

---

# tProbe™ Serial Data Communication Analyzer (Datacom Analyzer)

---



818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878  
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: [info@gl.com](mailto:info@gl.com)  
Website: <https://www.gl.com>

# tProbe™ with Datacom Analyzer

Portable tProbe™ Datacom T1 E1 Analyzer



Back Panel

Front Panel

mTOP™ 1U Rack-mount tProbe™ Datacom T1 E1 Analyzer



Front Panel

Back Panel

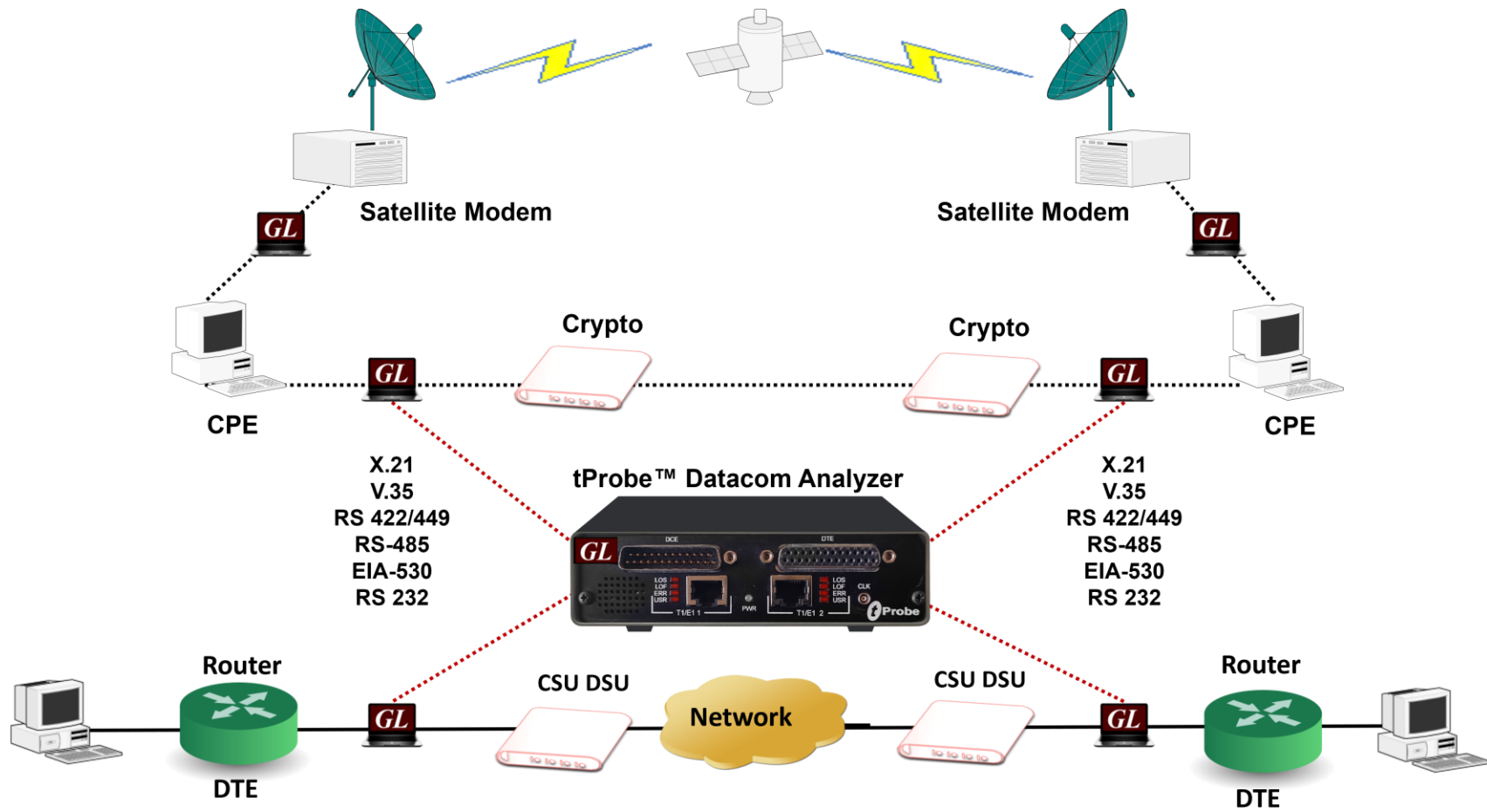
mTOP™ Probe tProbe™ T1 E1 Analyzer (Front Panel)



mTOP™ Probe tProbe™ T1 E1 Analyzer (Back Panel)



# Introduction



- The tProbe™ T1 E1 and Datacom analyzer is designed for test and verification of data communications equipment and circuits
- Software selectable modes are provided to emulate DTE, DCE and non-intrusive monitoring for both synchronous (Sync), and asynchronous (Async) modes

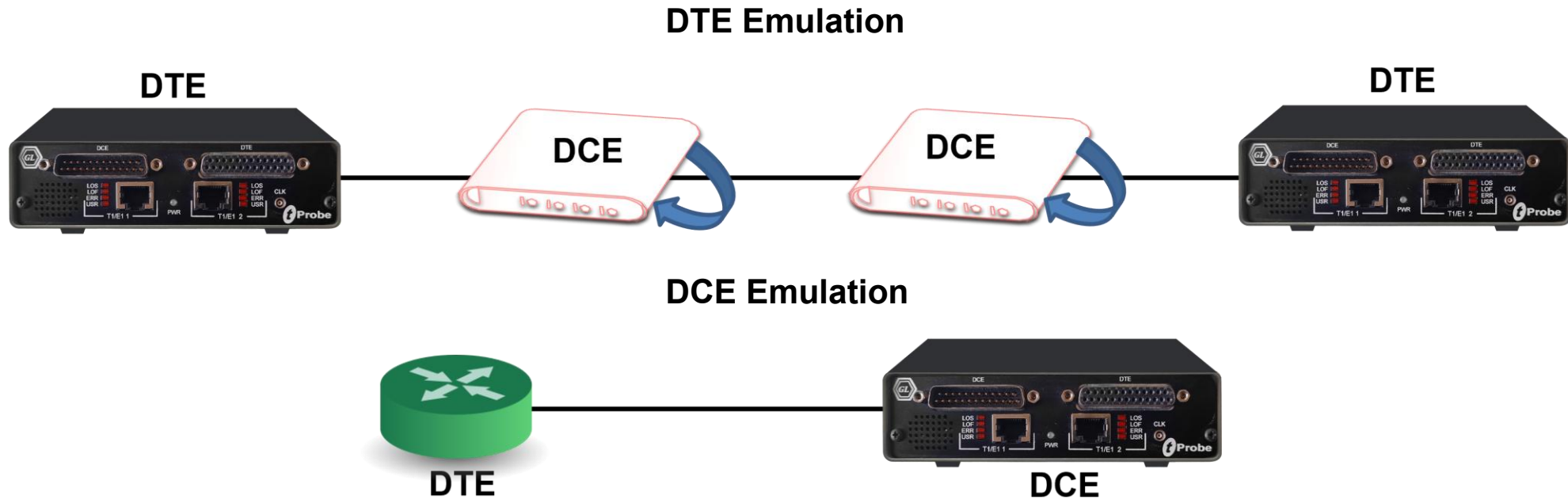
# Main Features

- Supported Line interfaces – V.24, V.35, X.21, RS-232, RS-449, EIA-530 and EIA-530A
- Allows user to define custom frequency data rate for all encoding options
- Supports Frequency Measurement, [PPP Analysis](#) and [HDLC Analysis](#)
- Sync BER from 300 b/s to 16.384Mbps - very wide dynamic range
- Async BER from 75 b/s to 115.2Kbps
- DTE or DCE emulation mode
- SYNC clock source and sense selection
- Windows Client / Server provides the capability of remote operation, automation, and multi-site connectivity
- Client Server (WCS) module also supports enhanced BER testing

# Main Features (Contd.)

- Supports NRZ, FM0, FM1 and Differential Manchester encoding schemes
  - Manchester IEEE BER from 75 b/s to 115.2Kbps
  - Manchester GE Thomas BER from 75 b/s to 115.2Kbps
  - Differential Manchester BER from 75 b/s to 115.2Kbps
  - Manchester FM0 and FM1 BER from 75 b/s to 115.2Kbps
  - NRZI BER from 0.5Mbps to 10Mbps
- Real time View of Data
- Record Playback of Files
- Delay and Impairment of Data
- Protocol Analysis for HDLC and PPP

# Typical Application



- Bidirectional monitoring with Y-adapter cable
- Monitor control leads, frequency
- DTE / DCE emulation for end-to-end testing of data networks, bidirectional monitoring for a greater level of troubleshooting for data networks
- Verifying end-to-end transmission through DCE or DTE

# Frequencies

Interface	Mode	Frequency	
		Low	High
<b>RS-232</b> <b>V.35</b> <b>EIA_530</b> <b>EIA_530A</b> <b>RS-449</b> <b>X.21</b>	Async	75 bps	115.2 Kbps
	Sync	300 bps	16.384 Mbps
	Manch IEEE	75 bps	1.024 Mbps
	ManchGE T	75 bps	1.024 Mbps
	NRZI	0.5 Mbps	10 Mbps
	ManchDiff	75 bps	1.024 Mbps
	ManchFM0	75 bps	1.024 Mbps
	ManchFM1	75 bps	1.024 Mbps

