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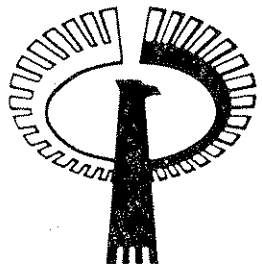

Phoenix
microsystems, inc.

Phoenix Instruction Book

5000
Modem Test Set

This instruction book contains the following sections:

Phoenix microsystems, inc.
991 Discovery Drive
Huntsville, Alabama 35806

5000 Modem Test Set

Phoenix microsystems, inc.

Phoenix Instruction Book

34-00012-012TB
2nd Edition, 1 January 1987

Printed in the USA

description

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NOTICE: This section replaces first edition dated 1 June 1986

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1st Edition	5/86				
2nd Edition	1/87				

introduction

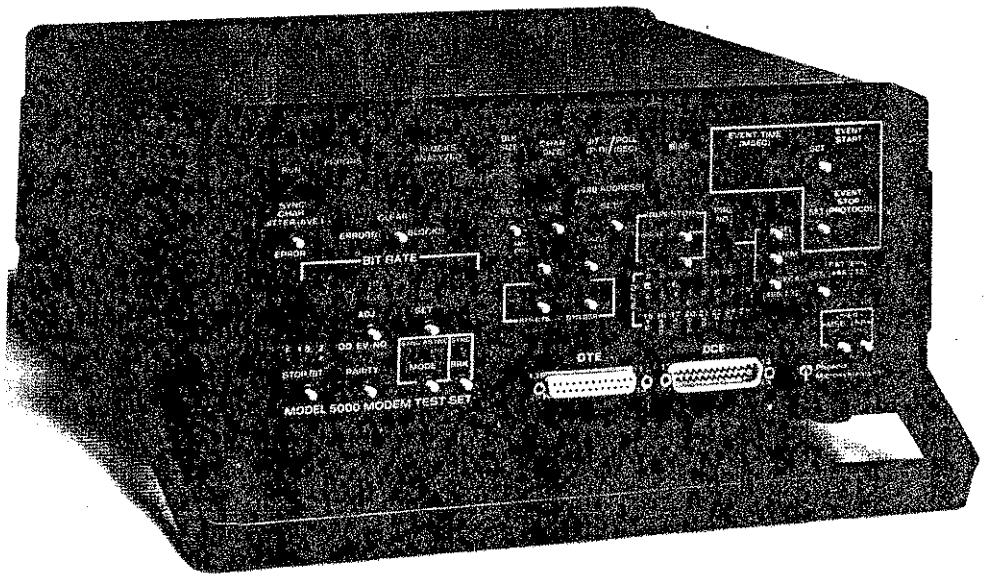
The Model 5000 Modem Test Set is a general purpose, intelligent, data communications link analyzer. It is capable of thoroughly testing a wide variety of modems and other data communications equipment.

Test features include:

- Variable bit length words
- Variable block lengths
- Selectable pseudorandom sequences and patterns
- Poll testing
- Variable bit rates
- Intelligent Modem Communication
- Parity options
- Adjustable stop bit width
- Event timing on all primary RS-232 functions
- Digital bias indication
- Modem and external clock measurement
- External clock source
- IEEE 488 or RS-232 remote programming.

INSTRUCTION BOOK

The 5000 Modem Test Set instruction book includes all the instructions on the basic unit and supports operation of the basic unit. Included also are any supplements necessary to define and support different configurations of the 5000, and the instructions for the various options for the 5000.



Phoenix Model 5000 Modem Test Set

PASS PROGRAM

An extended Product Assurance Support Service (PASS) program is available to meet the needs of those customers who require that their Phoenix Model 5000 always be current with the latest technology. While our customer service department will always answer questions regarding a malfunction in your 5000, we offer extended support for customers who desire to keep abreast of the latest in product design and want the expertise of Phoenix factory service to meet their repair needs.

While your 5000 is enrolled in the PASS program you will receive: free software enhancements for all new standard features added to the 5000; no labor charge for installation of new hardware updates to the Model 5000; no-charge repairs for your 5000; free use of a 5000 during the repair of your 5000 (if requested); remote diagnostic assistance via modem link (must be scheduled in advance); annual no-charge performance/calibration verification of your 5000; instruction book updates; hardware and software updates to correct 'bugs' that may develop; and software updates that provide easier operation of the existing features on your 5000.

In addition you will receive a password to allow you to access the Phoenix Bulletin Board. This electronic bulletin board will have a trouble message center, software enhancement announcements, application notes, and new product announcements.

To enroll your Model 5000 in the PASS program, contact Phoenix Customer Service at the address/number below. The PASS program is available for both in-warranty and out-of-warranty 5000's.

CUSTOMER SERVICE

For warranty work or questions about this product contact:

Customer Service Manager
Phoenix microsystems, inc.
991 Discovery Drive
Huntsville, Al 35806
Telephone 1-800-826-6798 USA
1-205-721-1200 USA
Telex # 752592 (PMIHTV)

When returning a 5000 for warranty work, a return material authorization (RMA) number must be obtained from customer service at the above address/phone number.

WARRANTY

Phoenix microsystems, inc. warrants each Model 5000 against defects in material and workmanship for a period of one year (options are also warranted for one year) from the date the Model 5000 shipped to the customer. If at any time during the warranty period, the test set should malfunction, Phoenix will repair, or at Phoenix's option replace the unit free of charge. The remedies listed herein are the user's sole and exclusive remedies. Phoenix microsystems, inc. shall not be liable for any indirect, direct, incidental, or consequential damages. Owner must return the unit to the factory, shipping prepaid and packaged to best commercial standard for electronic equipment. Phoenix will pay shipping charges for delivery on return. Customer is responsible for mode and cost of shipment to Phoenix.

Warranty does not apply if the unit has been damaged by accident, misuse or as a result of service or modification by other than Phoenix personnel.

The warranty registration card, shipped with the unit, must be completed and returned to Phoenix microsystems, inc. to validate this warranty.

1.0 GENERAL

The Phoenix Model 5000 Modem Test Set is a state-of-the-art, microprocessor based, data communications link analyzer. The Model 5000 may be utilized in production testing, data link testing, or remote testing. The IEEE-488/RS-232 interface control ports allow remote control and data sampling of every feature and function of the test set. The IEEE-488 port is configured to allow 30 test sets to be controlled from one controller. The RS-232 port allows the user to control the test set from any ASCII terminal or computer with an RS-232 port. Additionally, the Model 5000 can be controlled from a remote location by using a modem and entering the controls over a telephone line.

A triple Z80 microprocessor configuration is utilized that provides 95% of the test features in software. Therefore many custom requirements can be met simply by changing the software instruction set.

All test patterns utilized are standard to a wide variety of similar test equipment. Simply setting the bit rate, block size, parity, stop bits, sync or async, and pattern lengths will ensure synchronization.

For added convenience front and rear panel DCE (Data Communication Equipment) and DTE (Data Terminal Equipment) connectors are provided.

Special features of the Model 5000 include:

- Ten user defined programs to instantly configure all front panel controls
- Internal Ni-Cad battery to maintain programs in CMOS RAM when power is removed
- Real time clock operating as either a stop watch or time of day clock which is set and read by the controller
- Front panel selection of TTL or EIA interface levels
- Audible tone indication at completion of single block test
- Complete DCE signal active indicators

1.1 EQUIPMENT SUPPLIED

The Model 5000 is supplied with the following:

1. Instruction Book
2. Power Cord
3. RS-232/TTL Interface Module

1.2 OPTIONS

Table 1-1 presents the options available for the Model 5000.

Table 1-1. Model 5000 Options.

MODEL	FUNCTION
5500-J01	1% Accuracy Jitter Measurement
5000-C01	Precision Clock Offset
5000-100	CCITT V.35
5000-200	Bell 303 Interface
5000-300	RS-449 Interface

1.3 ACCESSORIES

Table 1-2 presents the Model 5000 accessories.

Table 1-2. Model 5000 Accessories.

MODEL	FUNCTION
5000 RK-5	19" rack mount kit
5000 ECCP	High density polyethylene equipment carrying case
5000-232	5 foot RS-232 25-conductor cable. Specify male to male, male to female, or female to female terminations when ordering.
5000-488	5 foot IEEE-488 24-conductor cable. Specify male to male, male to female, or female to female terminations when ordering.
5000-488E	Same as above with additional connector for parallel connection of multiple units on control bus.

1.4 EQUIPMENT SPECIFICATIONS

Table 1-3 presents the Model 5000 equipment specifications.

Table 1-3. Model 5000 Equipment Specifications.

CHARACTERISTIC	SPECIFICATION
Electrical	
Input	
Voltage	100 VAC ±10%
Frequency	50/60 Hz
Internal Bit	
RATES-fixed steps **Bold** - revision 2.0 and above	75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800,7200, 9600, 14400, 16000, **16800**, 19200, **32000, 38400, 48000, 56000, 64000, and 72000 bps.**
Accuracy	.01%
Variation	1.6% at 72000 bps (sync mode, revision 2.0 and above)
Frequency Measurement	
Resolution	.1 Hz
Range	50 bps to 72000 bps
Stop Bit	1.0, 1.5, 2.0
Parity	Even, Odd, None
Character Size	5, 6, 7, 8, or continuous
Operating Mode	Sync or Async
Poll Delay	10 milliseconds to 99 milliseconds
Bias	0 to 99% Resolution/count

Table 1-3. Equipment Specifications (Cont.).

CHARACTERISTICS	SPECIFICATION
Pattern **Bold** - available in framed mode	**63, 511**, and 2047 pseudorandom **constant mark, constant space, alternating,** fox, ping-pong poll, loopback poll, and PL1 - PL6
Program Storage	10 user defined program
Real Time Clock	
Resolution	.1 seconds
Accuracy	.01%
Outputs	
Levels	EIA minimum of +5 volts (space) -5 volts (MARK); TTL, 0 to +5 volt
Impedance	300 ohms minimum to 500 ohms maximum
Input	
Impedance	3000 ohms minimum to 7000 ohms maximum, 4500 ohms typical
Environmental	
Temperature	
Operating	0°C to 50°C
Storage	-40°C to 85°C
Humidity	10% to 90% non-condensing
Physical	
Dimensions	
Height	6 inches
Width	12 inches
Depth	12 inches
Weight	8 pounds

5000 Modem Test Set

Phoenix microsystems

Phoenix Instruction Book

34-00012-022TB
2nd Edition, 1 January 1987

Printed in the USA

installation

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NOTICE:: This section replaces first edition dated 1 June 1986

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RECORD OF CHANGES

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1st Edition	5/86				
2nd Edition	1/87				

2.0 GENERAL

This section contains information necessary for the correct installation of the Phoenix Model 5000 Modem Test Set. Included are initial inspection procedures, power and grounding requirements, and procedures for repackaging the instrument for shipment.

2.1 UNPACKING AND INSPECTION

The Model 5000 is carefully packaged to prevent damage in shipment. Upon receipt carefully inspect the condition of the shipping container and retain it for future use. After unpacking, examine the exterior of the unit to ensure it is free of scratches, dents, and any other visible signs of damage.

If the Model 5000 was damaged in shipment, file a claim with the carrier immediately. Check to ensure you have received the supplied equipment (listed in paragraph 1-1 of this manual).

2.2 SAFETY SUMMARY

The following safety precautions must be observed whenever the Model 5000 is operated, serviced, or repaired. Failure to comply with these and other specific warnings within this manual is a violation of Phoenix microsystems' safety standards of design, manufacture, and intended use of the test set. Phoenix microsystems assumes no liability for the customer's or user's failure to comply with these precautions.

GROUNDING

The Model 5000 chassis and cabinet must be connected to an electrical ground for proper operation anda to minimize shock hazard. The unit is furnished with a three-conductor power cable which incorporates a ground lead. The power cable must be connected to an approved three-contact electrical outlet or to a three-conductor to two-conductor adapter with a grounding wire (green) connected to electrical ground at the outlet.

EXPLOSIVE ATMOSPHERE

The Model 5000 must never be operated in the presence of any flammable gases or fumes. Power must not be applied to this or any instrument under such conditions due to the potential for explosion.

HIGH VOLTAGE CIRCUITS

Only qualified maintenance personnel should remove the instrument covers. Dangerous voltages may exist within the Dangerous voltages may exist within the unit even after the power cable has been disconnected. Do not attempt to replace components with the power cable connected. To avoid possible serious injury always disconnect the power and discharge circuits, before touching any internal circuits or components.

SERVICE AND ADJUSTMENT

The Model 5000 contains few user serviceable parts. Internal service or adjustment should only be performed by Phoenix microsystems' repair personnel or authorized maintenance facilities to ensure that the safety features of the instrument are not compromised.

FUSES

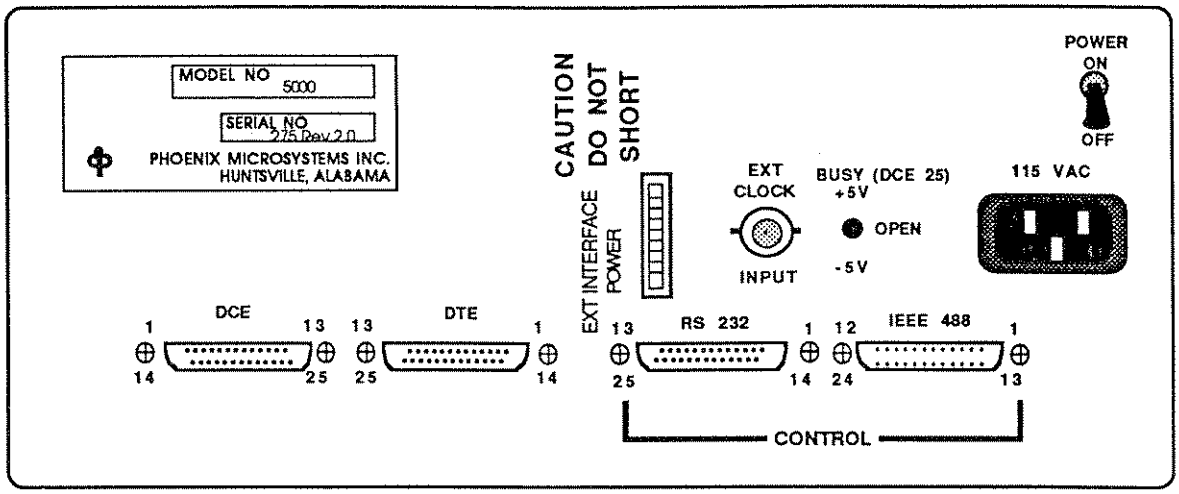
Always replace a blown fuse with an identical replacement fuse. Never use a fuse of a larger value or attempt to defeat or bypass the fuse.

ENVIRONMENTAL

Do not exceed the operating temperature limits (0 to 50 degrees C).

2.3 REAR PANEL CONNECTORS

The rear panel, shown in figure 2-1, is fitted with all of the primary connectors for modem and controller interface.



Model 5000 Rear Panel
Figure 2-1

2.3.1 Modem Connector (DCE)

The modem connector (DCE) is a male, 25 pin subminiature connector which provides interface to the modem under test. Any standard 25 pin D subminiature female connector may be used as a mating connector. Among the female connectors available are AMP 206770-1, Belden 9DSJ-025, Winchester 49-11255, and T&B Ansley 609-255. Table 2-1 presents the DCE connector pin assignments, function, and signal source. The electrical characteristics of the modem connector are as follows:

Signal Polarity

Positive voltage is binary zero, space and "on" or "true".

Negative voltage is binary one, mark and "off" or "false".

Signal Levels

Input--Test set requires +2.5 volts or greater for operation on all modem generated signals.

Output--Test set generates all outputs as -5 volts to +5 volts in EIA mode and zero to +5 volts for TTL.

Impedance Level

Input--Test set provides a 3000 ohm minimum to 7000 ohm maximum load to all modem generated signals. Typical impedance is 4500 ohms.

Output--Test set output impedance is 300 ohm minimum to 500 ohm maximum on all test set generated functions. Typical value is 430 ohms.

Table 2-1. DCE Connector Pin Assignments.

