



Operation Manual

# HDLC - CISCO

Annex to TSW200E1's Operation Manual

Version: 2  
Revision: 3  
December/2008



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### 1 - Introduction

The **HDLC CISCO** module has three tests: PING, MONITOR and TRACEROUTE. The PING test tries to establish a link with a remote node to exchange IP packets via this connection. The PING test reaches level 3 of the OSI layer model. It is performed in a user-network interface (UNI) and it allows checking if the link is active and also if there is link integrity. It tracks the sending and receiving of frames for error detection. It also allows checking end-to-end connectivity within the network and checking of the remote nodes response times by sending PING packages.

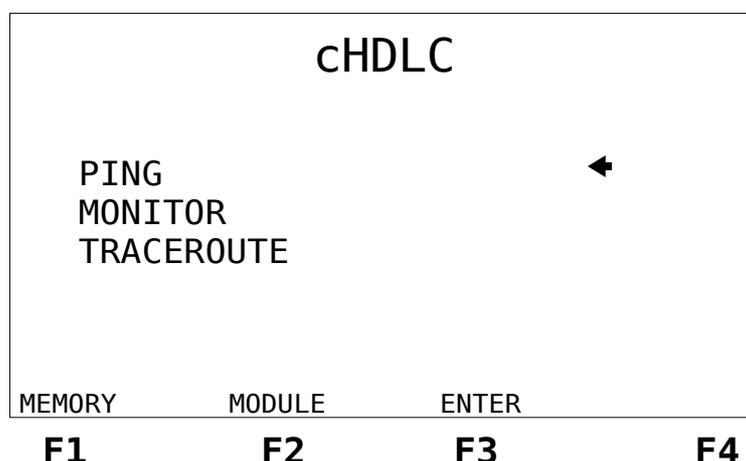
The MONITOR test displays information about the load of the circuit under test.

The main characteristics of the HDLC CISCO module are:

- Interfaces: V.24/ RS232, V.35/V.11, V.36/V.11, X.21/V.11, RS530 and G703-2M.
- Rate of operation from 1200 bps up to 2048kbps.
- Synchronous communication mode.

## 2 - HDLC CISCO Module Operation

When selecting the HDLC CISCO module at the Module screen, the screen below will be displayed.



To go back to the module screen, press the <F2> (MODULE) key.

In this screen, it is possible to choose which of the HDLC CISCO module tests will be run. To choose the test, place the cursor at the desired line, use the ↑ and ↓ keys, and press the <F3> (ENTER) key.

To access the HDLC CISCO module memory, press the <F1> (MEMORY) key from this screen. Data from the last performed test are stored in memory. The navigation on the memory screens is similar to the one used for the running tests and will be described in the following sections. Data stored in memory can be printed. To do this, press the PRINT key from any memory screen. The PRINT screen will be shown, and then the printing parameters can be configured. For more details about printout, please check the TSW200E1 operation manual.

### 2.1 - PING Test Configuration

When selecting the PING test, the first configuration screen will be displayed. The configuration screens will be shown on the following figures.

To alternate among the screens, press the <F1> (BACK) and <F4> (NEXT) keys. To move the cursor to the desired line, use the ↑ and ↓ keys. Most parameters can be changed using the ← and → keys. Others may be edited: press the DATA key to do this.

<b>PING</b>			
Interface:	RS232 ←		
Test Period:	CONTINUOUS		
Tx Clock Source:	INTERNAL		
Tx Rate:	64000bps		
MENU <span style="float: right;">NEXT</span>			
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

<b>SLARP</b>			
SLARP Request:	YES		
Local IP:	255.255.255.255 ←		
Peer IP:	255 .255.255.248		
Keepalive:	10		
BACK <span style="float: right;">MENU</span> <span style="float: right;">NEXT</span>			
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

<b>ICMP</b>			
Remote IP:	255.255.255.231 ←		
Size:	0064		
Ping Rate:	99		
Ping Count:	CONTINUOUS		
BACK <span style="float: right;">MENU</span>			
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

- Interface: Selects the RS232, V.35, V.36, X21, RS530 or G703-2M interface. When choosing the G703-2M interface, it is necessary to configure many interface-related parameters. To do this, press the <F3> key (CFG G703). These parameters are described at the next screens.
- Test Period: Chooses the test time as CONTINUOUS or TIMER. To edit the test time, choose TIMER and press the DATA key. Use the alphanumeric keys to edit and

then press <F4> (ENTER) to go back to the configuration screen.

