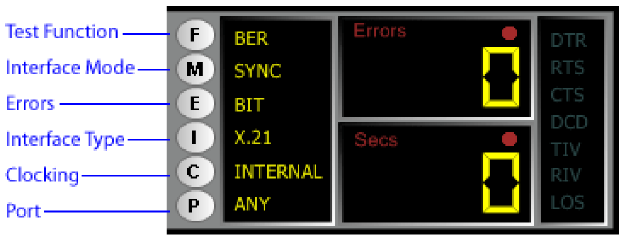
To change the duration, click and drag on the **SYNC TIME** control in a circular motion. As the control is dragged, the red HH:MM:SS values in the Time Display will increase using a clockwise motion and decrease using an anti-clockwise motion.

The default mode for the **SYNC TIME** control is **H:M:S**, whereby the time is updated one second at a time. Alternatively, each of the hours, minutes and seconds values can be set separately by either clicking on the desired value in the Time Display and then clicking and dragging the **SYNC TIME** control or by typing in the value from the keyboard. The currently selected value is highlighted in the Time Display along with the relevant HOURS, MINS, SECS label which is shown beneath the **SYNC TIME** control.

The maximum test duration that can be set is 99 hours, 59 minutes and 59 seconds.

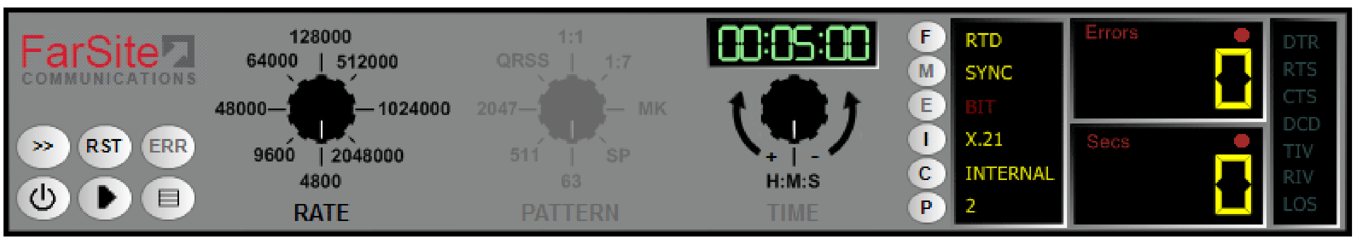
4.4 Configuration Buttons

The configuration buttons provide a convenient way to select some of the BERT more frequently used options. The same options are also available within the Additional Configuration dialog.



4.4.1 Test Function

The BERT can perform both Bit Error Rate Tests (**BER**) and Round Trip Delay Tests (**RTD**). Use the **Test Function (F)** button to switch between the two types of test. In the Round Trip Delay mode, the **Pattern Control** is disabled and the unused **Interface Mode (M)** and **Errors (E)** buttons are greyed out as shown below.



4.4.2 Interface Mode (BER only)

The test can be run in either **ASYNC** or **SYNC** mode. Use the **Interface Mode (M)** button to toggle between these two values.

4.4.3 Errors (BER only)

The Errors Counter (see below) will display the number of Bit Errors, Block Errors, Errored Seconds, Parity Errors, Framing Errors or All Errors. Pressing the **Errors (E)** button cycles round the available values.

4.4.4 Interface Type

The type of interface that the FarSync port is connected to is configured using the **Interface Type (I)** button. The supported values include:

- V.24
- X.21
- V.35
- RS530
- RS449
- RS485-2W (2-wire Multi-Drop)
- RS485-4W (4-wire Multi-Drop)

Pressing the button cycles round the available values.

The maximum supported rates for each type of interface are as follows

Interface Type	Maximum Rate		
V.24	64Kbps *		
X.21	Flex/K2Ee:2Mbps	Flex-HS:16Mbps	K2Ee-HS:20Mbps†
V.35	2Mbps		
RS530	Flex/K2Ee:2Mbps	Flex-HS:16Mbps	K2Ee-HS:20Mbps†
RS449	Flex/K2Ee:2Mbps	Flex-HS:16Mbps	K2Ee-HS:20Mbps†
RS485 (4-wire point-to-point)	Flex/K2Ee:2Mbps	Flex-HS:16Mbps	K2Ee-HS:20Mbps†

* If Terminal Timing is used then the maximum rate for V.24 is 128K
† 20Mbps if one port is use, otherwise 16Mbps

Note that if an encoded mode is used, for example FM0 or FM1, then the Maximum Rate is reduced from 16 Mbps to 10 Mbps.

4.4.5 Clocking

The FarSync port can be configured to use **INTERNAL**, **EXTERNAL**, **INTERNAL+TT**, **EXTERNAL+TT** or **BIDIRECT** (where TT is Terminal Timing and BIDIRECT is bidirectional clocking).

Pressing the clocking **(C)** button cycles round the various options.

Note that if the Advanced Clocking option is selected in the **Additional Configuration** dialog, it overrides and disables this Clocking setting.

It is recommended that Terminal Timing is used for line speeds of 2Mbps and above. This can eliminate potential clock phase problems related to propagation delays when using a single clock.

Note: Terminal Timing is not supported when using NRZI encoding.

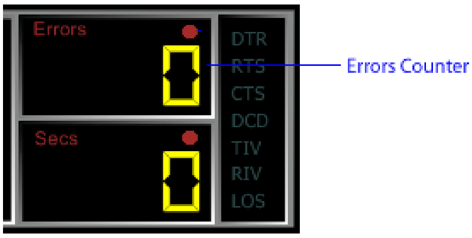
The BERT should be connected to the peer/network via a KCR1-**V2** cable when using Terminal Timing in RS232 (V.24), V.35 and RS530 (RS422) interface modes.

The rate of the clock should be configured using the **RATE** control as described above.

4.4.6 Port

The FarSync port to be used can be selected by pressing the **Port** button. If you have multiple FarSync devices/cards or multiport cards installed, this button enables you to cycle round the available FarSync ports. The value of **ANY** will enable the FarSync BERT to simply select the first detected FarSync port. More information on selecting specific ports can be found in Section 4.9.1.

4.5 Error Counter (BER Only)



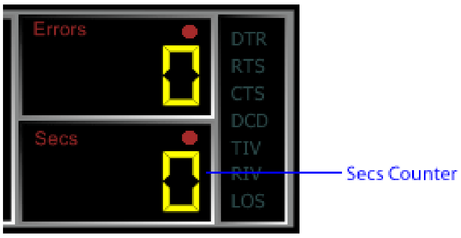
The FarSync BERT **Errors** counter displays a count of the errors detected. Use the **Errors** button to select the required counter value. The options include:

- Error Seconds
- Bit Errors
- Block Errors
- Framing Errors
- Parity Errors
- All Errors

Note that the Error Seconds, Bit and Block counts are available simultaneously, via the statistics table, using the **Table** button.

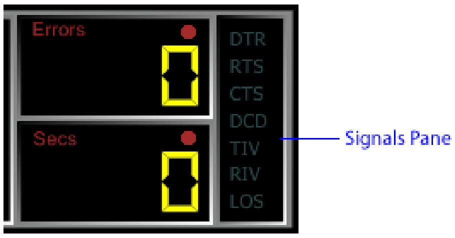
The **Errors** selection can be set before or during test execution.

4.6 Secs Counter



The **Secs** counter, when coloured yellow, displays the total number of seconds that the test has been running for. At the beginning of the test it is coloured red and displays the number of elapsed seconds before the first synchronisation is achieved (BER Only).

4.7 Signals Pane



The FarSync BERT's current DTE signal states are displayed in the Signals Pane. Clicking the DTR and RTS indicators will toggle their output states.

- DTR Click on the DTR indicator to toggle its output state.
- RTS Click on the RTS indicator to toggle its output state.
- CTS Shows the state of the incoming CTS signal.
- DCD Shows the state of the incoming DCD signal.
- TIV Click on the TIV indicator to invert the FarSync BERT's output data signals. This can be done at any time, before or during the test. The state of this option is toggled each time the TIV indicator is clicked. This option is useful to try when you suspect that the device/cabling under test may have it data signals inverted. Note that this indicator is not used during Round Trip Delay or Multi-Drop tests.
- RIV The RIV indicator shows the state of the FarSync BERT's auto inversion (IV) support. If the Auto Invert (RIV) option is enabled and the FarSync BERT fails to synchronise with the inbound data stream for 2 seconds, the BERT will invert the receive data signals to see if perhaps the peer and/or cabling has been inverted. Whilst the FarSync BERT has the receiver inverted, the RIV indicator will be highlighted. Note that this indicator is not used during Round Trip Delay or Multi-Drop tests.
- LOS When the FarSync BERT is unable to synchronise with the incoming data (e.g. due to a physical break in the line, the wrong test pattern configured etc.) the Loss-of-Sync (**LOS**) indicator will be highlighted.

4.8 Injecting Errors (BER Only)

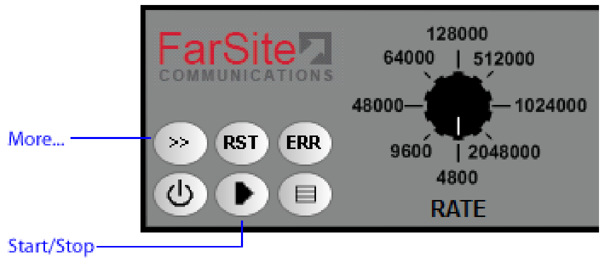
Whilst a test is active, you can request that the FarSync BERT inject errors into its outbound data by pressing the **ERR** button (shown above). Pressing the button by itself once will inject a single bit error. If one of the host PC number keys ('1'..'8') is pressed at the same time as the ERR button then the corresponding number of bit errors will be generated in a single burst.

See Section 4.9 for details on further configuration options available in the **Additional Configuration** dialog (displayed via the **More** button).

See Section 6 for details of how to use the FarSync BERT in script mode.

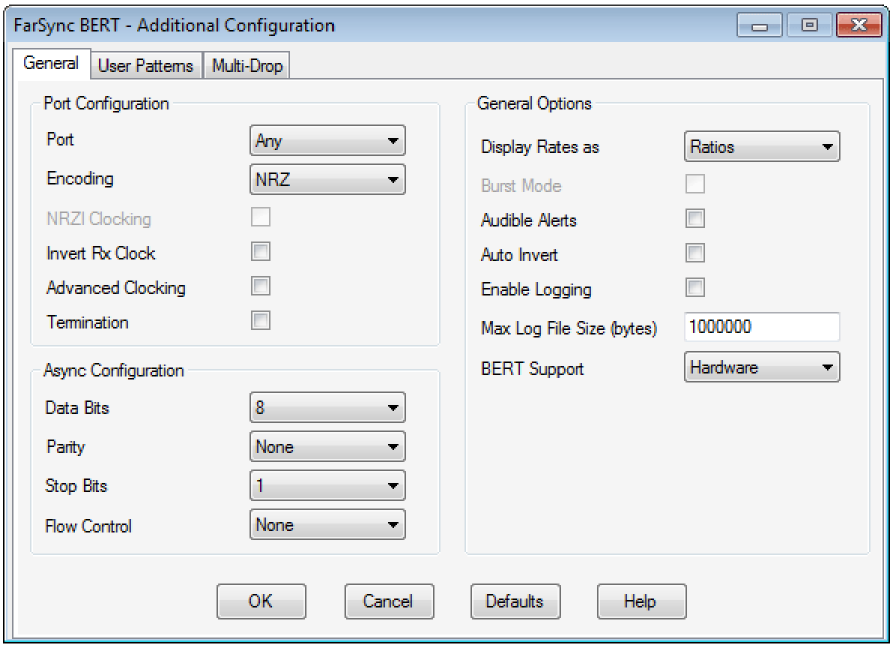
4.9 Additional Configuration

Further additional configuration options are available via the **Additional Configuration** dialog which is displayed on pressing the **More** button (shown below).

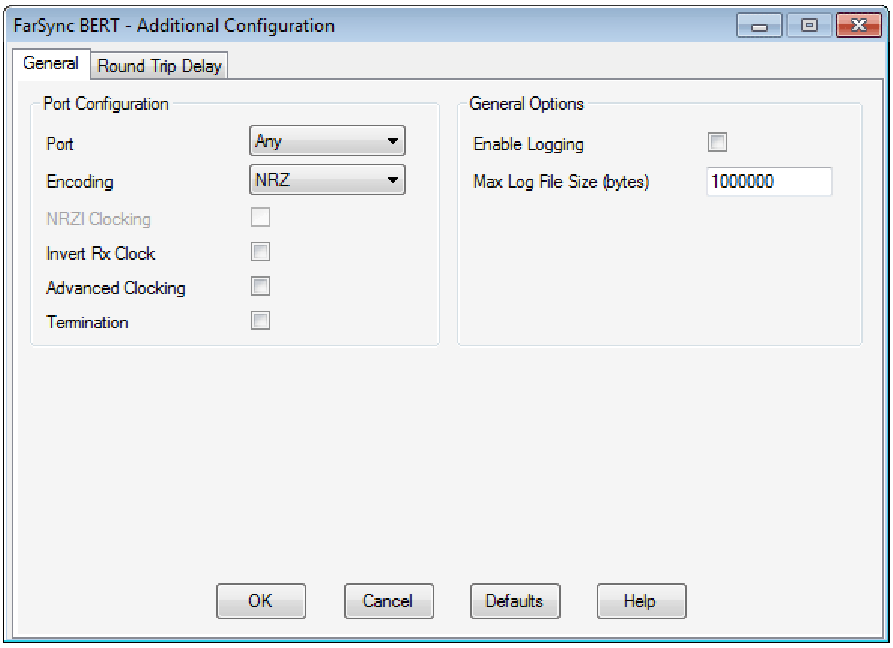


Note that pressing the **More** button during a test will cause the test to stop. Simply press the **Start** button (shown above), after closing the **More** dialog, to start a new test using the new settings.

The Additional Configuration options that are displayed will change according to the current Test Function setting. For the BER tests, **General**, **User Patterns** and **Multi-Drop** tabs are displayed as shown below.



For RTD tests, **General** and **Round Trip Delay** tabs are displayed as shown below.



Please select the required Test Function before clicking on the **More** button to access the appropriate options.

4.9.1 General - Port

The FarSync BERT uses one FarSync (port). If you intend to only ever use one FarSync Flex (physical instance) then you should be able to leave the **Port** parameter as its default value (**Any**) and skip the rest of the discussion regarding the **Port** parameter.

If, however, you want to use a FarSync K2Ee card (which supports 2 ports) or, alternatively, multiple FarSync Flexes

- simultaneously i.e. using multiple instances of the FarSync BERT
  OR
- one at a time - but not using the same FarSync port each time

then read on.

Multiple FarSync devices can be installed in the PC. Each instance will have a unique index associated with it. This index number is displayed in Device Manager next to a prefix of "SDCI" e.g.

