

Operation Manual
MODEL VI-700
Precision
Manual or Programmable
Voltage and Current Source



VI-700 IM/Rev J
© Copyright- 2001 IET Labs, Inc.



IET LABS, INC.
534 Main Street, Westbury, NY 11590

www.ietlabs.com
TEL: (516) 334-5959 • (800) 899-8438 • FAX: (516) 334-5988

WARRANTY

We warrant that this product is free from defects in material and workmanship and, when properly used, will perform in accordance with applicable IET specifications. If within one year after original shipment, it is found not to meet this standard, it will be repaired or, at the option of IET, replaced at no charge when returned to IET. Changes in this product not approved by IET or application of voltages or currents greater than those allowed by the specifications shall void this warranty. IET shall not be liable for any indirect, special, or consequential damages, even if notice has been given to the possibility of such damages.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.



WARNING



OBSERVE ALL SAFETY RULES
WHEN WORKING WITH HIGH VOLTAGES OR LINE VOLTAGES.

**Dangerous voltages may be present inside this instrument. Do not open the case
Refer servicing to qualified personnel**

HIGH VOLTAGES MAY BE PRESENT AT THE TERMINALS OF THIS INSTRUMENT

WHENEVER HAZARDOUS VOLTAGES (> 45 V) ARE USED, TAKE ALL MEASURES TO
AVOID ACCIDENTAL CONTACT WITH ANY LIVE COMPONENTS.

USE MAXIMUM INSULATION AND MINIMIZE THE USE OF BARE
CONDUCTORS WHEN USING THIS INSTRUMENT.

Use extreme caution when working with bare conductors or bus bars.

WHEN WORKING WITH HIGH VOLTAGES, POST WARNING SIGNS AND
KEEP UNREQUIRED PERSONNEL SAFELY AWAY.



CAUTION



DO NOT APPLY ANY VOLTAGES OR CURRENTS TO THE TERMINALS OF THIS
INSTRUMENT IN EXCESS OF THE MAXIMUM LIMITS INDICATED ON
THE FRONT PANEL OR THE OPERATING GUIDE LABEL.

Contents

Chapter 1: INTRODUCTION	1
Chapter 2 : SPECIFICATIONS	2
2.1 Voltage - Standard	2
2.2 HP - High Power Option - 200 mA Load Current Capacity	2
2.3 HV - High Voltage Option - 200 V Output	2
2.4 Current -Standard	2
2.5 HI - High Current Option - 200 mA Output	3
2.6 IEEE-488 Bus Functions - Optional	3
2.7 General	4
Chapter 3 : OPERATION	5
3.1 Initial Inspection and Setup	5
3.2 Power	5
3.2.1 AC Line Operation	5
3.3 Operation Mode: Local or Remote	5
3.3.1 Local Operation	5
3.3.2 Remote Operation, Optional	5
3.3.2.1 IEEE-488 Control	5
3.3.2.2 BCD Control	6
3.4 Setting of Output Level	6
3.5 Connection to Terminals	6
3.6 Overload Indicators	7
3.7 HP - High Power Option - 200 mA Load Current Capacity	7
3.8 HV - High Voltage Option - 200 V Output	7
3.9 HI - High Current Option - 200 mA Output	7
Chapter 4 : IEEE-488 PROGRAMMING	9
4.1 Introduction	9
4.2 Capabilities	9
4.3 Address Switch Settings	9
4.3.1 Auto Addressing	9
4.4 Bus Set-Up Procedure	9
4.5 Controlling the Model VI-700	10
4.6 Programming	11
Chapter 5 : CALIBRATION	13
5.1 Equipment Required	13
5.2 Disassembly Procedure	13
5.3 Calibration Steps	13
5.3.1 Voltage Calibration	13
5.3.2 X10 Output - Optional	13
5.3.3 Current calibration	15
5.3.4 High Current Output Calibration - Optional	15
5.3.5 Current Overload Indicator Setting	15

Figures

Figure 1.1: VI-700 Manual or Programmable Voltage and Current Source	1
Figure 2.1: Typical OPERATING GUIDE Affixed to Unit	3
Figure 5.1: Layout for VI-700 Printed Circuit Board	14

Tables

Table 2.1 EEEE-488 Bus Functions	3
Table 3.1 Digital Input Connector Pin Assignments	8

Chapter 1

INTRODUCTION

The IET **Model VI-700** (Figure 1.1) is a versatile precision dialable or remotely programmable voltage and current source. Its three ranges provide up to 20 V full scale (200 V with the HV option), and down to 100 μ V resolution; and 20 mA full scale down to 0.1 μ A resolution. Both voltage and current outputs are available simultaneously. The output is set by a range selector and thumbwheel switches in the **LOCAL** mode, or by a digital input at the rear panel. The **REMOTE mode** control can be a BCD parallel or IEEE-488 interface.