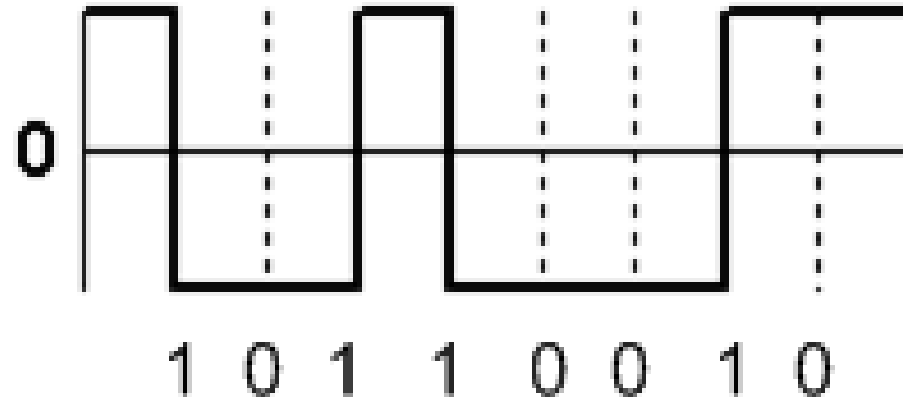
# Async Mode of Operation

- Data is transmitted without the clock
- Adds the start, stop, and parity check bits to the data. The start bit is used to start the process
- Asynchronous transmission is easy to implement but less efficient as it requires an extra 2–3 control bits for every 8 data bits
- This method is usually used for low volume transmission
- Transmitters and receivers extract the data using their own clock, and they do not share the common clock as in serial communication mode

# Sync Mode of Operation

- Requires the clock signal to be transmitted from the source along with the data
- Data rate for the link is same for the transmitter and receiver
- Transmitter and receiver share a common clock

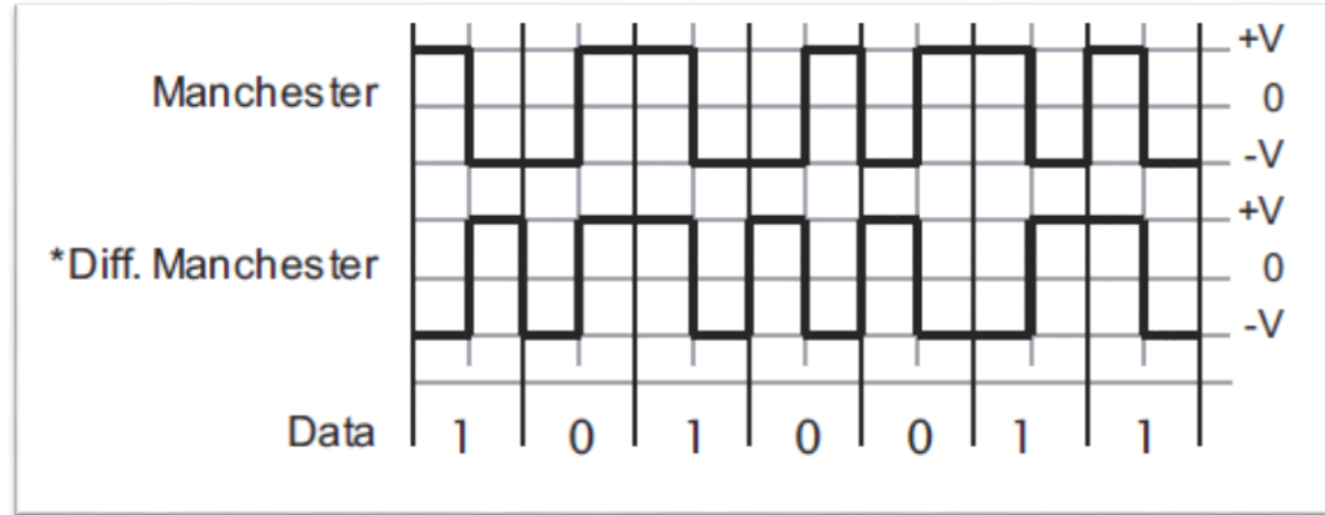
# NRZ (Nonreturn to Zero-Level) Coding



- Uses two different voltage levels (one positive and one negative) as the signal elements for the two binary digits.
- A change in the signal level occurs every time a "one" occurs, but when a "zero" occurs, it remains the same, i.e., no transition occurs



# Differential Manchester



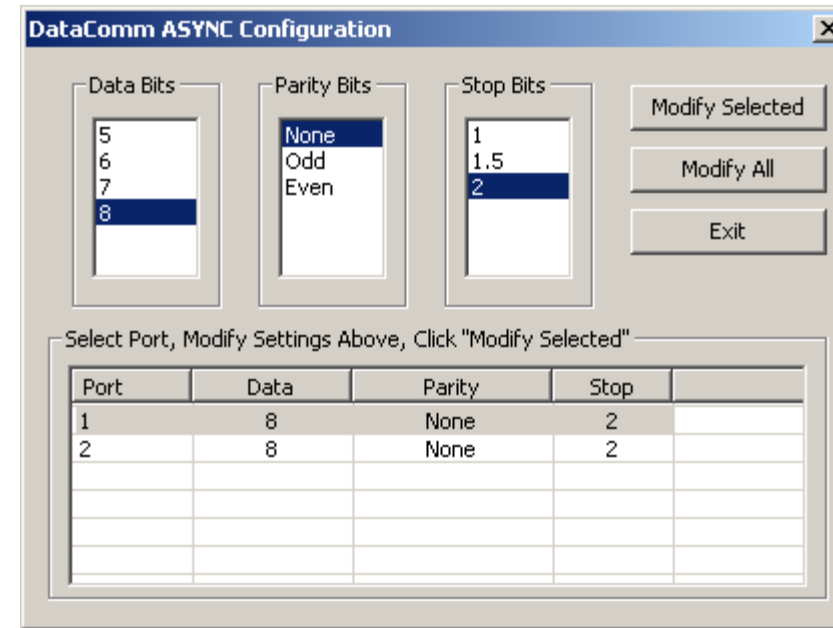
- Uses the presence or absence of transitions to indicate logical value
- In differential Manchester encoding, if a "1" is represented by one transition, then a "0" is represented by two transitions and vice versa. It is a differential encoding

# Datacom Interfaces

- **RS232C:** It is a standard interface for serial data for connecting DTE to DCE computer serial ports
- **RS-423:** It is a higher speed unbalanced interface similar to RS-232C. The Datacom board supports this with RS-232C interface setting
- **RS-449:** It is a high speed serial data communication interface. This interface used unbalanced or pairs of signals to transmit and receive clock and data. This interface typically uses a 37 pin connector
- **RS-422/RS-485:** It is similar to the RS-449 standard with changes only to the logic levels. This is sometimes used with a multi drop configuration of up to 10 receivers with 1 transmitter. Difficult to setup but can fill low cost reliable data communications
- **V.35:** It is another high speed serial data communication interface. This interface also uses unbalanced or pair of signals to transmit and receive clock and data. This interface typically uses a 35 pin connector
- **RS-530:** It is another high speed serial data communication interface. It is a common interface used to replace a 25 pin connector instead of using the RS-449 DB-37 or V.35 connectors

# ASync Configuration

Configuration functionality allows to configure various Tx/Rx parameters such as Data Bits, Parity Bits, and Stop Bits



# Monitoring of Control Signals and Frequency

Data Comm Rx Status

Ports

	1	2	
RXD			
RXC			
TXC			
CTS			
RI			
DSR			
DCD			
TM			
Freq	16 383 928	16 383 928	

# Monitoring of Control Signals and Frequency (Contd.)

- **RXD:** (Received Data) -This is the serial encoded data received by a DTE from a DCE which has in turn received from another source
- **RXC:** (Receive Complete) -The RXC bit will be set to HIGH(1) when data is received and is available in the buffer
- **TXC:** (Transmit Complete) -The TXC bit is set to HIGH(1) when a transmission is completed and there is no other data to send
- **CTS: (Clear to Send)** - This is set to HIGH(1) by a DCE to allow/ prevent the DTE to transmit data
- **RI:** (Ring Indicator) -This signal is used for auto answer applications. DCE raises when incoming call detected
- **DSR:** (Data Set Ready) -This should be set to HIGH(1) by a DCE whenever it is powered on. It can be used by the DTE to determine that the DCE is on line
- **DCD:** (Data Carrier Detect) - This is set to HIGH(1) by a DCE when it detects the data carrier signal on the datacom line
- **Frequency:** Displays operating Frequency in Hertz
- **TM:** Test Mode

# Datacom Cables

# RS-530 Male to Female Cable



**RS530 Male to RS530 Female**

- The RS-530 is a standard high speed data communications serial interface which can be used with external cables to support different serial interface connectors

# RS530 Female to Female



RS530 Female to RS530 Female

# RS530 Male to Male



RS530 to RS530 Male

# RS232C

- This is a standard interface for serial data for connecting DTE to DCE computer serial ports
- It is used for slower data communications due to the logic and interface used



# RS449

- This is a high-speed serial data communication interface
- This interface uses unbalanced (RS-423) and balanced (RS-422) to transmit and receive clock and data
- This interface typically uses a 37 pin connector



**RS449 DCE to RS530**



**RS530 to RS449 DTE**

# V.35

- This is a high-speed serial data communication interface
- Uses unbalanced or pair of signals to transmit and receive clock and data
- This interface typically uses a 35 pin connector