To access this display, use Start-Computer(right-click)-Manage-Device Manager

By default, each index is associated with a physical instance of a FarSync device (Flex or K2Ee). Therefore, in the case of the Flex, if you start by installing FlexA, this will appear as SDCI0. If you then install another Flex, FlexB, this will be assigned an index of 1 i.e. SDCI1. If you remove FlexA and FlexB, then whenever you subsequently insert either Flex, FlexA will always appear as SDCI0 and FlexB as SDCI1 - regardless of the order you use to insert them; or if, for example, you only insert FlexB - it will still appear as SDCI1 even though FlexA (SDCI0) is not inserted. An alternative (port-centric) mapping scheme can be used but is should not normally be necessary (see "Why do I need to reinstall drivers when I replace one FarSync Flex with another?" in FarSync Flex FAQ).

By default, the FarSync BERT's **Port** parameter is set to **Any** and will consequently simply use the first FarSync port that it detects. This is a suitable setting if you only ever have one Flex physical inserted into the machine at one time. Even if, for example, you replace FlexA(SDCI0) with FlexB(SDCI1), the setting does not need to change since the FarSync BERT will just use the first one that it locates.

If, however, you have multiple Flexes inserted at the same time, one instance of FarSync BERT will need to be started for each Flex. Once the FarSync BERT has been started you need to select the port it should use. You do this by setting the **Port** parameter to the Flex's index number. So, for instance, FlexA would be selected by setting **Port** to 0; FlexB by setting **Port** to 1.

When using multiple Flexes, a single Port Setting value will persist for all FarSync BERT instances. So if you exit the BERT and restart it, you should then reset the **Port** parameter to the required setting.

In the case of the FarSync K2Ee, again, each instance will appear in Device Manager with its own unique index number e.g. SDCI0, SDCI1 etc. However, since the FarSync K2Ee supports multiple ports, if you want to select a specific port to be used by the FarSync BERT, then you need to configure not only the SDCI index number but also the FarSync port number on that K2Ee card e.g. 0/A or 0/B. Alternately, as before, you can leave the FarSync BERT's port selection as **Any** and then the BERT will simply choose to use the first detected port.

4.9.2 General - Encoding

The Encoding parameter defines the type of data encoding to be used on the line connected to this port when configured for **SYNC** mode. When using the port in **ASYNC** mode, you should always set the encoding option to NRZ. FM0/1 and (D)MAN are supported by the FarSync K2Ee between rates of 1200bps and 10Mbps. NRZI, FM0/1 and (D)MAN are supported by the FarSync Flex between rates of 100bps and 2Mbps. In HighSpeed mode the rates are between 100bps and 10Mbps.

For detailed information on the precise card/encoding-specific rates that are supported, refer to the FarSync FAQ.

Note that the use of MK and SP patterns is not recommended if you are using Manchester (MAN) encoding.

Default: NRZ

Supported encoding schemes:

	K2Ee	Flex
NRZ	✓	✓
NRZI	×	✓
FM0	✓	✓
FM1	✓	✓
MAN (Manchester)	✓	✓
DMAN (Differential Manchester /Conditioned Diphase)	✓	✓

4.9.3 General - NRZI Clocking

Although some clocking information is included in the NRZI bitstream, it may not be adequate enough to allow for reliable clock recovery.

The NRZI Clocking option allows for a separate one times clock to be provided with the encoded data, thus enhancing reliability.

Default: Disabled

Supported by:

K2Ee	Flex
×	✓

4.9.4 General - Invert Rx Clock

The Invert Rx clock option is used to change the phase of the internal clock by 180 degrees (for received data). If

- you are seeing excessive receive errors
  and
- it is not possible to use Terminal Timing
  and
- the port is configured for **Internal (INT)** Clocking

then inverting the clock may solve the problem.

Default: Disabled

4.9.5 General – Advanced Clocking

This option is used to specify whether Advanced Clocking is used on the FarSync port. When the Advanced Clocking option is selected, it overrides the Clocking setting and disables the (C) button on the Front Panel.

When Advanced Clocking is selected, the values are set according to keys/values in the Registry. If you wish to use Advanced Clocking then please contact FarSite support at support@farsite.com for further information.

4.9.6 General - Termination

This option is used to specify whether termination is used on the FarSync port.

Default: Disabled

4.9.7 General - Data Bits (BER only)

This parameter is used to configure the number of async data bits (8,7,6 or 5) in each character. This is only applicable when the BERT is set in **ASYNC** mode and is thus not supported when using the FarSync K2Ee.

Default: 8

Supported by:

K2Ee	Flex
✗	✓

4.9.8 General - Parity (BER only)

This parameter is used to configure the async parity setting (NONE, ODD, EVEN, MARK or SPACE) for the FarSync port. This is only applicable when the BERT is set in **ASYNC** mode and is thus not supported when using the FarSync K2Ee.

Note: The use of SPACE is typically not recommended due to, in some cases, the start/parity bits not always being uniquely identifiable which can in turn lead to problems achieving synchronisation.

Default: None

Supported by:

K2Ee	Flex
✗	✓

4.9.9 General - Stop Bits (BER only)

This parameter is used to configure the number of async stop bits (1 or 2) between each character. This is only applicable when the BERT is set in **ASYNC** mode and is thus not supported when using the FarSync K2Ee.

Default: 1

Supported by:

K2Ee	Flex
✗	✓

4.9.10 General - Flow Control (BER only)

This parameter is used to configure the type of async flow control (NONE, RTS-CTS or XONOFF) used on the FarSync port . This is only applicable when the BERT is set in **ASYNC** mode and is thus not supported when using the FarSync K2Ee.

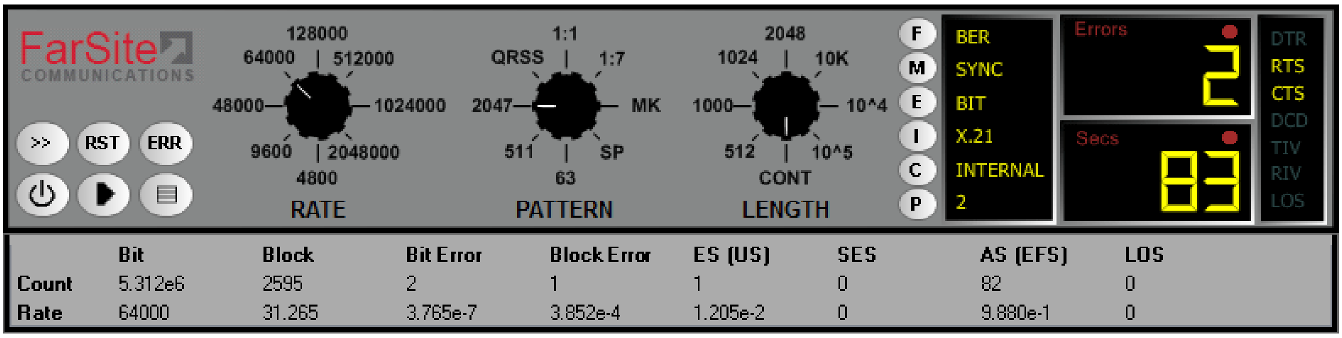
Default: Off

Supported by:

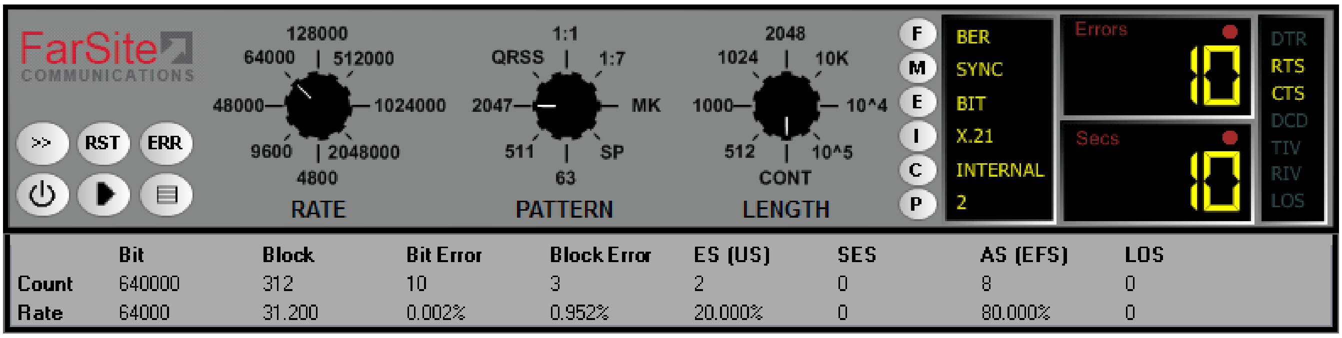
K2Ee	Flex
✗	✓

4.9.11 General - Display Rates (BER only)

The FarSync BERT results pane can display the rates achieved either as **Ratios** or **Percentages**. Set this parameter to the format you require.



Rates shown as **Ratios**



Rates shown as **Percentages**

4.9.12 General - Burst Mode (BER only)

By default the FarSync BERT expects data to be received at a constant rate based on the configured line rate. In some test cases, the receive data arrives in bursts. In synchronous burst modes, the associated clock is idle in between bursts. In this case the Burst Mode parameter should be set to avoid the FarSync BERT reporting errors when the idle periods are detected.

4.9.13 General - Audible Alerts (BER only)

By default the FarSync BERT will report errors only via its statistics displays/output. However, if the **Audible Alerts** option is enabled, the BERT will also sound alerts; one to indicate errors and one to indicate any state transitions to LOS. The audible alert rate will always be greater than or equal to 1 second. i.e. each audible alert indicates one or more errors have occurred within the last second.

4.9.14 General - Auto Invert (RIV) (BER only)

Occasionally the equipment and/or cabling being tested by the BERT has been wired incorrectly such that the data lines are actually inverted. If the **Auto Invert** option is enabled, the BERT will check for this and automatically invert the received data (if still in LOS after 2 secs) to determine if synchronisation can then be established. The BERT will toggle between inverted and non-inverted Rx mode, every 2 seconds until synchronisation has been achieve Note that whenever the BERT is inverting the receive data the RIV indicator will be lit.

4.9.15 General - Enable Logging

If this option is selected, the FarSync BERT outputs a summary of its tests in a log file as described in the Logging section. If this option is deselected, no writing to the log file takes place. Logging is performed for both BER and RTD modes.

4.9.16 General - Maximum Log File Size

By default the maximum size of this file is set to be 1MB. This limit can be configured via the Maximum Log File Size parameter. This can be set to any value up to 1GB. A value of 0 is used to configure an unlimited size.

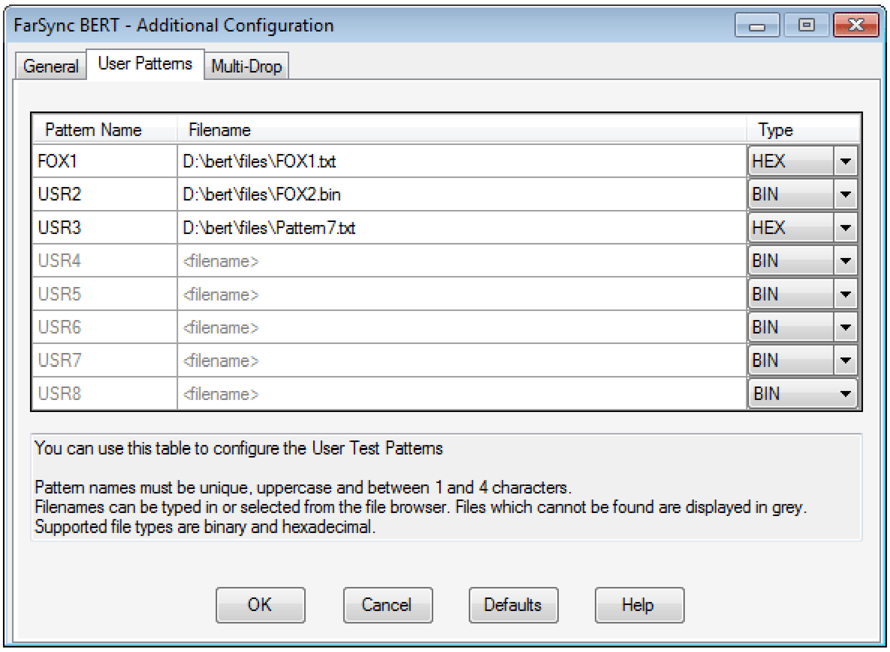
4.9.17 General - BERT Support (BER only)

On earlier builds of the BERT-enabled FarSync Flex devices (with serial numbers < U4xxx/xxxx), the FarSync BERT could optionally be used with its BERT engine being run in hardware mode on the FarSync Flex device itself i.e. instead of it being run on the host PC. This enabled the FarSync Flex to support extended line rates. The maximum rate supported in that case, when using software mode, was 2Mbps. When hardware mode was used the maximum rate was 16Mbps. With current BERT-enabled FarSync Flex devices, with serial numbers >= U4xxx/xxxx, hardware mode is no longer needed and the Hardware/Software setting has no effect. This parameter can normally be left as “Hardware” since, if hardware support is not available on the selected device, then it will automatically revert to software mode.

Note that the hardware mode is not used when performing Multi-Drop tests.

4.9.18 User Patterns - Pattern Name (BER Only)

By default, the pattern names are marked as USR1 to USR8 where USR denotes User. The default pattern names can be changed by clicking on the name and by typing in a new value. Pattern names must be unique, uppercase and between 1 to 4 characters.

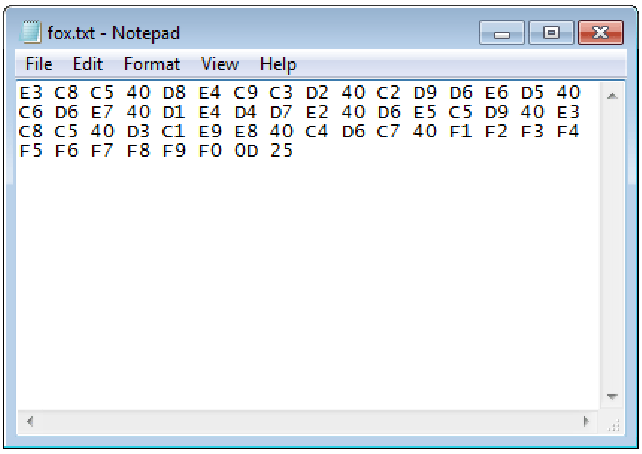


4.9.19 User Patterns - Pattern Filename

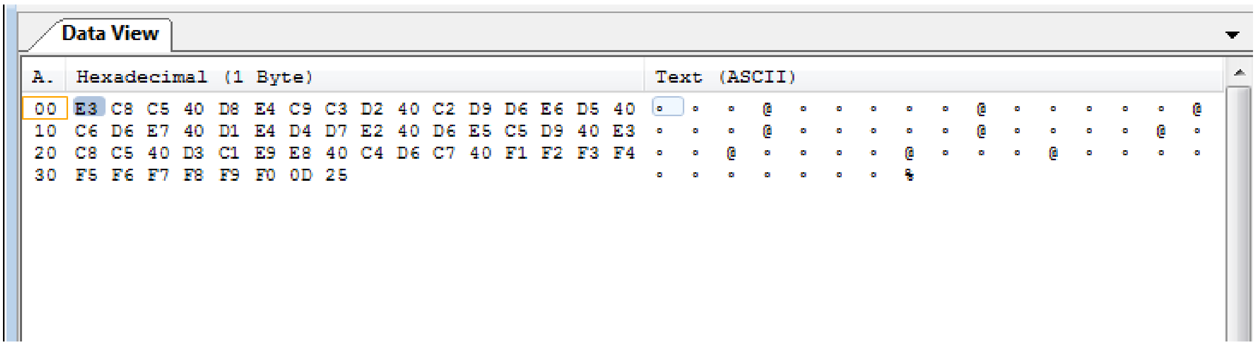
A pattern filename can be typed in or selected using the File Browser Dialog. To add a new filename, click anywhere within the <filename> box and type in the path to the filename or click on the button that appears in the <filename> box and select the desired file using the File Browser Dialog.

