



## Operation Manual

# PPP

Annex to TSW200E1's Operation Manual

Version: 1  
Revision: 3  
December/2008



# Copyright

This manual was created by the Wise Telecommunications Industry team.  
No part or contents of this manual can be reprinted without written authorization of Wise Telecommunications Industry.

Wise Telecommunications Industry reserves itself the right to alter its products, and the manual contents, at any time, without any prior warning, according to its own needs.

As the Wise Telecommunications Industry products are under constant development, some characteristics may not be included in the manuals; they can be added as annexes.

Any contribution or criticism that can better this product or manual will be welcomed by the company team.

If this manual contents are not according to the version of the equipment or its operation, please contact the company, using the phone/fax:  
55-61-3486-9100

or the e-mail:

[wise@wi.com.br](mailto:wise@wi.com.br)

Wise Telecommunications Industry

Commercial Department:

Setor de Indústria Bernardo Sayão  
SIBS quadra 01 conjunto D lote 12  
Núcleo Bandeirante – Brasília – DF – Brazil CEP 71736-104

Please visit our homepage: <http://www.wi.com.br>



# Summary

<u>1 - Section.....</u>	<u>1</u>
<u>1.1 - Sub-section.....</u>	<u>1</u>
<u>1.2 - Sub-section.....</u>	<u>1</u>
<u>1.2.1 - Sub-sub-section.....</u>	<u>1</u>
<u>2 - Section.....</u>	<u>1</u>
<u>3 - Appendix A.....</u>	<u>2</u>
<u>A.1 Sub-section.....</u>	<u>2</u>
<u>A.2 Sub-section.....</u>	<u>2</u>
<u>Appendix B.....</u>	<u>2</u>



## 1 - Introduction

The **PPP** module is used to establish a link with a remote node to send IP packages in this connection. At first, the module sends LCP (*Link Control Protocol*) protocol packages to establish, test and configure the link. Then, the module sends NCP (*Network Control Protocol*) packages to define the network protocol to be used. In this case the packages are from the IPCP protocol that defines the IP protocol parameters. The PPP test goes up to level 3 of the OSI layer model. The test is performed in an UNI (user/network interface). It allows checking if the link is active and if there is integrity in this link. The test follows the sending and receiving of the frames for error detection. It also allows checking the end-to-end connectivity inside the network and the remote nodes response times by sending PING packages.

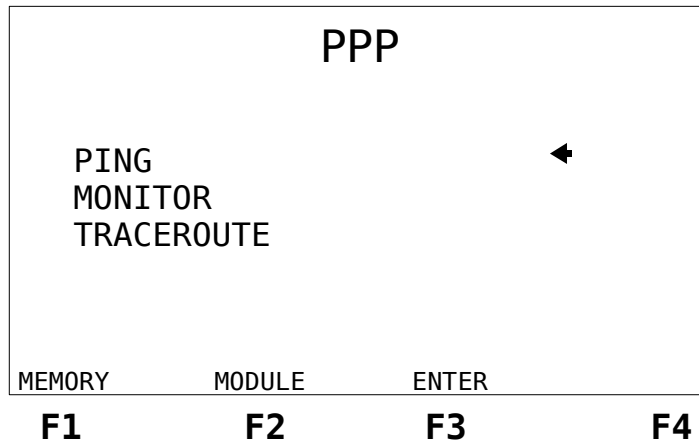
The monitor test shows information about the load, in bps, flowing through the circuit under test.

The main characteristics of the PPP Module are:

- Interfaces: V.24/RS232, V.35/V.11, V.36/V.11, X.21/V.11, RS530 and G.703 2M
- Operation Speed from 1200 bps up to 2048 kbps.
- Synchronous communication mode.

## 2 - PPP Module Operation

When selecting the PPP module from the Module screen, the following screen will be displayed.



From this screen it is possible to choose which of the PPP module tests will be run. To select the test, place the cursor on the desired line, use the ↑ and ↓ keys, and press the <F3> (ENTER) key. To return to the module screen press the <F2> (MODULE) key.

The PPP module memory is also accessed from this screen. Just press the <F1> (MEMORY) key. This memory stores data from the last test run. Navigation on the memory screens is analogous to that of the running tests screen and will be described on the following sections.

The test results can be printed from the equipment memory. Pressing the PRINT key in any memory visualization screen causes the TSW200E1 to display the print management screen. For more details about printing results consult the TSW200E1 Operation Manual section 6.3.

### 2.1 - PING Test Configuration

When selecting the PING test, the first configuration screen will be presented. There are three configuration screens that are shown on the following figures.

To alternate among the screens use the <F1> (BACK) and <F4> (NEXT) keys. To move the cursor to the desired line, use the ↓ and ↑ keys.