PIN NUMBER	NAME	FUNCTION	SIGNAL SOURCE
1	FG	Chassis Ground	
2	TD	Transmit Data	Test Set
3	RD	Receive Data	Modem
4	RTS	Request to Send	Test Set
5	CTS	Clear to Send	Modem
6	DSR	Data Set Ready	Modem
7	SG	Signal Ground	
8	DCD	Data Carrier Detect	Modem
9		Positive DC Test Voltage	Modem
10		Negative DC Test Voltage	Modem
11		Unassigned	
12	(S) DCD	Secondary Data Carrier Detect	Modem
13	(S) CTS	Secondary Clear To Send	Modem
14	(S) TD	Secondary Transmit Data	Test Set
15	TC	Transmit Clock	Modem
16	(S) RD	Secondary Receive Data	Modem
17	RC	Receiver Clock	Modem
18		Receiver Dibit Clock	Test Set
19	(S) RTS	Secondary Request To Send	Test Set
20	DTR	Data Terminal Ready	Test Set
21	SQ	Signal Quality Detect	Test Set
22	RI	Ring Indicator	Modem
23		Data Rate Select	
24	(TC)	External Transmit Clock	Test Set
25		Busy	Test Set

NOTE

The rear panel DCE connector is wired in parallel with the front panel DCE connector.

2.3.2 Data Terminal (DTE)

The data terminal (DTE) connector is a female, 25 pin D subminiature connector which provides the interface to emulate a modem for driving async terminal equipment. Any standard 25 pin D subminiature male connector may be used as a mating connector. Among the male connectors available are AMP 206771-1, Belden 9DPJ-025, Winchester 49-1125P and T&B Ansley 609-25P. Table 2-2 presents the DTE connector pin assignments, function and signal source. The electrical characteristics of the DTE connector are as follows:

Signal Polarity

Positive voltage is binary zero, space or "on" or "true".

Negative voltage is binary one, mark and "off" or "false".

Signal Levels

Input--Test set requires +2.5 volts or greater for operation on all terminal equipment generated signals.

Output--Test set generates all outputs as -5 volts to +5 volts in EIA mode and zero to +5 volts in TTL.

Impedance Levels

Input--Test set provides a 3000 ohms minimum to 7000 ohms maximum load to all terminal signals. Typical impedance is 4500 ohms.

Output--Test set output impedance is 300 ohms minimum to 500 ohms maximum on all test set generated signals. Typical value is 430 ohms.

NOTE

The rear panel DTE connector is wired in parallel with the front panel DTE connector.

Table 2-2. DTE Connector Pin Assignments.

PIN NUMBER	NAME	FUNCTION	SIGNAL SOURCE
1	FG	CHASSIS GROUND	
2	TD	TRANSMIT DATE	TERMINAL EQUIPMENT
3	RD	RECEIVE DATA	TEST SET
4	RTS	REQUEST TO SEND	TERMINAL EQUIPMENT
5	CTS	CLEAR TO SEND	TEST SET
6	DSR	DATA SET READY	TEST SET
7	SG	SIGNAL GROUND	
8	DCD	DATA CARRIER DETECT	TEST SET
9		NOT USED	
10		NOT USED	
11		NOT USED	
12	(S) DCD	SECONDARY DATA CARRIER DETECT	NOT USED

Table 2-2. DTE Connector Pin Assignments (Cont.).

PIN NUMBER	NAME	FUNCTION	SIGNAL SOURCE
13	(S) CTS	SECONDARY CLEAR TO SEND	NOT USED
14	(S) TD	SECONDARY TRANSMIT DATA	NOT USED
15	TC	TRANSMIT CLOCK	
16		NOT USED	
17		NOT USED	
18		NOT USED	
19		NOT USED	
20	DTR	DATA TERMINAL READY	TERMINAL EQUIPMENT
21		NOT USED	
22		NOT USED	
23		NOT USED	
24		NOT USED	
25		NOT USED	

2.3.3 RS-232 Remote Control Port

The RS-232 remote control port is a female, 25 pin D subminiature connector which provides the interface to allow the operator to control the 5000 remotely with either a modem or an ASCII terminal.

NOTE

The primary interface configuration is for modem operation. To drive the test set from a terminal it is necessary to reverse leads on pins 2 and 3 between the terminal and the Model 5000.

Any standard male, 25 pin D, subminiature connector may be used to connect to the RS-232 port. A listing of some available male connectors may be found in paragraph 2.3.2. Table 2-3 presents the RS-232 port pin assignments, functions, and source. The electrical characteristics of the RS-232 remote control port are as follows:

Signal Levels

Input--Test set requires an input level of zero to +5 volts on all signals supplied by the modem or terminal.

Output--Test set generates +8 volts to -8 volts minimum output levels on all outputs.

Signal Polarity

+8 volts is binary zero, space "on" or "true".

-8 volts is binary one, mark "off" or "false".

Impedance Levels

Output Impedance--All test set output lines have less than 500 ohms output impedance.

Input Impedance--The test set input lines (CTS, RD, etc.) have greater than 3000 ohms input impedance.

Table 2-3. RS-232 Port Pin Assignments.

PIN NUMBER	NAME	FUNCTION	SIGNAL SOURCE
1	FG	CHASSIS GROUND	
2	TD	TRANSMIT DATA	TEST SET
3	RD	RECEIVE DATA	MODEM OR TERMINAL
4	RTS	REQUEST TO SEND	TEST SET
5	CTS	CLEAR TO SEND	MODEM OR TERMINAL
6	DSR	DATA SET READY	MODEM OR TERMINAL
7	SG	SIGNAL GROUND	
8 thru 19		NOT USED	
20	DTR	DATA TERMINAL READY	TEST SET
21 thru 25		NOT USED	

2.3.4 IEEE-488 Remote Control Port

The IEEE-488 remote control port is a female, 24 pin, ribbon type connector which provides the interface to allow the operator to control the 5000 test set remotely over the IEEE-488 data bus. A male, 24 pin, ribbon connector such as the 3M 3548-1000, Amphenol 840-57F-20240-2 and the T&B Ansley 609-24M may be used to mate with the IEEE-488 connector. Table 2-4 presents the pin assignments and functions for the IEEE-488 connector.

NOTE

SIGNAL LEVELS
≥ + 2.0 VOLTS IS BINARY ZERO OR FALSE
≤ + 0.8 VOLTS IS BINARY ONE OR TRUE

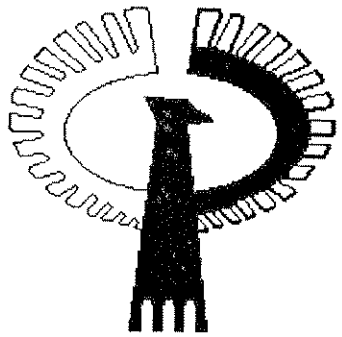
2.4 PACKAGING FOR SHIPMENT

Use the original packing material, if available, when packing the 5000 for shipment. If the original material is not available, package the 5000 to the current best commercial standards for electronic equipment. Phoenix microsystems' customer service department can provide information and recommendations on packing materials to be used.

Table 2-4. IEE-488 Port Pin Assignments.

PIN NUMBER	FUNCTION	PIN NUMBER	FUNCTION
1	DIO1	13	DIO5
2	DIO2	14	DOO6
3	DIO3	15	DIO7
4	DIO4	16	DIO8
5	EOI	17	REN
6	DAV	18	SIGNAL GROUND PAIRED WITH 6
7	NRFD	19	SIGNAL GROUND PAIRED WITH 7
8	NDAC	20	SIGNAL GROUND PAIRED WITH 8
9	IFC	21	SIGNAL GROUND PAIRED WITH 9
10	SRQ	22	SIGNAL GROUND PAIRED WITH 10
11	ATN	23	SIGNAL GROUND PAIRED WITH 11
12	SHIELD	24	SIGNAL GROUND

5000 Modem Test Set



Phoenix microsystems, inc.

Phoenix Instruction Book

34-00012-132TB
2nd Edition, 1 January 1987
Change 1, 1 March 1987

Printed in the USA

operation

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2nd Edition	1/87				
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3.0 GENERAL

This section of the instruction book contains a description of the controls, displays, and indicators used on the Model 5000 Modem Test Set. A description and discussion of operator selectable parameters is also included in this section along with initial turn-on procedures and operating instructions.

3.1 CONTROLS, DISPLAYS, and INDICATORS

3.1.1 Controls

All front panel controls are momentary push buttons that allow the user to single step or scroll through the various options for each switch. This method was selected to allow all features to be programmable by the user or remote programmable from the IEEE-488 or RS-232 control ports.

Only one rear panel control is provided. The primary power switch is located on the right hand side of the panel as viewed from the rear (refer to figure 2-1).

The controls, shown in figure 3-1, are keyed by index number to table 3-1, a listing of the controls and their function. Instruction book references are included in table 3-1 to permit the user to locate additional information on any control.

Table 3-1. Model 5000 Controls.

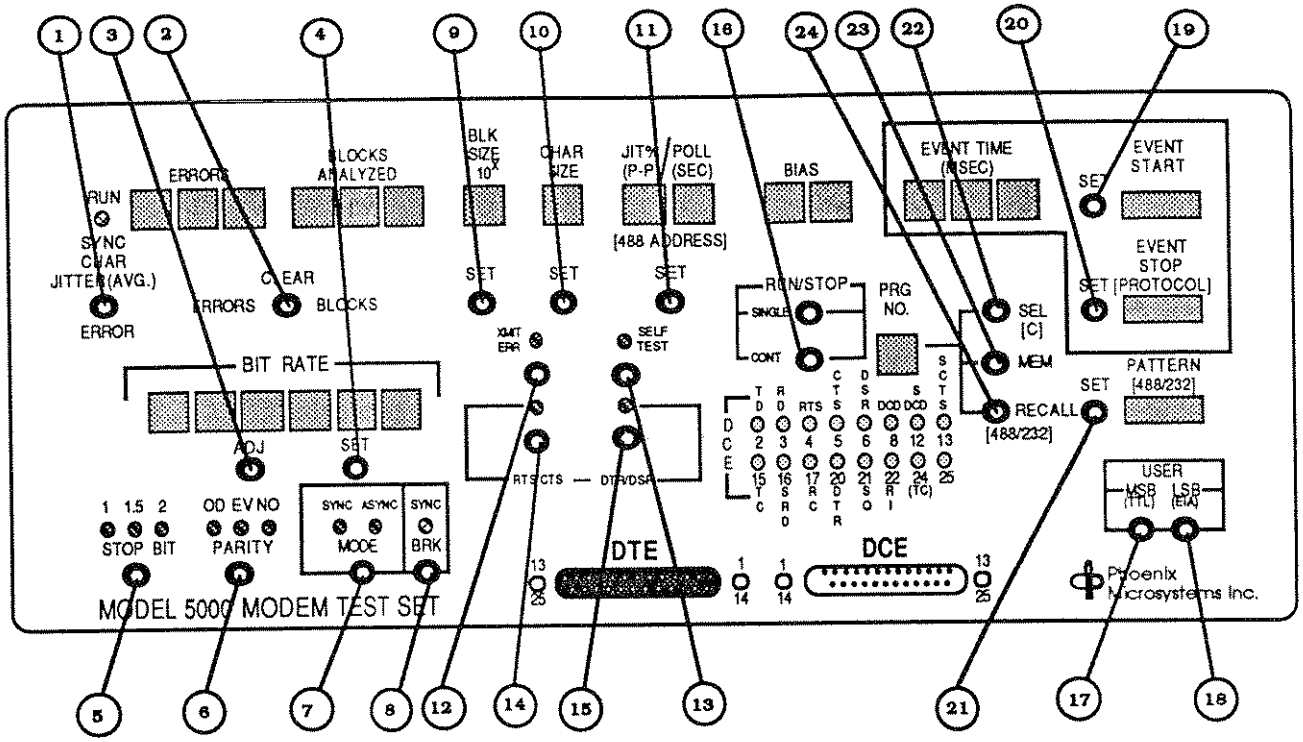
INDEX NUMBER	CONTROL	FUNCTION	I. B. REF
1	SYNC CHAR JITTER (AVE) ERROR	When pressed, the blocks analyzed window displays the number of errored blocks received; the errors window shows the number of errored words if a random pattern is selected. Otherwise, the number of sync errors is displayed in sync mode and the number of errored messages is displayed in async mode.	Section 3.3.2
2	CLEAR ERRORS BLOCKS	Resets all the counts displayed in the errors and blocks analyzed windows, except for the jitter average.	Section 3.2.11
3	BIT RATE ADJ	When pressed, the bit rate, if generated internally, is increased by a small increment; or decreased by the same quantity if the bit rate switch is pressed at the same time.	Section 3.2.1

Table 3-1. Model 5000 Controls (Cont.).

INDEX NUMBER	CONTROL	FUNCTION	I. B. REF
4	BIT RATE SET	When pressed, the next higher bit rate available is selected.	Section 3.2.1
5	STOP BIT	Selects the number of stop bits; 1, 1.5, or 2.	Section 3.2.5
6	PARITY	Selects parity; odd, even, or none.	Section 3.2.4
7	MODE	Selects sync, async, or async framed communication. Async framed is selected by keeping the **MODE** switch pressed for 2 to 3 seconds.	Section 3.2.7
8	BRK	When indicator is blinking (sync recovered), depressing the switch turns it solid on (sync), keeping the switch pressed for 2 to 3 seconds forces the test set to lose sync and try to regain it.	Section 3.2.8
9	BLK SIZE 10^X	Sets the block size to a power of ten.	Section 3.2.9
10	CHAR SIZE SET	Sets the character size (5, 6, 7, 8 bits, or infinity)	Section 3.2.6
11	(488 ADDRESS) SET	When the jitter option is not present, sets the poll delay (0-99 milliseconds); when the configuration program is recalled, sets the 488 bus address of the test set.	Section 4.2.3
12	XMT ERR	Sets/resets error injecting (1 error per pattern, excluding ALT, MARK, SPACE and USER patterns) in the pattern.	Section 3.2.14
13	SELF TEST	Sets/resets the self-test mode.	Section 3.2.15
14	RTS/CTS	Activates/deactivates RTS (CTS on DCE port).	Section 3.2.12
15	DTR/DSR	Activates/deactivates DTR (DSR on DCE port).	Section 3.2.13

Table 3-1. Model 5000 Controls (Cont.).

INDEX NUMBER	CONTROL	FUNCTION	I. B. REF
16	RUN/STOP SINGLE	Starts/stops test. Selects analysis of a single block of data.	Section 3.2.16
	CONT	Selects continuous analysis of blocks of data until test is stopped.	
17	USER MSB (TTL)	Sets the upper nibble of the user pattern byte, if this pattern is selected. Otherwise, sets the interface levels to the TTL specs.	Section 3.5
18	USER LSB (EIA)	Sets the lower nibble of the user pattern byte, if this pattern is selected. Otherwise, sets the interface levels to EIA specs.	Section 3.5
19	EVENT START SET	Selects the event that will start the measurement.	Section 3.3.4
20	EVENT STOP SET (PROTOCOL)	Selects the event that will stop the measurement. When configuration program is recalled, it selects the protocol (CR/LF or ACK/NACK).	Section 3.3.4
21	PATTERN SET (488/232)	Selects the pattern. When the configuration is recalled, it selects the remote port interface (IEEE-488 or RS-232).	Section 3.5
22	PRG NO. SEL (C)	Selects one of the ten programs stored or the remote configuration program.	Section 3.4
23	PRG NO. MEM	Stores the current test set configuration in the program memory location indicated by the displayed number (0-9).	Section 3.4
24	PRG NO. RECALL (488/232)	Recalls the selected program configuration and configures the test set accordingly. If the selected program is **C** it recalls the configuration of the remote port (488/232) and allows the operator to modify it.	Section 3.4



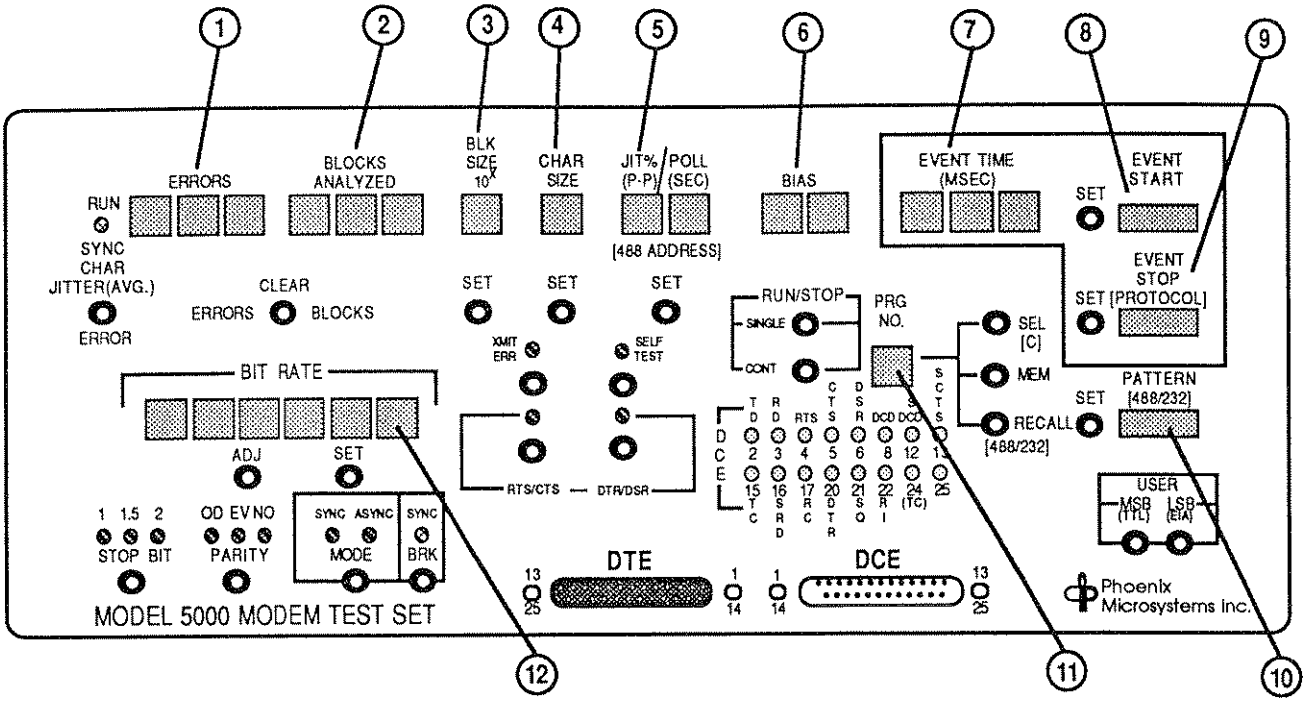
Model 5000 Front Panel Controls
Figure 3-1

3.1.2 Displays

The alpha-numeric displays on the Model 5000 are used to present information to the operator concerning test setup, test progress, and test results. The displays are shown in figure 3-2 and are keyed by index number to table 3-2. Table 3-2 lists the displays, their function, and their location in the instruction book.