4.9.20 User Patterns - Pattern Filetype

The two filetypes which are supported are hexadecimal and binary. A hexadecimal filetype is expected to be of the format as shown in the diagram below.

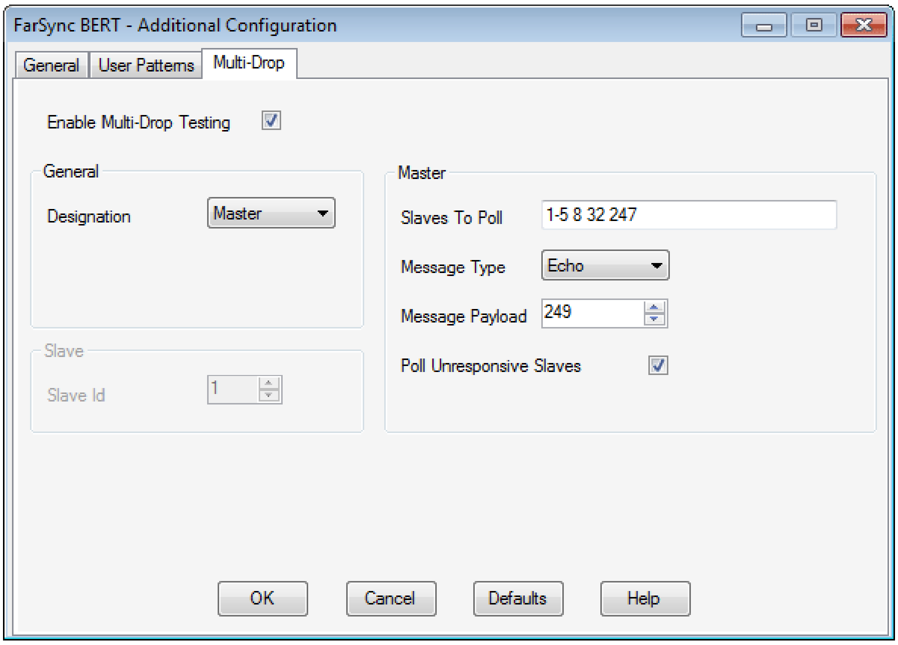


A binary filetype is expected to be of the format as shown in the diagram below (as viewed in a binary viewer).



4.9.21 Multi-Drop - Enable Multi-Drop Testing

When the checkbox is selected, the BERT will enter the Multi-Drop test mode. For further information about the Multi-Drop mode, see the Multi-Drop section. Once Multi-Drop mode has been selected, the other Multi-Drop options on the tab can be configured.



4.9.22 Multi-Drop - Designation

Each node in the Multi-Drop test must be configured to either a 'Master' or a 'Slave'. When configured to be a master, the applicable 'Master' configuration options become available for configuration. When configured to be a slave, the 'Slave' options become available for configuration.

4.9.23 Multi-Drop - Slave Id

Enter the desired Slave Id for this Multi-Drop node. Each Slave Id on the Multi-Drop network must be unique. Slave Id's must be in the range from 1 to 247.

4.9.24 Multi-Drop - Slaves To Poll

Enter a list of slaves to poll. Use spaces or commas to separate individual entries, e.g. **1 2 3** or **1,2,3** or **1, 2, 3** and a hyphen to set a range, e.g. **1-3** or any combination of the two, e.g. **1 2 4-6**.

Slaves can be entered in any order (except ranges), but when the list is saved, they will be sorted and any duplicates will be removed.

4.9.25 Multi-Drop - Message Type

Currently, the only supported message type is 'Echo'. This Message Type will be echoed by the slave receiving the message.

4.9.26 Multi-Drop – Payload Length

The Message Payload length defines the number of bytes used to carry the pattern to each of the slaves. The Payload length must be between 1 and 249 bytes.

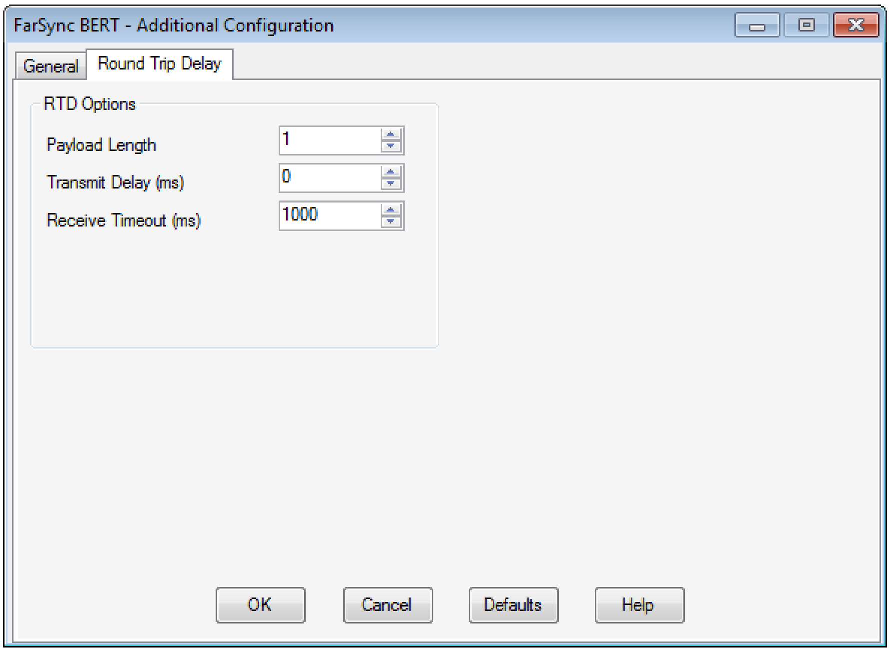
4.9.27 Multi-Drop - Poll Unresponsive Slaves

If a slave fails to echo back a message (before a timeout), it will be excluded from the list of slaves to poll unless this option is selected.

Note that if this option isn't selected, you should make sure that you start the slaves before starting the master, otherwise the test will stop when the master fails to get the response from the slave.

4.9.28 Round Trip Delay –Payload Length

Sets the length of the payload (in bytes). The payload length must be between 1 and 31 bytes.



4.9.29 Round Trip Delay - Transmit Delay

Sets the delay (in milliseconds) between the receipt of one packet and the transmission of the next. If the value is set to 0, the next packet is transmitted as soon as the previous one is received. The delay must be between 0 and 3,600,000 (1 hour).

4.9.30 Round Trip Delay - Receive Timeout

Sets the receive timeout (in milliseconds). If a transmitted packet is not received within this time it is deemed to have been lost (even if it subsequently arrives). The next packet will then be transmitted according to the configured Transmit Delay value.

Note that the Receive Timeout timer starts before the payload is clocked out onto the line. This means that the value that you set for Receive Timeout should include the time it takes for the data to be clocked out onto the line and also the Round Trip Delay time. An example of how long it takes to clock a payload length of 30 bytes out at 300 bps is shown below:

30 * 8(bits) / 300bps * 1000 = 800ms

So in this example the Receive Timeout should be set to 800ms + expected Round Trip Delay time + a margin.

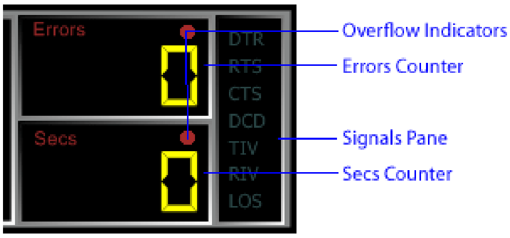
5 Results

The FarSync BERT outputs the results of its tests in 3 ways

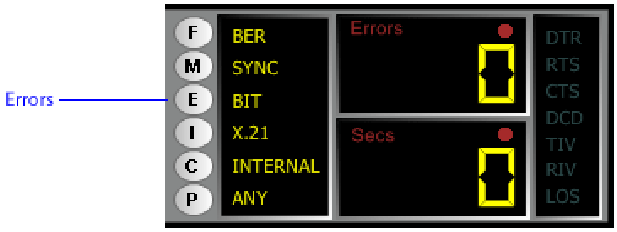
- Error and Seconds counters, signals and LOS indicators in its Compact View
- Detailed statistic counters and rates in the Statistics/Results Table
- Results Summary in the FarSync BERT log file

5.1 Compact View Results

Whilst the test is running the **Errors** counter will display the number of Bit Errors, Block Errors, Errored Seconds, Parity Errors, Framing Errors or All Errors that have occurred during the test. The **Secs** counter displays the total number of seconds that the test has been running for.



Pressing the **Errors** button (as shown in the diagram below) causes the **Errors** counter to switch between **BIT**, **BLOCK, SECONDS, PARITY, FRAME** and **ALL** error counter values.



If the **Errors** or **Secs** value overflows then the Overflow Indicators are highlighted. Note that the actual value can be obtained from the statistics/results table (see below). The overflow condition can be reset by using the **Reset** button.

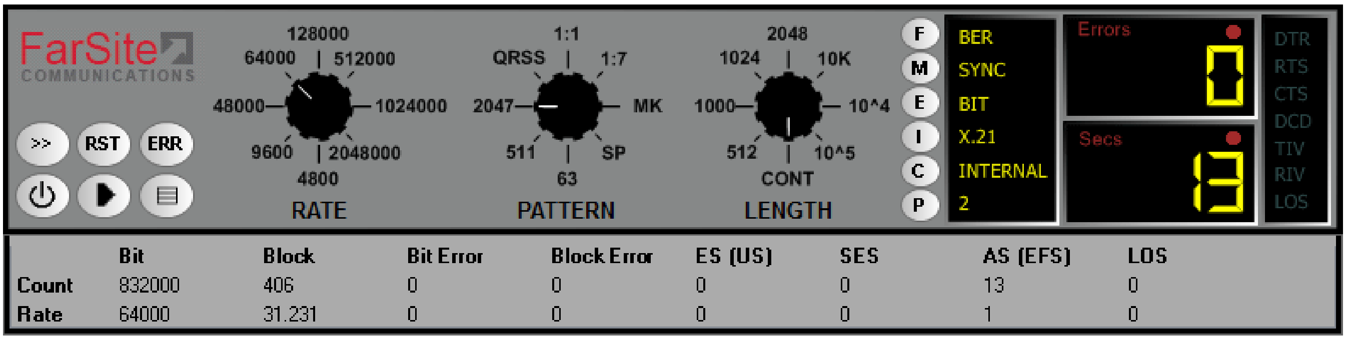
When the FarSync BERT is unable to synchronise with the incoming data (e.g. due to a physical break in the line, the wrong test pattern configured etc.) the Loss-of-Sync (**LOS**) indicator will be highlighted.

The interface signals states (DTE and DCE), as well as the RIV indicator, are updated in real-time in the Signals pane whilst the test is running.

5.2 Statistics/Results Table

At any point the **Table** button can be used to display a table of statistics for the current (or most recent) test. Depending on the Test Function and Multi-Drop settings, one of three possible results tables will be displayed.

5.2.1 BER Results



This statistics/result table displays industry-standard count values (e.g. ITU-T G.821) which help indicate the current quality of the line:

- Bits - number of bits received
- Blocks - number of blocks received
- Bit Errors - number of bits received with errors
- Block Errors - number of blocks received with errors
- Errored Secs (ES) / Unavailable Secs(US) - number of secs during which one or more errors has been detected
- Severely Errored Secs (SES) - number of secs during which > 30% of blocks are in error or of which the bit error density is $>10^{-2}$
- Available Secs (AS) / Error Free Secs (EFS) - number of sec during which no errors have been detected
- Loss of Sync (LOS) - number of times synchronisation has been lost

The following rate values are also displayed:

- Bits - number of bits received per sec
- Blocks - number of blocks received per sec
- Bit Errors - number of error bits received per sec
- Block Errors - (number of blocks received with errors) per sec
- Error Secs (ES) / Unavailable Secs(US) - % of secs during which one or more errors has been detected
- Severely Errored Secs (SES) - % of secs during which > 30% of blocks are in error or for which the bit error density is $>10^{-2}$
- Available Secs (AS) / Error Free Secs (EFS) - % of secs during which no errors have been detected
- Loss of Sync (LOS) - % of time during which there has been loss of sync

To return to the compact view (i.e. without the statistics table displayed) press the **Table** button once more.

5.2.2 Multi-Drop Results

FarSync BERT - Multi-Drop Results

Slaves		Bit	Block	Bit Error	Block Error	ES (US)	SES	AS (EFS)	LOS	Inverted
Total	Count	2.485e7	48604	3	3	3	0	53	0	
	Rate	417208	816.009	0.000%	0.006%	5.357%	0	94.643%	0	
1	Count	3.108e6	6078	1	1	1	0	6	0	
	Rate	417260	816.119	0.000%	0.016%	14.286%	0	85.714%	0	
2	Count	3.108e6	6078	0	0	0	0	7	0	
	Rate	416013	813.680	0	0	0	0	100.000%	0	
3	Count	3.108e6	6078	0	0	0	0	7	0	
	Rate	419942	821.365	0	0	0	0	100.000%	0	
4	Count	3.106e6	6074	2	2	2	0	5	0	
	Rate	414897	811.484	0.000%	0.033%	28.571%	0	71.429%	0	
5	Count	3.106e6	6074	0	0	0	0	7	0	
	Rate	421240	823.890	0	0	0	0	100.000%	0	
8	Count	3.106e6	6074	0	0	0	0	7	0	
	Rate	416412	814.446	0	0	0	0	100.000%	0	
32	Count	3.106e6	6074	0	0	0	0	7	0	
	Rate	418639	818.802	0	0	0	0	100.000%	0	
247	Count	3.106e6	6074	0	0	0	0	7	0	
	Rate	413377	808.511	0	0	0	0	100.000%	0	

The Multi-Drop Results Dialog displays the results for each slave being polled and also displays the **Total** results which are the combined results of all the slaves.