The optional **HV** output extends the range of the output voltage to 200 V at 10 mA. It provides an output at the rear panel 10 times higher-than that at the front panel. The optional **HI** feature extends the output current to 200 mA.

The optional, **HP** output extends the output load current capacity to 200 mA for all the voltage ranges. This makes the VI-700 suitable for many precision low to moderate power applications.

The VI-700 offers many full performance features. It fulfills a variety of laboratory needs. Its wide output range (up to 200 V), very low output impedance (5 m Ω , typical), low noise and ripple, and 200 mA load current capability suit the VI-700 to a variety of applications, such as simulation, calibration, A/D and D/A converter evaluations, and product development.

Front panel overload indicator lamps warn of exceeding of voltage load or current compliance limits. This feature assures the user that the output is within specifications without having to make any measurement or computations. The standard model may still be used within the overload condition and will function for approximately 50-100% overload with only a slight degradation of specifications.



Figure 1.1: VI-700 Manual or Programmable Voltage and Current Source

Chapter 2

SPECIFICATIONS

For convenience to the user, the pertinent specifications are given in an **OPERATING GUIDE**, shown in Figure 2. 1, affixed to the case of the instrument.

2.1 Voltage - Standard

Output Ranges:

200 mV, 2 V, 20 V, (200 V with HV Option).

Resolution:

100 μ V, 1 mV, 10 mV,
(100 mV with HV Option).

Accuracy:

$\pm(75 \text{ ppm} + 0.5 \text{ LSD})$ at 23°C, nominal line voltage, no load, after warmup of 10 minutes; worst case error $<0.75 \text{ LSD}$ (least significant digit), typically $<0.5 \text{ LSD}$.

Output Current:

70 mA (200 mA with HP Option), maximum load, with LED overload indicator, for conformance with accuracy specifications; 50-100% current overload output is available with slightly reduced accuracy.

Output Impedance:

5 m Ω typical, 40 m Ω for 20 V range.

Noise and Ripple:

50 μ V_{rms} on 200 mV and 2 V ranges, 100 μ V_{rms} on 20 V range; exclusive of random transients.

Temperature Coefficient:

10 ppm/°C typical, 15 ppm/°C maximum.

2.2 HP - High Power Option - 200 mA Load Current Capacity

Output Current: 200 mA, maximum load, with LED

overload indicator, on all ranges.

Since significant current may be drawn from this unit, it is advisable to leave the **mA** terminals open. The current **OVL** LED will remain on if the **mA** terminals are open, and this indicator may be disregarded. The **OVL** indicator will be off and will behave normally under normal operation.

2.3 HV - High Voltage Option - 200 V Output

Output Voltage:

0 to 200 V.

Resolution:

1 mV, 10 mV, 100 mV.

Output Current:

10 mA (may be increased).

Accuracy:

$\pm(0.01\% + 0.5 \text{ LSD})$; applies to $>20 \text{ V}$.

2.4 Current -Standard

Output Ranges:

200 μ A, 2 mA, 20 mA.

Resolution:

0.1 μ A, 1 μ A, 10 μ A.

Accuracy:

$\pm(75 \text{ ppm} + 0.75 \text{ LSD})$ at 23°C, nominal line voltage, no load, after warmup of 10 minutes; worst case error $<1 \text{ LSD}$ (least significant digit).

Compliance:

0-20 V; with LED overload indicator.