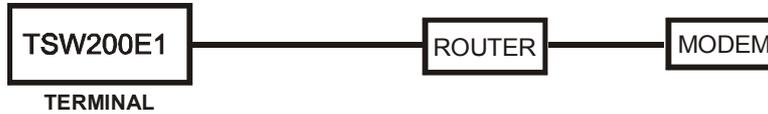
- Tx Clock Source: Allows choosing the transmit clock source as INTERNAL or EXTERNAL.
- Clock Edge: Allows choosing if data is valid at the positive or negative clock edge. The options are NORMAL or INVERTED. It is only available if the previous option was chosen as EXTERNAL.
- Tx Rate: Allows choosing the transmit rate from 1200 bps to 2M bps. It is only available if Tx Clock Source is selected as INTERNAL.
- SLARP Request: Defines if the equipment should perform the SLARP address request. The user can choose YES or NO.
- Local IP: Displays the IP address assigned to the test set. To edit this address, press the DATA key. The editing screen will be displayed. The CLEAR key forces the IP to be zero. Use the alphanumeric key to edit the desired value, and the ← and → keys to move the cursor. When editing is done, press the <F4> (ENTER) key. If the SLARP Request option is set as YES, the remote end assigns an IP to the test set during the negotiation.
- Peer IP: Displays the IP address of the remote end with which the connection will be established. The CLEAR key sets the IP to zero. Please see the previous item for instructions on how to change the displayed value. The remote end normally provides this IP address, but it can request it. When this happens, the IP value provided is chosen by this parameter.
- Keepalive: Defines the interval, in seconds, between sending KEEP ALIVE packets.
- Remote IP: Displays the remote end IP address where the PING packets must be sent. This address can be different from that of the Peer IP. Please see the Local IP item for instructions on how to change the exhibited value.
- Size: Chooses the size of the PING packets sent during the test. It can vary from 0 to 2000. To change the packet size, press the DATA key. The editing screen will be displayed. Use the alphanumeric keys to edit the desired value, and the ← and → keys to move the cursor. When done editing, press <F4> (ENTER).
- Ping Rate: Defines the time interval, in seconds, between sending each PING packet. It can vary from 0 to 99. Note that the chosen Ping Rate also is used as time-out. So, if there is no answer within the specified time, the equipment gives a time-out message and tries to send a new frame.
- Ping Count: Defines the number of PING packets that will be sent during the test. The test can continuously send PINGs or send a fixed user-selectable number of packets. Press the DATA key to undo editing and use the alphanumeric keys for choosing the desired value.

When the interface G703-2M is selected, the option CFG G703 is displayed over the <F3> key at the first test configuration screen. When selecting it by pressing the <F3> key, the G703-2M interface configuration screens are reached, as shown below.

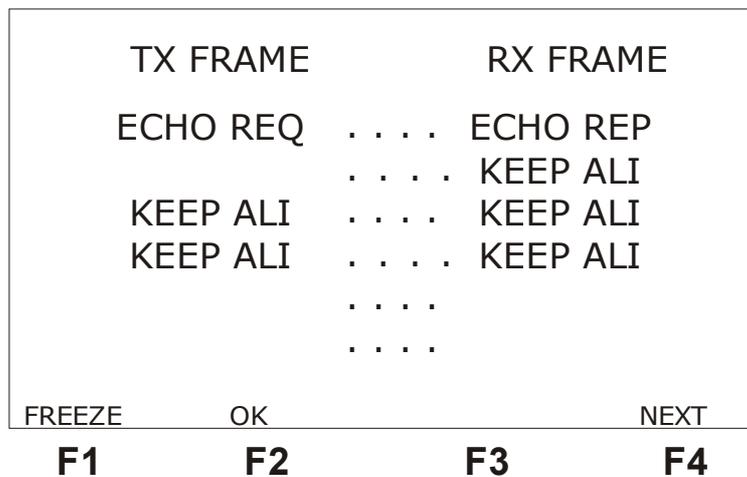


## 2.2 - Performing the PING test

The figure below exemplifies how to run a PING test.



After correctly configuring and connecting the equipment, the test can be started by pressing the START/STOP key. The transmitter keeps sending HDLC CISCO protocol packets (SLARP packets) to establish, configure and test the link connection. The following screen is displayed, showing the sent and received frames.