The calculations used for the **Total** results are as follows:

- Bit Count — Sum of the Bit counts for each slave
- Bit Rate — Total Bit Count / Total duration of all slaves
- Block Count — Sum of Block Counts for each slave
- Block Rate — Total Block Count / Total duration of all slaves
- Bit Error Count — Sum of the Bit Error Counts for each slave
- Bit Error Rate — Total Bit Error Count / Total duration of all slaves
- Block Error Count — Sum of the Block Error Counts for each slave
- Block Error Rate — Total Block Error Count / Total duration of all slaves
- ES Count — Sum of the ES Counts for each slave
- ES Rate — Total ES Count / Total ES+AS+LOS Counts
- SES Count — Sum of the SES Counts for each slave
- SES Rate — Total SES Count / Total ES+AS+LOS Counts
- AS (EFS) Count — Sum of the Total AS Counts for each slave
- AS (EFS) Rate — Total AS Count / Total ES+AS+LOS Counts
- LOS Count — Sum of the LOS Counts for each slave
- LOS Rate — Total LOS Count / Total ES+AS+LOS Counts

The ES, SES, AS and LOS Counts and rates are based on 'whole second' values and so their calculations differ somewhat from those used to calculate the Bit and Block Rates.

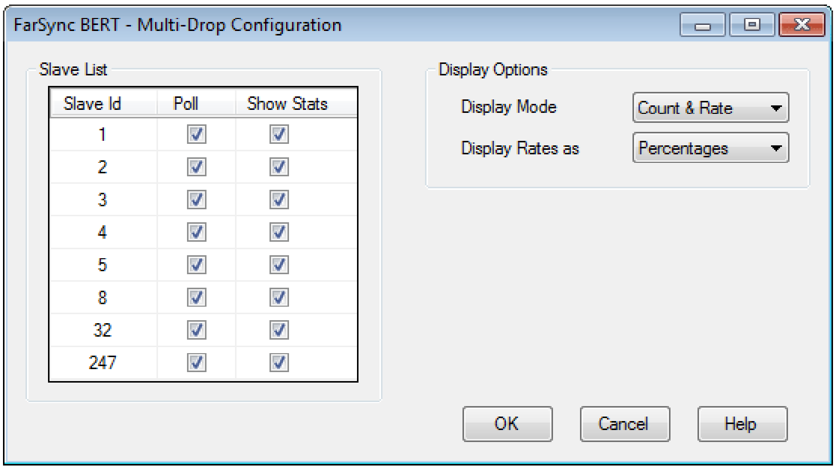
Note that the LOS Count in the Multi-Drop test is the number of seconds the slave has lost sync. This differs from that displayed in the normal BER test which shows the number of times sync has been lost.

If a slave is out of sync, the results for that slave are highlighted in red. If a slave has stopped responding altogether, (i.e. it's not echoing back any data), it is highlighted in gray.

When the transmitter/receiver is inverted in an attempt to achieve sync, the **TIV**/**RIV** text will be displayed in the **Inverted** column for that slave.

5.2.3 Multi-Drop Results Configuration

The Multi-Drop Results Configuration Dialog can be accessed by double-clicking anywhere on the Multi-Drop Results Dialog.

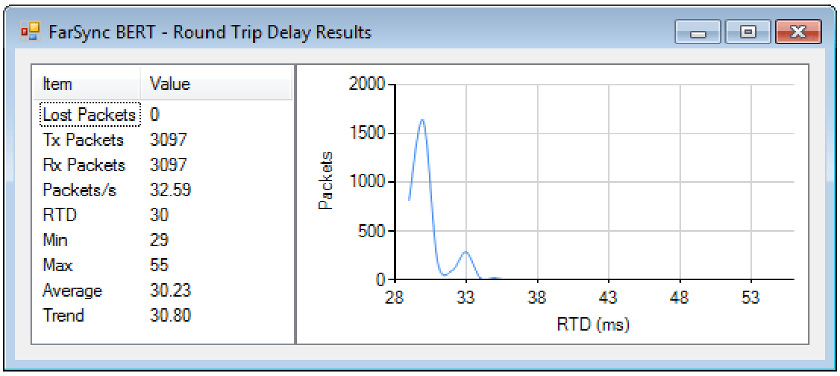


- Poll — Each configured slave is shown in the **Slave List**. By default all slaves in the list are polled (sent messages), but you can exclude a slave from the test by deselecting the **Poll** option for that slave. When a slave is excluded, the **Show Stats** option is disabled and the slave isn't listed in the **Multi-Drop Results** dialog. An excluded slave can be polled again by reselecting the **Poll** option.
- Show Stats — The results for any slave can be excluded from the results table by deselecting the **Show Stats** option. The slave will still be polled, but its results will not be displayed separately. Its results however, will still be used in the calculation of the **Total** results.
- Display Mode — The results for each slave (and the **Total**) can be shown as counts, rates, or both.
- Display Rates As — The rates can be displayed as either ratios or percentages.

If the **Slave List** is updated in the Additional Configuration – Multi-Drop tab, the settings for **Poll** and **Show Stats** will be retained for any slaves that remain in the list. If new slaves are added to the list, the default is for **Poll** and **Show Stats** to be selected.

5.2.4 Round Trip Delay Results

The Round Trip Delay Results are displayed as shown below. The individual Round Trip Delay values are displayed on a chart.



where

- Lost Packets The total number of packets that have been lost. A lost packet is defined as a packet that is received after the configured Receive Timeout.
- Tx Packets The total number of packets that have been transmitted
- Rx Packets The total number of packets that have been received
- Packets / sec The total number of received packets divided by test duration
- RTD The last reported Round Trip Delay value (in milliseconds). The Round Trip Delay statistics are updated every 0.5 seconds
- Min The minimum Round Trip Delay value measured (in milliseconds)
- Max The maximum Round Trip Delay value measured (in milliseconds)
- Average The sum of each Round Trip Delay value divided by total number of received packets
- Trend The sum of the last ten Round Trip Delay values divided by ten

The Round Trip Delay results are plotted on a chart. The x-axis shows the Round Trip Delay times (in milliseconds) for the packets and the Y-axis shows the number of occurrences of each time.

Clicking on the chart will cycle through three different graph modes. These are line, spline and column. All three modes show exactly the same data, but in a slightly different format. Depending on the generated data, one display mode may produce a better graph than the others.

Note that as the chart is dynamically generated from the results, it isn't displayed until the Round Trip Delay values are received during the test. In the case where all packets are lost, no chart is displayed.

5.3 Test Startup and Initial Synchronisation

Note that when each test is started there will be an initial period before synchronisation is achieved.

During this initial period

- the **Errors** and **Secs** pane heading becomes highlighted once the test starts
- the Seconds counter turns red and starts to be incremented
- the LOS indicator becomes highlighted
- the LOS Rate figure shown in the Results table displays 100%
- no other errors will be indicated

Once synchronisation is achieved for the first time

- the Seconds counter value will be reset to 0 and its display will turn Yellow
- the LOS indicator will become un-highlighted
- the statistics counters will be reset and then will start to be maintained based on the ongoing results of the test

Subsequent LOS transitions will result in the counters/results being updated accordingly (but will not result in them being reset unless explicitly requested by the user pressing the **Reset** button).

5.4 Test Completion

If the test is setup to run continuously (i.e. with **LENGTH** set to **CONT**) then use the **Stop** button to complete the test when required. If the **LENGTH** is not set to **CONT**, this length value determines how many bits to test in the received datastream before completing the test. Note that the count does not start until initial synchronisation is achieved.

Test results are retained until either the test is restarted by pressing the **Start** button) or the test is reset at any time (using the **Reset** button).

5.5 Logging

Logging can be enabled by selecting the Enable Logging checkbox in the Additional Configuration – General tab.

If logging is enabled, the results of each test are logged to the **fsbert<device index>.<port index>.log** file which can be found in the current user's **My Documents** folder. [Note that this folder is expected to be found under %HOMEDRIVE%\%HOMEPATH%. If these environment variables have been changed from their normal default values then you should create a **My Documents** folder in the location referenced by those values]. Alternatively you can set a system environment variable, FSBERTLOGPATH, to point to a folder of your choice, to be used by the BERT to hold its log files.

The log file can grow in size quite quickly. Its maximum size is controlled by the **Maximum Log File Size** value discussed in Section 4.9.16. You can optionally manually delete it, as and when required, and a new version will be created on the next logging event. When the **Maximum Log File Size** has been reached, the fsbert00.log file, for instance, is renamed, fsbert0.0.bak.log, and a new fsbert0.0.log created.

If you have multiple FarSync devices installed then the first digit in the filename of the log file produced will match the index of the device used. For an installation with a single FarSync device this value will always be 0. If you are using multiport FarSync devices i.e. a FarSync K2Ee card, then the last digit in the filename will indicate the port in use i.e. 0=PortA, 1=PortB

5.5.1 BER Logging

fsbert0.0.log - Notepad

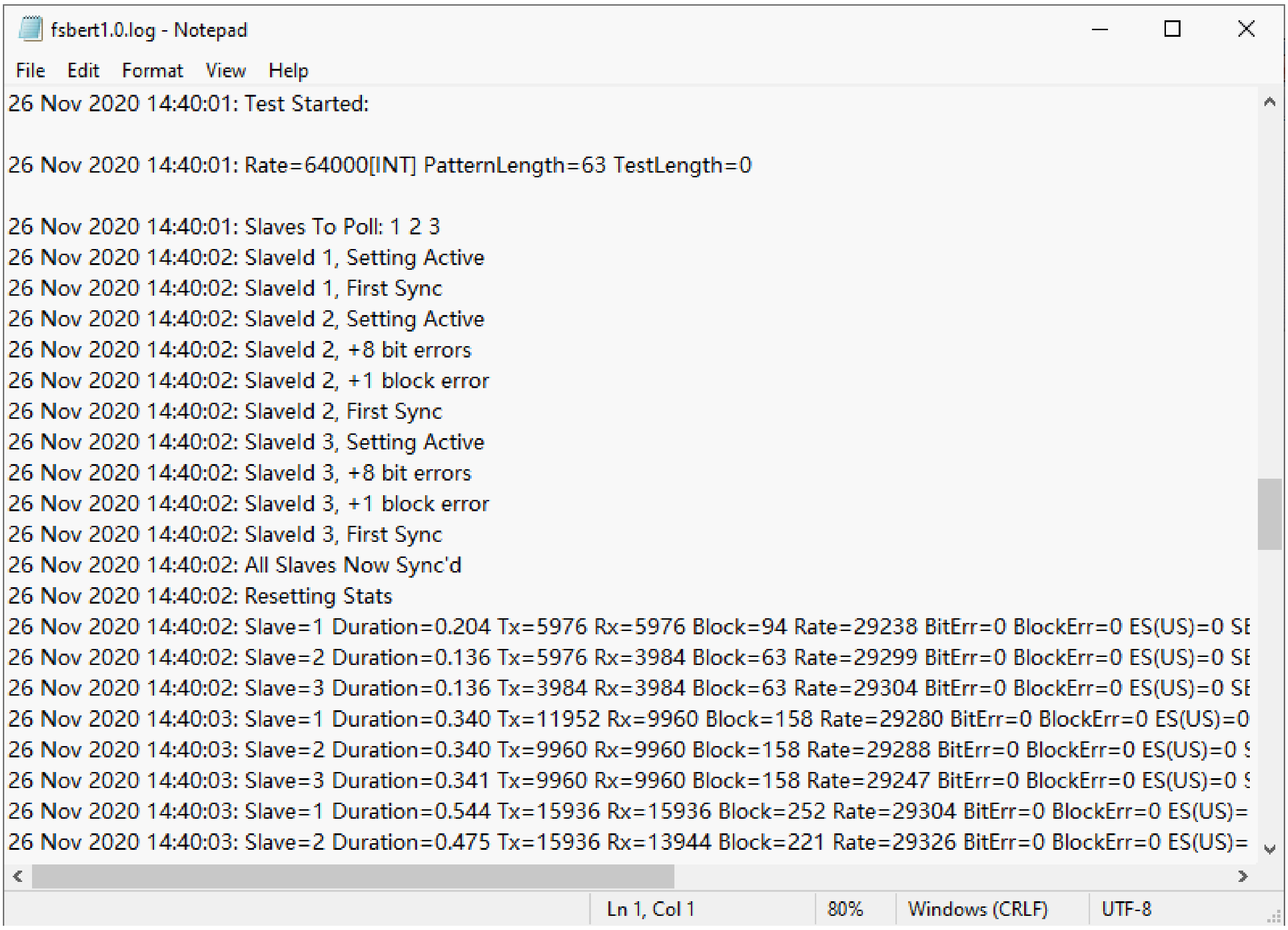
File Edit Format View Help

```
16 Oct 2020 16:26:44: Test started:

16 Oct 2020 16:26:44: Rate=9600[INT] PatternLength=2047 TestLength=15000

16 Oct 2020 16:26:45: In sync

16 Oct 2020 16:26:46: +1 block errors

16 Oct 2020 16:26:46: +105 bit errors

16 Oct 2020 16:26:46 Duration(s)=1.107
TxCount=10240 RxCount=10240 BlockCount=5 Rate=9249
BitErr=105 BlockErr=1 ES(US)=1 SES=0 AS=0 es=0 ses=0
BER=1.025e-02 ESR=1.000e+00 SESR=0.000e+00 ASR=0.000e+00
->LOS=0 ->SYNC=0 LOSR=0.00

16 Oct 2020 16:26:46: Test completed

16 Oct 2020 16:26:52: Test started:

16 Oct 2020 16:26:52: Rate=9600[INT] PatternLength=2047 TestLength=15000

16 Oct 2020 16:26:53: In sync

16 Oct 2020 16:26:53: +1 block errors

16 Oct 2020 16:26:53: +1889 bit errors

16 Oct 2020 16:26:53: LOS

16 Oct 2020 16:26:53 Duration(s)=0.533
TxCount=7680 RxCount=7680 BlockCount=3 Rate=14400
BitErr=1889 BlockErr=1 ES(US)=0 SES=0 AS=0 es=0 ses=1
BER=2.460e-01
->LOS=1 ->SYNC=0 LOSR=3.92

16 Oct 2020 16:26:54: Test completed
```

This file contains a summary of each test run, and includes:

- start/stop timestamps
- timestamp of each detected error
- test statistics summary at time of completion

5.5.2 Multi-Drop Logging



The Multi-Drop log is updated twice every second with statistics for each slave being polled and is also updated when significant events occur.