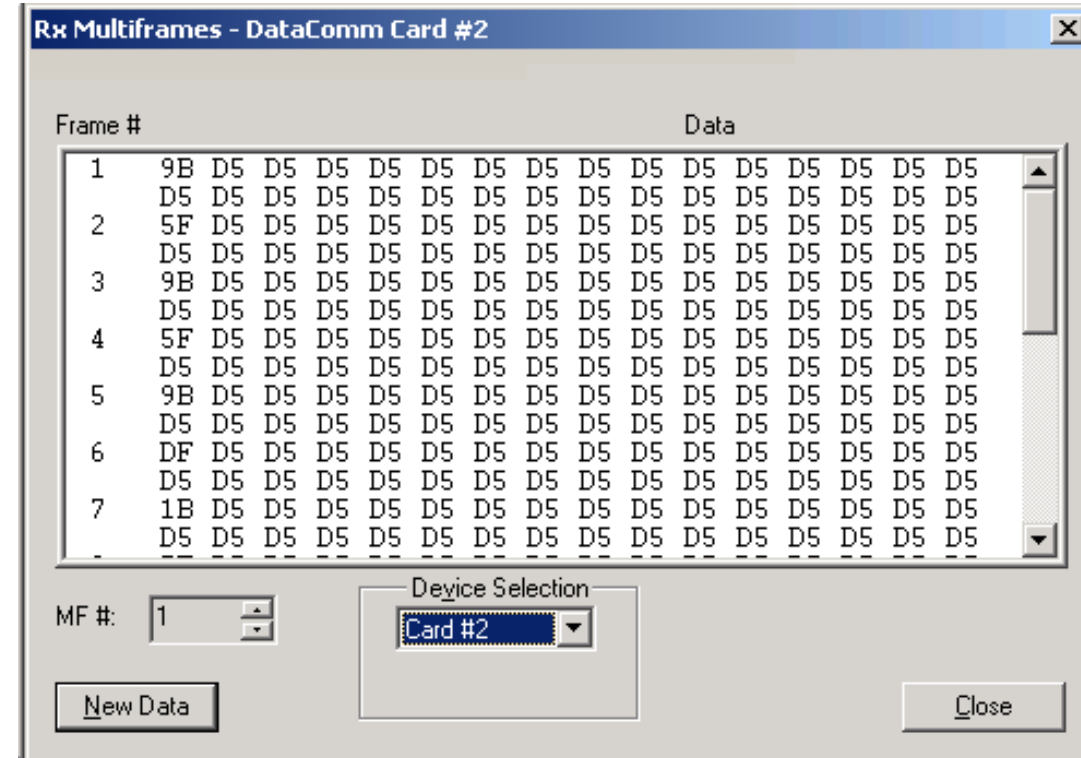
**V.35 Male to RS530 Male**



**RS530 Female to V.35 DCE**

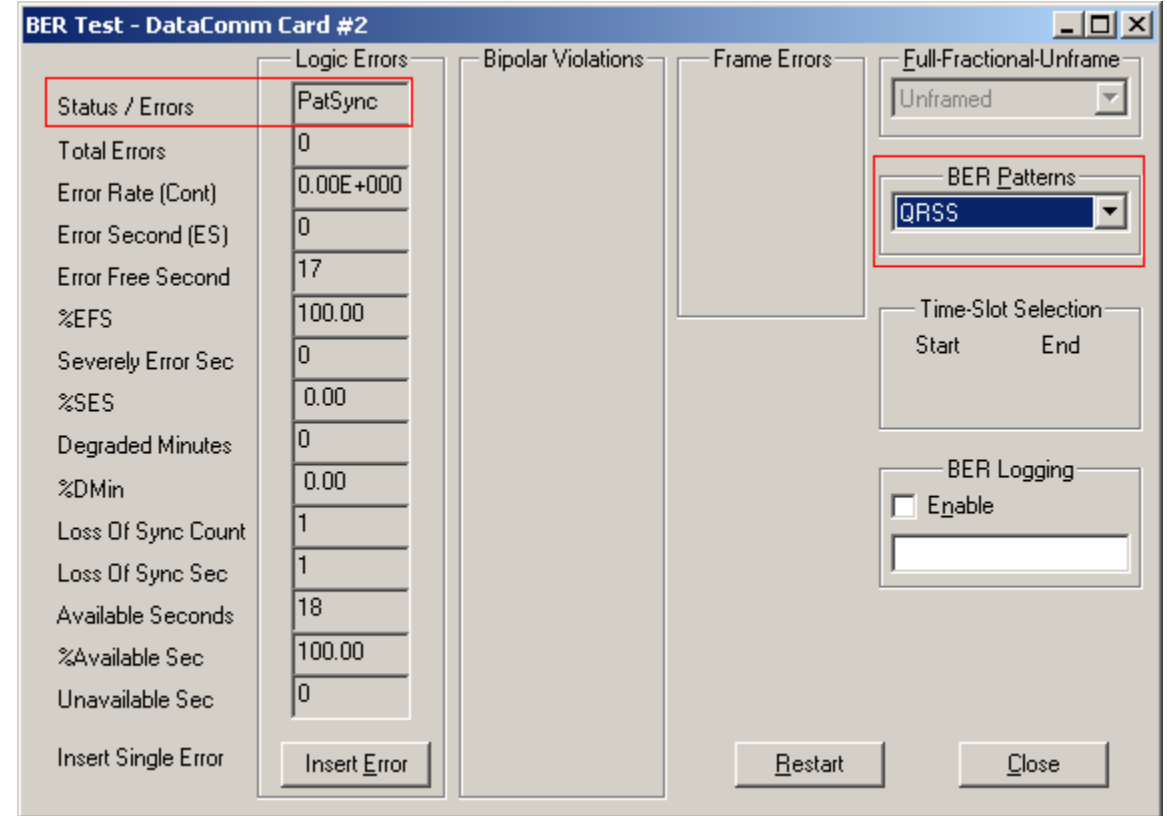
# Monitoring Data in Realtime

- This application permits viewing data on a Datacom port – both directions simultaneously
- Approximately 2 seconds of data is captured for viewing



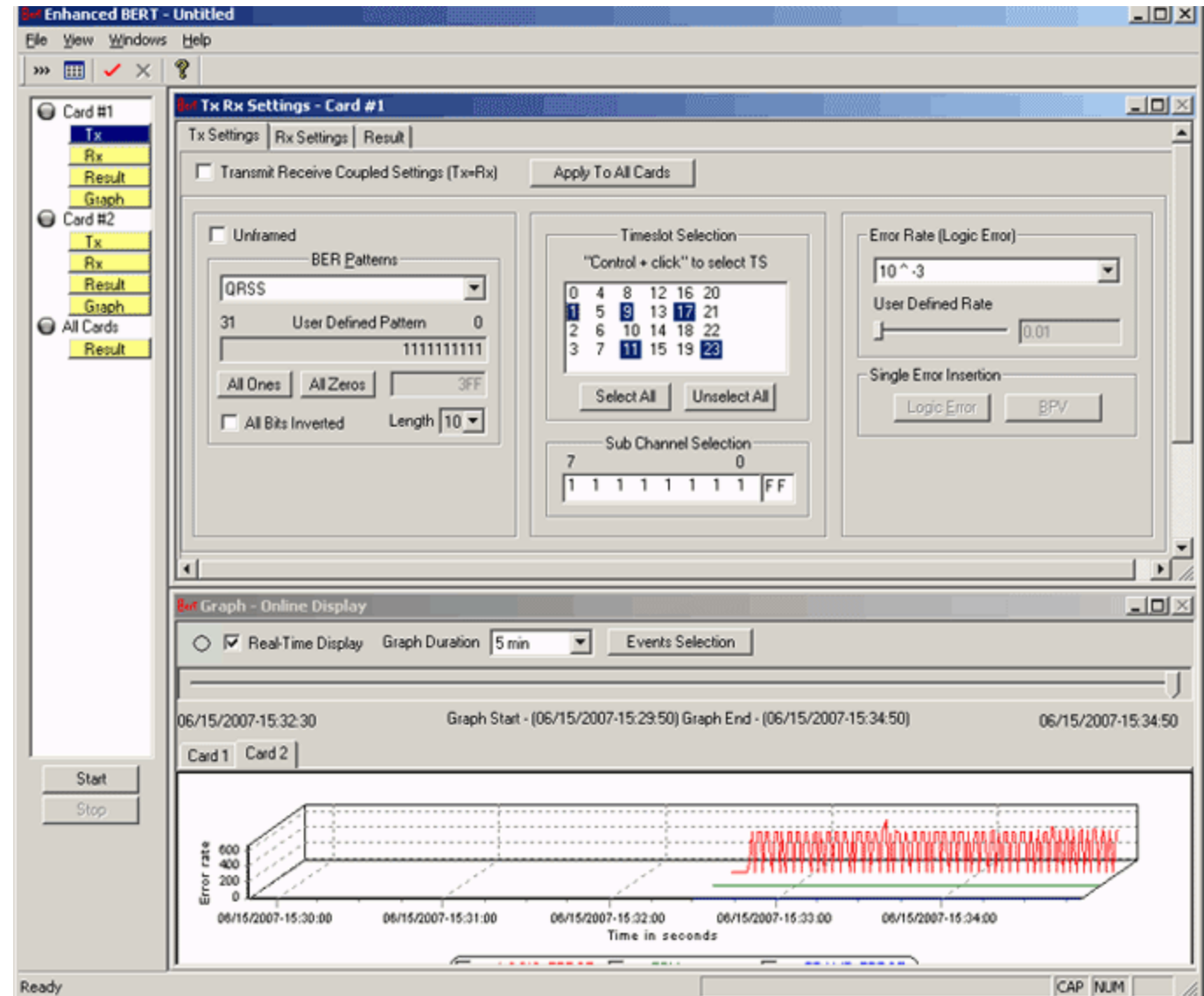
# Bit Error Rate Test for Async and Sync

- The Bit Error Rate Test (BERT) application for Datacom Analyzer generates/detects data that are defined in Pseudo Random Bit Sequence (PRBS)