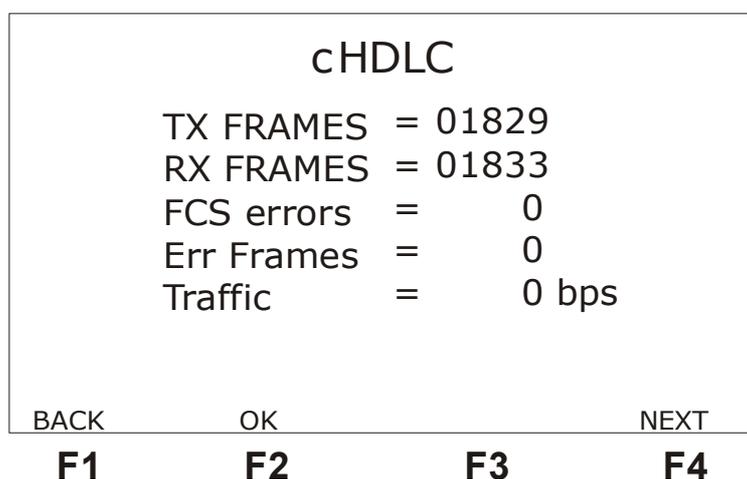


By pressing the <F1> (FREEZE) key, the screen is frozen, allowing frame analysis. Instead of the function keys menu, the number of the last frame displayed and the number of received frames are shown. Using the ← and → keys, it is possible to go the first or last received frames. Using the ↑ and ↓ keys it is possible to check the sent and received frames line by line. To update the screen again, press <F1> (UPDATE).

At the end of the address negotiations, the OK screen, depicted next, is shown on the display if the equipment remains on the Frames screen. Else it is accessible from any other screen by means of the <F2> (OK) key. From that screen, it is possible to check the other screens that the equipment presents during the test. The Frames screen is accessed by pressing the <F1> (FRAMES) key, the Counters screen by the <F2> (COUNTERS) key, the Sending Ping screen when pressing the <F3> (PING) key and the event log screen by pressing the <F4> (EVENT) key.



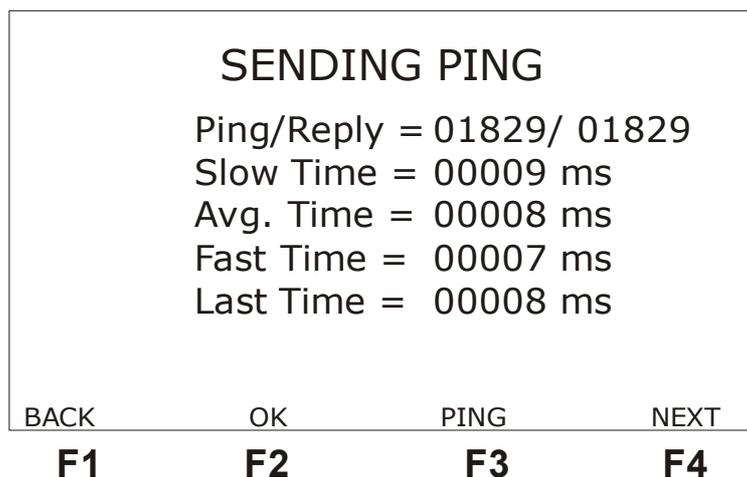
When the <F4> (NEXT) key is pressed from the Frames screen or the <F2> (COUNTERS) key from the OK screen, the following counters screen is depicted.



- **TX FRAMES:** indicates the total number of transmitted frames during the running test.
- **RX FRAMES:** indicates the total number of received frames during the running test.
- **FCS ERRORS:** indicates the total number of FCS errors (CRC-based error detection) found.
- **ERR FRAMES:** indicates the total number of frames that do not obey to the link protocol standards or too big frame or non-integer number of octets.
- **TRAFFIC:** indicates the ICMP frame bit rate.

Every counter is zeroed when the CLEAR key is pressed. To go back to the Frames screen, press the <F1> (BACK) key.

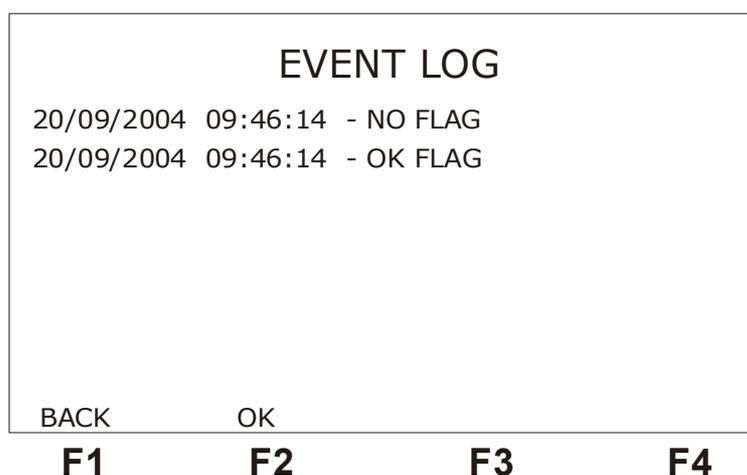
When the <F4> (NEXT) key is pressed, the following screen will be displayed.