The log entry includes:

- Test details
- Requests to start/stop polling slaves
- When slaves start/stop being active (i.e. start/stop echoing back messages)
- When slaves achieve/lose sync
- Bit and block errors
- Requests to reset statistics
- Slave results

5.5.3 Round Trip Delay Logging

```
26 Nov 2020 15:30:27: Round Trip Delay Test Started

26 Nov 2020 15:30:27: Rate 4800[INT] Payload Length 1, Transmit Delay 0, Receive Timeout 1000
26 Nov 2020 15:30:28: tx 34, rx 33, lost 0, late 0, last 1, min 1, max 2, trend 1.800
26 Nov 2020 15:30:28: tx 67, rx 66, lost 0, late 0, last 2, min 1, max 2, trend 2.000
26 Nov 2020 15:30:29: tx 101, rx 100, lost 0, late 0, last 2, min 1, max 2, trend 1.700
26 Nov 2020 15:30:29: tx 134, rx 133, lost 0, late 0, last 2, min 1, max 2, trend 1.900
26 Nov 2020 15:30:30: tx 167, rx 166, lost 0, late 0, last 1, min 1, max 2, trend 1.300
26 Nov 2020 15:30:30: tx 201, rx 200, lost 0, late 0, last 2, min 1, max 3, trend 2.000
26 Nov 2020 15:30:31: tx 234, rx 233, lost 0, late 0, last 2, min 1, max 3, trend 2.000
26 Nov 2020 15:30:31: tx 268, rx 267, lost 0, late 0, last 2, min 1, max 3, trend 1.700
26 Nov 2020 15:30:32: tx 301, rx 300, lost 0, late 0, last 2, min 1, max 3, trend 1.100
26 Nov 2020 15:30:32: tx 335, rx 334, lost 0, late 0, last 2, min 1, max 3, trend 1.800
26 Nov 2020 15:30:33: tx 368, rx 367, lost 0, late 0, last 2, min 1, max 3, trend 2.000
26 Nov 2020 15:30:33: tx 402, rx 401, lost 0, late 0, last 2, min 1, max 3, trend 1.500
26 Nov 2020 15:30:34: tx 435, rx 434, lost 0, late 0, last 2, min 1, max 3, trend 2.000
26 Nov 2020 15:30:34: tx 469, rx 468, lost 0, late 0, last 1, min 1, max 3, trend 1.900
26 Nov 2020 15:30:35: tx 502, rx 501, lost 0, late 0, last 1, min 1, max 3, trend 1.000
26 Nov 2020 15:30:35: tx 536, rx 535, lost 0, late 0, last 1, min 1, max 3, trend 1.800
26 Nov 2020 15:30:36: tx 547, rx 547, lost 0, late 0, last 2, min 1, max 3, trend 1.800
26 Nov 2020 15:30:36: Test completed
```

The Round Trip Delay log is updated twice every second. A log entry is also made if an unexpected packet is received (late packet) and on a receive timeout (lost packet).

The logged values are described below:

- Tx   number of packets transmitted
- Rx   number of packets received
- lost   number of packets transmitted but not received
- late   number of packets transmitted but received after receive timeout (also counted as lost)
- last   the last measured RTD time
- min   minimum measured RTD time
- max   maximum measured RTD time
- trend   average of last 10 measured RTD times

If packets are being logged as **late**, it indicates that they are being received after the receive timeout has expired. Increasing the receive timeout to a suitably large value will stop this from occurring.

5.6 Monitoring

The FarSync Line Monitor is supplied with the FarSync BERT. This application supports real-time monitoring of transmitted and received data as it appears on the line being monitored. To use the FarSync Line Monitor to monitor the FarSync BERT's traffic the BERT **must** be run in software mode[2] (see BERT Support in Section 4.9.17).

[2] Note that when the BERT is running in hardware mode, the FarSync Line Monitor will actually display internal status information being passed back from the FarSync Flex to the host PC.

6 Command Line Mode

As well as running the FarSync BERT in its standard **GUI mode** (where the BERT is depicted graphically), you can alternatively use it in **Command Line Mode**. The same BERT engine, **BertClient.exe**, is used for both modes.

To run the BERT in **Command Line Mode**, start a command prompt and run **%FSBERTPATH%\bertclient**.

To see a list of available command line options, run **BertClient** with the command line parameter ? as shown below:

6.1 Command Line Options

```
Command Prompt

D:\>%FSBERTPATH%\BertClient -?

BertClient Version 4.1.0.0
Copyright (C) FarSite Communications Ltd. 2010..2020
Command-line Params: -?
BertClient Command Line Options:

-c<card>       (Card number)
-p<port>       (Port number)
-m<mode>       (Interface Mode: Sync, Async)
-i<interface>  (Interface Type: V.24, X.21, V.35, RS530, RS449, RS485-2W, RS485-4W)
-n<encoding>   (Encoding Type: NRZ, NRZI, FM0, FM1, MAN, DMAN)
-k<clockrate>  (Clock Rates: 15..16000000 (device dependent), Int rate, or Ext if -e specified)
-a<bits>       (Async Data Bits: 5, 6, 7, 8)
-y<parity>     (Async Parity: NONE, ODD, EVEN, MARK, SPACE)
-z<stop>       (Async Stop Bits: (1, 2)
-X<flow>       (Async Flow Control: NONE, RTS, XON)
-N             (Use NRZIClocking)
-e             (Use external clock)
-x             (Use invert rx clock)
-r             (Use termination)
-q<secs>       (Queue Size of data in seconds)
-t<testpttrn>  (Test pattern to use: 63,511,2047,2^15,2^20,2^23,QRSS,1:7,1/16,2/8,3/24,MK,SP,1:1,FOX,USER)
-l<length>     (Length of test data in bits)
-L<duration>   (Duration of test in seconds)
-S<duration>   (Duration of No-Sync timeout in seconds)
-s             (Stop on Error - after 1st sync)
-b             (Use Burst Mode)
-o<size>       (Max log file size: 0..1000000000)
+x<extended>   (Extended Config: any combination of RxTerminalTiming=1,TxTerminalTiming=2,TIV=8)
+v             (Use auto-invert)
+S             (Use s/w-based BERT mode)
+l             (Enable data logging)
+u<filename>   (User Pattern filename)
+U<filetype>   (User Pattern filetype: BIN, HEX)
+M<type&id>    (Multi-Drop test: +Mm<slave list> or +Ms<slave id>, e.g. +Mm1.4,6,8 or +Ms7)
+q             (Poll Quiet Slaves, Multi-Drop only)
+d<datalen>    (Data Length in bytes, Multi-Drop & Round Trip Delay only)
+R             (Round Trip Delay test)
+r<rxtimeout>  (Receive Timeout in ms, Round Trip Delay only)
+t<txdelay>    (Transmit Delay in ms, Round Trip Delay only)
+y             (Start with DTR asserted)
+z             (Start with RTS asserted)

e.g. bertclient -c2 -mSYNC -iX.21 -k1024000 -t2047 -l2048000


D:\>
```

When using the BertClient in the Command Line Mode the Enable Data Logging (+l) option can be used to log more detailed information compared to what is output to the terminal.

Note that when specifying test patterns (**-t**) containing a ^, (i.e. 2^15), you might have to use two ^^ (i.e. 2^^15), as a single one can be stripped out by the environment. Using double quotes should also work (i.e. –t”2^15”).

6.2 Hardware Mode

The Hardware Mode is the default mode when running the FarSync BERT from the GUI, and it's the same case when running the **BertClient** from the command line. An example of the BertClient running in Hardware Mode is shown below.

```
C:\Windows\System32\cmd.exe

D:\>%FSBERTPATH%\BertClient -c0 -mSYNC -iX.21 -k1024000 -t2047 -l2048000

BertClient Version 4.1.0.0
Copyright (C) FarSite Communications Ltd. 2010..2020
Command-line Params: -c0 -mSYNC -iX.21 -k1024000 -t2047 -l2048000
16 Oct 2020 16:02:36 Duration(s)=1.000
TxCount=1024001 RxCount=1024001 BlockCount=501 Rate=1024001
BitErr=0 BlockErr=0 ES(US)=0 SES=0 AS=1 es=0 ses=0
BER=0.000e+00
->LOS=0 ->SYNC=0 LOSR=0.00

16 Oct 2020 16:02:37 Duration(s)=2.000
TxCount=2048001 RxCount=2048001 BlockCount=1001 Rate=1024000
BitErr=0 BlockErr=0 ES(US)=0 SES=0 AS=2 es=0 ses=0
BER=0.000e+00 ESR=0.000e+00 SESR=0.000e+00 ASR=1.000e+00
->LOS=0 ->SYNC=0 LOSR=0.00


D:\>
```

where:

- -c2 use card 2
- -mSYNC use synchronous
- -iX.21 use X.21 interface
- -k1024000 use 1Mbps linespeed
- -t2047 use pattern 2047
- -l2048000 terminate test when 2Mbits have been received

In Hardware Mode, the test status is updated every second.

6.3 Software Mode

To run the BertClient in Software Mode, use the +S option on the command line. Here the option to stop the test on the first detected error (-s) has also been specified.

```
C:\Windows\System32\cmd.exe

D:\>%FSBERTPATH%\BertClient -c0 -mSYNC -iX.21 -k1024000 -t2047 -l2048000 +S -s

BertClient Version 4.1.0.0
Copyright (C) FarSite Communications Ltd. 2010..2020
Command-line Params: -c0 -mSYNC -iX.21 -k1024000 -t2047 -l2048000 +S -s
16 Oct 2020 16:05:16 Duration(s)=0.063
TxCount=65536 RxCount=65536 BlockCount=32 Rate=1032518
BitErr=0 BlockErr=0 ES(US)=0 SES=0 AS=0 es=0 ses=0
BER=0.000e+00
->LOS=0 ->SYNC=0 LOSR=0.00

16 Oct 2020 16:05:17 Duration(s)=0.576
TxCount=589824 RxCount=589824 BlockCount=288 Rate=1024704
BitErr=0 BlockErr=0 ES(US)=0 SES=0 AS=0 es=0 ses=0
BER=0.000e+00
->LOS=0 ->SYNC=0 LOSR=0.00

16 Oct 2020 16:05:17 Duration(s)=1.088
TxCount=1114112 RxCount=1114112 BlockCount=544 Rate=1024344
BitErr=0 BlockErr=0 ES(US)=0 SES=0 AS=1 es=0 ses=0
BER=0.000e+00 ESR=0.000e+00 SESR=0.000e+00 ASR=1.000e+00
->LOS=0 ->SYNC=0 LOSR=0.00

16 Oct 2020 16:05:18 Duration(s)=1.599
TxCount=1638400 RxCount=1638400 BlockCount=800 Rate=1024469
BitErr=0 BlockErr=0 ES(US)=0 SES=0 AS=1 es=0 ses=0
BER=0.000e+00 ESR=0.000e+00 SESR=0.000e+00 ASR=1.000e+00
->LOS=0 ->SYNC=0 LOSR=0.00


D:\>
```

where:

- -c2 use card 2
- -mSYNC use synchronous
- -iX.21 use X.21 interface
- -k1024000 use 1Mbps linespeed
- -t2047 use pattern 2047
- -l2048000 terminate test when 2Mbits have been received
- +S use software mode
- -s terminate the test on the first detected error following synchronisation

In the software mode, the status output is updated approximately twice a second.

6.4 Multi-Drop Mode

Each instance of the **BertClient** can implement either a master node or a slave node. It is recommended that each of the slave nodes on the network are implemented using the **BertClient's Command Line Mode**.

The command line for a typical slave node is shown below:

```
C:\>%FSBERTPATH%\bertclient -c4 -iRS485-4W -nMAN -k512000 +Msl

BertClient Version 4.1.0.3
Copyright (C) FarSite Communications Ltd. 2010..2020
Command-line Params: -c4 -iRS485-4W -nMAN -k512000 +Msl
^C
C:\>
```

where:

- -c4 use card 4
- -iRS485-4W use interface RS485 4-Wire
- -nMAN use Manchester encoding
- -k512000 use 512kbps linespeed
- +Ms1 perform the Multi-Drop test using Slave Id 1

Each instance of the **BertClient** slave should be started before the **BertClient** master is started. Care should be taken to ensure that the interface, encoding and linespeed match the values selected on the **BertClient** master.

The **BertClient** slave is terminated using Ctrl-C.

The **BertClient** master can also be run from the command line (although it is recommended to use the GUI mode). An example of running an instance of a **BertClient** master from the command line is shown below:

```
C:\>%FSBERTPATH%\BertClient -c2 -IRS485-2W -nMAN -k512000 -S60 -L60 +Mm1.3

BertClient Version 4.1.0.2
Copyright (C) FarSite Communications Ltd. 2010..2020
Command-line Params: -c2 -IRS485-2W -nMAN -k512000 -S60 -L60 +Mm1.3
SlaveId 1, Setting Active
SlaveId 1, First Sync
SlaveId 1, First Sync, Resetting Stats
SlaveId 2, No Data
SlaveId 2, Not Active, So Don't Poll
SlaveId 3, No Data
SlaveId 3, Not Active, So Don't Poll
SlaveId 1, ElapsedUsecs 65009, Tx 15936, SRxBit 13944, SRxBlock 6, RxRate 214493
SlaveId 1, BitErr 0, BlockErr 0, ES(US) 0, SES 0, AS 0, es 0, ses 0
SlaveId 1, BER 0.00, ESR 0.00, SESR 0.00, ASR 0.00, ->LOS 0, ->SYNC 0, ->LOSR 0.00
SlaveId 1, ElapsedUsecs 576429, Tx 127488, SRxBit 125496, SRxBlock 61, RxRate 217712
SlaveId 1, BitErr 0, BlockErr 0, ES(US) 0, SES 0, AS 0, es 0, ses 0
SlaveId 1, BER 0.00, ESR 0.00, SESR 0.00, ASR 0.00, ->LOS 0, ->SYNC 0, ->LOSR 0.00
SlaveId 1, ElapsedUsecs 1074760, Tx 235056, SRxBit 233064, SRxBlock 113, RxRate 216852
SlaveId 1, BitErr 0, BlockErr 0, ES(US) 0, SES 0, AS 1, es 0, ses 0
SlaveId 1, BER 0.00, ESR 0.00, SESR 0.00, ASR 100.00, ->LOS 0, ->SYNC 0, ->LOSR 0.00
SlaveId 1, ElapsedUsecs 1582338, Tx 344616, SRxBit 342624, SRxBlock 167, RxRate 216530
SlaveId 1, BitErr 0, BlockErr 0, ES(US) 0, SES 0, AS 1, es 0, ses 0
SlaveId 1, BER 0.00, ESR 0.00, SESR 0.00, ASR 100.00, ->LOS 0, ->SYNC 0, ->LOSR 0.00
SlaveId 1, ElapsedUsecs 2093863, Tx 456168, SRxBit 454176, SRxBlock 221, RxRate 216908
SlaveId 1, BitErr 0, BlockErr 0, ES(US) 0, SES 0, AS 2, es 0, ses 0
SlaveId 1, BER 0.00, ESR 0.00, SESR 0.00, ASR 100.00, ->LOS 0, ->SYNC 0, ->LOSR 0.00
SlaveId 1, ElapsedUsecs 2604671, Tx 565728, SRxBit 565728, SRxBlock 276, RxRate 217197
SlaveId 1, BitErr 0, BlockErr 0, ES(US) 0, SES 0, AS 2, es 0, ses 0
SlaveId 1, BER 0.00, ESR 0.00, SESR 0.00, ASR 100.00, ->LOS 0, ->SYNC 0, ->LOSR 0.00
```

where:

- -c2 use card 2
- -iRS485-4W use interface RS485 4-Wire
- -nMAN use Manchester encoding
- -k512000 use 512kbps linespeed
- -S60 allow 60 seconds for all slaves to synchronise
- -L60 run the test for 60 seconds after all slaves being polled have synchronised
- +Mm1.3 perform Multi-Drop test as master, poll slaves 1,2,3 (the dot, denotes a range)

In this example, slaves 2 and 3 weren't active, and +q (poll quiet slaves) wasn't specified. The output shows that slaves 2 and 3 returned **No Data** as expected, and so were dropped from the poll list. Slave 1 achieved sync and as the test progressed its AS count increased as expected.