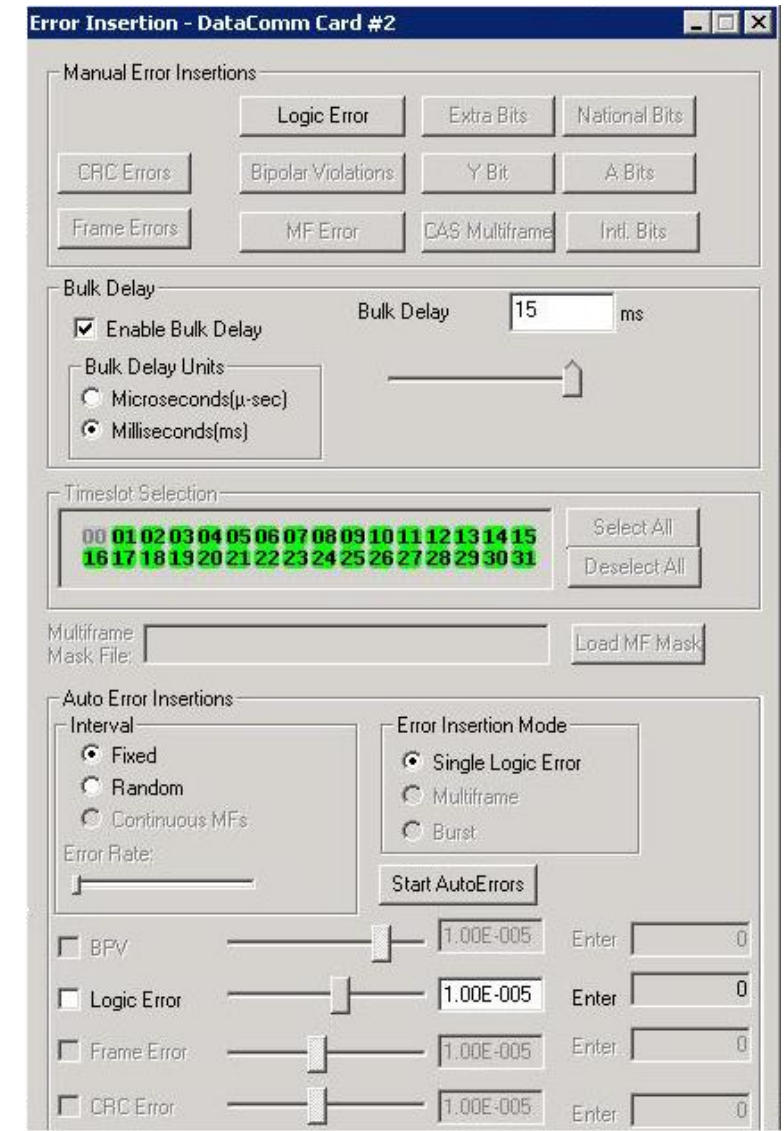
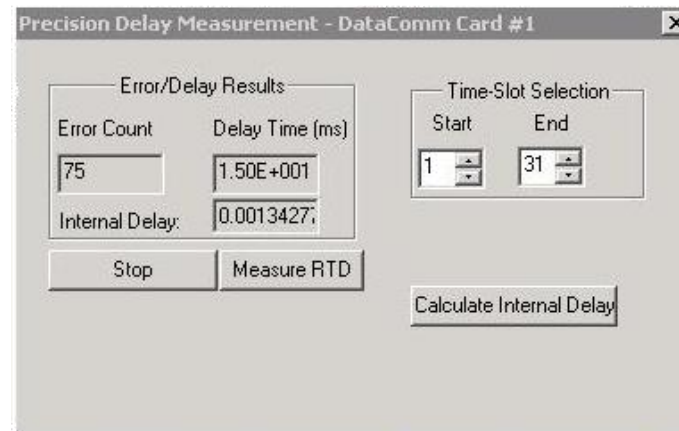
# Enhanced Bit Error Rate Test

- The enhanced features include support for multiple ports, with a consolidated result view for all ports
- The Tx and Rx settings for all the cards can be independently controlled or coupled as per the convenience of the user
- The Enhanced BERT measures the correctness of data received on datacom according to the repetitive pattern file for a given transmission



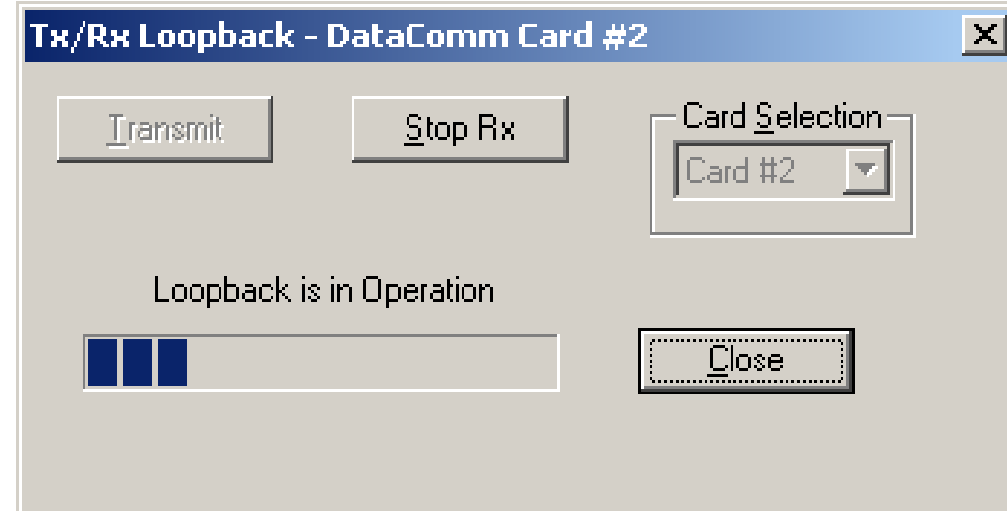
# Precision Delay Measurement

- Precision Delay Measurement measures the Round-Trip Delay of a system

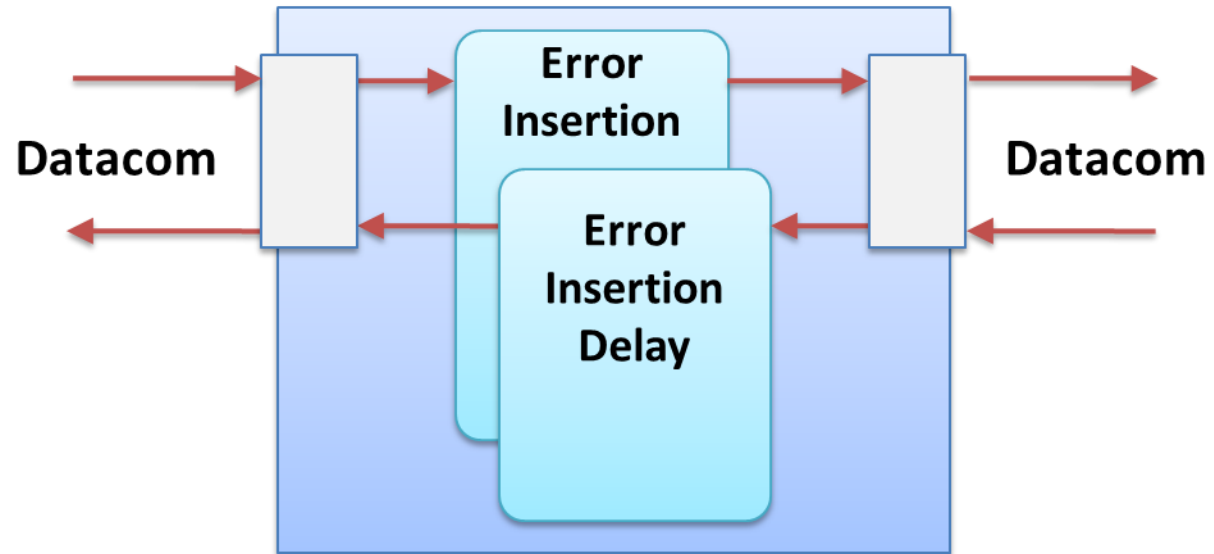


# Rx to Tx Loop back

- Loop backs the received data from back to the transmitting port
- Used in conjunction with a Bit Error Rate Tester to verify the operation of analyzer



# Error Insertion



- Permits inserting single, fixed, automatic, random, and burst error into the incoming bit stream

# Manual Error Insertion

**Error Insertion - DataComm Card #1**

Manual Error Insertions

Logic Error    Extra Bits    National Bits

CRC Errors    Bipolar Violations    Y Bit    A Bits

Frame Errors    MF Error    CAS Multiframe    Intl. Bits

Bulk Delay

Enable Bulk Delay    Bulk Delay: 0 ms

Bulk Delay Units

Microseconds( $\mu$ -sec)

Milliseconds(ms)

Timeslot Selection

00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15  
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Select All  
Deselect All

Multiframe Mask File:  Load MF Mask

Auto Error Insertions

Interval

Fixed

Random

Continuous MFs

Error Rate:

Error Insertion Mode

Single Logic Error

Multiframe

Burst

Start AutoErrors

BPV     1.00E-005    Enter  0

Logic Error     1.00E-005    Enter  0

Frame Error     1.00E-005    Enter  0

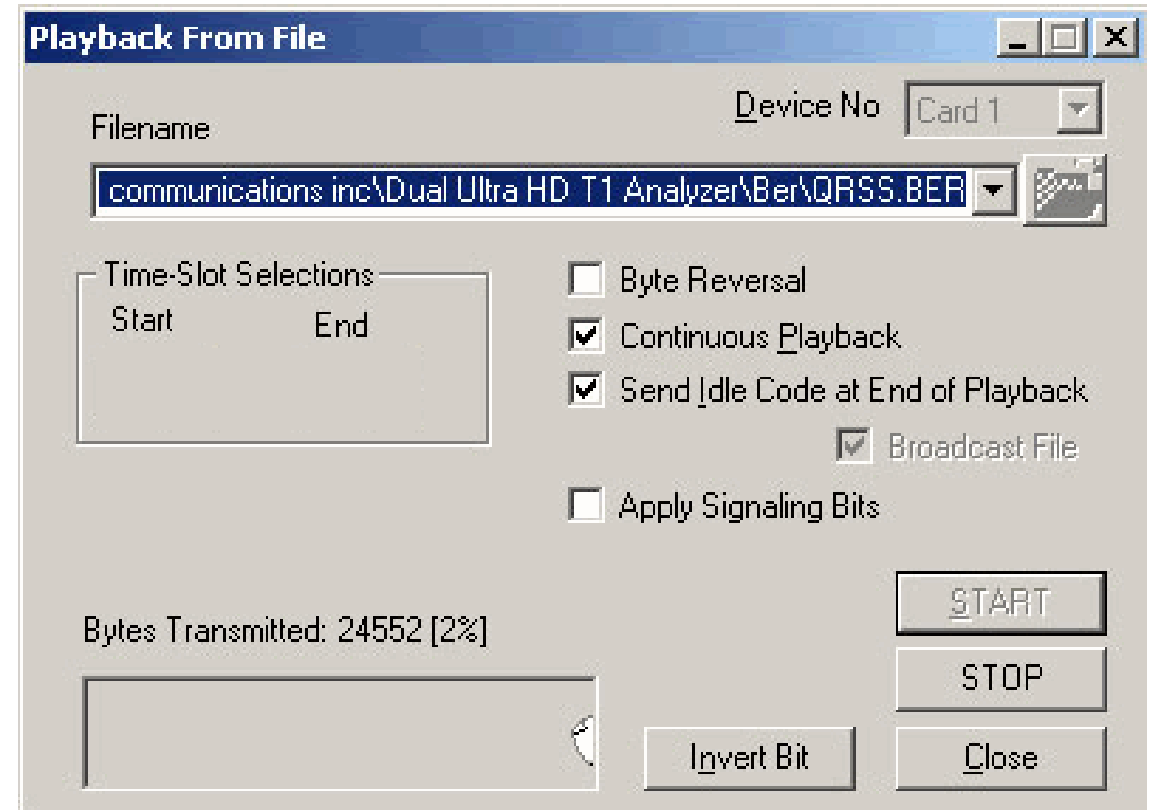
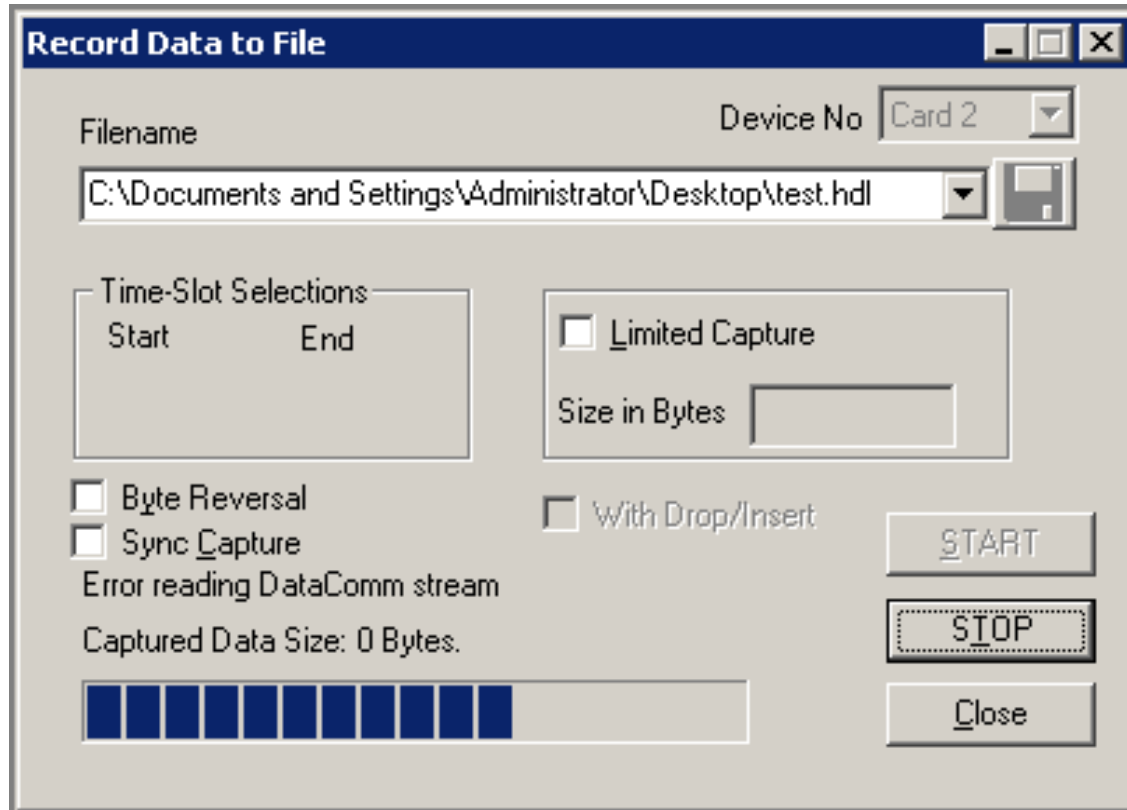
CRC Error     1.00E-005    Enter  0

# Loopback Testing

- No Loopback – This option disables any existing loopback conditions
- Outward Loopback – In this configuration the data sent from the CSU are received by the Datacom interface and are immediately retransmitted to the CSU
- Diagnostic (Input + Output) Loopback – Loops the internal transmit clock and data to the internal receive clock and data along with looping the external clock and data back to the incoming device
- Cross-port Loopback – It takes the Rx data from the DTE and places it on the Rx of the DCE. It also takes Rx data from the DCE and places it on the Tx of the DTE

# Optional Applications

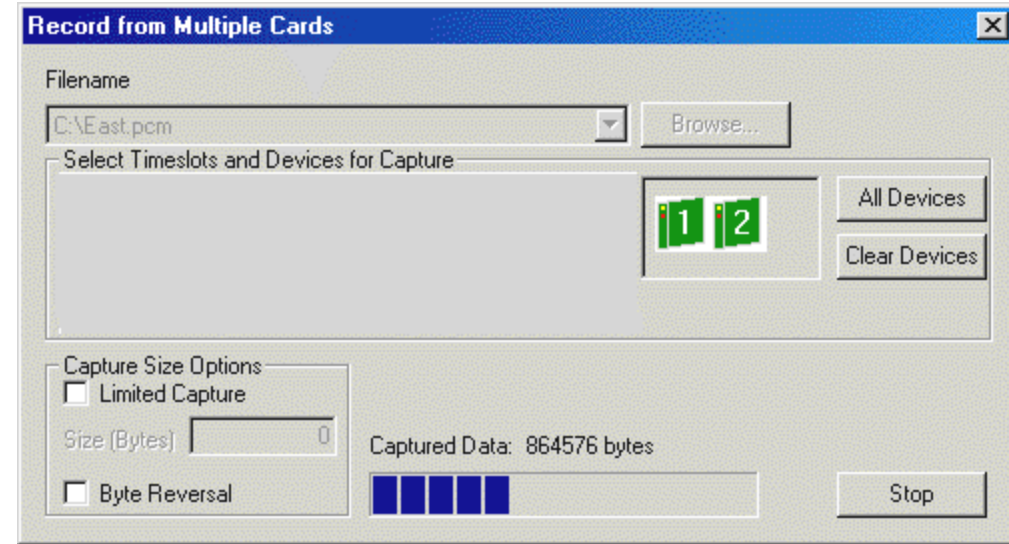
# Record / Playback Applications



- Record / Playback Disk Files: This application permits capture of data being transmitted on the Datacom ports to / from a file

# Record from Multiple Cards

- This application permits capture of data being transmitted on (any one or all) Datacom ports to a file
- Bytes may be captured in reverse order or normal order
- Limit captured (specific number of bytes) data to files



# Automated Record/Playback (ARP)

Task #	Filename	Tx/Rx	Card #	Timeslots	Capture/Transmit Size	Invert Bits	Reverse Bits	Continuous	Safe Margin
0	C:\Program Files\GL Communications Inc\Dataco...	Tx	1	N/A	713	Yes	No	Yes	Default
1	C:\Program Files\GL Communications Inc\Dataco...	Tx	2	N/A	44	Yes	No	Yes	Default
2	C:\Program Files\GL Communications Inc\Dataco...	Rx	1	N/A	No Limit	No	No	No	Default
3	C:\Program Files\GL Communications Inc\Dataco...	Rx	2	N/A	No Limit	No	No	No	Default

Task #	Status	Bytes Tx/Rx	Bytes Underru...
0	IN PROGRESS	0	0
1	IN PROGRESS	0	0
2	IN PROGRESS	6300160	0
3	IN PROGRESS	6300160	0

- Provide various menus to transmit/receive data simultaneously
- Comprises of various columns to display the status of parameters for any given data file
- Comprises of various columns to display the status of all tasks queued in the Task Status Viewer

# List of Available Protocol Analyzer

- HDLC Analysis
- Frame Relay Analysis
- PPP Analyzer

# HDLC Analysis

**HDLC Protocol Analysis LAPF**

File View Capture Statistics Database Configure Help

0 GoTo

Dev	TSlot	Frame#	TIME (Relative)	Len	Error	DLCI	DE	BECN	FECN	CTL	Sequence Number
✓ 2	0-23	0	00:00:00.000000	6		0	0	0	0	Sup...	
✓ 2	0-23	1	00:00:00.005239	6		0	0	0	0	Sup...	
✓ 2	0-23	2	00:00:00.010479	38		0	0	0	0	Infor...	
✓ 2	0-23	3	00:00:00.015890	6		0	0	0	0	Sup...	
✓ 2	0-23	4	00:00:00.021135	6		0	0	0	0	Sup...	
✓ 2	0-23	5	00:00:00.026380	6		0	0	0	0	Sup...	

Card2 TimeSlots=0-23 Frame=0 at 00:00:00.000000 OK Len=6

HDLC Frame Data + FCS

```

===== LAPF Layer =====
0000 EA = .....0 (0)
0000 C/R = .....0. Command(User). Response(Network)
0000 DLCI = 0 (000000.. 0000....)
0001 EA = .....1 (1)
0001 DE = .....0. (0)
0001 BECN = .....0.. (0)
0001 FECN = ....0... (0)
0002 Ctl = .....01 Supervisory
0002 Supervisory Function = ....00.. RR
0003 P/F = .....1 (1)
  
```

Hex Dump of the Frame Data

```

+-----+-----+-----+-----+-----+-----+-----+-----+
00 01 01 45 73 AA                                     Es²
  
```

Supervisory Function	Frame Count(Supervisory Function)
RR (0)	49%
total RR (0)	49%

C:\Program Files\Gl Communication 526 Frames

# Supported Protocols

- LAPD
- LAPF
- IP
- TCP
- UDP
- ICMP
- STUN
- DNS
- HTTP
- FTP
- SNMP
- Cisco HDLC
- ARP
- LAPB
- DHCP

# HDLC Playback

**Transmit HDLC**

port 1  
port 2

Playback File  
C:\Program Files\GL Communications Inc\Datacomm Analyzer\hdlc\_isdn\dcoss.hdl Browse...