In this screen it is possible to visualize the number of PING packets sent and the number of replies received (Ping/Reply) and some other data about the PING message response times: the slowest response time (Slow Time), the fastest time (Fast Time), the average response time (Avg. Time) and the last time. The CLEAR key clears the PING counters, but it does not interrupt the test. When the time defined in the Ping rate parameter expires without reply to the packet sent, a timeout warning is displayed.

By pressing the <F3> (PING) key the equipment start sending PING packets. The <F3> key label now turns to STOP. By pressing it, the sending of PING packets is ended. To go back to the Counters screen, press the <F1> (BACK) key.

The equipment presents a screen with the test event log. The event log informs the instant of start and end of a certain condition. The figure below displays an example.



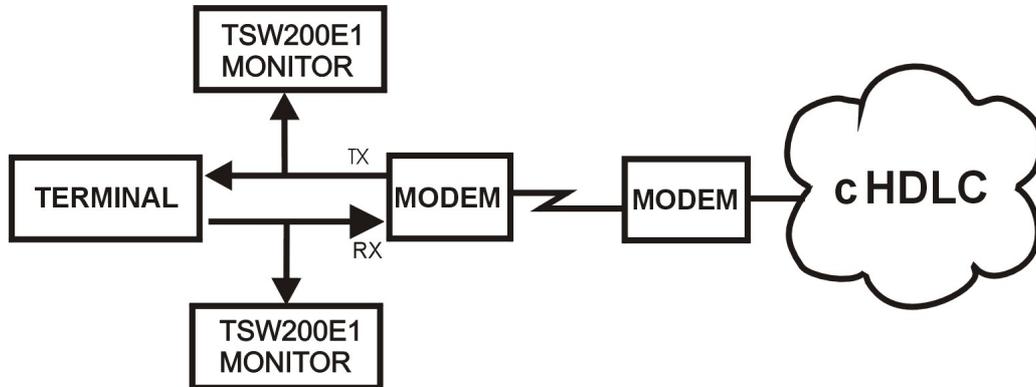
To go back to the SENDING PING screen, press the <F1> (BACK) key.

When the START/ STOP key is again pressed, from any screen, the test is interrupted and the equipment goes back to the configuration screen.

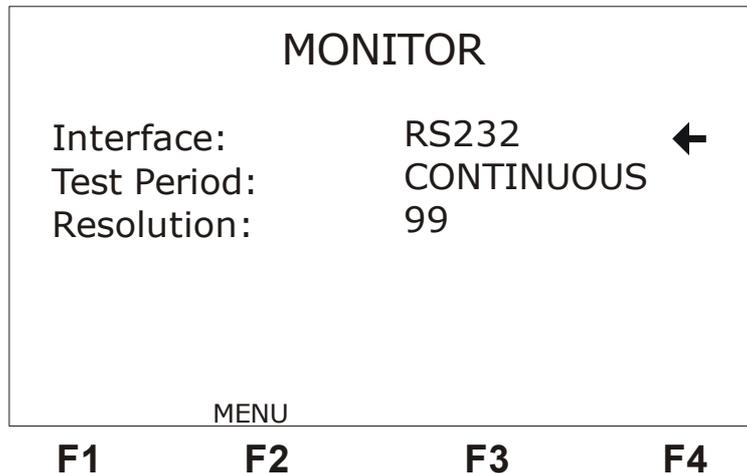
### 2.3 - The MONITOR test

The MONITOR test uses the selected interface receiver only. That means that it does not transmit. It only receives frames from one of the ends of the communication and informs by means

of a load graph (number of bits per second) that the equipment receives. To monitor both ends of the communication, it is necessary to have two equipments, one monitoring the transmission and another one, the reception. See an example of how this test can be run on the next figure.