For the **BertClient** master, if the +l option was specified, the results would also have been written to the log file.

6.5 RTD Mode

The Round Trip Delay test is implemented using the command line parameter +R. An example of the Round Trip Delay test in **Command Line Mode** is shown below:

```
Command Prompt
D:\>%FSBERTPATH%\BertClient -c0 -mSYNC -iX.21 -k9600 -L10 +R +r100 +t0 +d10

BertClient Version 4.1.0.0
Copyright (C) FarSite Communications Ltd. 2010..2020
Command-line Params: -c0 -mSYNC -iX.21 -k9600 -L10 +R +r100 +t0 +d10
tx 34, rx 33, lost 0, late 0, last 0, min 0, max 2, trend 0.800
tx 67, rx 66, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 101, rx 100, lost 0, late 0, last 0, min 0, max 2, trend 0.500
tx 134, rx 133, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 168, rx 167, lost 0, late 0, last 0, min 0, max 2, trend 0.300
tx 201, rx 200, lost 0, late 0, last 1, min 0, max 2, trend 0.900
tx 234, rx 233, lost 0, late 0, last 1, min 0, max 2, trend 0.900
tx 267, rx 266, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 300, rx 299, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 334, rx 333, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 367, rx 366, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 400, rx 399, lost 0, late 0, last 1, min 0, max 2, trend 0.900
tx 434, rx 433, lost 0, late 0, last 1, min 0, max 2, trend 0.800
tx 467, rx 466, lost 0, late 0, last 1, min 0, max 2, trend 0.800
tx 500, rx 499, lost 0, late 0, last 1, min 0, max 2, trend 1.300
tx 533, rx 532, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 566, rx 565, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 600, rx 599, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 633, rx 632, lost 0, late 0, last 1, min 0, max 2, trend 1.000
tx 666, rx 665, lost 0, late 0, last 1, min 0, max 2, trend 0.300
tx 667, rx 667, lost 0, late 0, last 1, min 0, max 2, trend 0.500

D:\>
```

where:

- -c2 use card 2
- -mSYNCuse synchronous
- -iX.21 use X.21 interface
- -k9600 9600bps linespeed
- -L10 run the test for 10 seconds
- +R perform Round Trip Delay test
- +r100 receive packet timeout of 100ms
- +d10 use 10 byte payload length

The status output is updated twice a second.

7 Script Files

To run a series of tests, a script/batch file can be used to automate the process. The script/batch file can be run from a Windows command line prompt by simply typing the name of the batch file. An example script/batch file is shown below:

```
@echo off
echo.
echo FarSync BERT Script
%FSBERTPATH%\bertclient -c1 -mSYNC -iX.21 -k1024000 -t2047 -l2048000 -s
if not %ERRORLEVEL% == 1 goto fail
%FSBERTPATH%\bertclient -c1 -mSYNC -iX.21 -k64000 -t2047 -l80000 -s
if not %ERRORLEVEL% == 1 goto fail
%FSBERTPATH%\bertclient -c1 -mSYNC -iX.21 -k9600 -t2047 -l1000 -s
if not %ERRORLEVEL% == 1 goto fail
goto success
:fail
echo.
echo ------------
echo Test failed!
echo ------------
echo.
goto end
:success
echo.
echo ----------------
echo Tests successful
echo ----------------
echo.
:end
```

Note the use of the -s command line parameter used in the script/batch file. This makes the test terminate as soon as an error is detected which is normally desirable when running in script mode.

8 API Support

As well as supporting GUI and scripting modes, the FarSync BERT also includes native API support. This enables the BERT to be configured and executed directly from within customer applications.

The FarSync BERT API is a COM-based API that enables support from any COM-compatible host application. This includes, for example, applications developed in Python, C#, Java, VBS and LabVIEW.

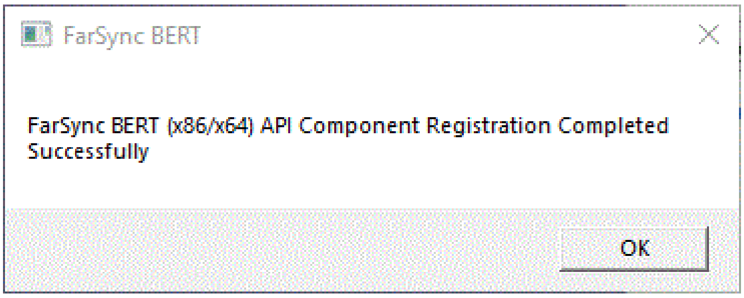
The same BERT engine, **BertClient**.exe, is used in LabVIEW mode as is used in GUI and script modes.

8.1 Installation

To install the FarSync BERT API support

- ensure the target application environment(s) e.g. LabVIEW, and the FarSync BERT are not currently running
- copy the **BERT_API** folder onto one of your local hard discs
- run **fsbert_api_install** (from your local copy of the **BERT_API\install** folder) – this should complete displaying the following dialog

Note that it will show (**x86/x64)** if you install onto an x64 platform and (**x86**) when being installed onto an x86 platform:



Being a COM-based API, the FarSync BERT API appears very similar in all the different types of applications from which it can be used. It really only varies with regard to the specifics of the application environment itself.

Sample, illustrative Python, C#, VBS and LabVIEW applications are included in the **BERT_API\examples** folder.

8.2 Methods

The following methods are available to applications using the FarSync BERT Interface. These all map onto the corresponding operations that are supported by the FarSync BERT GUI itself.

Method	Parameters	Description
Start	None	Once the interface instance has been configured (i.e. via its port and pattern properties) the **Start** method should be called to start an actual BERT test
InjectError	newVal - I16: Number of error bits to inject	Whilst a BERT test is running, errors can be injected in the outbound datastream via the **InjectError** method
Reset	None	Whilst a BERT test is running, the statistics can be reset at any time via the **Reset** method i.e. without needing to stop the test
Stop	None	Use the **Stop** method to stop BERT test that is currently running
SetPatternFileName	SAFEARRAY(byte)* filename short length	Required to set the PatternFileName property – the property can be read using the corresponding property accessor in Section 8.3
SetMultiDropSlaveList	SAFEARRAY(byte)* - slavelist short - length	Required to set the MultiDropSlaveList property – the property can be read using the corresponding property accessor in Section 8.3

These methods are demonstrated in the supplied samples.

8.3 Properties

The following properties are available to applications using the FarSync BERT Interface. These map onto the corresponding configuration and statistical properties that are supported by the FarSync BERT GUI itself.

Property	Type	Description
Device	I16 (W)	Specifies the FarSync device instance to be used - this number is the same as the # identified in Device Manager in FarSync WAN Adapters - FarSync Flex/K2Ee (SDCI#). This property is read by the FarSync BERT whenever a BERT test is started. Default = 0
Port	I16 (R/W)	Specifies the port number of the selected FarSync device Default = 0
Interface	FsBertInterfaceConstants (R/W): FsBertInterface_V24 (1) FsBernterface_X21 (2) FsBertInterface_V35 (3) FsBertInterface_RS530 (6) FsBertInterface_RS449 (6) FsBertInterface_RS485 (7)	Specifies the interface type of the FarSync port. This property is read by the FarSync BERT whenever a BERT test is started. Default = V24
Rate	I32 (R/W)	Specifies the rate of the line connected to the FarSync

		port. This property is read by the FarSync BERT whenever a BERT test is started. Default = 9600
Clocking	FsBertClockingConstants (R/W): FsBertClocking_Internal (0) FsBertClocking_External (1) FsBertClocking_Internal_TT (2) FsBertClocking_External_TT (3) FsBertClocking_Bidirect (4)	Specifies the Clocking mode the FarSync port will use. This property is read by the FarSync BERT whenever a BERT test is started. Default = FsBertClocking_Internal
Async	BOOLEAN (R/W)	Specifies whether the FarSync port will be configured for Sync or Async mode. TRUE ==> The FarSync port will use Async mode FALSE ==> The FarSync port will use Sync mode This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE i.e. e Sync mode
Termination	BOOLEAN (R/W)	Specifies whether termination is used on the FarSync port. This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE
Encoding	FsBertEncodingConstants (R/W): FsBertEncoding_NRZ (0x80) FsBertEncoding_NRZI (0xa0) FsBertEncoding_FM0 (0xc0) FsBertEncoding_FM1 (0xd0) FsBertEncoding_MAN (0xe0) FsBertEncoding_DMAN (0xf0)	Specifies the encoding mode used by the FarSync port. This property is read by the FarSync BERT whenever a BERT test started. Default = NRZ
InvertRxClock	BOOLEAN (R/W)	Specifies whether the port should change the phase of the internal clock by 180 degrees (for received data) - (see Invert Rx Clock). This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE
NRZIClocking	BOOLEAN (R/W)	Specifies whether the port provides a separate one times clock with the (NRZI) encoded data - (see NRZI Clocking). This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE
AdvancedClocking	BOOLEAN (R/W)	Specifies whether Advanced Clocking is used on the FarSync port. This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE
DataBits	I16 (R/W)	Specifies the number of async data bits (8,7,6 or 5) in each character. This is only applicable when the BERT is set in **ASYNC** mode. This property is read by the FarSync BERT whenever a BERT test is started.

		Default = 8
StopBits	I16 (R/W)	Specifies the number of sync stop bits (1 or 2) in each character. This is only applicable when the BERT is set in **ASYNC** mode. This property is read by the FarSync BERT whenever a BERT test is started. Default = 1
Parity	FsBertParityConstants (R/W): FsBertParity_NONE (0) FsBertParity_ODD (1) FsBertParity_EVEN (2) FsBertParity_MARK (3) FsBertParity_SPACE (4)	Specifies the async parity setting for the port. This is only applicable when the BERT is set in **ASYNC** mode This property is read by the FarSync BERT whenever a BERT test is started. Default = NONE
FlowControl	FsBertFlowControlConstants (R/W): FsBertFlowControl_NONE (1) FsBertFlowControl_RTS (2) FsBertFlowControl_XON (3)	Specifies the async flow control setting for the port. This is only applicable when the BERT is set in **ASYNC** mode. This property is read by the FarSync BERT whenever a BERT test is started. Default = NONE
InvertTx	BOOLEAN (R/W)	Specifies whether the BERT should invert its transmit data (See Invert Tx (TIV)). This property value can be optionally updated by the VI during the test. Default = FALSE
AutoInvert	BOOLEAN (R/W)	Specifies whether the BERT should automatically invert the received data (if still in LOS after secs) to determine if synchronisation can then be established (See AutoInvert (RIV)). This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE
Pattern	FsBertPatternConstants (R/W): FsBertPattern_63 (1) FsBertPattern_511 (2) FsBertPattern_2047 (3) FsBertPattern_2_15 (4) FsBertPattern_2_20 (5) FsBertPattern_23 (6) FsBertPattern_QRSS (7) FsBertPattern_1_7 (8) FsBertPattern_1_16 (9 FsBertPattern_2_8 (10) FsBertPattern_3_24 (11) FsBertPattern_ALT_1_0 (13) FsBertPattern_FOX (14) FsBertPattern_MK (15) FsBertPattern_SP (16)	Specifies the pattern to be used for the next test to be started. This property is read by the FarSync BERT whenever a BERT test is started. Default = 2047
TestLength	I32 (R/W)	Determines how many bits to test in the received datastream before completing the test - (see Length).

		A value of 0 implies the test will run continuously until the **Stop** method is called (or until, for example, the FarSync port is disconnected) This property is read by the FarSync BERT whenever a BERT test is started. Default = 0
BurstMode	BOOLEAN (R/W)	Specifies whether the test should use Burst Mode or not. This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE (i.e. don't use Burst Mode)
LoggingMode	BOOLEAN (R/W)	Specifies whether the test should perform logging or not. This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE
MaxLogFileSize	I32 (R/W)	Specifies maximum log file size to be used - (see MaxLogFleSize) This property is read by the FarSync BERT whenever a BERT test is started Default = 1000000
DTR	BOOLEAN (R/W)	Indicates the state of the DTR (output) signal. TRUE ==> Asserted; FALSE ==> Deserted. This property value can be optionally updated by the VI during the test. Default = FALSE
RTS	BOOLEAN (R/W)	Indicates the state of the RTS (output) signal. TRUE ==> Asserted; FALSE ==> Deasserted. This property value can be optionally updated by the VI during the test. Default = FALSE
CTS	BOOLEAN (RO)	Indicates the state of the CTS (input) signal. TRUE ==> Asserted; FALSE ==> Deasserted.
DCD	BOOLEAN (RO)	Indicates the state of the DCD (input) signal. TRUE ==> Asserted; FALSE > Deasserted.
InSync	BOOLEAN (RO)	Indicates whether the current test is in sync or not.
Status	FsBertStatusConstants (RO): FsBertStatus_Starting (1) FsBertStatus_Started (2) FsBertStatus_Stopped (3) FsBertStatus_StartError (4) FsBertStatus_AccessError (5)	Indicates the state of the current test.
softwareMode	BOOLEAN (R/W)	Specifies whether the test should run in hardware or software mode (see BERT Support in Section 4.9.17). This property is read by the FarSync BERT whenever a BERT test is started. Default = FALSE (i.e. use Hardware Mode if supported by device)

RIV	BOOLEAN (RO)	Indicates whether the BERT is currently inverting its received data (see Auto Invert (RIV))
Duration	DBL (RO)	Reports how long the current test has been running (µsecs).
BitCount	DBL (RO)	Reports the number of bits received during the current test.
BlockCount	DBL (RO)	Reports the number of blocks received during the current test.
BitErrorCount	DBL (RO)	Reports the number of errored bits received during the current test.
BlockErrorCount	DBL (RO)	Reports the number of errored blocks received during the current test.
ESCount	DBL (RO)	Reports the number of errored seconds (ES) during the current test.
SESCount	DBL (RO)	Reports the number of seriously errored seconds (SES) during the current test.
ASCount	DBL (RO)	Reports the number of available (non-errored) seconds (AS) during the current test.
LOSCount	DBL (RO)	Reports the number of times synchronisation has been lost during the current test.
LOSDuration	DBL (RO)	Reports how long synchronisation has been lost for during the current test.
BitRate	DBL (RO)	Reports the received bit rate achieved during the current test.
BlockRate	DBL (RO)	Reports the received block rate achieved during the current test.
BitErrorRate	DBL (RO)	Reports the received bit error rate calculated over the duration of the current test
BlockErrorRate	DBL (RO)	Reports the received block error rate calculated over the duration of the current test.
ESRate	DBL (RO)	Reports the proportion of seconds that were errored seconds (ES) during the current test.
SESRate	DBL (RO)	Reports the proportion of seconds that were seriously errored seconds (SES) during the current test.
ASRate	DBL (RO)	Reports the proportion of seconds that were available seconds (AS) during the current test.
LOSRate	DBL (RO)	Reports the proportion of seconds where synchronisation was lost during the current test.
StopType	FsBertStopTypeConstants (R/W): FsBertStop_LENGTH (0) FsBertStop_TIME (1)	Specifies whether the test should terminate when the specified number of bits have been received or after the specified number of seconds have elapsed.
TestTime	I32 (R/W)	If StopType is set to TIME, this specifies the length of the test in seconds. The duration of the test starts after Sync is first achieved.