## PPP

---

PING			
Interface:	RS232 ←		
Test Period:	CONTINUOUS		
Tx Clock Source:	INTERNAL		
Tx Rate:	64000bps		
MENU NEXT			
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

LCP			
MRU:	2000 ←		
Authentic:	NO		
Quality:	NO		
Magic Number:	YES		
PFC:	NO		
ACFC:	NO		
BACK	MENU	NEXT	
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

IPCP			
IP-Compression:	NO ←		
IP-Address:	YES		
Local IP:	255.255.255.255		
Peer IP:	255 .255.255.248		
BACK	MENU	NEXT	
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

## PPP

---

ICMP	
Remote IP:	255.255.255.231 ←
Size:	0064
Ping Rate:	99
Ping Count:	CONTINUOUS
BACK	MODULE
<b>F1</b>	<b>F2</b> <b>F3</b> <b>F4</b>

A description of the configuration parameters of the PPP Module follows:

- **Interface:** Selects the operating interface as RS232, V35, V36, X.21, RS530 or G.703-2M. When choosing the G.703-2M interface, it is necessary to configure many parameters. To do this, press <F3> (CFG G703). For the detailed description of these parameters, please see the following pages of this manual.
- **Test Period:** selects if the test runs continuously or for a determined amount of time. To edit the test total time press DATA. Use the alphanumeric keys and the ←, ↑, → and ↓ keys to move the cursor. Key in the Time to Begin test and the Test Time. To cancel editing, press <F1> (EXIT). To confirm and to end editing press <F4> (ENTER).
- **Tx Clk Src:** Allows choosing the clock source as INTERNAL or EXTERNAL.
- **Clock Edge:** Allows choosing if data are valid on the positive or negative edge of the clock. The options are NORMAL or INVERTED. It is only available if the previous option was chosen as EXTERNAL.
- **Tx Rate:** Chooses the transmission rate from 1200 up to 2048 kbps. This option is available only if Tx Clk Src was chosen as INTERNAL.
- **MRU:** The Maximum Received Unit allows the user to edit the maximum package size used in the communication. The standard value is 1500. To edit this value press the DATA key, with the cursor pointing to the MRU line. The editing screen will be exhibited. Use the alphanumeric keys to edit and then press <F4> (ENTER) to go back to the configurator screen.
- **Authentic:** Allows negotiating the protocol authentication. The Standard is NO (no authentication). It cannot be modified.
- **Quality:** Allows negotiating the monitoring of the quality of the protocol link. The Standard is NO and it cannot be changed.
- **Magic Number:** Allows negotiating a number that allows detecting a loop in the link or some other anomaly in the data link. The standard is NO and it *can* be changed.
- **PFC:** Allows negotiating the compression of the protocol fields for the PPP frame. The standard for this option is NO and it cannot be changed.
- **ACFC:** Allows negotiating the compression of the control and address fields of the PPP frame. The standard for this option is NO and it cannot be changed.
- **IP-Compression:** Allows negotiating the use of a protocol-specific compression. The standard for this option is NO and it cannot be changed.
- **IP-Address:** Allows negotiating the IP address to be used for the end-to-end test. The

## PPP

user can choose between YES or NO.

- Local IP: Displays the IP address assumed by the test set. Press DATA to edit. The editing screen will be displayed. Use the alphanumeric keys to edit the desired value and the ← and → keys to move the cursor. Press <F4> (ENTER) when done. If the value 000.000.000.000 is chosen, the remote node assigns an IP to the test set during the negotiation.
- Peer IP: Displays the IP address for the remote node that the user desires to connect to. See the preceding item for instructions on how to change the displayed value.
- Remote IP: Shows the IP address for the remote node to which the user desires to send the PING packages to. This address can be different from the Peer IP. See the item Local IP for instructions on how to change the displayed value.
- Size: Chooses the size of the PING packets sent during the test. It can vary from 0 to 2000. To change the size of the packets, press the DATA key. The editing screen will be displayed. Use the alphanumeric keys to edit the desired value, and the keys ← and → to move the cursor. Press <F4> ENTER to quit editing.
- Ping Rate: Defines the time interval, in seconds, between sending each PING packet. It can vary from 0 to 99. Note that the defined Ping Rate also functions as a time-out value. In that way, if there is no answer during this interval, the equipment will display a time-out message and will try 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 it can send a fixed amount of packets. This amount is user-defined. Press the DATA key to edit and use the alphanumeric keys to choose the desired value.