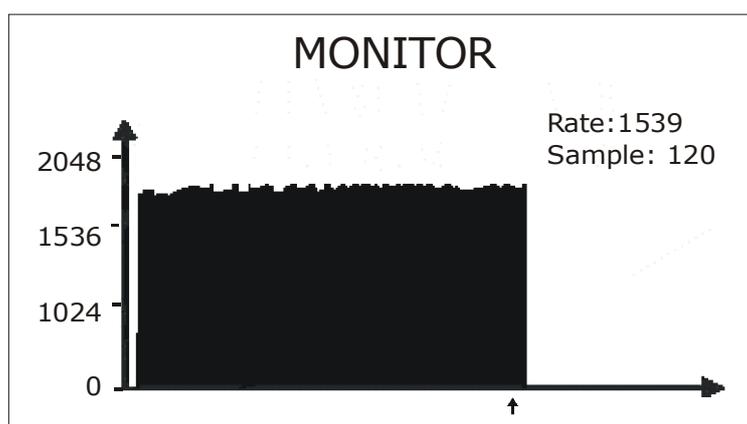


The following screen is the MONITOR test parameter configuration screen.



- Interface: Selects the operating interface as RS232, V35, V36, X.21, RS530 or G.703-2M. When choosing the interface G703-2M, the user must configure many interface-related parameters. To do this, press the <F3> key (CFG G703). For a parameter description, please check section 2.2.1 of this manual.
- Test Period: selects if the test is continuously run or if it is timed. To edit the test time, press the DATA key. Use the alphanumeric key and the ←, →, ↑ and ↓ keys to move the cursor. Key in the starting test time (Time to Begin) and the desired test time (Test Duration). Press the <F1> key (EXIT) to cancel editing. When finishing editing press <F4> (ENTER) to confirm.
- Resolution: Defines the interval, in seconds, between each column traced in the graph.

The graph presents the last 120 samples of the test just run. See a test example on the following figure. The rate value and the number of the sample corresponding to the position pointed to by the small arrow-shaped cursor below the graph are presented. Use the ← and → keys to move the cursor a position at a time and the ↑ and ↓ keys to move it quickly through the graph.



## 2.4 - The TRACEROUTE Test configuration (Optional Mode)

When choosing the TRACEROUTE, the first configuration screen will be presented. The configuration screens are shown in the figures below.

To toggle among the screens, use the keys <F1> (BACK) and <F4> (NEXT). To move the cursor up to the desired line, use the ↑ and ↓ keys. Most of the parameters can be modified using the ← and → keys. Some others can be edited. To do so, press the DATA key.

TRACEROUTE	
Interface:	RS232 ←
Test Period:	CONTINUOUS
Tx Clock Source:	INTERNAL
Tx Rate:	64000bps
<span style="margin-right: 100px;">MENU</span> <span>NEXT</span>	
F1	F2
F3	F4

- Interface: Chooses the operating interface as RS232, V.35, X.21, RS530 or G703-2M. When the G703-2M interface is chosen, it is necessary to configure many interface-specific parameters. To do so, press the <F3> key (labelled CFG G703). These parameters are described in section 2.1, above.

- Test Period: Chooses the test period as CONTINUOUS or timer. To select the test time, choose timer and press the DATA key. Use the alphanumeric keys to edit and then press <F4> (ENTER) to go back to the configuration screen.

- Tx Clock Source: Allows choosing the transmission clock source as INTERNAL or EXTERNAL

- Clock Edge: Allows choosing if data is valid in the positive or negative clock

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edges. The options are NORMAL or INVERTED. This option is available only if the previous option was chosen as EXTERNAL.

- Tx Rate: Allows choosing the transmission rate as 1200 bps and 2M bps. It is available only if Tx Clock Source was chosen as INTERNAL

```

                                SLARP
SLARP Request:  YES
Local IP:      255.255.255.255 ←
Peer IP:       255 .255.255.248
Keepalive:     10

BACK          MENU          NEXT
F1           F2           F3           F4

```

- SLARP Request: Defines if the equipment should perform the SLARP address request. The user can choose YES or NO.
- Local IP: Displays the IP address assigned to the test set. To edit this address, press the DATA key. The editing screen will be displayed. The CLEAR key forces the IP to be zero. Use the alphanumeric key to edit the desired value, and the ← and → keys to move the cursor. When editing is done, press the <F4> (ENTER) key. If the SLARP Request option is set as YES, the remote end assigns an IP to the test set during the negotiation.
- Peer IP: Displays the IP address of the remote end with which the connection will be established. The CLEAR key sets the IP to zero. Please see the previous item for instructions on how to change the displayed value. The remote end normally provides this IP address, but it can request it. When this happens, the IP value provided is chosen by this parameter.
- Keepalive: Defines the interval, in seconds, between sending KEEP ALIVE packets.

```

                                TRACEROUTE
Remote IP:     255.255.255.231 ←
Size:          0064
Max. Hops:     30

BACK          MODULE
F1           F2           F3           F4

```

- Remote IP: Displays the IP address of the remote end, the one to which the PING packets will be sent to. This address can be different from the Peer IP. See the Local IP item for instructions on how to change the displayed value.
- Size: Chooses the size of the PING packets that are sent during the test. It can vary from 0 to 2000. To change packet size, press the DATA key. The editing screen will be displayed. Use the alphanumeric keys to edit the desired value, and the ← and → keys to move the cursor. When finished editing, press <F4> (ENTER).
- Max. Hops: Maximum quantity of hops for performing the test. At most 30 hops will be allowed.