SyncTime	I32 (R/W)	Specifies how long the test should run without Sync being achieved.
PatternFilename	SAFEARRAY(BYTE) I16 (RO)	Specifies the filename of the User Pattern Filename. The length is specified by length(I16)
PatternFiletype	FsBertUserPatternTypeConstants (R/W): FsBertUserPatternType_BIN (0) FsBertUserPatternType_HEX (1)	Specifies the filetype of the User Pattern File. See UserPatterns for the correct format of HEX based text files.
MultiDropMode	BOOLEAN (R/W)	Specifies whether a Multi-Drop mode test should be run (see Multi-Drop for details). Default = FALSE
MultiDropDesignation	FsBertMultiDropConstants (R/W): FsBertMultiDropDesignation_-MASTER (0) FsBertMultiDropDesignation_-SLAVE (1)	Specifies if this node should be configured as a Master or a Slave node.
MultiDropSlaveList	SAFEARRAY(BYTE), I16 (RO)	In Master mode, specifies the list of slaves to be polled. Slaves can be entered individually i.e. 3,4,5 or as a range i.e. 3-5, or a combination of both i.e. 3,4-6,8 10 11. The length is specified by Length (I16).
MultiDropSlaveId	I32 (R/W)	In Slave mode, specifies the Id of the slave.
MultiDropPollQuietSlaves	BOOLEAN (R/W)	In Master mode, specifies if unresponsive slaves continue to be polled. Default = FALSE
MultiDropPayloadLength	I32 (R/W)	In Master mode, specifies the size (in bytes) of the payload sent in each packet.
MultiDropSlaveSelect	I32 (R/W)	Specifies the slave from which to read results and status information. If MultiDrop mode is TRUE, this should be called before calling BitCount, BlockCount etc. and before MultiDropSlaveDuration, MultiDropActive, MultiDropSync, MultiDropRIV and MultiDropTIV.
MultiDropSlaveDuration	DBL (RO)	Reports the specified slave's share of time (in µsecs), since the test began.
MultiDropRIV	BOOLEAN (RO)	Reports the receiver inversion status of the specified slave.
MultiDropTIV	BOOLEAN (RO)	Reports the transmitter inversion status of the specified slave.
MultiDropSync	BOOLEAN (RO)	Reports the state of synchronisation of the specified slave.
MultiDropActive	BOOLEAN (RO)	Reports if the specified slave is actively echoing back messages.
RoundTripDelayMode	BOOLEAN (R/W)	Specifies whether a Round Trip Delay test should be run (see Round Trip Delay for details). Default = FALSE.
RTDPayloadLength	I32 (R/W)	Specifies the size of the Round Trip Delay packet payload.

RTDTransmitDelay	I32 (R/W)	Specifies the delay between receiving one packet and transmitting the next packet.
RTDReceiveTimeout	I32 (R/W)	Specifies the timeout to wait for a transmitted packet to be received.
RTDLostPackets	DBL (RO)	Reports the number of packets which have been transmitted but not received.
RTDTxPackets	DBL (RO)	Reports the number of packets which have been transmitted.
RTDRxPackets	DBL (RO)	Reports the number of packets which have been received.
RTDTime	DBL (RO)	Reports the Round Trip Delay time of the last packet received at the sampling time.
RTDMin	DBL (RO)	Reports the minimum Round Trip Delay time received.
RTDMax	DBL (RO)	Reports the maximum Round Trip Delay time received.
RTDAverage	DBL (RO)	Reports the average Round Trip Delay time received.
RTDTrend	DBL (RO)	Reports the average of the last 10 Round Trip Delay packets received.
RTDTimes	SAFEARRAY(I32,I32), I16	A 2-dimensional array containing the Round Trip Delay times and the number of each occurrence. Returns the array size as RTDTimes (I16).

A range of these properties are demonstrated in the supplied samples.

8.4 Logging

As in the GUI and Command Line Modes, if logging is enabled, the BERT's log file (see Section 5.5) is updated with each test that is run from the BERT-enabled application. The maximum log file size can be configured programmatically via the **MaxLogFileSize** property.

8.5 LabVIEW Support

A number of additional points, relating to use of the FarSync BERT API specifically from LabVIEW applications (VIs), are detailed in the following sections.

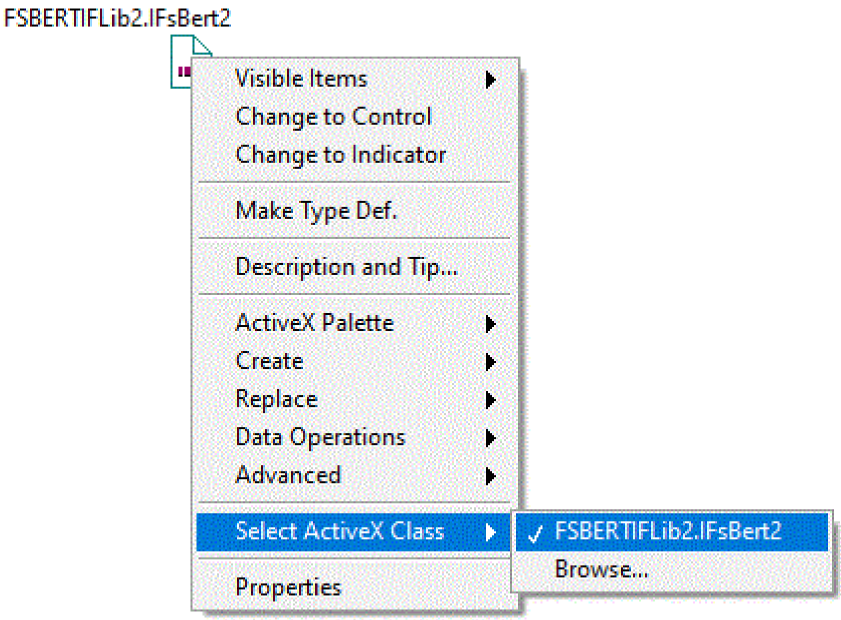
The FarSync BERT LabVIEW support has been developed and tested using **LabVIEW 2010-2020**.

8.5.1 Opening the Interface

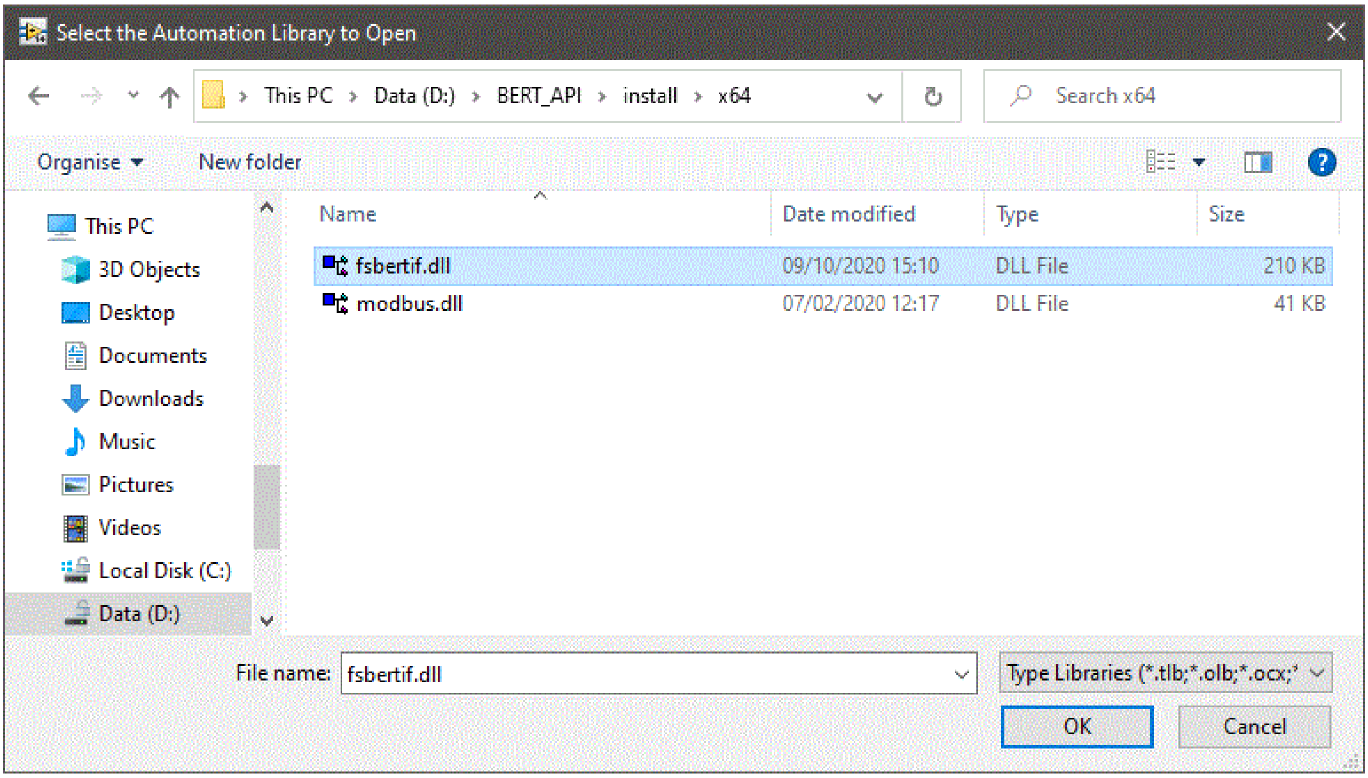
To utilise the FarSync BERT interface from a LabVIEW VI, it firstly needs to open the interface.

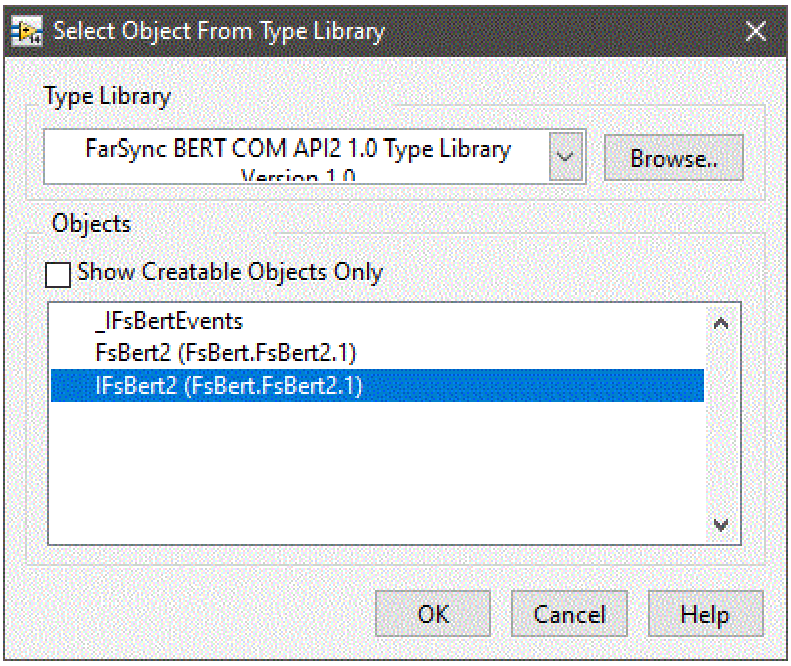
To do this, create an **Automation Refnum** control which is located in LabVIEW's **Controls:Classic»Classic Refnum** palette - see https://www.ni.com/docs/en-US/bundle/labview/page/types-of-refnum-controls.html

Right-click and use the ActiveX Class menu option to select the version of IFsBert interface that you have installed e.g. FSBERTIFLib2.IFsBert2

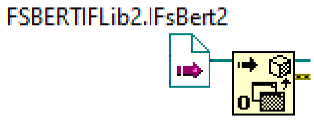


If the FSBERTIFLib2.IFsBert2 option is not available then you need to use the Browse option to use the **Select Object From Type Library** dialog to point LabVIEW at the fsbertif.dll off the **BERT_API\install** folder where you installed the FarSync BERT files in the installation step above (see Section 8.1).



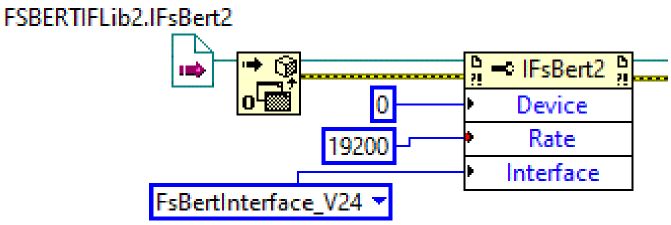


Now that the interface type has been set, add an **Automation Open** function which is located on LabVIEW's **Functions:Connectivity»ActiveX** palette[3] - see https://www.ni.com/docs/en-US/bundle/labview-api-ref/page/functions/automation-open.html and assign its **Automation Refnum** input to the output from the **Automation Refnum** control.



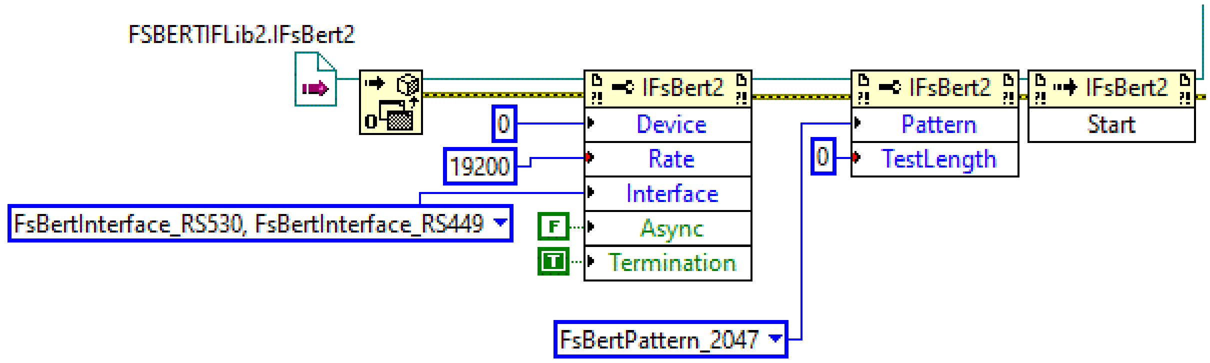
The reference output from the **Automation Open** function can then be used for all subsequent FarSync BERT interface calls.