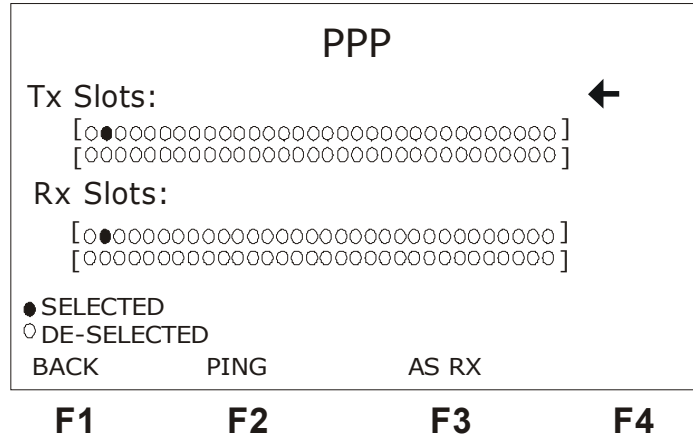
When the G703-2M interface is selected, the label CFG G703 is displayed over the <F3> key, at the first test configuration screen. When <F3> is pressed, the G703-2M interface configuration screens are reached. They are shown below.

PPP			
Framing:	PCM30C ←		
Line Code:	HDB3		
Termination:	75Ω UNBAL		
Idle Code:	11111111		
NFAS/NMFAS:	DEFAULT		
ABCD:	DEFAULT		
PING NEXT			
F1	F2	F3	F4

- Framing: Selects the frame structure. The structures are PCM30, PCM30C, PCM31, PCM31C and UNFRAMED.
- Line Code: Allows the user to choose the line code as HDB3 or AMI.
- Termination: The user can choose the cable termination interface as 75 ohms UNBAL, 120 ohms BAL, HIGH-Z UNBAL or HIGH-Z BAL.
- Idle Code: Selects the Idle Code to be sent for the deselected channels. Press the DATA key to edit.

## PPP

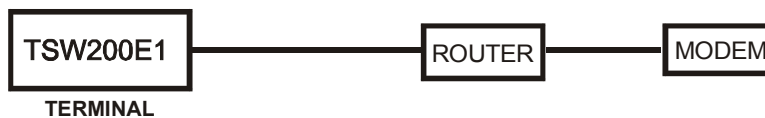
- NFAS/NMFAS: The USER option allows the programming of the NFAS/NMFAS word (Sa). The DEFAULT option programs the word “010000000001011”. To toggle between these two options use the ← or → keys . Press the DATA key to edit.
- ABCD Bits: The DEFAULT option keeps all ABCD bits at 1000. The USER option allows programming the 30 ABCD words of timeslot 16, but only for the PCM30 and PCM30C structures.



- Tx Slots: Selects the timeslot(s) for transmission, from 01 to 31.
  - Rx Slots: Selects the timeslot(s) for reception, from 01 to 31.
- To go back to the selected configuration test screen, press <F2>.

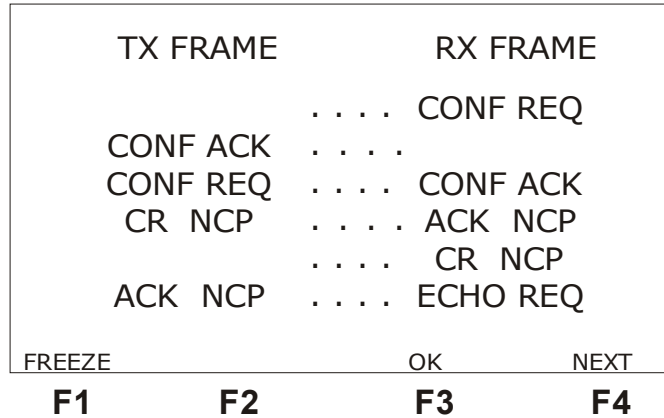
### 2.2 - Performing the PING test

The following figure exemplifies how the PING test must be executed.



After correctly configuring and connecting the equipment, the test can be started by pressing the START/STOP key. At first, the transmitter continuously sends PPP protocol packages (LCP packages) to establish, configure and test the link connection. The screen below displays the frames that are sent and received.

## PPP



See on the table below the meaning of the packages exchanged during communication.