Table 3-2. Model 5000 Front Panel Displays.

INDEX NUMBER	DISPLAY	FUNCTION	I.B. REF
1	ERRORS	Displays error measurement selected by switch 1.	Section 3.3.2
2	BLOCKS ANALYZED	Displays number of blocks analyzed or number of block errors (when switch 1 is depressed).	Section 3.3.1
3	BLK SIZE 10^X	Displays block size selected as a power of 10.	Section 3.2.9
4	CHAR SIZE	Displays the character size selected.	Section 3.2.6
5	JIT%/POLL (P-P)/(SEC) (488 ADDRESS)	Displays peak-to-peak jitter (jitter board installed); poll delay when a poll pattern is selected; or 488 address of test set when configuring the remote port.	Section 3.3.1
6	BIAS	Displays measured ratio of ones to zeros in the received data stream.	Section 3.3.3
7	EVENT TIME (MSEC)	Displays measured interval between event start and stop occurrence.	Section 3.3.4
8	EVENT START	Displays event start.	Section 3.3.4
9	EVENT STOP SET (PROTOCOL)	Displays event stop or protocol (CR/LF or ACK/NACK when configuring the remote port.	Section 3.3.4 Section 4.2.2
10	PATTERN (488/232)	Displays selected pattern or remote interface selected when configuring remote port.	Section 3.5 Section 4.2.1
11	PRG NO.	Displays the selected program number.	Section 3.4
12	BIT RATE	Displays the current active bit rate.	Section 3.2.1



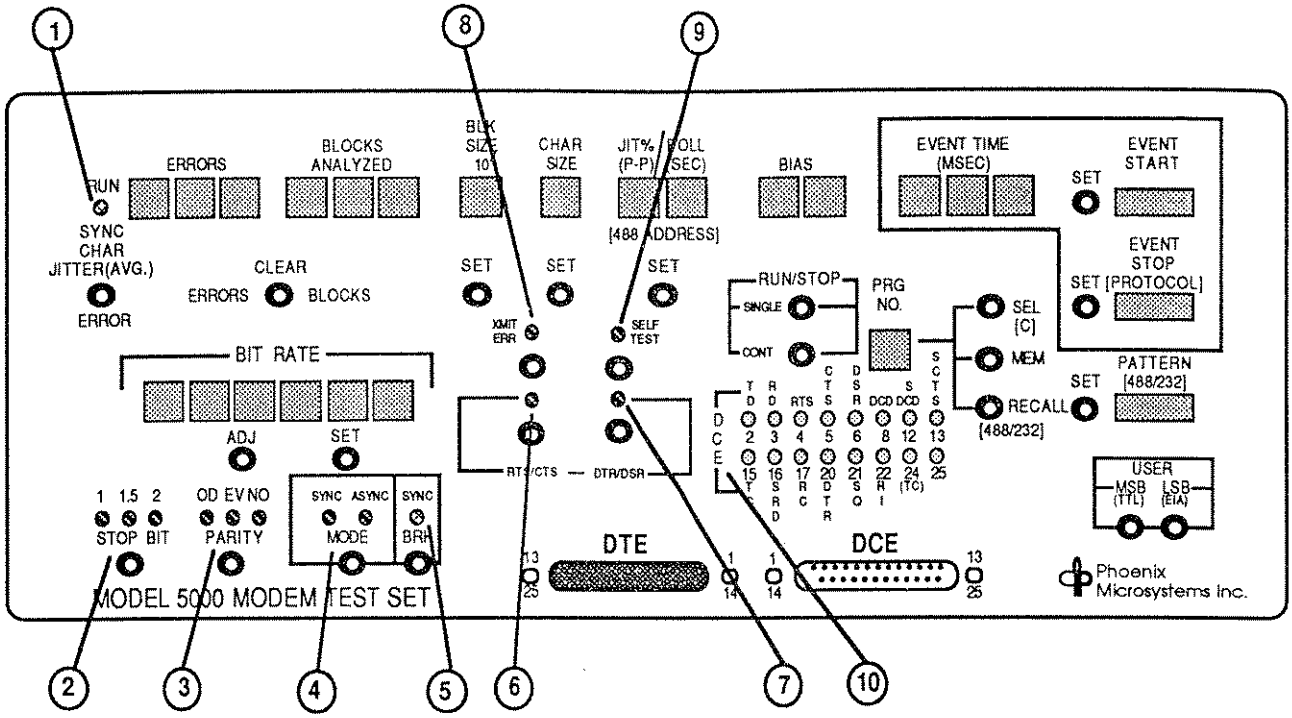
Model 5000 Front Panel Displays
Figure 3-2

3.1.3 Indicators

Light emitting diodes (LED) are used on the Model 5000 to convey status information. These LEDs are illustrated in figure 3-3 and their functions are presented in table 3-3. Table 3-3 also provides a reference to additional information in this instruction book.

Table 3-3. Model 5000 Front Panel LED Indicators.

INDEX NUMBER	DISPLAY	FUNCTION	I.B. REF
1	RUN	Displays status of test set (running or stopped).	----------
2	1 1.5 2 STOP BIT	Displays number of stop bits selected.	Section 3.2.5
3	OD EV NO PARITY	Displays the parity selected.	Section 3.2.4
4	SYNC ASYNC MODE	Displays mode selected. When the async indicator is blinking, the async framed mode is selected.	Section 3.2.7
5	SYNC BRK	Displays the following conditions: 1) (solid on) test set in sync. 2) (solid off) test set not in sync. 3) (blinking) test set has lost and recovered sync	Section 3.2.8
6	RTS/CTS	Displays status of RTS line.	Section 3.2.12
7	DTR/DSR	Displays status of DTR line.	Section 3.2.13
8	XMIT ERR	Displays status of error injection control.	Section 3.2.10
9	SELF TEST	On only when unit is in self-test mode.	Section 3.2.15
10	DCE	Displays the status of the following signals on the DCE connector: TD/RD/RC/TC/(TC) -- on if edge transitions are sensed. Other lines - on if signal is "true".	Section 3.3.5



Model 5000 Front Panel LED Indicators
Figure 3-3

3.2 OPERATOR SELECTABLE PARAMETERS

The following paragraphs detail the various parameters that are operator selectable on the Model 5000.

3.2.1 Bit Rate

The bit rates are selected by the **SET** switch under the **BIT RATE** display. The bit rate is transmitted out on pin 24 of the DCE connector for sync mode internal clock. Standard bit rates (in bps) are as follows (**bold** for Rev. 2.0 and above):

(1) 75	(2) 110.01
(3) 134.50	(4) 150.00
(5) 300.00	(6) 600.00
(7) 1200.00	(8) 1800.00
(9) 2000.00	(10) 2400.00
(11) 4800.00	(12) 7200.00
(13) 9600.00	(14) 14,400.00
(15) 16,000.00	**(16) 16,800.00**
(17) 19,200.00 [18,000 in continous or framed mode]	
(18) 32,000.00	**(19) 38,400.00**

(20) 48,000.00 **(21) 56,000.00**
(22) 57,600.00 **(23) 64,000.00**
(24) 72,000.00
(25) --- (sync mode only - uses external clock from modem)

Bit rate adjust switch allows the user to vary the bit rate, in bps increments, according to the following (sync mode):

Data Rate (bps)	Adjustment in bps
(1) 72,000	**1142.9**
(2) 64,000	**901.4**
(3) 57,600	**729.1**
(4) 56,000	**788.17**
(5) 48,000	**505.3**
(6) 38,400	**322.7**
(7) 32,000	**223.8**
(8) 19,200	80.3
(9) 16,800	**70.3**
(10) 16,000	55.7
(11) 14,000	45.1
(12) 9,600	20.04
(13) 7,200	11.27
(14) 4,800	5.01
(15) 2,400	1.25
(16) 2,000	0.87
(17) 1,800	0.70
(18) 1,200	0.31
(19) 600	0.08
(20) 300	0.019
(21) 150	0.005
(22) 134.5	0.004
(23) 110	0.003

Depressing the **ADJ** switch increments the bit rate while depressing the **ADJ** switch and the **SET** switch the bit rate is decremented to a lower bit rate. The bit rates are incremented or decremented by the amounts listed in the **ADJ** column above.

3.2.2 Bit Rate (Modem Clock Generated)

In the synchronous testing mode, the Model 5000 can be switched to the modem generated clock. The **BIT RATE SET** switch is depressed until all dashes (-----) appear on the display momentarily. The test set is now using the modem clock (DCE pin 15) and measures (up to 72KHZ) the modem clock to a resolution of .1 HZ and an accuracy of better than .01%.

3.2.3 Bit Rate (External Clock Source)

Connect a TTL clock source of the desired bit rate to the BNC connector on the rear panel. The test set automatically switches to, measures, and displays the external clock to a resolution of .1 HZ and an accuracy of better than .01%.

CLOCK REQUIREMENTS:

INPUT VOLTAGE:
Low 0 + 0.4 Volts
High 5.0 -1.0/+0.5 Volts

FREQUENCY MEASUREMENT RANGE:
50 HZ to 72KHZ
50 HZ to 307.2 KHZ for ASYNC x 16

NOTES

Input frequency of the external clock source must be sixteen (16) times the desired bit rate in the asynchronous mode for 5, 6, 7, or 8 data bit formatting. In the sync mode or in async continuous (char size) the bit rate is identical to the external clock input.

Model 5000's with revisions previous to revision 2.0 will not run a test above 19,200 Kbps even if the external frequency is correctly measured.

3.2.4 Parity

In the async mode (5, 6, 7, and 8 bit character size) parity may be selected as even, odd, or none.

3.2.5 Stop Bit

In the async mode (5, 6, 7, and 8 bit character size) the stop bit may be selected as 1, 1.5, or 2.

3.2.6 Character Size

Character size (**CHAR SIZE**) is selected in the async mode for data bit lengths of 5, 6, 7, or 8. This is independent of start, stop, and parity bits. The maximum word length is 13 bits consisting of 2 start bits, 1 parity bit, 8 data bits and 2 stop bits. The minimum word length is seven bits consisting of 1 start bit, 5 data bits and 1 stop bit. It is possible to run a continuous data stream in the async mode by selecting infinite character size (-). In this mode there is no word formatting. The test set transmits only the data pattern requested by the operator as a continuous bit stream.

3.2.7 SYNC/ASYNC Mode

The Model 5000 is capable of synchronous (SYNC) and asynchronous (ASYNC) operation. When the **SYNC** mode is selected, the test set sends a continuous data stream out on pin 2 of the DCE. Transmit data is clocked out with a clock source. The clock source may be any one of three clocks. The first clock is generated by the test set, displayed as the bit rate, and transmitted out on pin 24 of the DCE connector. The second possibility is use of the modem generated clock. The bit rate is set to all dashes (-----) and the test set switches data clocking to pin 15 of the DCE. Pin 24 clock output is turned "off." The third possibility is an external clock source connected to the test set rear panel via a BNC connector. The test set automatically switches to the clock source and momentarily displays E-U-C (for External User Clock) in the **BIT RATE** display. The test set then displays the measured frequency. External frequencies may be any frequency from 50 HZ to 19.2 KHZ. The clock is transmitted out on pin 24 of the DCE connector.

When the **ASYNC** mode is selected, the test set clocks data out at a bit rate selected by the test operator. Data is formatted with start and stop bits, 5, 6, 7, or 8 data bits, and optional parity. There is an infinite character mode set by dash (-) in the **CHAR SIZE** display. In this mode data is transmitted as a continuous stream without start, stop, and parity bits.

Model 5000s with software revisions 2.0 and above can be operated in the **ASYNC FRAMED** mode.

NOTE

In the framed mode, 2047, Ping, Pong, and Poll's patterns are NOT available.

The framed mode allows the tester to test and count errors in the framing bits just as it does in the data bits. To enter this special mode, the operator depresses and holds the mode select switch down for approximately 2-3 seconds. When the Model 5000 has entered the framed mode, the sync LED indicator will blink. It is not possible to operate the Model 5000 in the continous mode when the framed mode has been selected.

The test operator may use the external clock input as a time base for clocking data out by connecting a TTL (0-5 volt) input to the BNC connector on the rear panel. The input frequency is divided by 16 for data clocking in character sizes 5, 6, 7, or 8. The maximum input frequency is 307.2KHZ which means the maximum data rate is 19.2 Kbps.

When the character size is set to infinite (-), or the async framed mode is selected, the input clock frequency and the data rate are identical.

3.2.8 SYNC Indicator/SYNC BRK Switch

The **SYNC** indicator states are as follows:

(1) Solid Off indicates that synchronization of the received data stream with the selected pattern has not been achieved or that 2 seconds have elapsed with no data being received.

(2) Blinking indicates that synchronization has been achieved after being lost. Blinks if sync was ever lost, even momentarily, and will continue to blink until sync is "set" by either the operator or the controller.

(3) Solid On indicates that synchronization has been maintained since the last time the sync was set by the operator or from the beginning of the test. (Depressing the **SYNC BRK** switch for less than 2 seconds will set the sync indicator to a solid on if the indicator was previously blinking.)

The synchronization patterns used to determine the sync indicator status are as follows:

PATTERN	SYNC COMPARE PATTERN
2047 (char size 5)	2nd, 3rd, 4th characters of pattern (approximately) achieves sync.
2047 (other char sizes, or framed mode), 63, 54 ALT, mark space.	1st three characters of pattern (approximately) achieves sync.
Ping Pong PL1 - PL6	See poll pattern section.

Sync is lost if data stops for approximately 2-3 seconds, the operator depresses sync switch for 2-3 seconds, or the following patterns were not received.

2047 (char size 5)	2nd, 3rd, and 4th characters are not received correctly in three successive patterns.
2047 (other char sizes, and framed mode.	1st, 2nd, and 3rd bytes are not received correctly in three successive patterns.
511	1st, 2nd, and 3rd characters are not correctly received in four successive patterns.
63	1st three characters are not correctly received in five successive patterns.
ALT, MARK SPACE, FOX USRPT1..6	1st three characters of the pattern are not correctly received.

If data stops for approximately 1-2 seconds in any pattern, the sync indicator will be set to off. If the proper pattern then continues, the indicator will blink. The **SYNC BRK** switch has two functions:

Momentarily (less than 2 seconds) depressing the switch will force the sync indicator to a solid "on" if the synchronization pattern is being received properly.

Depressing the switch for 2-3 seconds will force synchronization to be broken. When the switch is released, the sync indicator will blink, indicating synchronization has been lost and recovered.