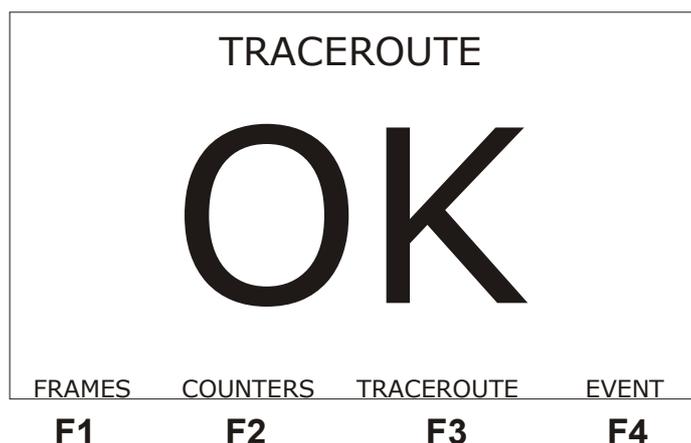
## 2.5 - Performing the TRACEROUTE Test (Optional Mode)

After correctly configuring and connecting the equipment, the test can be started by pressing the START/STOP key. The transmitter keeps sending HDLC CISCO protocol packets (SLARP packets) to establish, configure and test the link connection. The following screen is displayed, showing the sent and received frames.

TX FRAME		RX FRAME	
ECHO REQ	. . . .	ECHO REP	
	. . . .	KEEP ALI	
KEEP ALI	. . . .	KEEP ALI	
KEEP ALI	. . . .	KEEP ALI	
	. . . .		
	. . . .		
<b>FREEZE</b>	<b>OK</b>	<b>NEXT</b>	
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

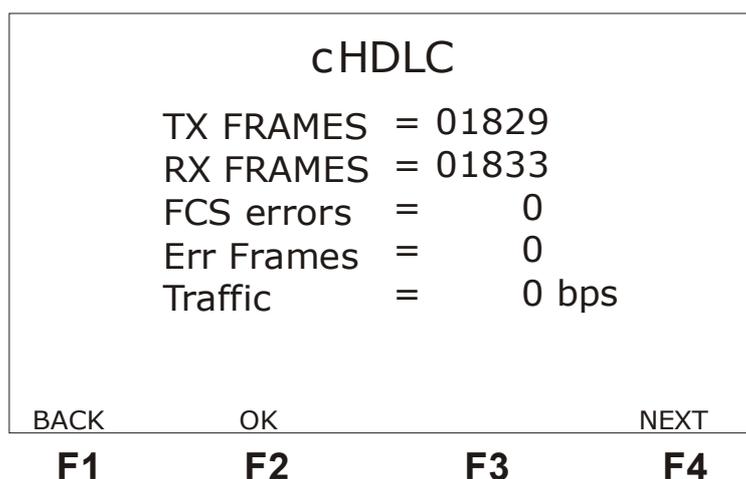
By pressing the <F1> (FREEZE) key, the screen is frozen, allowing frame analysis. Instead of the function keys menu, the number of the last frame displayed and the number of received frames are shown. Using the ← and → keys, it is possible to go the first or last received frames. Using the ↑ and ↓ keys it is possible to check the sent and received frames line by line. To update the screen again, press <F1> (UPDATE).

At the end of the address negotiations, the OK screen, depicted next, is shown on the display if the equipment remains on the Frames screen. Else it is accessible from any other screen by means of the <F2> (OK) key. From that screen, it is possible to check the other screens that the equipment presents during the test. The Frames screen is accessed by pressing the <F1> (FRAMES) key, the Counters screen by the <F2> (COUNTERS) key, the TRACEROUTE screen when pressing the <F3> (PING) key and the event log screen by pressing the <F4> (EVENT) key.



From this screen it is possible to check the other screens presented by the equipment during the test. The FRAMES screen is reached by pressing <F1> (FRAMES). The COUNTERS screen, by pressing <F2> (COUNTERS). The TRACEROUTE screen, by pressing <F3> (TRACEROUTE) and the events log screen by pressing <F4> (EVENT).