Command	Name	Description
CONF REQ	Configure Request	Request to open the connection
CONF ACK	Configure Ack	Means that the configurations sent by the CONF REQ command were accepted
CONF NAK	Configure Nak	Means that there is at least one option, sent by the CONF REQ command, not accepted that should be negotiated
CONF REJ	Configure Reject	This packet is sent when there are options in CONF REQ that were not recognized or that cannot be negotiated.
TERM REQ	Terminate Request	Packet sent to terminate the connection
TERM ACK	Terminate Ack	Packet sent to confirm the disconnection request
CODE REJ	Code Reject	Used to reject an unknown LCP packet
PROT REJ	Protocol Reject	Used to reject a PPP packet carrying an unspecified protocol in the Protocol field.
ECHO REQ	Echo-request	Used to test loopback for a connection (see next comand)
ECHO REP	Echo-reply	Used to test loopback for a connection by sending back Echo-Reply when receiving an Echo-Request
DISC REQ	Dischard Request	Used to test the connection SINK mechanism

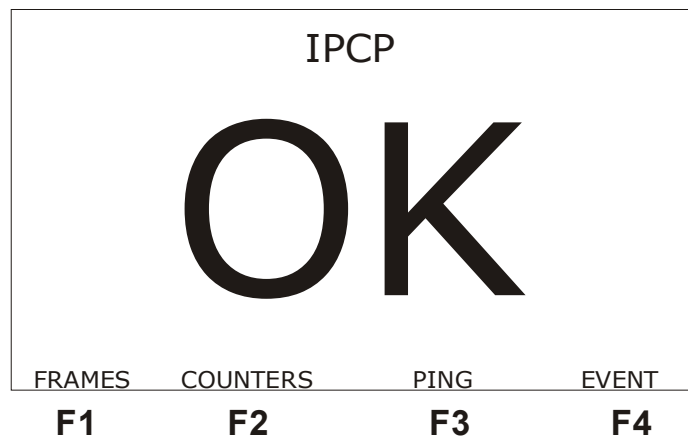
Pressing the <F1> (FREEZE) key freezes the screens, allowing the analysis of the frames. Instead of the function keys, the number of the last frame displayed and the number of received frames are displayed. By using the ← and → keys, it is possible to go to the first or to the last received frame. Using the ↑ and ↓ keys it is possible to check the received and sent frames in a line-by-line basis. To update the screen use the <F1> (UPDATE) key. The CLEAR key erases the received and transmitted frames until that moment.

Soon after the negotiations of the LCP configurations are accepted, NCP packages are sent to configure the level 3 protocol parameters, which will be loaded by the PPP. As the protocol for this level is the IP, the NCP to configure it will be the IPCP (*Internet Protocol Control Protocol*). At the end of the negotiations the OK screen, displayed below, is shown on the equipment display if the equipment remains on the Frames screen. Otherwise, it is accessible from any other screen by using the <F2> (OK) key. In this way it is possible to view the other screens that are displayed during the test. The Frames screen is accessed by the <F1> (FRAMES) key. Press the <F2>

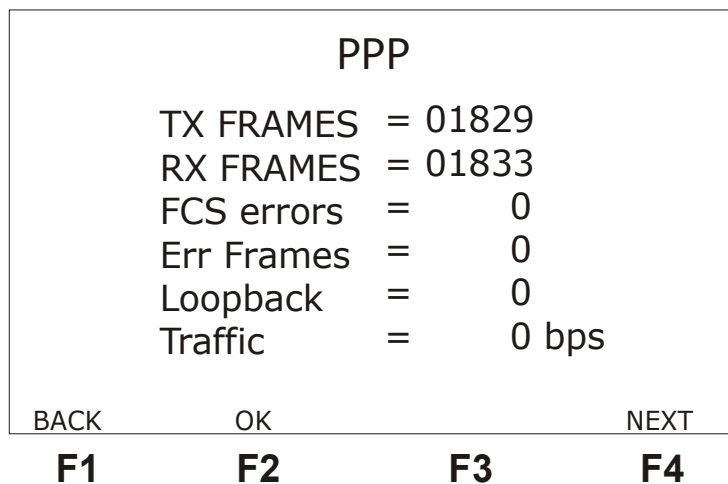
## PPP

---

(COUNTERS) key to go to the counters screen. The Sending Ping screen is reached by pressing the <F3> (PING) key and the Event Log screen by pressing the <F4> (EVENT) key.



By pressing the <F4> (NEXT) key from the FRAMES screen or <F2> (COUNTERS) from the OK screen, the following counters screen is shown.



The description of each of the counters displayed on the above figure is shown below.

**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.

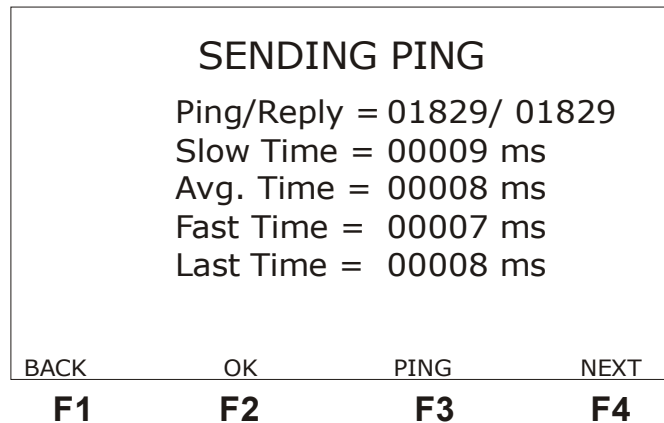
**FCS ERRORS:** indicates the total number of FCS errors found (CRC-based error detection).