3.2.9 Block Size (BLK SIZE)

The block size is a measure of the number of bits, words, or polls received so far during the test. The block size may be any number from 1 to 10^8 units depending on mode of operation. When the block size is changed from a high number to a low number, press the **CLEAR ERRORS BLOCKS** switch to begin immediate testing at the smaller block size.

When in the Sync or Async infinity modes, the number of bits tested relate directly to the exponent of ten displayed.

EXAMPLE: BLK SIZE = 3

Bits per block = 10^3 =1000

When in the Async mode with a fixed word length of 5, 6, 7, or 8 data bits the exponent relates to words analyzed.

EXAMPLE: BLK SIZE = 2

Words analyzed per block = 10^2 = 100

When doing poll patterns the display indicates the number of polls received.

NOTE

For Model 5000s with software revisions below 2.0 with data rates of 14,000 bps and above use block sizes greater than 1.

3.2.10 CHAR ERROR Switch

Depressing the **CHAR ERROR** switch yields several alternate test results for several different functions.

When random patterns are being checked, the **ERRORS** window displays the number of words which contained one or more errors.

If a sync poll test is being conducted, the **ERRORS** window displays the number of times DCD on the modem did not recognize the sync characters on the leading edge of the poll transmission. Maximum number of sync errors per poll is one.

In the async poll test, depressing the **CHAR ERROR** switch changes the **ERRORS** display to indicate the number of words in error as determined by comparison with the character size entered in the **CHAR SIZE** window (for more details see section 4.1 of this instruction book).

3.2.11 CLEAR ERRORS BLOCKS Switch

The **CLEAR ERRORS BLOCKS** switch resets the block and error count to zero. The operator should actuate the switch any time the block size is changed to ensure immediate counting of the desired block size.

3.2.12 RTS/CTS Switch

When the RTS/CTS switch is depressed and the indicator above the switch is illuminated, Request To Send (RTS) is set "true" on pin 4 of the DCE connector and pin 5 of the DTE connector. The **RTS/CTS** switch also controls the transmit data function. When RTS is "true" the test set sends out the data stream called for by the front panel settings. Changing RTS to "false" causes the transmitter to be held in a continuous MARK condition for EIA outputs. RTS is controlled by the test set microprocessor and the operator specified poll delay time during poll testing when active. Switching RTS from the "false" state forces it off and disables transmission.

3.2.13 DTR/DSR Switch

When the DTR/DSR switch is depressed and the indicator above the switch is illuminated, DTR is set "true" on pin 20 of the DCE interface. Pin 6 of the DTE interface is also set "true".

3.2.14 XMIT ERR Switch

The **XMIT ERR** switch injects one error per pattern when activated for any of the three pseudorandom patterns of 63, 511, and 2047. The flashing LED above the switch alerts the operator to the active status. Poll errors may be injected in any of the poll messages. The error insertion in all poll messages is made as the least significant bit of the last character of the message.

3.2.15 SELF TEST Switch

The Model 5000 can be self-tested by depressing the **SELF TEST** switch. This causes receive data to be tied to transmit data independent of the "outside world" connections. Testing can be performed on all patterns (except poll patterns) while displaying blocks analyzed and error data. Further verification of error recognition can be made by activating the **XMIT ERR** switch while transmitting any one of the three pseudorandom patterns of 63, 511, or 2047.

3.2.16 RUN/STOP Switches

To display errors and blocks analyzed, testing must be initiated via the **SINGLE** or **CONT** test switches. The **SINGLE** switch performs one block of testing at the completion of which an audible tone is sounded. The **CONT** switch allows continuous testing while error and block numbers are displayed and updated in real time.

3.3 DISPLAYS/INDICATORS

3.3.1 BLOCKS ANALYZED Display

The **BLOCKS ANALYZED** display indicates the number of blocks received by the receive processor. This display directly reflects the number of blocks or poll patterns received. When the **BLOCKS ANALYZED** display exceeds 999, the display is blinked to inform the user of an overrange condition. All displayed digits are valid.

Units with revision 3.60 and above measure block errors and display the data in the **BLOCKS ANALYZED** display when the **CHAR ERROR** switch is pressed.

3.3.2 ERRORS Display

The number of errors that occur in the receive data stream can be viewed on the **ERRORS** display in real time. If the number of errors exceeds 999 at any time the display blinks to indicate an overrange condition. The significant displayed digits are correct during period of overrange. Through the use of an external controller any number of errors can be logged.

Several error display modes exist depending on the test that is being run. When a random pattern is received, the number of bit errors that is received is displayed.

Poll testing can be performed in both the sync and async modes. In the sync mode, the **ERRORS** display presents the total errors in real time. Errors can be both sync errors and message errors. A sync error is displayed each time the test set does not recognize the leading sync characters after DCD is true on the modem. A single message error is displayed each time one or more bits in the text is in error. This means that the maximum number of errors displayed per poll is one, regardless of the number of bit errors. The number of sync errors can be obtained as the difference between the total errors and the sync errors by depressing the **CHAR ERROR** switch.

In the async mode, the test set continuously monitors the modem output for start bits regardless of the state of DCD. During periods of DCD "false", the transmit data output is clamped to a mark condition. Any transition of the modem is recognized as an error. When DCD goes "true", the test set performs an analysis of receiver

input data. Any incorrect bits are displayed as errors. This means that errors displayed per poll are the sum of the total errors made by the unit under test. In SCRX all characters received after the message ends are counted in the bit error count. Also, failure to complete the message before DCD goes "false" is counted in the error count.

On units fitted with the jitter measurement option, the **ERRORS** display presents the average jitter in 1024 edge samples. The display is updated each time a sample block is analyzed. The average jitter is calculated as the sum of the absolute values of edge transitions from ideal divided by the number of samples. (Jitter is displayed on the **JIT%/(P-P)** display except when a poll pattern is selected.)

3.3.3 BIAS Display

The **BIAS** display indicates the ratio of "MARK" to "SPACE" pulse width. All spaces are a 0 indication while all marks are a 99 indication. Normal readouts (in a pseudorandom pattern or ALT) should be between 48 and 52. The measurement is made at the receiver as the average over one second and is updated at a one second rate.

3.3.4 EVENT TIME (MSEC) Display

The test set can perform event timing on any of the primary RS-232 signals. The event time must always occur on a change of state for both the event start and event stop functions. If either function does not change state, then the event time cannot be read. At power up event times are displayed in milliseconds with a resolution of 100 microseconds for readings less than 100 milliseconds. The maximum displayed time is 999 milliseconds. It is possible to change the scale of measurement. When event times are displayed in seconds the resolution is 100 milliseconds with a maximum of 99 seconds. When the event times are displayed in microseconds, the resolution is 500 nanoseconds for readings less then 100 microseconds; the maximum displayed reading is 999 microseconds. Events of longer duration are displayed as OF (overflow). The event start and event stop may be set to either the rising edge (+) or the falling edge (-) of any of the signals. The event time is continuously updated in one second intervals. If the event being read is a single event, the reading is held on the display. Event start and stop may be any combination of the following signals.

+RTS (Rising Edge)	+DTR
-RTS (Falling Edge)	-DTR
+CTS	+SQ
-CTS	-SQ
+DSR	+RI
-DSR	-RI
+DCD	+TD
-DCD	-TD
+TC	+RD
-TC	-RD
+RC	-RC

NOTE

For event times longer than one second refer to real time clock.

3.3.5 DCE Status Monitors

The status of the DCE output and input lines can be quickly verified by looking at the LED array in the lower center right portion of the front panel. An active line is defined as positive 2.5 volts or greater for EIA signal levels. TTL active level is defined as zero volts. The test set turns the LED "on" for an active line. Two separate methods exist for determining if a line is active. Lines that normally change state such as TD, RD, RC, TC, and (TC) require edge transitions to keep the LED monitor

"on". Transmit patterns of mark and space will not indicate active status. The balance of the monitored lines are steady state levels and are read high "on" and low "off" for EIA output levels. TTL mode steady state levels are high "off" and zero "on".

3.4 STORING AND RECALLING PROGRAMS

One of the unique features of the Model 5000 is the versatile programming feature. This allows the user to set up any test configuration possible on the front panel, regardless of complexity, and store the setup for later recall. The programs are stored in CMOS RAM with a Ni-Cad battery back-up, producing a virtually permanent memory. During periods of operation the Ni-Cad is trickle charged to maintain peak battery capacity. Memory retention during "off" periods should be several months. If program storage has been lost, refer to the maintenance section for battery replacement. There are ten programs available to the user numbered 0 through 9 and selected via the **SEL(C)** switch. To store a program perform the following steps:

1. Set the front panel to the desired configuration for performing the test.

2. Select the desired storage location (0-9).

3. Press the **MEM** switch.

The front panel test configuration setup is now stored. To recall any stored program, perform the following steps:

1. Select the number of the desired program (0-9) by pressing the **SEL(C)** switch.

2. Press the **RECALL** switch.

The test set is now configured according to the preset conditions and awaiting the operator command for either a single block test or continuous testing.

3.5 PATTERN SELECTION

The Model 5000 generates a variety of test patterns for both continuous testing and poll testing.

Pseudorandom patterns for continuous testing include patterns 2047, 511, or 63 bits in length. The pseudorandom patterns represent the industry recognized standards for minimum feedback requirements to generate a serial data stream one bit less than the binary number. In addition the pattern generation is compatible with equipment from other major test equipment manufacturers. This means that the Model 5000 will transmit to and receive from most existing test equipment. Other patterns include:

ALT - Alternate marks and spaces are generated with an equal mark to space ratio.

MARK - Test set transmits a constant mark

SP - Test set transmits a constant space

U-"X","X2" Test set generates a user defined pattern selected with the MSB switch for "X", and LSB for "X2". "X" is any hex number from 0 through F. The test set sends out a data pattern defined by the hex number. The sync mode data pattern is eight bits long and then repeats. In the async infinity mode, the data pattern is repeated every eight bits. For character sizes of 5, 6, and 7 data bits, the pattern consists of the least significant bits and is repeated identically for every word sent by the test set transmitter.

FOX - Test set transmits 'FOX' message.

USRPT1 thru 6 - Test set transmits programmable transmit poll messages TPL1 thru TPL6, compares received data with receiver programmable poll messages RPL1 thru RPL6. The test performed is a BERT test; no poll delays are programed.

Custom user patterns may be downloaded from the controller via IEEE-

488/RS-232 control ports. The pattern length may be up to 100 characters and may be loaded as any combination and mix of hex and ASCII characters.

PING-PONG - This poll test is an exercise of two modems and two modem test sets operating over a two-wire system. Operation consists of a master station (PING) sending out a message to the slave station (PONG) and the slave station responding to the master. The master station has RTS "false" for the delay period set by the operator. When the delay expires RTS is driven "true". The modem then drives CTS "true" and the transmitter sends the poll message. The master station poll message is bisync EBCDIC code consisting of:

PING
HEX 32 32 32 37 FF FF FF FF FF 32 32 32 32 60 60 C1 C1 2D FF
ALPHA SY SY SY ET SY SY SY SY - - A A EQ

At the end of the message, the master transmitter is clamped to a MARK condition and RTS is driven "false". The slave station (PONG) begins data analysis as soon as DCD is driven "true" by the modem. At the end of the message the modem drives DCD "false" and the test set begins the POLL DLY set in by the operator. When the POLL DLY(minimum 100 microseconds, maximum 990 milliseconds) expires, RTS is driven "true" by the test set. The modem responds with CTS "true" which keys the transmitter for transmission. The slave station message is:

PONG
HEX 32 32 32 02 27 F5 C3 5C 5C 5C E3 C5 E2 E3 C9 D5 C7 5C 5C 5C 03 75 A4 FF
ALPHA SY SY SY SX ES 5 C * * * T E S T I N G * * * EX U

At the end of the message, the test set drives RTS "false" and waits for the next transmission. Error analysis is performed independently on both test sets in the following manner. The test set begins data analysis on the first data bit after the modem drives DCD "true". Errors are logged as either SYNC errors or message errors. The test set performs a bit-by-bit comparison on the sync characters. Any variance is logged as a sync error. If the test set detects sync errors, the message portion of the transmission is ignored. If the sync characters are recognized as being proper, the test set performs a bit-by-bit comparison of the message portion of the transmission. The maximum number of errors logged per poll is one regardless of the number of bits in error during the transmission.

PL1 - The test set enters the polling mode. RTS is controlled by the test set and is automatically dropped for the period set in POLL DLY (10-990 milliseconds). After the delay, RTS is driven "true" and the transmitter waits on CTS to be driven "true" by the modem before sending the poll message. The poll message is the EIA recommended "sync sync EOT." The test set begins data analysis on the first bit after DCD is driven "true" by the modem. Error analysis consists of two parts--sync errors and message errors. The test set does a bit-by-bit comparison to find the sync words. Transitions on the data line between DCD "true" and recognition of the first sync character are ignored. Any bit error in the sync characters results in no detection of sync. The test set will log one error if sync is not detected, then the message portion of the transmission is ignored and no message errors are logged. If the sync characters are detected properly, the test set does a bit-by-bit comparison of the message data. Detection of one or more errors in the message will cause the error display to be incremented by one. Only one error will be registered regardless of the number of errors made during the message. The maximum number of errors registered per poll is one.

PL2 - This poll condition operates in the same manner as PL1. The only difference is the poll message. The transmission for this poll is the "FOX" pattern or THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK. The sync characters are "T" and "H".

PL3, PL4, PL5, and PL6 - These poll conditions are provided for the customer to write different unique poll messages. The maximum message length is 100 characters. These poll messages can be downloaded via the RS-232 programming port or the IEEE 488 interface. Operational details are given in Appendix A.

3.6 FREQUENCY MEASUREMENT

The Model 5000 can be employed as a frequency counter. It is necessary to interrupt all modem testing if the frequency to be measured is different from the modem bit rate. Set the **MODE** switch for **SYNC** testing. Connect a TTL level signal to be measured to the rear panel BNC connector. The test set automatically switches to the external clock source and momentarily displays E-U-C for External User Clock. The test set then displays the frequency of the external source with a resolution of .1 HZ and an accuracy of better than .01%. The display is blinked to alert the operator that an external clock is being measured. The frequency range of the counter is 50 Hz to 72 KHz.

The Model 5000 will measure the receive clock (pin 15 DCE) frequency any time the test set is set for external clock. Set the **MODE** switch to the **SYNC** position. Depress the **SET** switch under the **BIT RATE** display until the test set displays all dashes (------) momentarily. The test set will then display the measured frequency and blink the display to alert the operator of a measured value. The frequency is measured to a resolution of 0.1 HZ and an accuracy of better than .01%.

3.7 REAR PANEL INTERFACE

The rear panel contains all primary connectors to interface modem and controller. Refer to section 2.3 of this instruction book for details of the rear panel interface.

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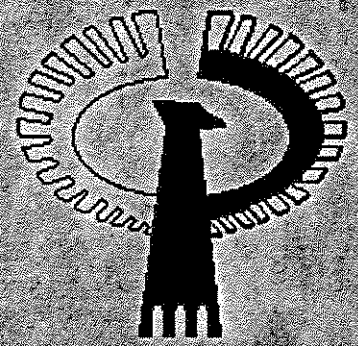
5000 Modem Test Set



Phoenix
microsystems, inc.

Phoenix Instruction Book

34-00012-142TB
2nd Edition, 1 January 1987
Change 1, 1 March 1987

Printed in the USA

application

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2nd Edition	1/87				
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4.0 GENERAL

The Phoenix microsystems Model 5000 Modem Test Set is a major advance in automated modem testing. When operated in a stand-alone environment it provides a complete feature set comparable with any bit error analyzer available. Beyond this, the Model 5000 may be remotely controlled, opening a whole new range of test possibilities. An RS-232 control port allows the Model 5000 to be driven directly from an ASCII terminal, over a modem link (allowing a central test site to control and monitor results at multiple points in a link) or via an RS-232 port from a computer. An IEEE-488 interface allows the many features of the Model 5000 to be integrated into an automated modem test setup driven and monitored completely by a single IEEE-488 controller. In addition to the obvious enhancements provided by the inclusion of remote access via RS-232 and IEEE-488 interfaces, the operational characteristics of the Model 5000 have also been expanded in several areas.

- Event timing in 100 microsecond intervals (with Revision 2.01 and above, 1microsecond, 1millisecond, and 1 second ranges are also available.)
- Measurement of modem clock frequency in external sync mode
- Provision for operation on a user supplied clock
- Measurement of user clock frequency

The following paragraphs detail the operation of the Model 5000's remote programming ports and provide programming examples on three different controllers.