VI-700 OPERATING GUIDE

CONSULT INSTRUCTION MANUAL FOR PROPER INSTRUMENT OPERATION

VOLTAGE		CURRENT	
OUTPUT RANGES	200 mV, 2 V, 20 V	OUTPUT RANGES	200 µA, 2 mA, 20 mA
RESOLUTION	100 µV, 1 mV, 10 mV	RESOLUTION	0.1 µA, 1 µA, 10 µA
ACCURACY	±(75 ppm + 0.5 LSD) (LSD=least significant digit), @ 23°C, no load, after warm-up, typically <0.25 LSD; worst case error <0.75 LSD.	ACCURACY	±(75 ppm + 0.5 LSD), @23°C, after warm-up; typically <0.5 LSD; worst case error <1 LSD.
OUTPUT CURRENT	70 mA, maximum load; with LED overload indicator		0-20 V; with LED overload
OUTPUT IMPEDANCE	5 mΩ typical, 40 mΩ for 20 V range		
NOISE and RIPPLE	50 µVrms on 200 mV and 2 V ranges, 100 µVrms on 20 V range (exclusive of random transients)		

Traceable to NIST
POWER 105-125V, 50-60Hz ;

OPERATION

1. **CNTRL MODE** button has no effect for non programmable units.
2. Make the most secure connection to the V terminals if significant current is drawn.
3. Current **OVL** LED indicator is on if mA terminals are open.
4. The ground terminal is connected to earth ground and may be connected to either **VOLTAGE** terminal.
5. Battery units may be used with ac connected if battery is low.

MODEL: VI-700

IET LABS, INC. • 534 Main Street, Westbury, NY 11590 • (800) 899-8438 (516) 334-5959

VILBL/p2/VI-700/10-11-99

Figure 2.1: Typical OPERATING GUIDE Affixed to Unit

2.5 HI - High Current Option - 200 mA Output

Output Current: 200 mA.
Resolution: 0.1 mA.
Accuracy: ±(0.01%+0.75 LSD)

Compliance:
 0- 18 V; with LED overload indicator.

2.6 IEEE-488 Bus Functions - Optional

See Table 2.1 for the particular Bus functions implemented in the VI-700.

Code	Description	Comments
SH1	Source Handshake	Included
AH1	Acceptor Handshake	Included
RL1	Remote, Local	Not implemented
SRI	Service Request	Not implemented
TO	Talker	Not implemented
L3	Listener	No Extended Capability

Table 2.1 IEEE-488 Bus Functions

2.7 General

Digital Input:

3-1/2 digit parallel BCD or IEEE-488 interface; a front panel pushbutton selects **REMOTE** or front panel thumbwheel operation.

Operating Temperature

Range:

-20°C to +40°C.

-20°C to +28°C, for HP -High Power Option.

Power Requirement:

105-125 V or 210-250 V; 50-60 Hz; 5 W.

Calibration Interval:

12 months.

Dimensions:

7.1 cm W x 22.9 cm D x 12.6 cm H
(8.5"x9.0"x2.8")

with IEEE-488 option:

22 cm W x 24 cm D x 12 cm H
(8.5"x9.25"x4.44")

Weight:

1.6 kg (3.5 lb) with no options.

Chapter 3

OPERATION

3.1 Initial Inspection and Setup

This instrument was carefully inspected before shipment. It should be in proper electrical and mechanical order upon receipt.

An **OPERATING GUIDE**, shown in Figure 2.1, is attached to the bottom of the instrument to provide ready reference to specifications.

3.2 Power

3.2.1 AC Line Operation

For a line powered unit, connect the VI-700 to a sounded power outlet. Operation at either 110 or 220 Vac is possible by selecting internal straps. Press the **PWR** switch which is push-on push-release button; the **PWR** LED indicator will light.

3.3 Operation Mode: Local or Remote

Operation of the VI-700 Precision Voltage and Current Source is straightforward and is graphically indicated on the front panel.

1. Plug the unit into a sounded ac outlet.
2. Pull out and set the handle for convenient operation.
3. Turn on the **PWR** switch. The **PWR** lamp and **READY** lamp (if present with IEE-488 option) should come on.

3.3.1 Local Operation

1. Set the **CNTRL MODE** switch to **LOCAL**, i.e. pointing to the thumbwheel switches. The associated **LOCAL** lamp (if present with IEEE-488 option) should come on. For units, without a remote programming option, this switch has no effect.
2. Program the output level manually as described in subsection “Setting of Output Level” below.

3.3.2 Remote Operation, Optional

The VI-700 provides convenient optional remote control operation through a choice of optional IEEE-488 bus control or a parallel BCD signal input.

Optical isolation allows the outputs to be floating and gives the user the option of using the voltage and current outputs in either polarity. They may also be tied to the ground terminal on the front panel.