**ERR FRAMES:** indicates the total number of frames that do not obey to the link protocol rule, or too big frame, or uneven number of octets.

**LOOPBACK:** indicates the total number of frames received with the Magic Number parameter equal to the Magic Number of the transmitted frames. This indicates that there is a loop in the communication.

**TRAFFIC:** indicates the rate of the ICMP frame bits.

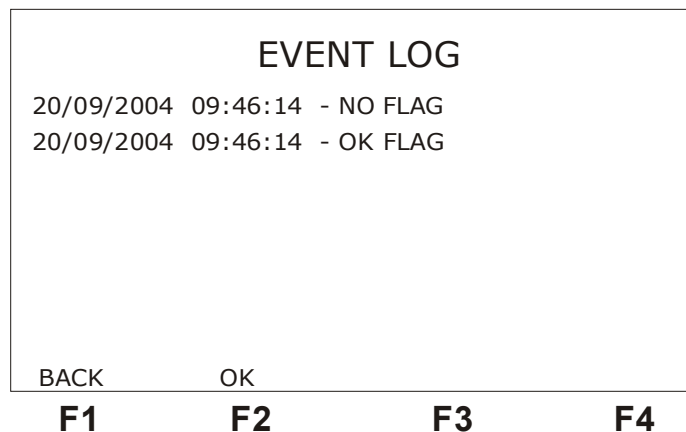
By pressing the CLEAR key, all counters are zeroed. To go back to the Frames screen, press <F1> (BACK). By pressing the <F4> (NEXT) screen, the following screen will be displayed.



In the screen above it is possible to visualise the number of PING packages that were sent (Ping Sent), as the number of received responses (Ping Rcvd) and data from the response times to the PING messages: 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 interval defined at the Ping Rate parameter expires and there is no answer to the packet sent, a time-out warning is displayed.

By pressing the <F3> (PING) key, the PING packet sending is started. The <F3> label changes from PING to STOP. Pressing <F3> (STOP) ends the sending of PING packets. To go back to the counters screen, press the <F1> (BACK) key.

The equipment also presents a test event log screen. The event log informs the start and end times of a certain condition. The following figure displays an example.



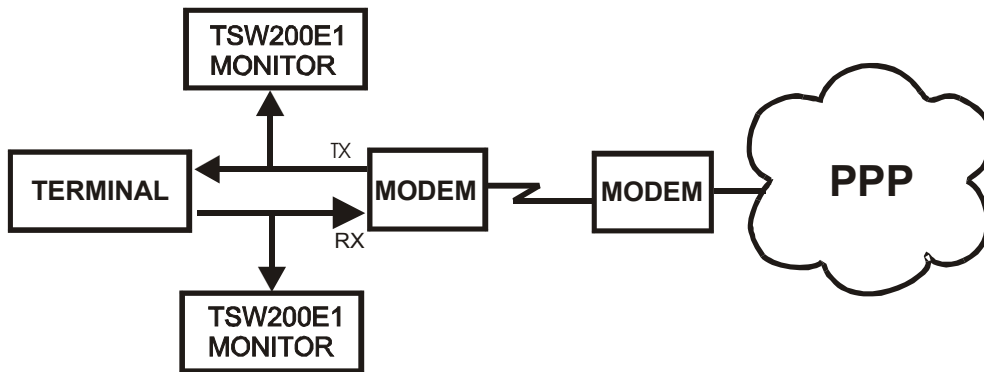
To go back to the SENDING PING screen, press the <F1> (BACK) key.

By pressing the START/ STOP key again, from any of the screens, the test is stopped and the equipment goes back to the configurator screen.