4.1 COMMAND DESCRIPTION

Every test function available on the front panel of the Model 5000 may be accessed via the RS-232 and IEEE-488 control ports. The commands and responses of both control ports are identical, except for the selected interface protocol. All commands are simple and logical abbreviations for the functions to be performed. In most cases a command which sets a certain condition can also be used to interrogate the present setting, simply by giving the command with no parameter. Certain test set configurations will inhibit selection of another condition. These are noted in the responses which follow each command. In the following sections, the parameters enclosed in square brackets [ ] are optional.

4.1.1 Pattern Select

Pattern select determines the transmitted data pattern and the expected receive pattern. Table 4-1 presents the pattern select commands and responses.

Table 4-1. Pattern Select Commands.

COMMAND	RESPONSE
2047	Selects the 2047 bit pseudorandom pattern
511	Selects the 511 bit pseudorandom pattern
63	Selects the 63 bit pseudorandom pattern
ALT	Selects an alternating mark/space data pattern
MARK	Selects an all mark data pattern
SP	Selects an all space data pattern
FOX	Selects a special user pattern preprogrammed to the standard "FOX" message 'THE QUICK BROWN FOX JUMPED OVER THE LAZY DOGS BACK'. The inter-character delay is initially set at 0.
USRPT[x]	Selects a programmed user pattern (x = 1 thru 6). The patterns are the transmit poll patterns currently programmed. ***NOTE*** When a user pattern is selected, the poll pattern is used to perform a BERT test, not a poll test. To reprogram a user pattern the user must program the transmit poll pattern using the command **TPL**. The specified delay is used as the inter-character delay, which can be independently changed with the command **CD**.
PING	Selects the ping poll pattern (Master)
PONG	Selects the pong poll pattern (Slave)
PL 1 to PL 6	Selects poll pattern 1 to 6
USER [x]	Either selects a user pattern (x=2 hex digits max) or returns the present user pattern of 2 hex digits
PAT	Returns the presently selected data pattern

4.1.2 Line Monitor/Selects

Fifteen signal lines of the RS-232 interface may be monitored. In addition, two of these lines may be actively controlled. In most cases these signals are simply referred to by name in order to request their state. Table 4-2 presents the line monitor and select commands and responses.

NOTE

All monitor signals are sampled at a 17 millisecond rate. This means that pulses less than 17 milliseconds in length may not be detected. To ensure a valid reading of any signal it may be necessary to read the signal's state multiple times. It should also be noted that the state of a signal may not be validly monitored for up to 17 milliseconds after any change.

Table 4-2. Line Monitor /Select Commands.

COMMAND	RESPONSE
TD	Transmitted Data. This is an edge sensitive monitor. It samples the transmit data line every 17 milliseconds. If a transition positive or negative is detected, the TD monitor is set to '1' (on). Detection of no transitions for approximately 1second returns this monitor to '0' (off).
RD	Received Data. The function of this monitor is the same as for TD described above.
RTS [x]	This command may be used to set Request To Send by following it with either a '1' or '0'. If no parameter is specified the present setting will be returned. This is a level sensitive monitor.
CTS [x]	This command may be used to set Clear To Send by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
DSR [x]	This command may be used to set Data Set Ready by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
DCD [x]	This command may be used to set Data Carrier Detect by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
PDTV [x]	This command may be used to set the positive dc test voltage (pin 9) by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
NDTV [x]	This command may be used to set the negative dc test voltage (pin 10) by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
QM [x]	This command may be used to set the eQualizer Mode by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.

Table 4-2. Line Monitor/Select Commands (Cont.).

COMMAND	RESPONSE
SDCD [x]	This command may be used to set Secondary Data Carrier Detect by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
SCTS	This command may be used to set Secondary Clear To Send by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
STD [x]	This command may be used to set Secondary Transmit Data by following it with either a '1' or '0'. If no parameter is specified, the monitor will return a value in the same way as TD described above.
SRD [x]	This command may be used to set Secondary Received Data by following it with either a '1' or '0'. If no parameter is specified, the monitor will return a value in the same way as TD described above.
RDC [x]	This command may be used to set Receiver Dibit Clock (pin 18) by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
SRTS [x]	This command may be used to set Secondary Request To Send by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
DTR [x]	This command may be used to set Data Terminal Ready by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
SQ [x]	This command may be used to set Signal Quality by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
RI [x]	This command may be used to set Ring Indicator by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
DRS [x]	This command may be used to set Data Rate Selector by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.

Table 4-2. Line Monitor/Select Commands (Cont.).

COMMAND	RESPONSE
BUSY [x]	This command may be used to set Clear To Send by following it with either a '1' or '0'. If no parameter is specified, the present setting will be returned. This is a level sensitive monitor.
TCX	Transmit Clock External. The function of this monitor is the same as for TD described above.

4.1.3 Event Timer

The Model 5000's event timer provides three ranges; 99 seconds to 100 milliseconds, 999 milliseconds to 100 microseconds, and 999 microseconds to 500 milliseconds. There are three commands associated with the event timer as follows:

EV [start/stop] -- This command is used to either select the event start and stop conditions or to read the time associated with an event. If the start/stop parameter field is included it must specify both the start and stop condition separated by at least one space. The possible event conditions are.

+DTR	+RTS
-DTR	-RTS
+SQ	+CTS
-SQ	-CTS
+RI	+DSR
-RI	-DSR
+RD	+DCD
-RD	-DCD

Where "+" indicates a rising edge trigger and " - " indicates falling edge.

NOTE

Rising edge trigger is assumed if "+" or " - " is not specified.

If the parameter field is deleted the latest event time is returned. The returned time will be in one of the following formats.

The "-" indicates the selected event has not occured since it was set.

The "0" indicates the start event was detected but the stop event did not occur less than 1 second thereafter.

The "XX.X" indicates the event has occurred and was less than 100 milliseconds. The returned result is to 100 microseconds resolution.

The "XXX" indicates the event has occurred and was greater than 99.9 milliseconds and less than 1 second. The returned result is to 1 millisecond resolution. With Revision 2.01 software and above, this time interval will be dependent on setting of ESCL (refer to table 4-1).

EVENTS -- This command returns the present start and stop events. The response is an ASCII string with the start event first, a single space, and the stop event.

ESCL [x] -- This command selects or returns the currently programmed event timer scale of measurement. x can one of the following:

0 - readout is in microseconds
1 - readout is in milliseconds
2 - readout is in seconds
none - returns the current setting
x is set to 1 at power up

4.1.4 Poll Pattern Modification

The messages sent and received as PL1 to PL5 may be modified by the user in either of two ways. The first method uses the remote access port to download a custom message of up to 100 characters into any or all of the poll patterns. The second method allows the user to customize the transmit and receive EPROM's within the Model 5000. Each of these are described in table 4-3.

Table 4-3. Poll Pattern Modification Commands.

COMMAND	RESPONSE
TPL X D [DATA]	This command allows for controller modification of the transmit poll message. The 'X' variable specifies the message to modify and is in the range of 1 to 5. 'D' specifies a timeout delay to be applied for retransmission of the data stream if a response is not received (this field has two different meanings in com mode. Refer to com mode discussion). If the time out is set to zero there is no wait for response and the poll delay begins immediately following the end of the poll transmission. Values from 01_H to FE_H select a response timeout in 10 millisecond increments (10 milliseconds to 2.54 seconds) during which the transmitter will wait for a response before beginning the poll delay. A value of FF_H will allow the transmission of a single poll and then waits for RTS to be set "true" either from the front panel or controller before the next poll is sent. ***NOTE*** For purposes of the timeout a response is detected as: the transition of DCD true and then false again. The data field contains the desired poll message. It may be expressed as any combination of hex and string characters. Hex values are specified as either one or two digits in the range 0-9 or A-F. Strings are delimited by a leading and trailing single quote mark, and may include any character in the ASCII character set from space (2DH) to (7EH) with the exception of its single quote character (2CH). Individual entries in the data field must be separated by either a space or comma. When operating in the switched carrier mode it is necessary to enter an extra character in front of the message to be sent. This character is used by the test set but is not transmitted out over the test port. The character to be inserted may be any ASCII character. FOR EXAMPLE: TPL 1 CB, 'TEST' Sets PL1 to send the message 'TEST' and wait up to 2 seconds for a response before entering the poll delay.

Table 4-3. Poll Pattern Modification Commands (Cont.).

COMMAND	RESPONSE
RPL X [DATA]	This command allows the controller to modify the message expected by the receiver. The format of each field is identical to the description under TPL above. Note however, the timeout delay field is not present. An alternate means to modify the 5000's poll messages is to modify the messages in the transmit and receive EPROM's. This has the advantage of making the modification permanent where as the download patterns are lost when the unit is turned off. The appendix shows the presently stored patterns. To modify these patterns requires that first the patterns preceding it must be moved to provide a gap just large enough to hold the new pattern. Then the new pattern must be placed into the gap. Finally the pointers to the messages in the table PNTPAT or RESTBB must be updated to point to each patterns new position. When operating in the switched carrier mode it is necessary to enter an extra character in front of the message to be sent. This character is used by the test set but is not transmitted out over the test port. The character to be inserted may be any ASCII character.

4.1.5 Configuration

The commands presented in table 4-4 are used to configure the Model 5000 to match the modem under test.

Table 4-4. Configuration Commands.

COMMAND	RESPONSE
MD [x]	This command is used to read or set the mode of operation. If the parameter field is included, it is interpreted as follows: A = async F = framed S = sync This will set the mode to SYNC, ASYNC, or ASYNC FRAMED in the Model 5000. Omission of the parameter field will return either A, S, or F indicating async, sync, or async framed mode respectively, as the current mode of operation. Selection of sync mode forces character size to continuous.

Table 4-4. Configuration Commands (Cont.).

CS [x]	This command is used to read or set the character size. If the parameter field is included, it must be one of the following: 5, 6, 7, 8, or C Where numerals specify fixed character sizes from 5 to 8 bits and "C" indicates continuous. If no parameter is specified, one of the above codes will be returned. Selection of a character size other than "C", when in sync mode, is an error. Selection of "C" in the async framed mode is an error.
BS [x]	This command is used to read or set the block size. If the parameter field is present, it should be a numeric value from 0 to 8 (2 to 8 with software revision 2.0 and above). If no parameter is specified, the returned value will be a single numeric digit from 0 to 8 (2 to 8 with software revision 2.0 and above). ***NOTE*** Selection of a new block size does not cause the present block size to be overridden. The new block size does not become effective until the end of the block at the last size setting. This is particularly noticeable when going from large to small blocks. To force immediate use of the new block size, the "CLR" command should be used following the setting of a new block size.
PR [x]	This command is used to read or set the parity selection. If the parameter field is present, it should be one of the following: E = even O = odd N = none If no parameter is set, the present setting will be returned.
SB [x]	This command is used to read or set the number of stop bits. If the parameter field is present, it should be 1, 1.5, or 2 to select one, one and a half, or two stop bits, respectively. If the parameter field is omitted, one of the above selections will be returned to show the present setting.

Table 4-4. Configuration Commands (Cont.).

COMMAND	RESPONSE
SY [x]	Sync control. The sync control command is used to monitor the present sync state and to break sync or reset to recovered sync flag. If no parameter is supplied, the Model 5000 will return one of the following responses: S = in sync R = recovered sync N = no sync By supplying a parameter, the sync command can be used to perform the following functions: B = break sync, forces the Model 5000 to attempt to reacquire sync R = reset recovered sync flag, changes the response from R to S ***NOTE*** Changing any of the following conditions may cause the Model 5000 to enter a false sync condition. Parity — Block size Stop bits — Character size Mode — Pattern To ensure valid sync following change of any of these parameters, the Model 5000 should be forced to break and reacquire sync.
XE [x]	Transmit Error. The parameter field, when included, should contain either a '1' to enable or a '0' to disable error transmission. When enabled, errors are transmitted once per pattern cycle. If used with no parameter, a single character response will be returned indicating status.
ST [x]	Self-Test. This command is used to select or read the state of the self-test function. The parameter field, when included, should contain either a '1' to enable or a '0' to disable self-test. If the parameter field is omitted, a single character response will be returned to show state.
BR [x]	Bit Rate. The bit rate command is used to select or read the present bit rate. If the parameter field is included, it must be selected from the following list of standard rates (rates in **bold** are available with software revision 2.0 and up): 75 — 110 — 134.5 — 150 300 — 1200 — 1800 — 2000 2400 — 4800 — 7200 — 9600 16000 — 19200 — **16800** — **32000** **38400** — **48000** — **56000** — **57600** **64000** — **72000**

Table 4-4. Configuration Commands (Cont).

COMMAND	RESPONSE
	If the selected rate is not in this list, an error response is generated. If no parameter is specified, the preset bit rate is returned. The returned rate will be in one of the following formats: x.xS The bit rate is generated by the Model 5000 and is exactly one of the standard rates listed above. x.xO The bit rate is generated by the Model 5000 and is at an "off" standard rate. -X The Model 5000 is set to operate from an external (modem) clock but nothing is measured. x.xX The Model 5000 is set to operate from an external (modem) clock of the returned rate. -U The Model 5000 is set to operate from a user supplied clock but nothing is measured. x.xU The Model 5000 is set to operate from a user supplied clock of the returned rate. ***NOTE*** Selection of external, user, or changing modes, will cause the Model 5000 to restart measurement of clock rate. It will take from 1 to 2 seconds to obtain the first reading.
BRU	Bit Rate Up. This command causes the Model 5000's bit rate clock to be incremented up one step.
BRD	Bit Rate Down. This command causes the Model 5000's bit rate clock to be decremented down one step.
BRC [x]	Bit Rate Count. This command allows direct setting of the Model 5000's internal bit rate counter. The parameter field is not optional and is the decimal devisor of the system clock required to obtain the selected frequency. The count must be within the range from 224 to 65511. The count to obtain any desired frequency is determined by the following: $count = 4.608 \times 10^6 / frequency$
EXT	The external clock command causes the Model 5000 to use the modem's clocks in sync mode. If the mode is set to async when this command is given, an error is generated.
BI	This command returns the present bias of the received data.
EUSR	This command enables use of user supplied clock if available.
DUSR	This command disables use of the user supplied clock.

Table 4-4. Configuration Commands (Cont.).

COMMAND	RESPONSE
PD [x]	This command is used to set or read the poll delay. If the parameter is included, it must be in the range from 0 to 99 to set delay. If no parameter is input, the returned delay is the reading currently displayed by the Model 5000 and is a value between 0 and .99 seconds.

4.1.6 Testing

The commands presented in table 4-5 control start and stop of a test as well as monitoring of the test results.

Table 4-5. Testing Commands.

COMMAND	RESPONSE
RUN [x]	This command is used to start a bit error test or to monitor the present run state. If the parameter field is included, it should be either a 'C' for continuous or 'S' for single run with a decimal number up to three digits long. The decimal number represents the number of blocks that the test set must analyze. Execution of the run command with no parameter will return either an 'R' to indicate running or 'S' to indicate stopped.
STOP	This command stops either a continuous or single run.
CLR	This command clears the blocks analyzed and the errors.
CD [x]	This command adds an intercharacter delay of x milliseconds (approximately) in the transmission of random patterns in async mode.
BA	This command returns the number of blocks analyzed. It is a number from 0 to 99,999,999. If the number of blocks analyzed has exceeded 99,999,999, the total number is evaluated modulo 1000 and a trailing "O" is appended to signal the overflow.
ERR1	This command returns the same data as is normally displayed in the bit error display. Refer to the manual (section 2.11) for further clarification of the meaning of the bit error display in various modes and patterns. Overflow of this display is handled in the same manner as the blocks analyzed display described above.
ERR2	This command returns the same data as is normally displayed in the character error display. Refer to the manual (section 2.12) for further clarification of the meaning of the character error display in various modes and patterns. Overflow of this display is handled in the same manner as the blocks analyzed display described above.

Table 4-5. Testing Commands (Cont.).

COMMAND	RESPONSE
BLKE	Units with revision numbers of 3.60 and above measure block errors. The resulting data is available on the remote ports using this command.
ES	Elapsed seconds of test (Software Rev 2.01 and above).
THRU	Returns the receiver throughput, that is, the number of blocks received per second rate.
JITTER MEASUREMENT (OPTION)	
JPP	This command requests the greatest peak to value of data jitter measured. Jitter is isynchronous distortion as defined in EIA RS 334-A.
JAVG	This command requests the value of the average data jitter.
EHOLD	This command resets and enables a continuous hold of the greatest peak-to-peak data jitter value for any length of test desired. Accumulating counters can be reset to zero with EHOLD command.
DHOLD	Command resets and disables the peak hold. Operation reverts to the greatest peak-to-peak data jitter in a 1024 bit sample, updated every 1024 bits. Reset to zero with the DHOLD command.
	NOTE For bit rates below 300 bps, the sample size is 256.