By pressing the <F4> (NEXT) screen from the Frames screen or <F2> (COUNTERS) from the OK screen, the following counter screen is displayed.



- *TX FRAMES*: indicates the total number of frames transmitted during the test in progress.
- *RX FRAMES*: indicates the total number of frames received during the test in progress.
- *FCS ERRORS*: indicates the total number of FCS error (CRC-based error detection) found.
- *ERR FRAMES*: indicates the total number of frames that do not obey to the link protocol standards, or frame too big, or non-integer number of octets.
- *TRAFFIC*: indicates the rate of the ICMP frame bits.

Every counter is reset when the CLEAR key is pressed. To go back to the Frames screen, press the <F1> (BACK) key.

When the <F4> (NEXT) key is pressed, the following screen will be displayed.

```
TRACEROUTE
1 255.255.255.248
  0214 ms 0214 ms 0214ms
2 255.255.254.001
  0214 ms 0214 ms 0214ms
3 255.255.253.001
  0214 ms 0214 ms 0214ms
4 255.255.253.231
  0214 ms 0214 ms 0214ms  END
BACK      OK      NEXT
F1      F2      F3      F4
```

This screen presents every hop performed during the test. It displays the hop number, the corresponding IP address and the response time to answer 3 pings. After 3 fruitless pings, timeout will be signalled.

The equipment also presents a test log events screen. The event log informs the start and end time of a specified condition. Next figure depicts an example.

To go back to the Counters screen press the <F1> (BACK) key.

When the START/STOP key is pressed again, from any screen, the test is interrupted and the equipment displays the configuration screen again.

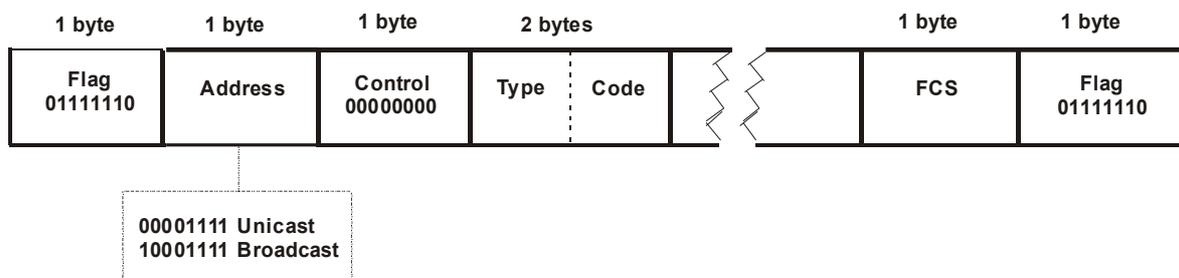
## Appendix A - CISCO HDLC Frame Structure

The main characteristics of the CISCO HDLC are:

- Bit-oriented;
- Operates in synchronous response mode in both directions;
- Frame delimiting, alignment and data transparency;
- Frame inspection to make sure that it is composed by an integer number of octets before zero insertion (*bit stuffing*) and after its extraction, at the receiving end;
- Frame size inspection to make sure that its size is within the specified limits;
- Transmission error detection;
- Network layer address negotiations.

### A.1 - CISCO HDLC Frame General Structure

HDLC CISCO (cHDLC) is an HDLC frame with an Ethernet Type Code to identify the frame network protocol. The basic frame structure is displayed on the following figure:



#### # Idle Flag Sequence

These Flag fields delimit the frame. Every frame must start and end with a flag sequence consisting of the first bit 0, followed by six bits 1 and another bit 0 (0111 1110 - 7E hexadecimal). The Flag previous to the field address is the frame start flag and the Flag after the FCS is the frame end flag.

Using this frame delimiting technique implies the use of *bit stuffing* to ensure data transparency. This technique causes insertion of a bit 0 every time that a sequence of five bits 1 is found in the transmitted data. At the receive end, for each sequence of five bits 1, the following bit must be suppressed, if it is equal to zero. If this bit is 1, then the receiver knows the end of the frame has come.

#### # Address Field

The address field assumes the value 0x0F for unicast packets or 0x8F for broadcast packets.

#### # Control Field

The control field has the sequence 00000000.