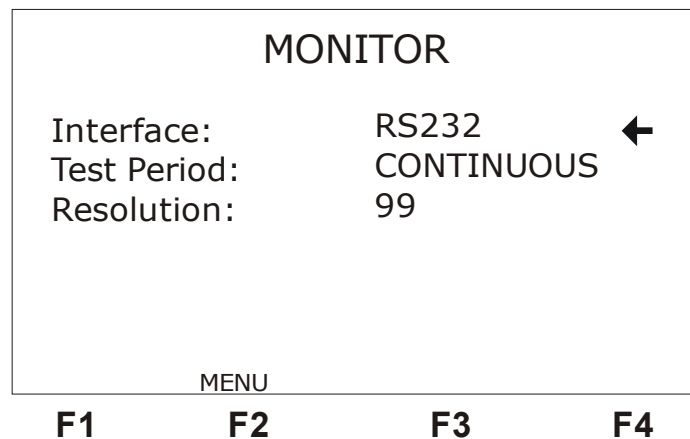
### 2.3 - The MONITOR test (Optional Mode)

The MONITOR test only uses the selected interface receiver. That means it does not transmit. It only receives frames from one of the ends of the communication and displays in a graph the load (in bits per second) that the equipment is receiving. To monitor both sides of the communication it is necessary to have two equipments, one monitoring transmission and the other

monitoring reception. The figure below shows an example of how to carry out a test.



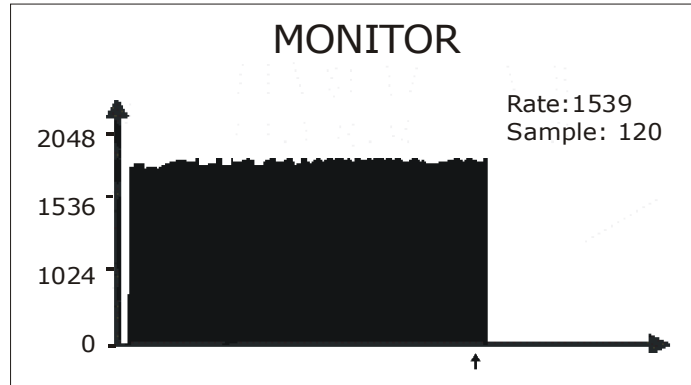
The following screen is the MONITOR test configuration parameters screen.



- Interface: Selects the operating interface as RS232, V35, V36, X.21, RS530 or G.703-2M. When choosing the G.703-2M interface, it is necessary to configure many parameters. To do this, press <F3> (CFG G703). For the detailed description of these parameters, please see the following pages of this manual.
- Test Period: selects if the test runs continuously or for a determined amount of time. To edit the test total time press DATA. Use the alphanumeric keys and the ←, ↑, → and ↓ keys to move the cursor. Key in the Time to Begin test and the Test Time. To cancel editing, press <F1> (EXIT). To confirm and end editing press <F4> (ENTER).
- Resolution: defines the interval, in seconds, between each column drawn in the graph.

The graph presents the last 120 samples of the test performed. See a test example in the following figure. The rate value and the sample number are displayed, corresponding to the position defined by the small arrow-shaped cursor just below the graph. To move the cursor, use the ↑ and ↓ keys.

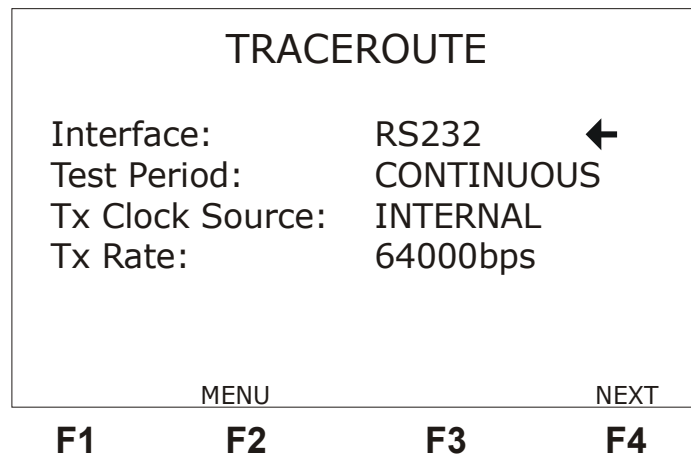




## 2.4 - The TRACEROUTE Test configuration (Optional Mode)

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.



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

## PPP

---

- 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.

LCP			
MRU:	2000	←	
Authentic:	NO		
Quality:	NO		
Magic Number:	YES		
PFC:	NO		
ACFC:	NO		
BACK	MENU		NEXT
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