Constant Carrier polling can be enabled for transmitted data, received data, or both. The new commands for this feature are:

(A) CCTX	Constant Carrier Transmit. This command causes the Model 5000 to hold the RTS output continuously to "true". In the synchronous mode, sync characters are transmitted between polls. This function operates in poll modes only and will return an error message if not in poll mode.
(B) SCTX	Switched Carrier Transmit. This command causes the Model 5000 to switch the RTS output to "true" when ready to transmit a poll, and then set it to "false". Sync characters are not transmitted between polls. This is the normal, default mode.
(C) CCRX	Constant Carrier Receive. This command enables the Model 5000 to receive polls with no transition of the DCD input signal between polls. The start of a poll is detected by matching the first character of the poll to incoming data.
(D) SCRX	Switched Carrier Receive. This command sets the Model 5000 to receive polls with transitions of the DCD inputs between polls. The start of the poll is detected by the transition of DCD from "false" to "true". This is the normal, default mode.

4.1.7 Miscellaneous

Table 4-6 presents the commands that perform various control functions governing operation of the Model 5000 itself.

Table 4-6. Miscellaneous Commands.

COMMAND	RESPONSE
EIA	Selects EIA levels.
TTL	Selects TTL levels.
FLOW1 [x]	Sets (x=1) or resets (x=0) flow control mode 1, or returns its status (set or reset). When this mode is activated during a BERT test, a transition of CTS to a false state will interrupt the transmission of data, a transition to the true state will reinitiate data transmission.
FLOW2 [x]	Sets (x=1) or resets (x=0) flow control mode 2, or returns its status (set or reset). When this mode is activated during a BERT test, the reception of the character DC3 (13H) will interrupt the transmission of data, the reception of the character DC1 (11H) will reinitiate data transmission.
FLOW3 [x]	Sets (x=1) or resets (x=0) flow control mode 3, or returns its status (set or reset). When this mode is activated during a BERT test, the reception of the character DC4 (14H) will interrupt the transmission of data, the reception of the character DC2 (12H) will reinitiate data transmission. ***NOTE*** Generally, it is not advisable to use the FLOW2 or FLOW3 commands with the pseudorandom patterns (2047, 511, 63), since problems can arise if the FLOW control words (DC1, DC2, DC3, and DC4) become part of these patterns.
IL [x]	Select or read the interface level setting. If included, the interface level parameter is either 'E' to select EIA or 'T' to select TTL. With no parameter specified the present setting is returned as a single character either 'E' or 'T'.
DKEY	This command disables the key switches on the Model 5000's front panel.

Table 4-6. Miscellaneous Commands (Cont.).

COMMAND	RESPONSE
EKEY	This command enables the key switches on the Model 5000's front panel. *NOTE* The key switches are enabled on power up.
DBELL	This command disables the Model 5000's end-of-test and glitch detect bell.
EBELL	This command enables the Model 5000's end-of-test and glitch detect bell. The bell is enabled on power up.
STO [x]	This command stores the present setting of all front panel switches into the program selected by 'x'. The value of 'x' must be in the range from 0 to 9.
RCL [x]	This command reconfigures the Model 5000 to the conditions stored in program 'x'. The value of 'x' must be in the range from 0 to 9.
VER	This command returns the software revision level and date which is installed in the Model 5000. *NOTE* Units prior to version 1/01 issued 12/15/82 do not respond to this command.
TIME [x]	This command accesses a real time clock accurate to .1 second which is maintained within the 5000. Format of the returned time is **HH:MM:SS.T.** On power up the clock is initialized to **00:00:00.0** and begins counting. The user may program the clock to a given time by entering the hours and minutes. Seconds are set to zero when time is programmed. This feature may be used as a time of day clock, which the controller may access, or it may be used in a stop watch mode to time events longer than the 1 second provided by the 5000's event time. To implement the stop watch event timing, the controller would be programmed to monitor the start event, using the appropriate 5000 monitor function. When the start event occurred, the time would be set to **00:00:00.0**. Then it would poll the 5000 until the stop event was detected at which time the counter would be stopped and read to capture the event time.
?	Returns menu of commands.

4.2 COMMUNICATION PORT SETUP

The Model 5000's remote programming ports use a soft-key approach to enable them to be configured to the users application. To accomplish this setup, a new entry has been added to the program number display on the Model 5000's front panel. Rolling the program number display to 'C' (communication) with the **SEL(C)** switch and then pressing **RECALL** will display the present configuration. Once **RECALL** has been pushed much of the display will go blank. The remaining displays indicate the present mode (RS-232 or IEEE-488), the selected protocol (ACK or CRLF), the IEEE-488 address, character size, bit rate, stop bits, and parity. The following subparagraphs provide details for these displays.

4.2.1 Port Select

The pattern display shows which of the two programming ports is active. Successive presses of the pattern set switch toggles this display between'232' and '488' selecting RS-232 and IEEE-488 ports, respectively.

4.2.2 Protocol

There are two communication protocols that may be selected. These are discussed in detail in the protocol section. The presently selected protocol is displayed in the event stop window and may be selected to either 'ACK' or 'CRLF' by the **EVENT STOP (PROTOCOL) SET** switch.

4.2.3 IEEE-488 Address

The Model 5000 implements a single primary address for both talk and listen function on the IEEE-488 bus. There are 31 possible addresses from 0 to 30. The present address is displayed in the **POLL (SEC)** window. To select a new address simply hold the **(488 ADDRESS)** set switch until the desired address is shown.

4.2.4 Character Size

The RS-232 port may be set to use either a 7 or 8 bit character length using the character size display and set switch.

4.2.5 Bit Rate

The bit rate in the RS-232 mode is displayed and set in the bit rate window. Standard rates are provided at (bps):

75	2000	**16800**
110	2400	**32000**
134.5	4800	**38400**
150	7200	**48000**
300	9600	**56000**
1200	16000	**57600**
1800	19200	**64000**
		72000

4.2.6 Stop Bits

The **STOP BIT** LEDs indicate the number of stop bits selected as **1, 1.5,** or **2.**

4.2.7 Parity

The **PARITY** LEDs indicate selected parity as odd **(OD)**, even**(EV)**, or none**(NO)**.

4.2.8 Event Start Display

As a convenience in setting up communication between the Model 5000 and the external communication device, the **EVENT START** display shows, in a scrolling display, all characters received at the selected port. Characters from 21H to 5EH are displayed, with characters outside this range showing as spaces. In addition the Model 5000 echos each received character so that a simple test at the external device can assure proper two-way communication.

Once the proper setup has been selected, the Model 5000 is returned to normal operation by pressing the **MEM** switch.

4.2.9 Conversational Mode

The advent of intelligent modems has added a new dimension to the needs of modem testing. In addition to the standard tests, intelligent modems require a means to exercise and verify their programmable functions. To address this new need, the Phoenix Model 5000 Modem Test Set has recently been upgraded (serial numbers 367 and up). With the incorporation of this upgrade, the 5000 has taken another step forward in automated modem testing. The following paragraphs detail the new functions which have been added to the 5000 and which are collectively referred to as the 5000's "Conversational Mode".

The Model 5000's conversational mode allows the operator to gain direct access from the remote port to a modem under test. In this way commands can be issued to the modem and its response verified. In automated testing applications, this will allow both the standard Bert tests as well as verification of proper operation of the intelligent command functions at a single test station. By eliminating the need to connect to multiple pieces of test equipment, productivity will be improved.

Conversational mode is a unique state of operation for the 5000. When commanded into conversational mode, a new set of remote commands become available. In the conversational mode, the front panel switches are inactive and only the conversational commands can be used. Likewise, in the normal test mode conversational commands are unavailable.

At power up the 5000 is in the test mode. The unit is placed in conversational mode by the "CONV" command. It may be returned to the test mode by the "TST" command.

The commands available in the conversational mode are detailed in table 4-7.

Table 4-7. Conversational Mode Commands.

COMMAND	RESPONSE
BRLN XX	This command is used in synchronous, constant-carrier operation. It sets the number of times in a row that the sync break pattern "BRPT" must be received to break sync. At power up the default value for "BRLN" is 4.
BRPT XX	This command is used in synchronous, constant-carrier operation. It sets the sync break pattern. This pattern must be received "BRLN" times in a row to break sync. At power up the default value for "BRPT" is 0FFH.
CCRX	Selects constant-carrier receive operation. In this mode, receiver operation is independent of DCD (pin 8). Sync is obtained by matching the first two characters of the selected poll message. Sync hunt is re-entered when "BRPT" is detected "BRLN" times in a row in the sync mode.
CCTX	Selects constant-carrier transmitter operation. In this mode, RTS (pin 4) is always high. In constant-carrier mode, all characters of the selected message (including the first) are transmitted.

Table 4-7. Conversational Mode Commands (Cont.).

COMMAND	RESPONSE
SCRX	Selects switched carrier receive mode. In this mode the receive data is assumed to be valid only when DCD (pin 8) is "true". The first character in the selected poll message is not used. If RCSY mode is selected ("RCST 1" command), character synchronization occurs 60 microseconds after DCD toggles "true". In normal mode, the second and third characters of the message are used as a sync pattern.
SCTX	Selects switched carrier transmit mode. In this mode, the RTS signal (pin 4) is toggled between messages. In this mode, the first character in the selected poll message is not transmitted.
CHR	This command is used to check the receiver buffer for a character waiting. One of three possible response ASCII codes will be returned. 0 - indicates 0 characters 1 - indicates character(s) available 2 - indicates buffer overflow (the receiver buffer is 128 characters wide (2 Kbytes with Revision 2.0 software))
SEND	This command causes the 5000 to return a character (if one is available) from the receiver buffer. This command should be used with "CHR" to check the status of the receiver buffer.
SENDA	This command is used to send a character received from the receiver to the remote port. The ASCII code for the character is sent (SEND sends two ASCII characters representing the two digits that form the Hex value of the character). The command is not acknowledged if there are no characters in the buffer.
SENDS	This command sends the entire contents of the receiver buffer, as a null terminated ASCII string, to the remote port.
RTS [x]	This command is used to monitor or control the RTS interface signal. If the command is sent without a parameter, the 5000 will return "RTS = 1", if it is "true", or "RTS = 0" if it is "false". If the command is sent with a parameter equal either to "0" or to "1", the RTS signal will be set to "false" or "true", respectively. "RTS = 1" does not cause the transmission of the poll message in the conversational mode.
ERTS [X]	This command enables or disables the transmitter/RTS interaction. In normal operation, the 5000 will force RTS "true" before transmitting a message. If "ERTS 0" has been issued, the transmitting message will not affect the state of RTS. Sending "ERTS 1" to the 5000 will return it to the normal operating mode.

Table 4-7. Conversational Mode Commands (Cont).

COMMAND	RESPONSE
PL1..PL6	Selects poll message 1 through 6. The transmit message is taken from the selected buffer. The default buffer at power up is PL1.
RCSY [x]	If X=1, this command sets the receiver to start framing when DCD changes from "false" to "true". 'RCSY 1' command is not accepted in constant-carrier mode, when the receiver is in the asynchronous mode. If X=0, the receiver will search for the first two characters in the selected poll message. These two characters will not be stored in the receive buffer. If the command is issued without a parameter, the present setting for RCSY is returned.
MSG	This causes the selected transmit poll message to be transmitted one time. In conversational mode, the poll delay occurs between bytes rather than between polls.
?	Returns menu of commands.

4.3 PROTOCOL

The Model 5000 operates using the 7 bit ASCII code. Commands to the Model 5000 consist of strings of ASCII characters in the range from space (20H) to DEL (7FH) terminated by a carriage return (0DH). Characters less than 20H are ignored except for back space (08H) which functions as a delete.

The response from the Model 5000 can take on one of several formats depending upon the selected protocol.

4.3.1 IEEE-488/CRLF

In this mode, commands which result in the Model 5000 sending a response expect it to be formatted as follows:

```
char 1
  "
  "
char x
CR
LF    EOI
```

The controlling device should be set to terminate its input on either the line feed character code or the assertion of the EOI line.

4.3.2 IEEE-488/ACK

Unlike the previous mode, in which the controller operated in an open loop manner, the ACK protocol provides a response to each command regardless of whether the command returns data. If the command is understood an ACK (06H) character is returned. If an error is encountered in interpreting the command, NAK (15H) is returned. If additional data is to be returned, it follows the first ACK and is terminated by a second ACK. The three possible responses are shown below.

```
    (error)      NAK    EOI
(good, no data)  ACK    EOI
  (good, data)   ACK
               char 1
                 "
                 "
               char x
               ACK    EOI
```

NOTE

In all cases the EOI line indicates end of response.

4.3.3 RS-232/ACK

Operation of the RS-232/ACK protocol is identical to the IEEE-488 protocol with the exception that there is no EOI line. It is the controllers responsibility to know if additional data is expected following the first ACK. In practice this knowledge comes naturally with the program organization.

This protocol uses a half duplex data transfer structure on the RS-232 port. The Model 5000 controls data flow to itself through the DTR line and sends data via the RTS/CTS handshake.

4.3.4 RS-232/CRLF

This mode is intended primarily for use with a directly connected terminal. It operates full duplex and echos every character received. The <Delete> and <Back Space> keys send a character sequence, the response to which will delete the last character. A <Control-x> will cause the Model 5000 to ignore the present line. If an error is encountered in interpreting the input line, it is reprinted to the error point and a '?' is inserted. The response to commands is shown on the line following the command.

4.4 PROGRAMMING EXAMPLES

Programming examples are provided on the following pages for FLUKE 1720A, HP 85, and Osborne computers.

4.4.1 Fluke 1720A Controller

Example 1 is for FLUKE 1720A operating with the 488/ACK protocol. Two points to note particularly are in lines 40 and 60. Line 40 causes the 1720A to terminate input strings from the Model 5000 on the EOI line. In line 60 a Device Clear command is sent to the Model 5000. There may be a delay of up to 1 second in processing the Device Clear command which is provided for the 'wait 1000' instruction.

Example 2 is for a FLUKE 1720A operating with the 488/CRLF protocol. The primary difference between use of the CRLF and ACK protocols can be seen in line 5. Here the 'term' instruction is used to force termination of input from the Model 5000 on line feed characters.