3.3.2.1 IEEE-488 Control

1. Set the **CNTRL MODE** switch to **REMOTE**. The **LOCAL** indicator remains on. The mode changes to **REMOTE** after the appropriate controller commands are given. Note that the status of the unit, i.e., being under local or remote control is determined first by the **CNTRL MODE** switch and next by the interface controller. The two may appear to conflicts but the VI-700 will *always* be in the **LOCAL** mode whenever the **CNTRL MODE** switch is set

to **LOCAL**, and will be in **REMOTE** whenever both the **CNTRL MODE** switch and the LED indicate **REMOTE**.

2. See Chapter on IEEE-488 programming.
3. Set the **MULTIPLIER** on the front panel manually. The **MULTIPLIER** is not under **REMOTE** control.
4. Set the output level remotely, replacing the front panel thumbwheel setting.

3.3.2.2 BCD Control

Units with a **BCD** option provide a connector on the rear panel for inputting a 3-1/2 digit BCD equivalent of the thumbwheel setting. This digital input is operative whenever the **CNTRL MODE** switch is set to **REMOTE**. The **MULTIPLIER** switches must be manually set.

The digital output pin assignments are given below in Table 3. 1. The digital output connector is a 26 pin header on the rear panel. It may be mated to many popular female connectors such as *3M Company Model 3399*, *GTE Sylvania Inc. Model 6BAXX-26-IXX-Y.X*, *T&B/Ansley Corp. Model 609-2600M* or equivalent. The rear panel connector pin numbering, as the connector is viewed straight on, is also shown in Table 3. 1.

The required input is a 5 V, positive true TTL compatible source.

3.4 Setting of Output Level

IMPORTANT: The VI-700 must be allowed to warm up for 15 minutes to reach specified accuracy. For maximum stability and minimum drift, allow the unit to warm up for at least one hour.

The front panel controls simultaneously set both the voltage and current output levels. This output may be conveniently and directly read on the front panel. The output in volts and milliamperes is exactly the **MULTIPLIER** setting times the number shown on the thumbwheel switches. For example, a setting of X10 and 1.335 outputs 13.35 V and 13.35 mA; a setting of X0.1 and .025 outputs 2.5 mV and 2.5 μ A.

The range used, i.e. X10, X1, or X0.1, should be the one providing the highest resolution. If 10 mV is required, for example, it should be obtained on the X0.1 range even though it is available on the X1 range. This allows for maximum accuracy even though all settings on an ranges will meet performance specifications.

In the case of a **REMOTE** input being used, it overrides the thumbwheel setting.

3.5 Connection to Terminals

Both voltage and current outputs are floating, and in the case of line operated units, may be connected to the earth ground terminal on the front panel.

A voltage of the indicated polarity will be present across the red and black **V** terminals. Be aware that the specified voltage exists **right at the terminals only**. If leads are used to bring this voltage to some remote load, then a voltage drop develops across these leads. Whether this drop is significant or not depends on the amount of current flowing. If, for example, the load is a high input impedance meter or other such device, then the lead potential is safely ignored. If, however, a large amount of current is drawn through the connecting leads, then a significant drop may develop across the leads and various contact resistances. The user should be aware of this and note the following procedures.

Whenever high currents are to be drawn, connections should be made with heavy cables and heavy duty spade terminals or banana plugs securely attached to the binding posts. If the output voltage is being monitored, then the voltage at the posts *and* at the load should be measured to determine the potential drop between them. These precautions are especially important whenever the X0.1 range is being used, because even very small resistances can result in a significant voltage relative to the least significant digit resolution of that range, i.e. 100 μ V.

If sensing at the load is desired to virtually eliminate this lead drop, consult IET Labs for instructions on implementing this technique.

In the case of the current output, no such problem

exists. The current indicated on the front panel is exactly the current flowing through the test load.

3.6 Overload Indicators

In order to provide the user with certainty that the output load capability is not being exceeded and that the VI-700 is performing within specifications, two **OVLD** indicator LED lamps are provided. As long as the appropriate indicator is off, its associated output is accurate as specified.

In the case of the current output, note that it is the *voltage or compliance* across the terminals, which cannot be exceeded, 20 volts in particular. An open circuit is therefore an overload condition and will cause that indicator to go on. This condition can be ignored, or, if desired, a short circuit strap may be placed across the current terminals to turn off this lamp.