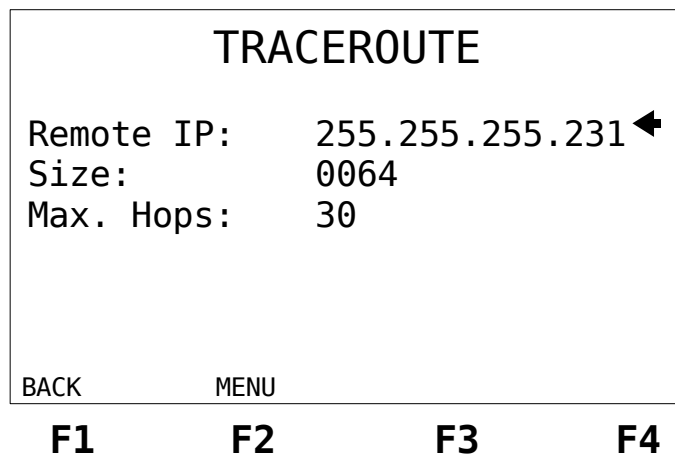
- MRU: The Maximum Received Unit allows the user to edit the maximum packet size used in the communication. The standard size is 1500 and the maximum is 2000. To edit this value, press the DATA key, with the cursor at the MRU line. The editing screen will be displayed. Use the alphanumeric keys to edit and then press <F4> (ENTER) to go back to the configuration screen.
- Authentic: Allows negotiating the protocol authentication. The standard is NO (no authentication). The YES option is not yet implemented.
- Quality: Allows negotiating the protocol link quality monitoring. The standard is NO and the YES option is not yet implemented.
- Magic Number: Allows negotiating a number that enables link loop detection or some other anomaly in the link data. The standard is NO, but it can be modified to YES. The number is a characteristic of the equipment and cannot be chosen.
- PFC: Allows negotiating the PPP frame protocol field compression. The standard is NO and the YES option is not yet implemented.
- ACFC: Allows negotiating the PPP field address and control field compression. The standard is NO and the YES option is not yet implemented.

IPCP			
IP-Compression:	NO	←	
IP-Address:	YES		
Local IP:	255.255.255.255		
Peer IP:	255 .255.255.248		
BACK	MENU		NEXT
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

- IP-Compression: Allows negotiating the use of a specific protocol

compression. The standard is NO and the YES option is not yet implemented..

- IP-Address: Allows negotiating the IP address to be used in the end-to-end test. The user can choose YES or NO.
- Local IP: Displays the IP address assumed by the test set. The CLEAR key sets the IP to zero. Press the DATA key to edit. The editing screen will be exhibited. Use the alphanumeric keys to edit the desired value and the ← and → keys to move the cursor. To end editing, press <F4> (ENTER). If the value 000.000.000.000 is set and the IP-Address option is YES , the remote end attributes an IP to the test set during the negotiation phase.
- 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. See the previous item for instructions on how to change the displayed value. The remote end generally provides this IP address, but it can request the address. When this happens, the value set by this parameter is provided.



- 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 properly configuring and connecting the equipment, press the START/STOP key to start the test. At first, the transmitter sends PPP protocol packets (LCP packets) to establish, configure and test the link connection. The screen shown below is displayed, depicting the sent and received frames.

## PPP

	TX FRAME		RX FRAME
		. . . .	CONF REQ
	CONF ACK	. . . .	
	CONF REQ	. . . .	CONF ACK
	CR NCP	. . . .	ACK NCP
		. . . .	CR NCP
	ACK NCP	. . . .	ECHO REQ
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

By pressing the <F1> key (FREEZE), the screen stops being updated, so as to allow data analysis. In place of the function keys menu, the number of the last frame displayed on screen and the number of received frames are shown. With the ← and → keys it is possible to go to the first or last received frame. With the ↑ and ↓ keys it is possible to examine, in a line-by-line basis, the received and sent frames. Press <F1> (UPDATE) to resume the updating of the screen. The CLEAR key erases the transmitted and received frame buffer. If the this key is pressed, the communication is stored starting from the moment when the key was pressed .

Please check the table on Section 2.1 for the meaning of the packets exchanged during communication.

Right after the LCP configuration negotiations are accepted, NCP packets will be sent to configure the level 3 parameters protocol, which will be loaded by the PPP. As IP is the protocol at this level, the NCP used to configure it will be the IPCP (Internet Protocol Control Protocol). At the end of the negotiations, the OK screen, displayed below, will appear on the equipment display if the equipment remains on the Frame screen. Else, it will be accessible from any screen by pressing the <F2> (OK) screen.

TRACEROUTE			
<b>OK</b>			
<b>F1</b>	<b>F2</b>	<b>F3</b>	<b>F4</b>

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).

## PPP

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

PPP	
TX FRAMES	= 01829
RX FRAMES	= 01833
FCS errors	= 0
Err Frames	= 0
Loopback	= 0
Traffic	= 0 bps
BACK	OK
F1	F2
F3	F4

- *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.
- *LOOPBACK*: indicates the total number of received frames that has the Magic Number parameter equal to the Magic Number for the received frames. This indicates there is a loop in the communication.
- *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
F1	F2
F3	F4

## PPP

---

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 SENDING PING 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.