FLUKE 1720A CONTROLLER
488/ACK PROGRAM
EXAMPLE #1

```
5  PRINT CHR$(27); "(2J";CPOS(4,20); ! CLEAR SCREEN AND POSITION CURSOR
10 PRINT "MTS 5000 --- 1720A MONITOR MODE ROUTINE"\PRINT\PRINT ! SIGN ON
11 PRINT "NOTE: THIS ROUTINE REQUIRES THE MTS 5000 TO BE SET"
12 PRINT"          TO THE 488/ACK PROTOCOL."
30 PRINT "ENTER DEVICE NUMBER";\INPUT D% ! SELECT DEVICE NUMBER
40 TERM ! SET FOR INPUT TERMINATION ON EOI
50 INPUT PORT 0 ! IFC ON IEEE-488 BUS
60 CLEAR @ D% \WAIT 1000\ ! GIVE IT A SECOND TO TAKE EFFECT
70 TIMEOUT 500 ! GIVE 'MTS 5000' .5SEC TO RESPOND
80 PRINT "(PMI)";\INPUT A$ ! PROMPT FOR COMMAND INPUT
90 IF LEN (A$)=0 THEN 80 ! IGNORE NULL LINES
100 PRINT @ D%,A$ ! SEND COMMAND TO MTS 5000
110 INPUT @D%,R$ ! GET RESPONSE FROM MTS 5000
```

```
120 IF R$=CHR$(21) THEN PRINT A$; "?"\GOTO 80 ! NAK INDICATES NOT UNDERSTOOD
130 IF LEN (R$)=1 THEN GOTO 80 ! IF ONLY ONE CHARACTER MUST BE ACK
140 R$=MID(R$,2,LEN(R$)-2) ! STRIP OFF LEADING AND TRAILING ACKS
150 PRINT A$; " = ";R$ ! SHOW THE RESPONSE
160 GOTO 80  ! PROMPT AGAIN TO START IT OVER
```

FLUKE 1720A CONTROLLER
488/CRLF PROGRAM
EXAMPLE #2

```
5  TERM CHR$(10)
10 OPEN "KB1:" AS NEW FILE 5%
15 PRINT CHR$(27); "[2J";CPOS(4,0);
20 PRINT "MTS 5000 --- 1720A CONTROL SIGNAL RESPONSE TEST"\PRINT\PRINT
25 PRINT "NOTE: THIS ROUTINE REQUIRES THAT THE MTS 5000 BE SET TO"
30 PRINT "          THE 488/CRLF PROTOCOL."
35 PRINT "SELECT DEVICE #";\INPUT D%
40 F$="###.#"
45 T1$="RESPONSE 'RTS' => 'CTS' (50 SAMPLES)       "
50 T2$="RESPONSE '-RTS' => '-CTS' (50 SAMPLES)      "
55 T3$="*****  NO 'CTS' ACTIVITY  *****"
60 T4$="RESPONSE 'RTS' => 'DCD' (50 SAMPLES)       "
65 T5$="RESPONSE '-RTS' => '-DCD' (50 SAMPLES)      "
70 T6$="*****  NO 'DCD' ACTIVITY  *****"
75 T7$="RESPONSE 'DCD' => 'CTS' (50 SAMPLES)       "
80 T8$="RESPONSE '-CTS' => '-DCD' (50 SAMPLES)      "
85 T9$="*****  NO 'DCD' OR 'CTS' ACTIVITY  *****"
200 INPUT PORT 0
201 CLEAR @ D%, "TEST START "; DATE$;\ WAIT 1000
202 LOCAL @ D%
205 PRINT #5%, "TEST START ";DATE$; \GOSUB 9000
210 E=0
220 GOSUB 1000
230 GOSUB 2000
240 GOSUB 3000
250 PRINT #5%, "END OF TEST ";DATE$;\ GOSUB 9000
260 PRINT "TEST AGAIN (Y/N)";
270 INPUT A$\ IF LEFT ("YES", LEN(A$))=A$ THEN 200 ELSE CLOSE 5% \ END
1000 X$="RTS 0"\ GOSUB  8000
1010 GOSUB 7200
1020 X$="EV RTS CTS"\ GOSSUB 8000\ X$="RTS 1"\ GOSUB 8000
1030 GOSUB 7000
1040 IF RIGHT (A$,1)="0" THEN 1160 ELSE GOSUB 6000
1050 X$="EV -RTS -CTS"\ GOSUB 8000\ X$="RTS 0"\GOSUB 8000
1060 GOSUB 7000
1070 IF RIGHT(A$,1)="0" THEN 1160 ELSE GOSUB 6100
1080 IF Z=50 THEN 1090 ELSE Z=Z+1\ GOTO 1020
1090 M3=M3/50\ N3=N3/50
1110 PRINT #5%, T1$;
1120 PRINT #5%, USING F$, "MIN:";M1;"   MAX:";M2;"      AVG:";M3
1130 GOSUB 7300
1140 PRINT #5%, T2$;
1150 PRINT #5%, USING F$, "MIN: ";N1;"      MAX:;N2;" ,   AVG:";N3\RETURN
1160 E=E+1
1170 PRINT #5%, T3$\ GOSUB 7300\ RETURN
2000 X$="RTS 0"\GOSUB 8000
2010 GOSUB 7200
```

```
2020 X$="EV RTS DCD"\ GOSUB 8000\ X$="RTS 1"\ GOSUB 8000
2030 GOSUB 7000
2040 IF RIGHT(A$,LEN(A$)-1)="0" THEN 2160 ELSE GOSUB 6000
2050 X$"EV -RTS -DCD"\ GOSUB 8000\ X$=RTS 0"\ GOSUB 8000
2060 GOSUB 7000
2070 IF RIGHT(A$,LEN(A$)-1)="0" THEN 2160 ELSE GOSUB 6100
2080 IF Z=50 THEN 2090 ELSE Z=Z+1\ GOTO 2020
2090 M3=M3/50\ N3=N3/50
2110 PRINT #5%, T4$;
2120 PRINT #5%, USING F$, "MIN:";M1;"   MAX:";M2;"      AVG:";M3
2130 GOSUB 7300
2140 PRINT #5%, T5$;
2150 PRINT #5%, USING F$, "MIN: ";N1;"      MAX:;N2;" ,  AVG:";N3\RETURN
2160 E=E+2
2170 PRINT #5%, T6$\ RETURN
3000 X$="RTS 0"\GOSUB 8000\ IF E<> 0 THEN 3160
3010 GOSUB 7200
3020 X$="EV DCD CTS"\ GOSUB 8000\ X$="RTS 1"\ GOSUB 8000
3030 GOSUB 7000
3040 IF RIGHT(A$,LEN(A$)-1)="0" THEN 3160 ELSE GOSUB 6000
3050 X$"EV -CTS -DCD"\ GOSUB 8000\ X$=RTS 0"\ GOSUB 8000
3060 GOSUB 7000
3070 IF RIGHT(A$,LEN(A$)-1)="0" THEN 3160 ELSE GOSUB 6100
3080 IF Z=50 THEN 3090 ELSE Z=Z+1\ GOTO 3020
3090 M3=M3/50\ N3=N3/50
3110 PRINT #5%, T7$;
3120 PRINT #5%, USING F$, "MIN:";M1;"   MAX:";M2;"      AVG:";M3
3130 GOSUB 7300
3140 PRINT #5%, T8$;
3150 PRINT #5%, USING F$, "MIN: ";N1;"      MAX:;N2;" ,  AVG:";N3\RETURN
3160 PRINT #5%, T9$\GOSUB 7300\ RETURN
6000 V=VAL(A$)
6010 IF M1>V THEN M1=V\ GOTO 6030
6020 IF M2<V THEN M2=V
6030 M3=M3+V\ RETURN
6100 V=VAL(A$)
6110 IF N1>V THEN N1=V\ GOTO 6130
6120 IF N2<V THEN N2=V
6130 N3=N3+V\ RETURN
7000 X$="EV"
7010 GOSUB 8000\ GOSUB 8100
7030 IF LEFT(A$,1)="-" THEN 7000
7040 RETURN
7100 IF RIGHT(A$,1)="I" THEN A$=LEFT(A$,LEN(A$)-1)
7200 Z=1\M1=9999\M2=0\M3=0\N1=M1\N2=M2\N3=M3\RETURN
7300 RETURN
8000 PRINT @ D%, X$\ RETURN
8100 INPUT @ D%, A$
8110 RETURN
8200 N=TIME
9005 A$=" AM"
9010 N=N/1000 ! CONVERT TO SECONDS
9020 N1=INT(N/3600)
9030 N2=N-(N1*3600)\ N2+INT(N2/60)
9040 N3=N-(N1*3600)-(N2*60)
9050 IF N1>12 THEN N1=N1-12\  A$=" PM"
9060 PRINT #5%, USING "##", " ";N1;":";N2;":";N3;A$
9070 RETURN
```

4.4.2 HP 85 Controller

Examples 3 and 4 are both for a HP 85 controller. They both use the 488/ACK protocol. Of particular importance in these examples is the use of the 'transfer' instruction (line 9020). Notice its use of EOI to terminate input to X$.

Example 3 provides a simple monitoring function recording the min., max., and delta of the external clock and bias, while also monitoring the bit and character error rates.

Example 4 provides an interactive monitor mode allowing commands to be entered from the keyboard.

HP 85 CONTROLLER
488/ACK PROGRAM
EXAMPLE #3

```
5 CLEAR
10 DIM X$(80), S$(80)
20 B1=100 @ B2=0
30 X1 = 50000 @ X2=0
100 S$ = "MO S" @ GOSUB 9000
110 S$ = "63" @ GOSUB 9000
120 S$ = "BS 2" @ GOSUB 9000
130 S$ = "RTS 1" @ GOSUB 9000
140 S$ = "EXT" @ GOSUB 9000
145 S$ = "SY B" @ GOSUB 9000
146 S$ = "XE 0" @ GOSUB 9000
147 S$ = "ST 0" @ GOSUB 9000
148 S$ = "SY" @ GOSUB 9000 @ IF X$ <> "S" THEN 148
150 S$ = "CLR" @ GOSUB 9000
170 S$ = "SY R" @ GOSUB 9000
180 S$ = "RUN C" @ GOSUB 9000
200 FOR N=1 TO 1000 @ NEXT N
1000 S$="ER" @ GOSUB 9000 @ R$=X$
1010 S$="BI" @ GOSUB 9000 @ B$=X$
1020 S$="ER1" @ GOSUB 9000 @ E$=X$
1030 S$="ER2" @ GOSUB 9000 @ C$=X$
1040 S$="BA" @ GOSUB 9000 @ A$=X$
1050 S$="SY" @ GOSUB 9000 @ S$=X$
2000 IF R$(LEN(R$),LEN(R$))<>"X" THEN 2100
2005 IF R$(1,1)="-" THEN 2100
2010 X=VAL(R$(1,LEN(R$)-1))
2020 X1=MIN(X1,X)
2030 X2=MAX(X2,X)
2100 B=VAL(B$)
2110 B1=MIN(B1,B)
2120 B2=MAX(B2,B)
2500 CLEAR
2504 DISP "********** BIT RATE **********"
2505 DISP "MIN: ";X1;"MAX: ";X2; "DELTA: ";X2-X1
2510 DISP "********** BIAS **********"
2520 DISP "MIN: ";B1;"MAX: ";B2; "DELTA: ";B2-B1
2530 DISP @ DISP "********** ERRORS **********"
2540  DISP "********** BIT ERRORS **********";E$
```

```
2550 T$="" @ FOR N=1 T0 LEN(C$)
2560 IF C$(N,N)<>"." THEN T$=T$ & C$(N,N)
2570 NEXT N
2580 DISP "CHAR ERRORS:   ";T$
2590 DISP "BLOCKS ANALYZED:   ";H$
2600 DISP @DISP "********** STATUS **********"
2610 IF S$="S" THEN DISP "IN SYNC" ELSE DISP "NO SYNC"
2620 IF R$(1,1)="-" THEN DISP "NO CLOCK" ELSE DISP "        "
3000 FOR N=1 TO 400 @ NEXT N @ GOTO 1000
9000 OUTPUT 700   ;S$
9010 IOBUFFER X$
9020 TRANSFER 700 TO X$ FHS  ; EOI
9030 IF NUM(X$)<>6 THEN 9000
9040  IF LEN(X$)=1 THEN RETURN
9050 X$=X$(2,LEN(X$)-1)
9060 RETURN
```

HP 85 CONTROLLER
488/ACK PROGRAM
EXAMPLE #4

```
5 CLEAR
10 DIM X$(80), S$(80)
100 DISP "{PMI}";
110 INPUT S$
120 GOSUB 9000
130 IF NUM(X$(1,1))=21 THEN DISP S$;"?" @ GOTO 100
140 IF LEN(X$)=1 AND NUM(X$)=6 THEN GOTO 100 ELSE DISP S$; "=";X$
150 GOTO 100
9000 OUTPUT 700   ;S$
9010 IOBUFFER X$
9020 TRANSFER 700 TO X$ FHS  ; EOI
9030 IF NUM(X$)<>6 THEN 9000
9040  IF LEN(X$)=1 THEN RETURN
9050 X$=X$(2,LEN(X$)-1)
9060 RETURN
```

4.4.3 Osborne Controller

Examples 5 and 6 run on an Osborne computer using CP/M and Microsoft Basic. In this application, two machine language routines, one for input and the other for output, are poked into memory. The hex machine codes for these routines are in lines 9000 and subsequently in each listing. The subroutines at 8000 and 8100 are used to output X$ to the Model 5000 and receive A$. Both examples use the 488/ACK protocol.