#### # Type Code Field

This field has two bytes to identify the frame protocol. Examples: IP 0x0800; Cisco SLARP 0x8035; EtherTalk 0x809B; AARP 0x80F3; IPX 0x8137; DECnet phase IV 0x6003

# **Data Field**

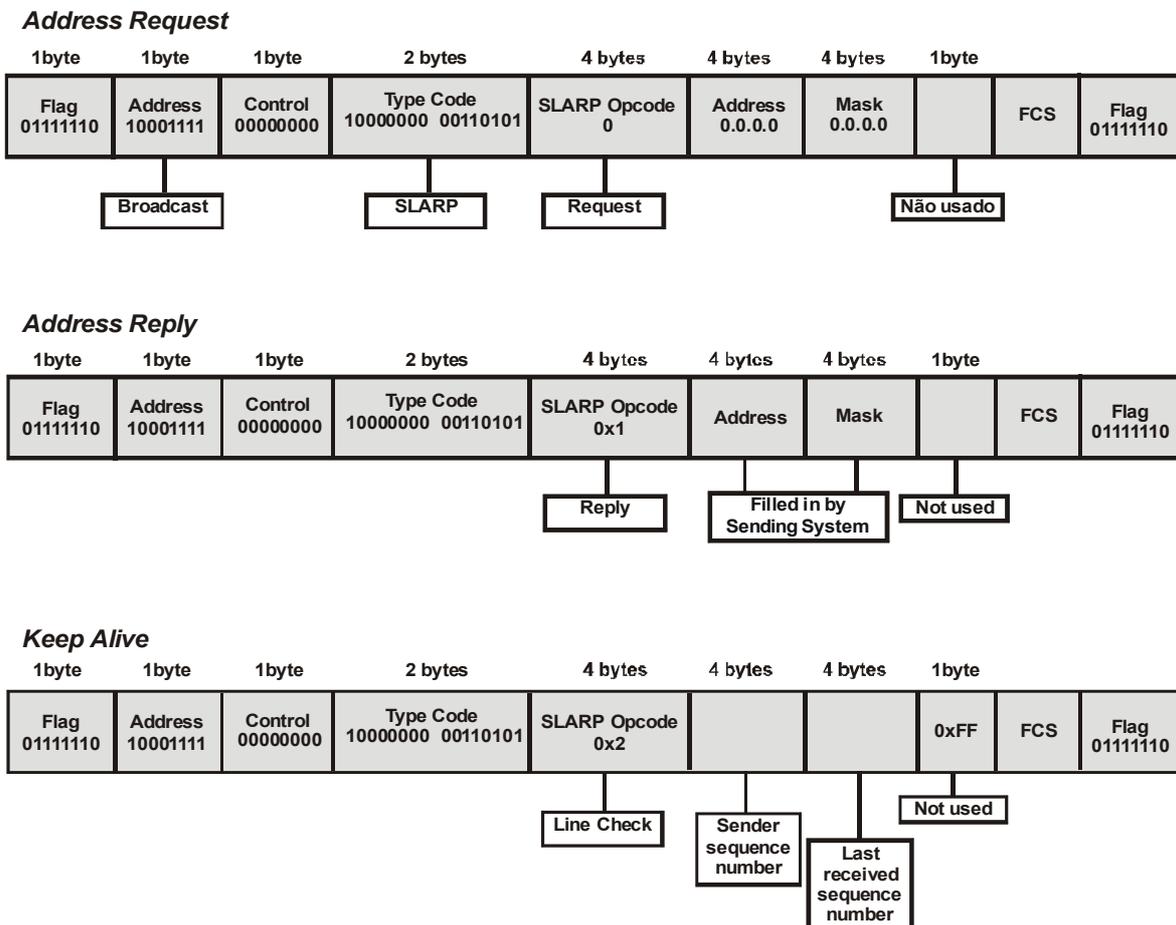
The Data field has zero or more bytes containing the datagram for the protocol specified in the Protocol field. The end of the information is detected when the flag sequence is detected.

# **FCS Field**

Frame Check Sequence.

## A.2 - SLARP

The dynamic address designation and the link integrity checking are done by using the SLARP protocol. The SLARP frames have a 4-byte code to discriminate between the two operations. Normally three types of code are defined: Address request uses code 0, and the reply uses code 1. The KEEP ALIVE frames use code 2. The figure below displays the three types of frame.



In the request address frames, the address and mask fields are zero and the last byte is not defined. The response frame includes the address and the network mask. Usually the end-to-end serial links use a 30-bit mask.

SLARP does not support complex configurations. It assumes that both link ends are in the same subnetwork and that one is host 1 and the other is host 2. If the SLARP receives a response and the IP network host number is 1, the system that requested assumes that it is host 2. If the answer indicates that it is from host 2, the system assumes to be host 1.

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To make sure that these links can be used for data transportation, the SLARP includes a basic keepalive mechanism. The two ends send messages and periodically monitor them to be aware of the link status.