### 3 - Glossary of Technical Terms

Following we present the meaning of many technical terms, as used throughout this manual.

#### **ICMP (*Internet Control Message Protocol*)**

It is an extension to the Internet Protocol (IP). Supports packets containing error, control and informational messages. The PING command, for example, uses ICMP to test an Internet connection.

It is the responsible for reporting error messages in the datagram processing.

#### **PING**

This small utility is used to see if a specified connection (a specific IP address) is active and to assess the time that a message takes to go from one node to the other of the connection. PING sends packages (generally of 64 bytes) to a node, which responds by sending another equivalent package.

#### **IP Address**

An identifier for a computer or device on a TCP/IP network. Networks using the TCP/IP protocol route messages based on the IP address of the destination.

#### **Protocol**

Set of rules that specify the message format and the timing involved in the communication between two systems.

## Appendix A – PPP Frame Structure

### A.1 - PPP Characteristics

PPP is short for point-to-point protocol. It is a method for connecting a computer to the Internet. More stable than older SLIP, provides error-checking features. It works on the data link layer of the OSI model. It sends the computer's TCP/IP packets to a server that puts them on the internet.

It is the Internet standard for transmission of IP packets over serial lines, synchronous and asynchronous.

It is a specification that goes from level 1 to 3, passing through MR-OSI level 2. It gets great acceptance and includes many variants.

The main characteristics of PPP are:

- ◆ Bit-oriented;
- ◆ It is *full duplex*, supporting also *half duplex* mode;
- ◆ Frame delimiting, alignment and data transparency;
- ◆ Frame inspection to guarantee that each frame is composed of an integer number of octets before zero insertion (*bit stuffing*) and after its deinsertion at reception;
- ◆ Transmission error detection.
- ◆ Link quality testing.
- ◆ Link configuration.
- ◆ Optional negotiation such as network layer addresses and data compression.

### A.2 - PPP Frame General Structure (Level 2)

The process of frame delivery for the services consists, essentially, in the sending of frames with the format shown below.

Field	Characteristic
01111110	8-bit idle flag
Address	8 or more bits
Control	8 or 16 bits
Protocol	16 bits
Data	variable length
FCS	16 bits
01111110	8-bit idle flag

#### # Idle Flag Sequence

These flag fields delimit the frame. Every frame must start and end with a flag sequence that consists in the first bit 0, followed by six bits 1 and one more bit 0 (0111 1110 - hexadecimal 7E).

The flag before the address field is the starting frame flag and the flag after the FCS is the end of frame flag.

The using of this technique of frame delimiting implies the adoption of the *bit stuffing* strategy to guarantee the data transparency. This technique presupposes the insertion of a bit 0 each time that a sequence of five bits 1 is found in the transmitted information. In the reception, for each sequence of five bits 1, the following bit must be suppressed, if it is equal to 0. If this bit is equal to 1, then the receiver knows it is the end of frame.



## PPP

---

### # **Address Field**

The address field contains the sequence 11111111, which is the standard address for broadcast. PPP does not signal individual station addresses.

### # **Control Field**

The control field contains the sequence 00000011.

### # **Protocol Field**

This field contains two bytes that identify the encapsulated protocol in the frame **DATA** field. It can identify **LCP** (0xC021) packages to establish, keep, configure and terminate the node-to-node connection and **NCP** packages (0x8021 for IPCP) to establish and to configure different network protocols.

### # **Data Field**

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

### # **FCS Field**

*Frame Check Sequence.* Normally 16 bits (2 bytes), but allows using 32 bits (4 bytes) to implement error detection in the frame sequence.

LCP packages:

Code	Identifier	Length	Data
1 to 11	1 byte	2 bytes	depends on the code

Code: LCP packages

- 1 - Configure-Request
- 2 - Configure-Ack
- 3 - Configure-Nak
- 4 - Configure Reject
- 5 - Terminate-Request
- 6 - Terminate-Ack
- 7 - Code-Reject
- 8 - Protocol-Reject
- 9 - Echo-Request
- 10 - Echo-Reply
- 11 - Discard-Request

In the Data field there can exist configuration options in the format:

Type	Length	Data
1 byte	1 byte	depends on the type

Type:

- 0 - Reserved
- 1 - MRU
- 3 - Authentication
- 4 - Quality Protocol

## PPP

---

- 5 – Magic Number
- 7 – Protocol-Field –Compression
- 8 – Address-and-Control-Field-Compression

### NCP packages:

After both ends of the communication have negotiated the link parameters, the PPP protocol sends NCP packages to choose and to configure one or more network protocols. The NCP packages are the same as for LCP, but in the Code field only codes 1 to 7 are used. Other codes are treated as unknown and must result in rejected codes.