Continuous Play    Limit:

Limited

Invert Bits ( Complement)

Flags Between Frames:

OverRuns: 24 (464736)

Transmission On All Selected Cards

Start    Abort    Card1 transmitted 17 247 out of 27 946 Frames ...

**HDLC Protocol Analysis LAPD**

File View Capture Statistics Database Configure Help

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Error	CTL	FUNC
✓ 2	0-31		472203	00:00:15.343818	45		Information	
✓ 2	0-31		472204	00:00:15.343912	6		Information	
✓ 2	0-31		472205	00:00:15.343915	11		Unnumbered	Reserved
✓ 2	0-31		472206	00:00:15.343921	11		Unnumbered	Reserved
✓ 2	0-31		472207	00:00:15.343927	6		Information	
✓ 2	0-31		472208	00:00:15.343930	6		Information	
✓ 2	0-31		472209	00:00:15.343948	11		Information	
✓ 2	0-31		472210	00:00:15.343967	11		Information	
✓ 2	0-31		472211	00:00:15.343973	6		Information	

Card2 TimeSlots=0-31 Frame=472203 at 00:00:15.343818 OK Len=45

HDLC Frame Data + FCS

```

----- LAPD Layer -----
0000 C/R = .....0. Command(User), Response(Netw
0000 SAPI = 010000.. (16)
0001 TEI = 1000000. (64)
0002 Ctl = .....0 Information
0002 N(S) = 0100001. (33)
0003 P = .....0 (0)
0003 N(R) = 0000101. (5)
    
```

Hex Dump of the Frame Data

```

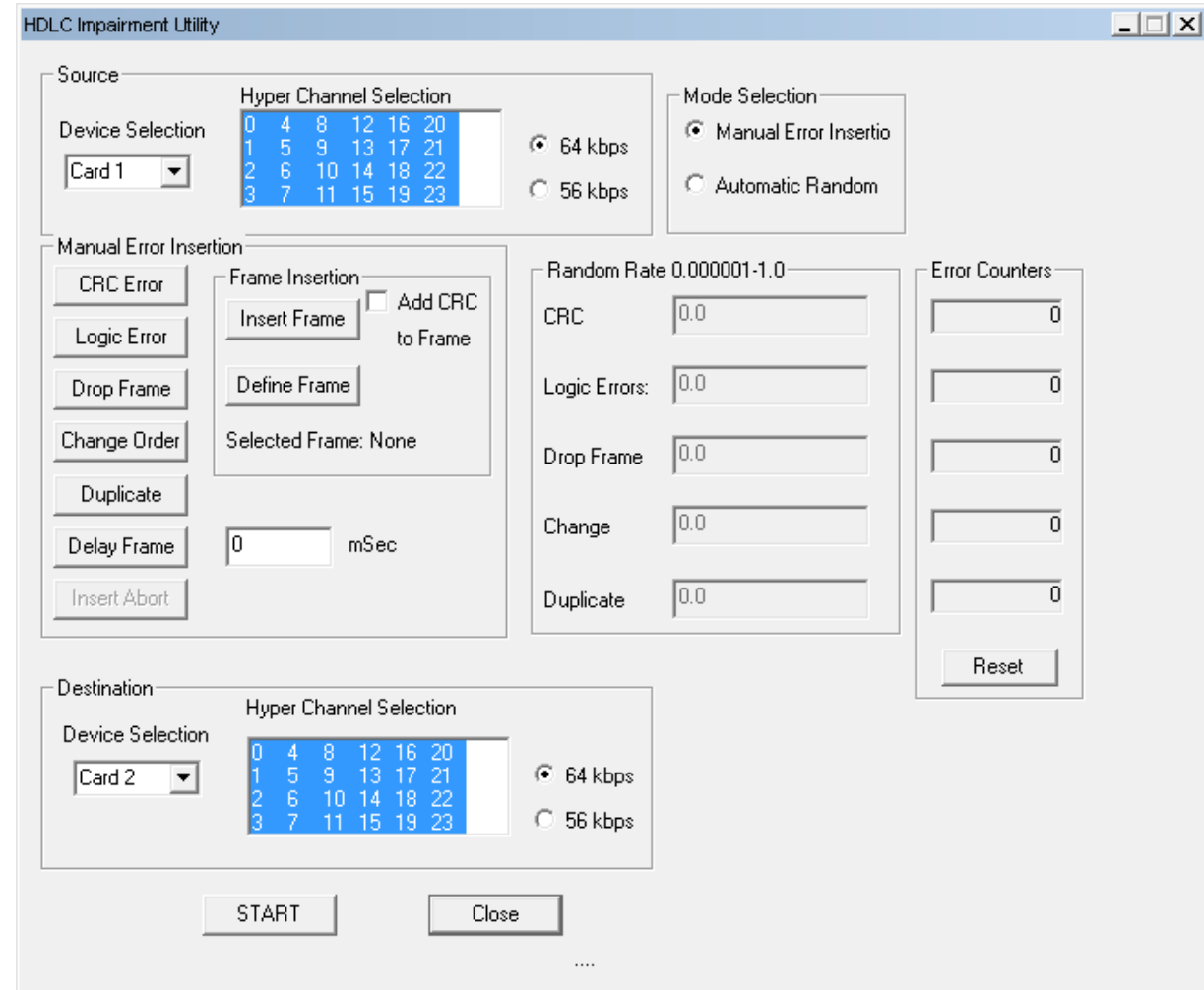
+-----+-----+-----+-----+-----+-----+
40 80 42 0A 10 41 DC 30 A0 20 C0 00 08 C5 19 C1 @|B AU0 A A A
94 C0 69 37 11 00 AC AD AC 4C 8C 4C 8C 0E 10 00 |Ai7 --LII|
2C 0D EC AC 2C 8C 2C 00 82 80 68 84 33 , i., III3
    
```

Output File Limit has been reached    C:\Temp.Hdl    Captured 1 170 209 frames    Errors 0 CRC, 510515 Fram

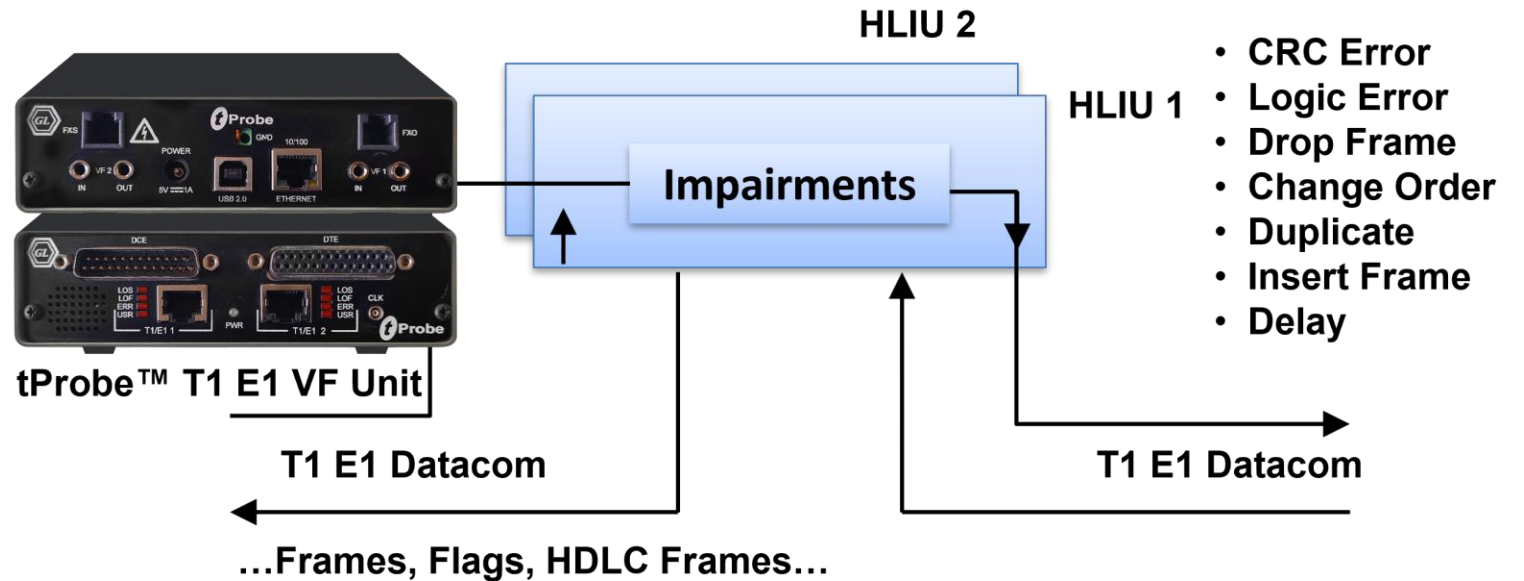
# HDLC Link Impairment Utility (HLIU)

# Features

- Provides flexible option to select Manual Error Insertion or Automatic Random Error Insertion Mode to inject errors as per requirement
- The HLIU application has the following features: Logic Errors, CRC Errors, Drop a Frame, Change Order of Frames, Duplicate a Frame, Insert a Frame, and Delay Frames
- Impairments can be introduced manually or automatically with a specified random rate, e.g.  $1 \times 10^{-4}$ , or one in 10,000
- This application helps us:
  - Understand the Delay a network can handle
  - Simulate Inline Error Insertion with ability to transmit / receive on different ports and allow hyper channel / timeslot selection
  - Control the error rate to correct the network
  - Error counters display the total number of CRC, Logic, Drop Frame, Change, and Duplicate errors impaired to an HDLC frame



# HLIU with T1 E1



- Input stream of HDLC frames is contained in a “single” stream
- The output stream of HDLC frames is contained in a similar structure
- The output stream of HDLC frames may be on a different card or the same card as the input

# Logic Error

- The first byte of the frame #1 changed from “00” to “FF”

The image displays two screenshots of the HDLC Protocol Analysis LAPD software interface. The top screenshot shows a table of captured frames with the first byte of frame #1 highlighted as '00'. Below the table is a hex dump of the frame data: 00 00 00 00 DE FC. The bottom screenshot shows the same table, but the first byte of frame #1 is now 'FF'. Its hex dump is: FF 00 00 00 0C 39. The software interface includes a menu bar (File, View, Capture, Statistics, Database, Configure, Help), a toolbar with various icons, and a 'GoTo' field with the value '0'.