To read/write a FarSync BERT property just create a **Property Node** (which is located on LabVIEW's **Functions:Connectivity»ActiveX** palette) and wire it up to use the interface reference and select the required property/properties to read/write e.g.



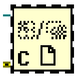
[3] Note that the **ActiveX** palette can be quickly located via the context menu of the **Automation Refnum** node. As you create additional nodes for the FarSync BERT interface, an **ActiveX** palette menu option will also appear in their context menus.

To use a FarSync BERT method just create an **Invoke Node** (which is located on LabVIEW's **Functions:Connectivity»ActiveX** palette) and wire it up to use the interface reference and select the required method e.g.



8.5.2 Closing the Interface

Once the VI has finished using the interface it should close it using the **Close Reference** function which is located on LabVIEW's **Functions:Connectivity»ActiveX** palette - see https://www.ni.com/docs/en-US/bundle/labview-api-ref/page/functions/close-reference.html.



8.5.3 Sample Virtual Instruments

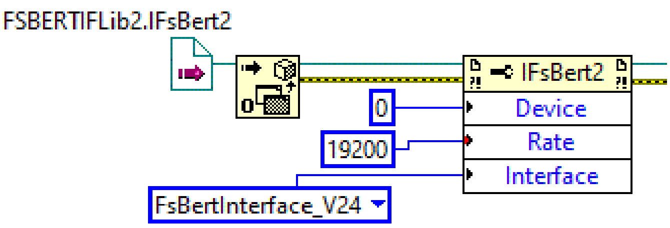
Two sample VI's, have been provided, fsbert.vi and RTD.vi. They both demonstrate how to interface to the FarSync BERT from a VI. These examples can be extended/modified to meet your specific requirements.

8.5.3.1 fsbert.vi

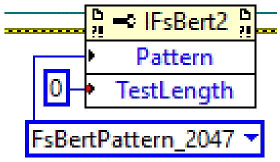
This VI demonstrates how to implement some of the features of the FarSync BERT's standard GUI:

- The BERT test is automatically started when the VI is run
- Clicking the **RTS** button will toggle the (output) state of RTS signal
- The **CTS** LED indicates the state of the (input) CTS signal
- The **Sync** LED indicates whether the BERT is currently in sync or not
- The **Inject** button injects errors into the output datastream for as long as the button remains pressed
- The **Reset** button resets the displays statistics
- <u>Both</u> the test <u>and the VI itself</u> are stopped when the **STOP** button is pressed

The sample configures the BERT port using the following:

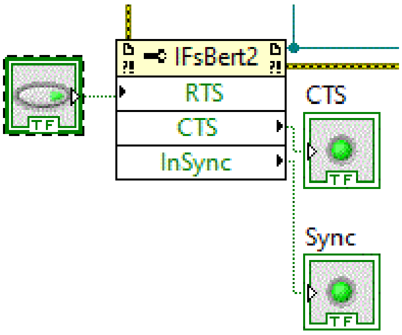


The sample configures the BERT test using the following:

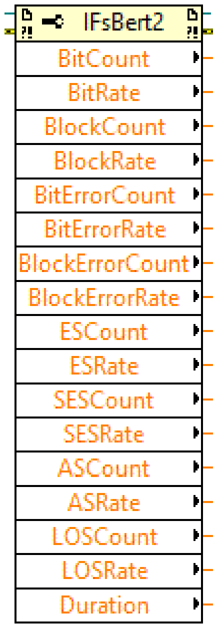


These property values are merely examples and can be set statically or dynamically by the user's own VI as required (note: a modified port configuration will not take effect until the next time the **Start** Method is called).

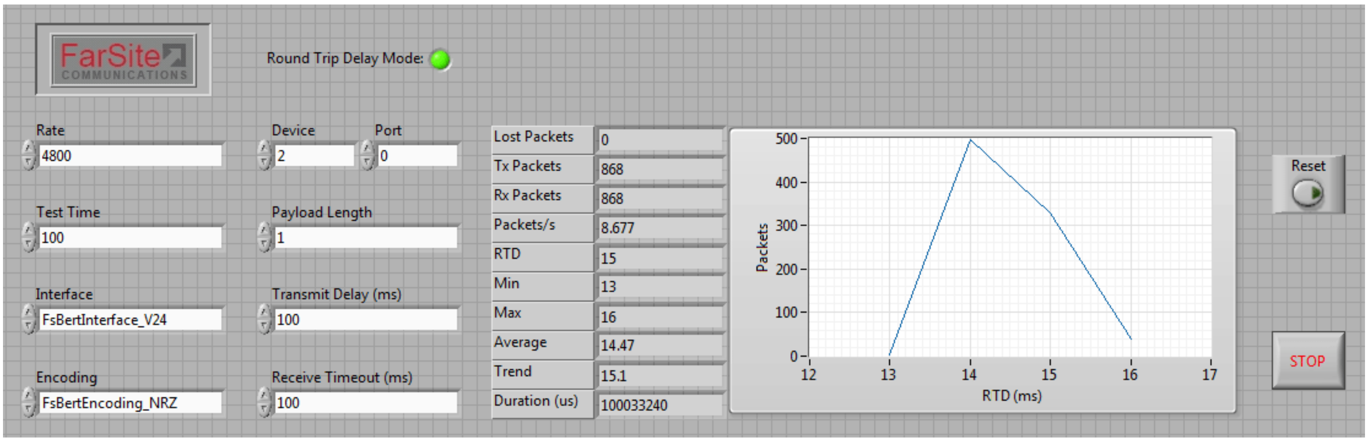
The sample's signals/LEDs are maintained using:



The sample's statistics are maintained via:



8.5.3.2 RTD.vi



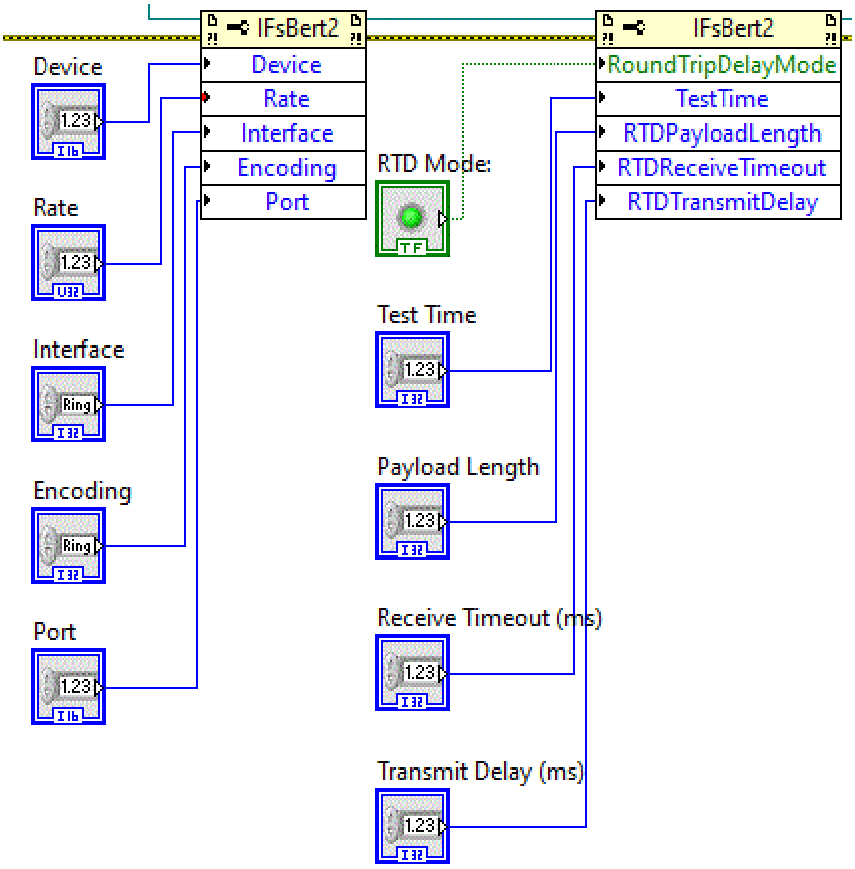
The Round Trip Delay VI sample demonstrates the features of the FarSync BERT's Round Trip Delay Mode.

Before running the test, the following parameters should be set:

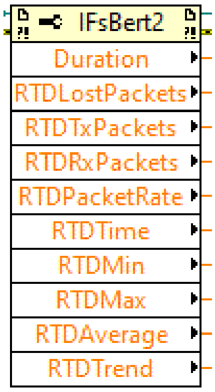
- Round Trip Delay Mode
- Device & Port
- Test Duration
- Rate
- Interface
- Encoding
- Payload Length (range: 1 to 31 bytes)
- Transmit Delay (range: 0 to 3,600,000ms)
- Receive Timeout (range: 0 to 10,000ms)

The RTD test is started automatically when the VI is run. Whilst the test is running the results table and chart are updated twice a second. The test can be stopped by stopping the VI or by pressing the Stop button.

The configuration is:



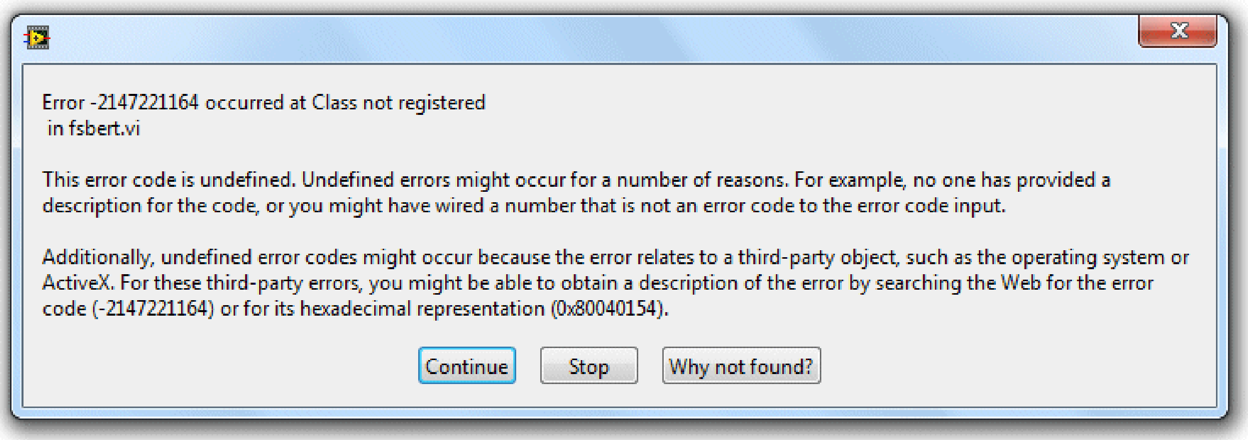
The results are maintained by:



For more details about the RTD results, see section 5.2.4 (Round Trip Delay Results).

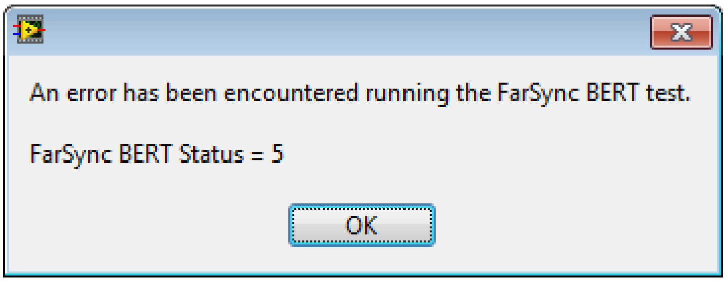
8.6 Troubleshooting

1) If, when you run the sample fsbert VI, the following dialog is displayed:



it implies that the BERT interface has not been registered successfully. Please quit LabVIEW and check the installation step described in Section 8.1.

2) If, when you run the sample fsbert VI, the following dialog is displayed:

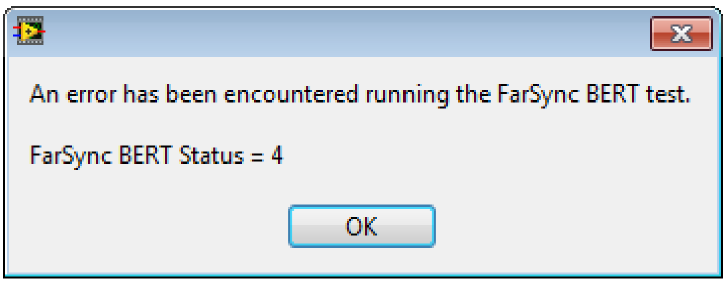


it implies that the FarSync port is not accessible. This could be, for example, because

- the FarSync device is physically not plugged in/enabled
- the wrong value has been assigned to the **Device** property
- the FarSync port is in use by another application e.g. the FarSync BERT is already running in GUI mode

Note that the Status value shown here corresponds to the Status property value, **FsBertStatus_AccessError (5)**, as listed in the Property table.

3) If, when you run the sample fsbert VI, the following dialog is displayed:



it implies that the BERT engine components themselves are not accessible. Please quit LabVIEW and check the installation step described in Section 8.1.

Note that the Status value shown here corresponds to the Status property value, **FsBertStatus_StartError (4)**, as listed in the Property table.

9 Calibration

The only calibration that your FarSync BERT requires is to verify the correct operating frequency of the internal crystal oscillator used for clock generation.

This can be performed without disassembling the unit by measuring the generated clock at the DCE interface.

It is recommended to test your BERT's calibration annually.

You will need:

- Your FarSync BERT
- For the USB BERT, a KCR1 cable; for the PCIe BERT, you will need a FCR2 cable
- A DB25 breakout box
- A calibrated frequency meter

To calibrate your FarSync BERT:

1. Install the BERT drivers and software on the host system to which you will attach your BERT
2. Plug in the USB BERT or install the PCIe BERT device
3. Allow ten minutes with your system running for the BERT to stabilise at the current ambient temperature
4. Use the BERT software to configure the BERT port. You will need to set the following settings:
5. RATE: 1024000,
6. MODE (**M**): SYNC,
7. INTERFACE (**I**): RS530,
8. CLOCK (**C**): INT
9. ENCODING: NRZ (from the additional configuration screen)
10. Attach your cables: the KCR1 cable will connect to the USB BERT and the FCR2 cable will connect to the PCIe BERT
11. Attach the breakout box. This needs to be on the **Port A** side of the FCR2 cable when using the PCIe BERT
12. Start (▶) the pattern generator using the BERT software
13. Use your frequency meter to measure the frequency of the clock on **pin 17**, using the ground reference on **pin 7** on the breakout box

Using these settings the expected voltage swing is nominally 0-5V, when unterminated, and the expected measured frequency is 1.024MHz with a variation tolerance of ±25ppm (USB BERT). If the measured frequency falls outside these limits, the device should be returned to FarSite for recalibration, using the standard FarSite returns procedure. Please contact FarSite support at support@farsite.com if you have any queries.

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