In the case of the **HP** - High Power Option - where up to 200 mA may be drawn, a shorting link will cause this current to be constantly drawn from the current terminals if the unit is on a high setting. This could cause overheating, and it is advisable to leave the **mA** terminals open. The current **OVLD** LED will remain on if the **mA** terminals are open, and this indicator may be disregarded. The **OVLD** indicator will behave normally under normal operation.

It is important to realize that the **OVLD** indicators are conservatively set. The output in the overload region may be used as long as care is exercised. The voltage output remains precise for 50-100% current overload with only a slight degradation in accuracy, of the order of one LSD (least significant digit.) The VI-700 can actually be used as a low power programmable power supply.

If both voltage and current connectors are used to supply power simultaneously to outside loads, one or both overload indicators may come on sooner than at the limits indicated above since they are determined by the total output capability of the instrument. There is a small amount of hysteresis built into the

overload indicator circuits in order to prevent them from flickering as the limit threshold is approached. This requires reducing the load substantially below the limit whenever it is necessary to reset or turn off the indicator.

3.7 HP - High Power Option - 200 mA Load Current Capacity

A unit with this option may be used in the same way as a standard unit. Caution should be exercised since a significant current is available and could overheat the item under load. The current overload indicator will be on; see the Overload Indicators section above.

3.8 HV - High Voltage Option - 200 V Output

WARNING
OBSERVE ALL SAFETY RULES
WHEN WORKING WITH HIGH VOLTAGES OR
LINE VOLTAGES.

HIGH VOLTAGE MAY BE PRESENT AT REAR PANEL WITH HV OPTION.

The rear output voltage is precisely 10 times the voltage set at the front panel. Up to 10 mA may be drawn. Exceeding that current will **not** turn on the **OVLD** indicator. Consult IET Labs if more current is required.

It is up to the user to consider placing a fuse or a current limiting resistor in series with the **X10 200 V OUTPUT** terminals as a safety measure.

3.9 HI - High Current Option - 200 mA Output

To obtain an X10 higher output current, set the VI-700 to the X10 Range, and either toggle the 200 mA toggle switch or depress the **200 mA OUTPUT** button switch to **200 mA**. The effective current multiplier becomes X100. The **200 mA** switch must be OFF in order to use the X0.1 and X1 current range.

Table 3.1 Digital Input Connector Pin Assignments

PIN NO.	FUNCTION
10	1 bit
12	2 bit
8	4 bit
24	8 bit
5	10 bit
7	20 bit
6	40 bit
20	80 bit
26	100 bit
14	200 bit
16	400 bit
18	800 bit
22	1000 bit
1	No connection
3	Ground
9	No connection
11	No connection
13	No connection
15	No connection
17	No connection
19	No connection
21	No connection
23	No connection
25	No connection
2	No connection
4	No connection

Connector Pin Numbering

25 23 21 19 17 15 13 11 9 7 5 3 1
 26 24 22 20 18 16 14 12 10 8 6 4 2

(Viewed Straight On)

Chapter 4

IEEE-488 PROGRAMMING

4.1 Introduction

The IEEE-488 interface converts the Model VI-700 Precision Voltage and Current Source into an instrument compatible with the standard IEEE-488-1978 interface bus. This capability allows the VI-700 to become part of a fully automated instrumentation system.

If necessary, it is strongly suggested that the user refer to documentation for background on the operation of this interface. In particular, a useful source is:

IEEE Standard Digital Interface for Programmable Instrumentation; ANSI/IEEE Std 488-1978; published by:

The Institute of Electrical and Electronics Engineers, Inc., 345 East 47th Street, New York, NY 10017

4.2 Capabilities

The IEEE-488 interface provides remote control over the front panel thumbwheel setting. Refer to Chapter 2 for the particular IEEE-488 capabilities implemented in this unit.

4.3 Address Switch Settings

The **BUS ADDRESS** DIP (Dual In-line Package) switch on the rear panel of the unit establishes the automatic address and other address modes of the unit. These settings are read and saved during power up as long as the **CNTRL MODE** switch is set to **REMOTE**. Changing these settings during operation

will have no effect unless the power is momentarily turned off and back on, or the **CNTRL MODE** switch is momentarily switched to **LOCAL** and back to **REMOTE**.