OSBORNE CONTROLLER
488/ACK PROGRAM
EXAMPLE #5

```
10 CLEAR, 45000!
17 RESTORE
20 MEM=50000!:LENGTH-99
21 PRINT CHR$(26);
22 INPUT "SELECT DEVICE NUMBER (0 TO 30): ",A1: IF A1<0 OR A1>30 THEN 22
23 COUT=MEM:CIN=MEM+48
26 MOUT=&HCEFF:MIN=&HCEFE:MSTAT=&HCEFD:ADDR=&HCEFC:STATE=&HCEFB
27 POKE STATE,0: POKE ADDR,A1
30 FOR X=0 TO LENGTH-1
40 READ A:POKE MEM+X,A:NEXT X
50 REM**********************************
60 PRINT CHR$(26)
61 GOSUB 6000
62 GOSUB 1000
70 GOSUB 5000:GOSUB 4000: GOSUB 100: GOSUB 4000: GOSUB 5010: GOSUB 4000
72 GOSUB 5100
73 GOSUB 2000: GOSUB 2100
80 GOSUB 3000: GOSUB 5110: GOSUB 70
100 GOSUB 7400: GOSUB 4000: SOSUB 7200: GOSUB 4000: GOSUB 7600: GOSUB 4000:GOSUB 7800
101 GOSUB 4000:GOSUB 7000: GOSUB 4000:RETURN
1000 X$="PL1" : GOSUB 8000
1010 X$="PD 1" : GOSUB 8000
1020 X$="XE 0" : GOSUB 8000
1025 X$="EXT" : GOSUB 8000
1030 X$="ST 0" : GOSUB 8000
1040 X$="MD S" : GOSUB 8000
1050 X$="BS 2" : GOSUB 8000
1060 X$="RTS 1" : GOSUB 8000
1070 X$="DTR 1" : GOSUB 8000
1080 X$="DKEY" : GOSUB 8000
1085 X$="SV R" : GOSUB 8000
1086 X$="RUN C" : GOSUB 8000
1090 RETURN
2000 PRINT CHR$(27); "=";CHR$(32+12);CHR$(32+35);
2010 X$="RUN":GOSUB 8000:GOSUB 8100: IF A$="R" THEN PRINT "RUNNING":RETURN:ELSE PRINT
          "STOPPED":RETURN
2100  PRINT CHR$(27); "=";CHR$(32+12);CHR$(32+35);
2110 X$="SY":GOSUB 8000:GOSUB 8100
2120 IF A$="S" THEN PRINT "SYNC              "
2130 IF A$="R" THEN PRINT "RECOVERED         "
2140 IF A$="N" THEN PRINT "NO SYNC           "
2150 RETURN
3000 PRINT CHR$(27); "=";CHR$(16+32);CHR$(32+1);:X$-"TD":GOSUB 8000: GOSUB 8100: PRINT A$
3010 X$="RD":GOSUB 8000: GOSUB 8100: PRINT "      ";A$
3020 X$="RTS":GOSUB 8000: GOSUB 8100: PRINT "     ";A$
3040 X$="DSR":GOSUB 8000: GOSUB 8100: PRINT "     ";A$
3050 X$="DCD":GOSUB 8000: GOSUB 8100: PRINT "     ";A$
3060 X$="TC":GOSUB 8000: GOSUB 8100: PRINT "      ";A$
3070 X$="RC":GOSUB 8000: GOSUB 8100: PRINT "      ";A$
3080 X$="DTR":GOSUB 8000: GOSUB 8100: PRINT "     ";A$
3090 X$="SQ":GOSUB 8000: GOSUB 8100: PRINT "      ";A$
3100 X$="TCX":GOSUB 8000: GOSUB 8100: PRINT "     ";A$
3110 RETURN
```

```
4000 K$=INKEY$: IF LEN(KS)=0 THEN RETURN
4010 IF K$="C" THEN X$="CLR":GOSUB 8000: RETURN
4020 IF K$="R" THEN X$="RUN C":GOSUB 8000: RETURN
4030 IF K$="S" THEN X$="RUN S":GOSUB 8000: RETURN
4040 IF K$="Q" THEN X$="STOP":GOSUB 8000: RETURN
4050 IF K$="X" THEN X$="XE":GOSUB 8000: GOSUB 8100: IF A$="0" THEN X$="XE 1"
4051 GOSUB 8000:RETURN:ELSE X$="XE 0":GOSUB 8000:RETURN
4060 IF K$="P" THEN 4200
4100 RETURN
4200 GOSUB 4250
4210 INPUT "ENTER POLL DELAY (0 TO 99): ";X
4220 IF X <0 OR X>99 THEN 4200
4230 X$="PD "+STR$(X):GOSUB 8000: GOSUB 4250: RETURN
4240 PRINT CHR$(27); "=";CHR$(22+32);CHR$(32);:RETURN
4250 GOSUB 4240:PRINT"                                    ":GOSUB 4240:RETURN
5000 X$="EV RTS CTS": GOSUB 8000: RETURN
5010 PRINT CHR$(27); "=";CHR$(5+32);CHR$(25+32);
5015 T=5
5020 X$="EV": GOSUB 8000: GOSUB 8100
5030 IF LEFT$(A$,1)<>"-"THEN 5060
5040 T=T-1: IF T=0 THEN 5060 ELSE 5020
5060 IF LEFT$(A$,1)<>"-"THEN PRINT "INACTIVE":RETURN
5070 IF RIGHT$(A$,1)="I" THEN A$=LEFT$(A$,LEN(A$-1)
5080 PRINT A$;"            ":RETURN
5100 X$="EV DCD RD": GOSUB 8000: RETURN
5110 PRINT CHR$(27); "=";CHR$(3+32);CHR$(40+32);
5120 GOTO 5015
6000 A$=CHR$(27)+CHR$(41):X$=CHR$(27)+CHR$(40)
6010 PRINT CHR$(30);"                POLL TEST"
6020 PRINT A$;"BIT ERR";X$;"    ";A$;"CHR ERR";X$;"     ";A$;"BLOCKS "X$;"     ";A$;"BIAS";X$
6030 PRINT CHR$(27); "=";CHR$(4+32);CHR$(32);
6040 PRINT A$;"----BIT RATE----"      RTS -> CTS      DCD --> RD";X$
6045 PRINT CHR$(27); "=";CHR$(19+32);CHR$(32);"═══════════════════════════════════════"
6050 PRINT CHR$(27); "=";CHR$(20+32);CHR$(32);
6060 PRINT "C";A$;"=CLEAR";X$,"    R";A$;"=RUN CONT"X$;"      S";A$;"=RUN SINGLE";X$;"
     Q";A$;"=QUIT RUN";X$
6070 PRINT "X";A$;"=XMIT ERR";X$,"B";A$;"=BLOCK SIZE";X$;"     P";A$;"=POLL DELAY";X$
6080 PRINT CHR$(27); "=";CHR$(15+32);CHR$(32);
6090 PRINT A$;" TD   RD   RTS   DSR   DCD";X$:PRINT:PRINT:
6100 PRINT A$;"TC   RC   DTR   SQ   TCX";X$
6110 PRINT CHR$(27); "=";CHR$(32+8);CHR$(32+30);"═══════════════════════"
6115 PRINT CHR$(27); "=";CHR$(32+10);CHR$(32+35);"TEST STATUS"
6120 FOR T=1 TO 10: PRINT CHR$(27); "=";CHR$(32+8+T);CHR$(32+30);"I":NEXT T
6130 PRINT CHR$(27); "=";CHR$(8+32);CHR$(32);
6140 PRINT "PHOENIX MICROSYSTEMS, INC."
6150 PRINT "PO BOX 4206"
6160 PRINT "HUNTSVILLE, AL 35802"
6170 PRINT "TEL: 205-536 2826"
6180 PRINT "CONTACT: 'SCOOTER' MAYO"
6190 RETURN
7000 X$="BR":GOSUB 8000:GOSUB 8100
7010 PRINT CHR$(27); "=";CHR$(5+32);CHR$(32);
7020 IF LEFT$(A$,1)="-" THEN PRINT "NO CLOCK          ":RETURN
7030 IF RIGHT$(A$,1)="X" THEN PRINT LEFT$(A$,LEN(A$)-1);"  MEASURED      ":RETURN
7040 IF RIGHT$(A$,1)="S"THEN PRINT LEFT$(A$,LEN(A$)-1);"   INT STD       ":RETURN
7050 PRINT LEFT$(A$,LEN(A$)-1);" INT NON-STD":RETURN
7200 X$="ER1": GOSUB 8000: GOSUB 8100
7210 PRINT CHR$(27); "=";CHR$(2+32);CHR$(32);
7220 IF RIGHT$(AA$,1)="0" THEN 7240
```

```
7230 PRINT USING "###          ";VAL(A$):RETURN
7240 PRINT USING "### OVR ";VAL(A$):RETURN
7400 X$="ER2":GOSUB 8000: GOSUB 8100
7410 PRINT CHR$(27); "=";CHR$(2+32);CHR$(10+32);
7415 X$=" "
7420 FOR T=1 TO LEN(A$)
7430 IF MID$(A$,T,1)<>"." THEN X$=X$+MID$(A$,T,1)
7440 NEXT T: A$=X$: GOTO 7220
7600 X$="BA": GOSUB 8000: GOSUB 8100
7610 PRINT CHR$(27); "=";CHR$(2+32);CHR$(20+32);
7620 GOTO 7220
7800 X$="BI": GOSUB 8000: GOSUB 8100
7810 PRINT CHR$(27); "=";CHR$(2+32);CHR$(31+32);
7820 PRINT USING "##";VAL(A$):RETURN
8000 X$=X$+CHR$(13)
8010 FOR N=1 TO LEN(X$)
8020 POKE MOUT, ASC(MID$(X$,N,1)):CALL COUT
8030 NEXT N
8040 CALL CIN
8050 IF PEEK(MIN)<>6 THEN 8010 ELSE RETURN
8100 A$=" "
8120 GOSUB 8140
8130 IF ASC(RIGHT$(A$,1))<>6 THEN 8120
8135 A$=LEFT$(A$LEN(A$)-1):RETURN
8140 CALL CIN
8150 A$=A$+CHR$(PEEK(MIN)):RETURN
9000 REM ********* DATA FOR IEEE-488 OUTPUT ROUTINE***********
9010 DATA &H3A,&HFB,&HCE,&HFE,&H01,&H28,&H1B,&H0E,&H5F,&HCD,&H4B,&HE5
9020 DATA &HE6,&H80,&H20,&HF9,&H3A,&HFC,&HCE,&HC6,&H20,&H4F,&HCD,&H4B,&HE5
9030 DATA &HE6,&H80,&H20,&HF9,&H3E,&H01,&H32,&HFB,&HCE,&H3A,&HFF,&HCE
9032 DATA &H4F,&H06,&H00,&HCD,&H4E,&HE5,&HE6,&H80,&H20,&HF9,&HC9
9040 REM ********** DATA FOR INPUT IEEE-488 ROUTINE
9050 DATA &H3A,&HFB,&HCE,&HFE,&H02,&H28,&H1B,&HOE,&H3F,&HCD,&H4B,&HE5,&HE6,&H30
9060 DATA &H20,&HF9,&H3A,&HFC,&HCE,&HC6,&H40,&H4F,&HCD,&H4B,&HF5,&HE6,&H80
9070 DATA &H20,&HF9,&H3E,&H02,&H32,&HFB,&HCE,&HCD,&H51,&HE3,&H32,&HFE,&HCE,&H70
9080 DATA &HE6,&H80,&H20,&HF5,&H3E,&H01,&H32,&HFD,&HCE,&HC9
```

OSBORNE CONTROLLER
488/ACK PROGRAM
EXAMPLE #6

```
10 CLEAR, 45000!
11 PRINT CHR$(26);
15 INPUT "SELECT DEVICE ADDRESS (0-30): ";A1
16 IF A1,0 OR A1>30 THEN 15
17 RESTORE
20 MEM=50000!:LENGTH=102
23 COUT=MEM:CIN=MEM+48
26 MOUT=&HCEFF:MIN=&HCEFE:MSTAT=&HCEFD:ADDR=&HCEFC:STATE=&HCEFB:STAT=&HCEFA
27 POKE STATE,0: POKE ADDR,A1
30 FOR X=0 TO LENGTH-1
40 READ A:POKE MEM+X,A:NEXT X
```

```
50 REM ******************************************
60 X$="EKEY":GOSUB 8000: IF PEEK(MIN)<>6 THEN 60
100 PRINT CHR$(27);CHR$(&H29);"<PMI>";CHR$(27);CHR$(&H28);:INPUT "  ",Z$
105 IF Z$= " " THEN 100
106 IF Z$="HELP" THEN GOSUB 1000: GOTO 100
110 X$=Z$: GOSUB 8000
120 IF PEEK(MIN)<>6 THEN PRINT Z$;"?":GOTO 100
130 IF PEEK(STAT) AND 1 = 1 THEN 100
140 GOSUB 8100: PRINT Z$; " = "; A$: GOTO 100
1000 GOSUB 2000
1010 PRINT "ALT                ALTERNATING MARK/SPACE PATTERN"
1020 PRINT "BA                 READ BLOCKS ANALYZED"
1030 PRINT "BI                 READ BIAS"
1040 PRINT "BR (R)             SET/READ BIT RATE"
1050 PRINT "BRD                STEP BIT RATE DOWN"
1060 PRINT "BRU                STEP BIT RATE UP"
1070 PRINT "BS (S)             SET/READ BLOCK SIZE 10^S"
1080 PRINT "CLR                CLEAR ERROR AND ABLOCK COUNTS"
1090 PRINT "CS (S)             SET/READ CHARACTER SIZE"
1100 PRINT "DCD                READ STATE OF 'DCD'"
1110 PRINT "DKEY               DISABLE FRONT PANEL KEYS"
1120 PRINT "EKEY               ENABLE FRONT PANEL KEYS"
1130 PRINT "DSR                READ STATE OF 'DSR'"
1140 PRINT "DTR                SET/READ STATE OF 'DTR'"
1150 PRINT "ER1                READ BIT ERRORS"
1160 PRINT "ER2                READ CHARACTER ERRORS"
1170 PRINT "EV (START STOP)    SET/READ EVENT TIMER"
1180 PRINT "EXT                SET TO EXTERNAL CLOCK"
1190 PRINT "IL (L)             SET/READ INTERFACE LEVEL"
1200 PRINT "MARK               MARK PATTERN SELECT"
1210 PRINT "MD (K)             SET/READ MODE (ASYNC/SYNC)
1220 PRINT "PD (D)             SET/READ POLL DELAY"
1230 GOSUB 2100
1240 PRINT "PING               PING PATTERN SELECT"
1250 PRINT "PL (N)             SET POLL PATTERN 1 TO 5"
1260 PRINT "PONG               PONG PATTERN SELECT"
1270 PRINT "PR (P)             SET/READ PARITY"
1280 PRINT "RC                 READ STATE OF 'RC'"
1290 PRINT "RCL (N)            RECALL PROGRAM 0 TO 9"
1300 PRINT "RD                 READ STATE OF 'RD'"
1310 PRINT "RND (N)            SET RANDOM PATTERN 2047, 511,63"
1320 PRINT "RIS (N)            SET/READ STATE OF 'RTS'"
1330 PRINT "RUN (R)            SET/READ RUN STATE"
1340 PRINT "SB (N)             SET/READ NUMBER OF STOP BITS"
1350 PRINT "SCTS               READ STATE OF 'SCTS'"
1360 PRINT "SDCD               READ STATE OF 'SDCD'"
1370 PRINT "SPACE              SPACE PATTERN SELECT"
1380 PRINT "SQ                 READ STATE OF 'SQ'"
1390 PRINT "SRD                READ STATE OF 'SRD'"
1400 PRINT "ST (N)             SET/READ STATE OF SELFTEST"
1410 PRINT "STO (N)            STORE PROGRAM 0 TO 9"
1420 PRINT "STOP               STOP TEST"
1430 PRINT "SY (S)             SET/READ SYNC (BREAK/RESET)"
1440 PRINT "TC                 READ STATE OF 'TC'"
1450 PRINT "TCX                READ STATE OF TCX"
1460 GOSUB 2100
1470 PRINT "TD                 READ STATE OF 'TD'"
1480 PRINT "USER (U)           SET/READ USER PATTERN"
1490 PRINT "XE (N)             SET/READ STATE OF ERROR XMIT"
```

```
1500 GOSUB 2100: RETURN
2000 PRINT CHR$(26);:RETURN
2100 PRINT:PRINT "PRESS ANY KEY TO CONTINUE";
2110 A$=INKEY$:IF LEN(A$)=0 THEN 2110 ELSE GOTO 2000
8000 X$=X$+CHR$(13)
8010 FOR N=1 TO LEN(X$)
8020 POKE MOUT, ASC(MID$(X$,N,1)):CALL COUT
8030 NEXT N
8040 CALL CIN
8050 IF PEEK(MIN)<>6 THEN 8010 ELSE RETURN
8100 A$=" "
8120 GOSUB 8140
8130 IF ASC(RIGHT$(A$,1))<>6 THEN 8120
8135 A$=LEFT$(A$LEN(A$)-1):RETURN
8140 CALL CIN
8150 A$=A$+CHR$(PEEK(MIN)):RETURN
9000 REM ********* DATA FOR IEEE-488 OUTPUT ROUTINE**********
9010 DATA &H3A,&HFB,&HCE,&HFE,&H01,&H28,&H1B,&H0E,&H5F,&HCD,&H4B,&HE5
9020 DATA &HE6,&H80,&H20,&HF9,&H3A,&HFC,&HCE,&HC6,&H20,&H4F,&HCD,&H4B,&HE5
9030 DATA &HE6,&H80,&H20,&HF9,&H3E,&H01,&H32,&HFB,&HCE,&H3A,&HFF,&HCE
9032 DATA &H4F,&H06,&H00,&HCD,&H4E,&HE5,&HE6,&H80,&H20,&HF9,&HC9
9040 REM ********** DATA FOR INPUT IEEE-488 ROUTINE
9050 DATA &H3A,&HFB,&HCE,&HFE,&H02,&H28,&H1B,&HOE,&H3F,&HCD,&H4B,&HE5,&HE6,&H30
9060 DATA &H20,&HF9,&H3A,&HFC,&HCE,&HC6,&H40,&H4F,&HCD,&H4B,&HF5,&HE6,&H80
9070 DATA &H20,&HF9,&H3E,&H02,&H32,&HFB,&HCE,&HCD,&H51,&HE3,&H32,&HFE,&HCE,&H70
9080 DATA &HE6,&H80,&H20,&HF5,&H3E,&H01,&H32,&HFD,&HCE,&HC9
```

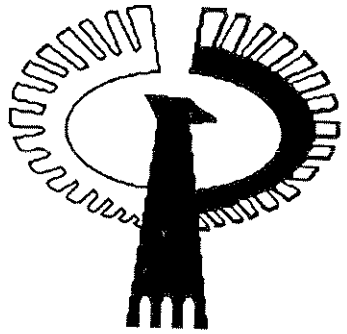
4.5 PRECISION CLOCK OPTION

The precision clock is a hardware option that allows precise adjustment of the baud rate. This adjustment can only be controlled over the remote port. The range of adjustment is ± 250 ppm in units of 25 ppm.

The commands are:

+ (x)	-sets the clock to +x ppm (x must be a multiple of 25).
+ Ø	-sets clock to nominal frequency
- (x)	-sets clock to -x ppm (x must be a multiple of 25).
SWP (x)	-sets sweep mode. Frequency sweeps between +x ppm and -x ppm at approximately a 1Hz rate.
SWP Ø	-turns sweep off.

5000 Modem Test Set



Phoenix microsystems, inc.

Phoenix Instruction Book

34-00012-052TB
2nd Edition, 1 January 1987

Printed in the USA

maintenance

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NOTICE: This section replaces first edition dated 1 June 1986

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RECORD OF CHANGES

CHANGE NUMBER	CHANGE DATE	CHANGE NUMBER	CHANGE DATE	CHANGE NUMBER	CHANGE DATE
1st Edition	5/86				
1st Edition	1/87				

5.0 TROUBLESHOOTING

Table 5-1 presents a guide to troubleshooting the Model 5000 at the user level. If the procedures in table 5-1 do not remedy the problem, it is recommended that the unit be returned to Phoenix customer service for repair.

Table 5-1. Model 5000 Troubleshooting Procedure.

SYMPTOM	CORRECTIVE ACTION
Programs are not retained in memory after power has been turned off.	Check to determine if the internal NiCad battery has discharged. Reprogram the unit and leave power on for 48 hours.
In the ASYNC infinity mode, synchronization is not retained in the test set receiving data.	Make sure spurious signals are not present on DCE pin 3 of the transmitting test set. Switch the transmitting test set to SYNC mode. (This does not affect data transmission.)
Test set does not achieve synchronization. (**SYNC** light out or will not stay solid 'on'.)	Ensure that no poll delay is set. Ensure that the modem is set up to use test clock (pin 24 DCE) or that the "- -- -" bit rate is set for external clock usage. Ensure RTS light is set ON.

5.1 BATTERY REPLACEMENT

The following steps should be observed to replace the NiCad battery in the Model 5000:

a. Remove and retain the four Phillips head screws that hold the front bezel in place (two on each side of the Model 5500).

b. Remove and retain the front bezel.

c. Remove and retain the four Phillips head screws that hold the rear bezel in place (two on each side of the Model 5000).

d. Remove and retain the rear bezel.

e. Lift off the top cover.

f. Locate the NiCad battery (on the left-front of the main circuit card when viewing the Model 5000 from the front).

g. Remove the NiCad battery from the clips on the printed wiring board.

h. Install a known good replacement battery on the printed wiring board.

i. Reassembly of the Model 5000 is the reverse of the disassembly procedure.

User's Notes