Dev	SubCh	Frame#	TIME (...)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)
✓ 1		0	00:00:...	6		Com...	0	0	Infor...	0	0	0
✓ 1		1	00:00:...	6		Com...	0	0	Infor...	1	0	0
✓ 1		2	00:00:...	6		Com...	0	0	Infor...	0	0	1

Hex Dump of the Frame Data

```
00 00 00 00 DE FC
```

Dev	SubCh	Frame#	TIME (...)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)
✓ 1		0	00:00:...	6		Res...	63	0	Infor...	0	0	0
✓ 1		1	00:00:...	6		Res...	63	0	Infor...	1	0	0
✓ 1		2	00:00:...	6		Res...	63	0	Infor...	0	0	1

Hex Dump of the Frame Data

```
FF 00 00 00 0C 39
```

# CRC Error

- The CRC error inserted on frame #15 and the CRC value is decremented from "E899" to "E898"
- HLIU application can insert a Single Shot or Random Rate CRC Error into an HDLC frame

The image displays two screenshots of the HDLC Protocol Analysis LAPD software interface. The top screenshot shows a table of captured frames with frame 15 selected. The hex dump below it shows the frame data: 00 00 00 06 E8 99. The bottom screenshot shows the same table, but frame 15 is marked with a red 'X' and labeled 'fcs error'. The hex dump below it shows the frame data: 00 00 00 06 E8 98. The status bar at the bottom of the second screenshot indicates 'Errors 1 CRC, 0 Frame'.

Dev	SubCh	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)
1		14	00:00:03.813000	6		Com...	0	0	Infor...	1	0	2
1		15	00:00:03.933875	6		Com...	0	0	Infor...	0	0	3
1		16	00:00:04.078750	6		Com...	0	0	Infor...	1	0	3

Hex Dump of the Frame Data

```
00 00 00 06 E8 99
```

Running Utilization 0.02% C:\Temp.Hdl Captured 50 frames

Dev	SubCh	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FI
1		14	00:00:21.033000	6		Com...	0	0	Infor...	1	0	2	
1		15	00:00:21.177875	6	fcs error								
1		16	00:00:21.298750	6		Com...	0	0	Infor...	1	0	3	

Hex Dump of the Frame Data

```
00 00 00 06 E8 98
```

Running Utilization 0.03% C:\Temp.Hdl Captured 50 frames Errors 1 CRC, 0 Frame

# Drop a Frame

- The frame # 1 order number changed from '01' to '02' due to a dropped frame

The image displays two screenshots of the HDLC Protocol Analysis LAPD software interface. The top screenshot shows a capture of three frames. The first frame (Frame# 1) is highlighted in blue, and its hex dump shows the sequence 00 00 00 01 57 ED, with the '01' byte highlighted in a red box. The bottom screenshot shows the same capture, but the second frame (Frame# 2) is highlighted in blue, and its hex dump shows the sequence 00 00 00 02 CC DF, with the '02' byte highlighted in a red box. This indicates that the frame numbering has shifted due to a dropped frame.

Dev	SubCh	Frame#	TIME (...)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)
✓ 1		0	00:00:...	6		Com...	0	0	Infor...	0	0	0
✓ 1		1	00:00:...	6		Com...	0	0	Infor...	1	0	0
✓ 1		2	00:00:...	6		Com...	0	0	Infor...	0	0	1

Hex Dump of the Frame Data

```
00 00 00 01 57 ED      Wi
```

Dev	SubCh	Frame#	TIME (...)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)
✓ 1		0	00:00:...	6		Com...	0	0	Infor...	0	0	0
✓ 1		1	00:00:...	6		Com...	0	0	Infor...	0	0	1
✓ 1		2	00:00:...	6		Com...	0	0	Infor...	0	0	3

Hex Dump of the Frame Data

```
00 00 00 02 CC DF      iB
```

# Change Order

The image displays two screenshots of the HDLC Protocol Analysis LAPD software interface, illustrating a change in frame order. Both screenshots show a table of captured frames and a hex dump of the frame data.

**Top Screenshot:**

Dev	TSlot	SubCh	Frame#	TIME [...]	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
✓ 1	1		0	00:00:...	6		Com...	0	0	Infor...	1	0	0	
✓ 1	1		1	00:00:...	6		Com...	0	0	Infor...	0	0	0	
✓ 1	1		2	00:00:...	6		Com...	0	0	Infor...	1	0	1	

Hex Dump of the Frame Data

```
00 00 00 01 57 ED          Vi
```

**Bottom Screenshot:**

Dev	TSlot	SubCh	Frame#	TIME [...]	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
✓ 1	1		0	00:00:...	6		Com...	0	0	Infor...	1	0	0	
✓ 1	1		1	00:00:...	6		Com...	0	0	Infor...	0	0	0	
✓ 1	1		2	00:00:...	6		Com...	0	0	Infor...	1	0	1	

Hex Dump of the Frame Data

```
00 00 00 00 DE FC          bi
```

- The frame # 0 order number is changes from '00' to 01', the frame # 1 order number is changes from '01' to 00'

# Duplicate a Frame

The image displays two screenshots of the HDLC Protocol Analysis LAPD software interface. The top screenshot shows a capture of three frames. The first frame (Frame # 0) is highlighted with a red box. The bottom screenshot shows the same capture, but the first frame (Frame # 0) has been duplicated as Frame # 1, and the original Frame # 0 is now Frame # 2. The hex dump below each table shows the frame data: 00 00 00 00 DE FC, with a flag 'pi' indicated.

Dev	TSlot	SubCh	Frame#	TIME	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
✓ 1	1		0	00:00...	6		Com...	0	0	Infor...	0	0	0	
✓ 1	1		1	00:00...	6		Com...	0	0	Infor...	0	0	0	
✓ 1	1		2	00:00...	6		Com...	0	0	Infor...	1	0	0	

Hex Dump of the Frame Data  
00 00 00 00 DE FC      pi

Dev	TSlot	SubCh	Frame#	TIME	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
✓ 1	1		0	00:00...	6		Com...	0	0	Infor...	0	0	0	
✓ 1	1		1	00:00...	6		Com...	0	0	Infor...	0	0	0	
✓ 1	1		2	00:00...	6		Com...	0	0	Infor...	1	0	0	

Hex Dump of the Frame Data  
00 00 00 00 DE FC      pi

- The frame # 0 duplicated as frame # 1

# Insert Frame

The image displays two screenshots of the HDLC Protocol Analysis LAPD software interface. The top screenshot shows a capture of three frames (14, 15, and 16) with a total frame count of 100. The bottom screenshot shows the same capture with a new frame (15) inserted, changing its length to 514 and its function to 'Res...', and the total frame count is now 101.

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Er...	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
1	1		14	00:00:01.776250	6		Com...	0	0	Infor...	0	0	7	
1	1		15	00:00:01.894125	6		Com...	0	0	Infor...	1	0	7	
1	1		16	00:00:02.015000	6		Com...	0	0	Infor...	0	0	8	

Hex Dump of the Frame Data  
00 00 00 0F 29 04

Off-line Viewing C:\Documents and Settings\Mahesh\ 100 Frames

Dev	TSlot	SubCh	Frame#	TIME (Relative)	Len	Er...	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
1	1		14	00:00:01.776375	6		Com...	0	0	Infor...	0	0	7	
1	1		15	00:00:01.798250	514		Res...	42	85	Infor...	0	85	85	
1	1		16	00:00:01.895625	6		Com...	0	0	Infor...	1	0	7	

Hex Dump of the Frame Data  
AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA  
AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA  
AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA  
AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA

Off-line Viewing C:\Documents and Settings\Mahesh\ 101 Frames

- At the end of file transmission, a predefined frame is being inserted and the total frame count is incremented by '1'

# Delay Frame

The screenshot shows the HDLC Protocol Analysis LAPD interface. The table below displays the captured frames. Frame 39 has a relative time of 00:00:04.900375, and frame 40 has a relative time of 00:00:10.019250. The 5-second interval between these two frames is highlighted with a red box, indicating an inserted delay.

Dev	SubCh	Frame#	TIME (Relative)	Len	Error	C/R	SAPI	TEI	CTL	P/F	N(S)	N(R)	FUNC
✓ 1		36	00:00:04.540625	6		Com...	0	0	Unn...	0			UI
✓ 1		37	00:00:04.658500	6		Com...	0	0	Unn...	0			UI
✓ 1		38	00:00:04.779375	6		Com...	0	0	Unn...	0			UI
✓ 1		39	00:00:04.900375	6		Com...	0	0	Unn...	0			UI
✓ 1		40	00:00:10.019250	6		Com...	0	0	Unn...	0			UI
✓ 1		41	00:00:10.020125	6		Com...	0	0	Unn...	0			UI
✓ 1		42	00:00:10.021000	6		Com...	0	0	Unn...	0			UI
✓ 1		43	00:00:10.021875	6		Com...	0	0	Unn...	0			UI

C:\Documents and Settings\Mahesh\Desktop\ 92 Frames

- The delay of 5 secs inserted between frame # 39 and frame # 40

# Supported Protocols for Frame Relay Analysis

- LAPF
- Multi-Protocol Encapsulation
- IP
- TCP
- UDP
- SMTP
- POP3
- STUN
- FTP
- SNMP
- DNS
- DHCP
- HTTP
- RIP
- NBNS (NetBIOS Name Service)
- IPM Reg (IPv4 Registration Message)
- Q933FRel
- SNAP
- PPP over Frame Relay
- FRF.12, FRF12.1, FRF.15
- LCP
- SVC Signaling
- LMI Signaling

# PPP Analysis

- Encapsulates other network layer protocols like IP for transmission on synchronous (like T1 or E1) and asynchronous communications lines

The screenshot displays the 'PPP Protocol Analysis' window. At the top, there is a menu bar (File, View, Capture, Statistics, Database, Configure, Help) and a toolbar with various icons. Below the toolbar is a table with the following columns: Dev, TSlot, Frame#, TIME (Relative), Len, Error, PPP Layer3Protocol, Mlppp Seq No, Source IP Address, and Destination IP Address. The table contains six rows of data, all with a checkmark in the 'Dev' column. Below the table, there is a detailed view of a selected frame (Frame 0) showing its structure: HDLC Frame Data + FCS, PPP Link Layer, Address (11111111), Ctl (00000011), Protocol (00000000), ML PPP Layer, and various flags like 'Beginning Fragment' and 'Ending Fragment'. At the bottom, there is a 'Hex Dump of the Frame Data' section showing hexadecimal values and their corresponding ASCII characters.