4.3.1 Auto Addressing

For **AUTO ADDRESSING**, select an unused Bus address between 0 and 30 decimal. Set the **BUS ADDRESS** switches for the desired address as described below. For a switch position to be in logical “1” position, it should be switched to the position marked “ON” on the body of the switch, and, of course, a logical “0” requires the switch actuator to be in the “OFF” or unlabeled position.

First, the “T”, “L”, and “S” switches for **TALK ONLY**, **LISTEN ONLY**, and **SRQ ENABLE** respectively, are not implemented on this unit and **MUST** remain **OFF** at all times.

Next set switches “1” through “5” as shown in Table 4.1.

The **LISTEN ONLY** function is not implemented on the VI-700, since such a function would not be operational or meaningful for such an instrument.

4.4 Bus Set-Up Procedure

1. Turn off power to the unit.
2. Set the **BUS ADDRESS** switch as indicated above.
3. Connect an IEEE-488 interface cable from an appropriate controller to the connector on the rear panel.

Table 4.1 BUS ADDRESS Switch Settings

DECIMAL	SWITCH SETTINGS	DECIMAL	SWITCH SETTINGS
ADDRESS	54321		54321
0	00000	16	10000
1	00001	17	10001
2	00010	18	10010
3	00011	19	10011
4	00100	20	10100
5	00101	21	10101
6	00110	22	10110
7	00111	23	10111
8	01000	24	11000
9	01001	25	11001
10	01010	26	11010
11	01011	27	11011
12	01100	28	11100
13	01101	29	11101
14	01110	30	11110
15	01111	31	Reserved, DO NOT USE

4. Set the front panel **CNTRL MODE** switch to **REMOTE**.
5. Turn on the **PWR** switch. This allows the unit to read the status of the rear panel **BUS ADDRESS** switch settings. These settings are read and saved during power up as long as the **CNTRL MODE** switch is set to **REMOTE**. Changing these settings during operation will have no effect unless the power is momentarily turned off and back on, or the **CNTRL MODE** switch is momentarily switched to **LOCAL** and back to **REMOTE**.
6. The **READY** and **LOCAL** lamps on the front panel should come on with turn on as long as the **CNTRL MODE** switch is set to **REMOTE**.

4.5 Controlling the Model VI-700

After performing any necessary initialization related

to the controller in the system, proceed as follows:

1. Set the VI-700 to **LISTEN** using its preset address. The **LSTN** lamp should come on.
2. Set the VI-700 to **REMOTE** using its preset address. The **REMOTE** lamp should come on.
3. Output a command string to the unit in the form of a 4 digit decimal number. This number must be given as an ASCII string made up of the characters 0-9 (HEX 30-39). Leading zeros are optional and need not be given. This number must be followed by an appropriate terminator such as a CR (carriage return), LF (line feed), comma, or the presence of an EOI signal on the bus which will terminate the listen message.
4. The decimal point in the output string is optional, but all decimal places, including zeros, must be given. For example, the command for the setting 10.000 (X10 Range) may be given as the string "10.000" or "10000", and the command for

03.00 (X1.0 Range) may be give as the string “03.00”, “3.00”, “300”, or “0300”.

5. If characters other than Hex 30-3F are out put in the command string, they will be ignored for those digit positions. All legal numerical characters in the command string will activate their respective decades.

4.6 Programming

IET Labs can provide IEEE-488 controllers which may be installed in a PC to control the VI-700 Voltage and Current Source. The **HI-488** Interface Hardware Series offers a convenient way of accomplishing this. See the attached catalog pages at the end of

this manual for controllers, cables, and software. Also available are **Testpoint** and **Testpoint Suite**, powerful data acquisition and handling tools under Windows. Data Sheets are attached at the end of this manual.

To aid the user in operating the VI-700, a sample representative program in BASIC is given on the following page.