Dev	TSlot	Frame#	TIME (Relative)	Len	Error	PPP Layer3Protocol	Mlppp Seq No	Source IP Address	Destination IP Address
✓ 2	1-31	0	00:00:00.000000	182		ML PPP	3132	202.174.156.34	72.37.201.145
✓ 2	1-31	1	-00:00:00.6825...	410		ML PPP	3130	72.37.201.145	202.174.156.34
✓ 2	1-31	2	00:00:00.001145	244		ML PPP	3133	202.174.156.34	72.37.201.145
✓ 2	1-31	3	00:00:00.883967	76		ML PPP	3134	202.174.156.37	72.37.201.145
✓ 2	1-31	4	00:00:00.884681	76		ML PPP	3135	202.174.156.37	72.37.201.145
✓ 2	1-31	5	00:00:00.885395	76		ML PPP	3136	202.174.156.37	72.37.201.145
✓ 2	1-31	6	00:00:00.886108	76		ML PPP	3137	202.174.156.37	72.37.201.145

```
Card2 TimeSlots=1-31 Frame=0 at 00:00:00.000000 OK Len=182
HDLC Frame Data + FCS
----- PPP Link Layer -----
0000 Address          = 11111111 (255)
0001 Ctl              = 00000011 (3)
0002 Protocol         = 00000000 00111101 ML PPP
----- ML PPP Layer -----
0004 Beginning Fragment = 1..... Yes
0004 Ending Fragment   = .1..... Yes
0004 Mlppp Class       = ..0000.. (0)

Hex Dump of the Frame Data
+-----+-----+-----+-----+-----+-----+-----+-----+
FF 03 00 3D C0 00 0C 3C 00 21 45 00 00 AA F9 89      y =A < !E 3u|
40 00 3F 06 C9 3C CA AE 9C 22 48 25 C9 91 06 B8      @ ? E<E@| "H%E' ,
E8 9F 00 44 EE F3 4C 96 B9 52 80 18 00 D7 08 84      e| Di6L|'R| x |
00 00 01 01 08 0A 02 73 1B B2 02 53 6A 22 03 00      s ' Sj"
00 76 08 02 F6 D1 03 1E 02 80 81 7E 00 66 05 38      v cN ||~ f 8
00 54 84 06 00 08 91 4A 00 03 08 00 00 40 81 26      T| 'J @|_
5C 6C FE 11 9C 26 53 41 4E 53 41 59 02 1A 00 00      \lp |SANSAY
00 0E 00 01 01 80 11 14 00 01 00 CA AE 9C 25 29      | E@|%)
72 00 CA AE 9C 25 29 73 17 40 42 1D 06 04 01 00      r E@|%)s @B
4E 00 01 01 80 0A 04 00 01 00 CA AE 9C 25 29 73      N | E@|%)s
05 80 01 00 01 00 40 B5 00 07 27 04 18 02 3C 0E      | @µ ' <
08 80 01 80 33 B7      | |3.
```

# Supported Protocols for PPP Analysis

- Link Control Protocol (LCP)
- Bridging PDU (BPDU)
- PPP, Multiplexed PPP
- Multi-class extension to MLPPP
- Multi-link PPP
- Network Control Protocol (NCP)
  - Internet Protocol Control Protocol (IPCP)
  - Bridging Control Protocol (BCP)
  - PPP Mux CP
- Cisco HDLC decodes
- STUN, SNMP, RIP
- Link Quality Report (LQR)
- DHCP, DNS, ICMP
- Van Jacobson TCP/IP compression decodes
- IPHC
- IP, TCP, UDP
- IEC
- PAP, CHAP
- SIP, MGCP, MEGACO
- RTP, CRTP, RTCP
- ISDN H.225, MPEG2
- T.38
- RAS, SCTP
- M2UA, M2PA, M3UA
- ISUP, SCCP
- SUA, IUA, TUP
- Test & Network Management Messages

# WCS Modules

- Windows Client / Server applications allow the user to operate analyzers remotely, write scripts for automation, or provide multi-client connectivity to a single Datacom analyzer
- WCS supports Enhanced BERT functionality

The screenshot displays the Datacom Analyzer 64-bit software interface. The main window shows a configuration table for two ports:

Port	Interface	Loopback	Termination	Clock	Mode	Data Rate
1	V35	No Loop Back	Terminate	Internal	Sync	16.384 Mbps
2	V35	No Loop Back	Terminate	Internal	Sync	16.384 Mbps

Below the table is the 'Data Comm Rx Status' window, which shows signal status for Port 1 DCE and Port 2 DTE. The status is 'Ready'.

Overlaid on the interface are two script windows:

- Untitled - WCS Server - DataComm:** Shows a log of commands and responses:

```
12:43:50.276AM: Connected: client #1160 at 192.168.10.96
12:43:54.009AM: 1160[2]: set dc interface v35 #*;
12:44:31.619AM: 1160[3]: set datarate 16.384 mbps #*; // Restore sensible se
12:44:56.105AM: 1160[4]: get cts, rts, dsr, dtr, dcd status #*;
12:45:41.061AM: 1160[5]: get tx clock source #*;
```
- Datacomm\_Interface.gls - GLClient:** Shows a script for connecting to a GL Server on 'MATLAB2011B':

```
Connected to GL Server on 'MATLAB2011B'
set dc interface v35 #*;
OK
set datarate 16.384 mbps #*; // Restore sensible setting
OK
get cts, rts, dsr, dtr, dcd status #*;
#1.cts[out]=1
#1.rts[in]=1
#1.dsr[out]=1
#1.dtr[in]=1
#1.dcd[out]=0
#2.cts[in]=1
#2.rts[out]=1
#2.dsr[in]=1
#2.dtr[out]=1
#2.dcd[in]=0
get tx clock source #*;
#1.tx_clk_src=internal
#2.tx_clk_src=internal

// Fix clock
get tx clock source #*;
set tx clock source external #*;
get tx clock source #*;
set tx clock source recovered #*;
get tx clock source #*;
set tx clock source internal #*;
get tx clock source #*;

// Fixed datarates
get datarate #*;
set datarate 300 bps #*;
get datarate #*;
set datarate 1200 bps #*;
get datarate #*;
```

# Pin Configurations on Datacom Units

# RS-530 Connections (DCE) Male Connector

Pin	Signal	Direction	Description
1	CHGND	Chassis Ground	Chassis Ground
2	RD -	Input to tProbe	Receive Data -
3	TD -	Output from tProbe	Transmit Data -
4	CTS -	Input to tProbe	CTS Receive -
5	RTS -	Output from tProbe	RTS Transmit -
6	DTR -	Output from tProbe	DTR Transmit -
7	GND	Signal Ground	Ground
8	DCD -	Output from tProbe	DCD Transmit -
9	TT +	Output from tProbe	Transmit Clock +
10	DCD +	Output from tProbe	DCD Transmit +
11	RT +	Input to tProbe	Receive Clock +
12	ST +	Output from tProbe	Secondary Timing +
13	RTS +	Output from tProbe	RTS Transmit +
14	RD +	Input to tProbe	Receive Data +
15	ST -	Output from tProbe	Secondary Timing -

# RS-530 Connections (DCE) Male Connector (Contd.)

Pin	Signal	Direction	Description
16	TD +	Output from tProbe	Transmit Data +
17	TT -	Output from tProbe	Transmit Clock -
18	TM	Input to tProbe	Test Mode
19	CTS +	Input to tProbe	CTS Receive +
20	DSR -	Input to tProbe	Data Set Ready -
21	RI	Input to tProbe	Ring Indicator
22	DTR +	Output from tProbe	DTR Transmit +
23	DSR +	Input to tProbe	Data Set Ready +
24	RT -	Input to tProbe	Receive Clock-
25	LL	Output from tProbe	Local Loop

# RS-530 Connections (DTE) Female Connector

Pin	Signal	Direction	Description
1	CHGND	Chassis Ground	Chassis Ground
2	TD -	Output from tProbe	Transmit Data -
3	RD -	Input to tProbe	Receive Data -
4	RTS -	Output from tProbe	RTS Transmit -
5	CTS -	Input to tProbe	CTS Receive -
6	DSR -	Input to tProbe	Data Set Ready -
7	GND	Signal Ground	Ground
8	DCD -	Input to tProbe	DCD Receive -
9	RT +	Input to tProbe	Receive Clock +
10	DCD +	Input to tProbe	DCD Receive +
11	TT +	Output from tProbe	Transmit Clock +
12	RTC +	Input to tProbe	Secondary Receive Clock+
13	CTS +	Input to tProbe	CTS Receive +
14	TD +	Output from tProbe	Transmit Data +
15	RTC -	Input to tProbe	Secondary Receive Clock-

# RS-530 Connections (DTE) Female Connector (Contd.)

Pin	Signal	Direction	Description
16	RD +	Input to tProbe	Receive Data +
17	RT -	Input to tProbe	Receive Clock -
18	LL	Output from tProbe	Local Loop
19	RTS +	Output from tProbe	RTS Transmit +
20	DTR -	Output from tProbe	DTR Transmit -
21	RL	Output from tProbe	Remote Loop
22	DSR +	Input to tProbe	Data Set Ready+ or Remote Indication
23	DTR +	Output from tProbe	DTR Transmit +
24	TT -	Output from tProbe	Transmit Clock -
25	TM	Input to tProbe	Test Mode

Thank you