This program first initializes the controller, then sets the device in the REMOTE and LISTEN modes, then outputs a command string provided by the operator to the device, and finally sets the device to the LOCAL mode. Note that the variable BA0% refers to the controller board number.

```

100 \*****
110 \*      SAMPLE VI SERIES IEEE-488 COMMAND PROGRAM      *
120 \*
130 \* MX3
140 \*****
150 CLEAR 20000, 40000!
160 CLS : KEY OFF
170 \
180 \This program let's you write a device dependent command string
190 \to any device number.
200 \
210 \— Load link that calls DOS resident driver (REMOVE IF COMPILED)
220 \
230 DEF SEG = &H3600
240 BLOAD "GPIBBASI.BIN", 0
250 IE488 = 0
260 \
270 \— Initialize MBC-488 board using "SYSCON" command
280 \
290 CMD$ = "SYSCON MAD=3, CIC=1, NOB=1, BA0=&H300" \change to suit
300 A% = 0: FLAG% = 0: BRD% = 0
310 CALL IE488(CMD$, A%, FLAG%, BRD%) \initialize
320 IF FLAG% <> 0 THEN PRINT "Error #"; HEX$(FLAG%); " in initialization": STOP
330 \
340 INPUT "Enter device number: ", DN
350 \
360 \— Set device into REMOTE —————
370 CMD$ = "REMOTE " + STR$(DN)
380 CALL IE488(CMD$, A%, FLAG%, BRD%)
390 IF FLAG% <> 0 THEN PRINT "Error in setting to remote. Error code ";
HEX$(FLAG%): INPUT "Continue "; G$: IF G$ = "y" OR G$ = "Y" THEN 400 ELSE 100
400 \
410 \— Send command to device —————
420 \
430 PRINT : INPUT "(type 'Q' to quit) Enter device command string: ", X$
435 IF X$ = "Q" THEN 530 ELSE IF X$ = "" THEN 430
440 CMD$ = "OUTPUT " + STR$(DN) + "[\$]"
450 CALL IE488(CMD$, X$, FLAG%, BRD%)
460 IF FLAG% <> 0 THEN PRINT "Error in output of command. Error code ";
HEX$(FLAG%): INPUT "Continue "; G$: IF G$ = "y" OR G$ = "Y" THEN 400 ELSE 100
470 GOTO 350
530 RUN "MENUV"

```

Chapter 5

CALIBRATION

The VI-700 should be calibrated every twelve months or more frequently if inaccurate outputs are suspected.

5.1 Equipment Required

1. Precision digital dc voltmeter, 4-1/2 digit, with 0.2 V, 2 V, and 20 V full scale ranges, accurate to better than 0.01%.
2. Precision digital dc ammeter, 4-1/2 digit, with 0.2 mA, 2 mA, and 20 mA full scale ranges, accurate to better than 0.01%.

5.2 Disassembly Procedure

WARNING

HIGH VOLTAGES EXIST WITHIN THIS INSTRUMENT.
REFER SERVICING AND CALIBRATION TO QUALIFIED PERSONNEL.
OBSERVE ALL APPLICABLE SAFETY PRECAUTIONS.

OBSERVE ALL ESD PRECAUTIONS.

Remove the four screws on the bottom of the unit that are inside the feet. Carefully lift off the top cover.

All calibration steps are performed on the printed circuit board. Refer to Figure 5.1 for the locations of the various test points and trimmer potentiometers. In the instructions to follow, the notation “A” refers to an integrated circuit (IC), and an appended number refers to a particular pin on that IC, e.g. 1-A5/2 refers to pin 2 of IC 5 on the main printed circuit

board. The notation “T” refers to a trimmer potentiometer.

5.3 Calibration Steps

Turn on the VI-700 and allow it to stabilize for one hour.

5.3.1 Voltage Calibration

1. Attach the digital voltmeter (DVM) leads securely to the voltage output binding posts.
2. Set the VI-700 to 0.000 on the X0.1 range.
3. Adjust trimmer 1-T4 to obtain a voltage as close to zero as possible. 50 μ V or less is satisfactory.
4. Set the VI-700 to 1.799 on the X10 range.
5. Adjust trimmer 1-T1 to obtain a voltage of 17.990 V.
6. Set the VI-700 to 1.799 on the X1 range.
7. Adjust trimmer 1-T3 to obtain a voltage of 1.7990 V.
8. Set the VI-700 to 1.799 on the X0.1 range.
9. Adjust trimmer 1-T5 to obtain a voltage of 179.90 mV.

5.3.2 X10 Output - Optional

The X10 output is calibrated as follows:

1. Set the front panel output to 19.99 V.
2. Monitor the rear panel output.
3. Locate the potentiometer in the center of the PC board attached to the roof of the unit.
4. Adjust the potentiometer until the X10 output voltage is 199.9 V.

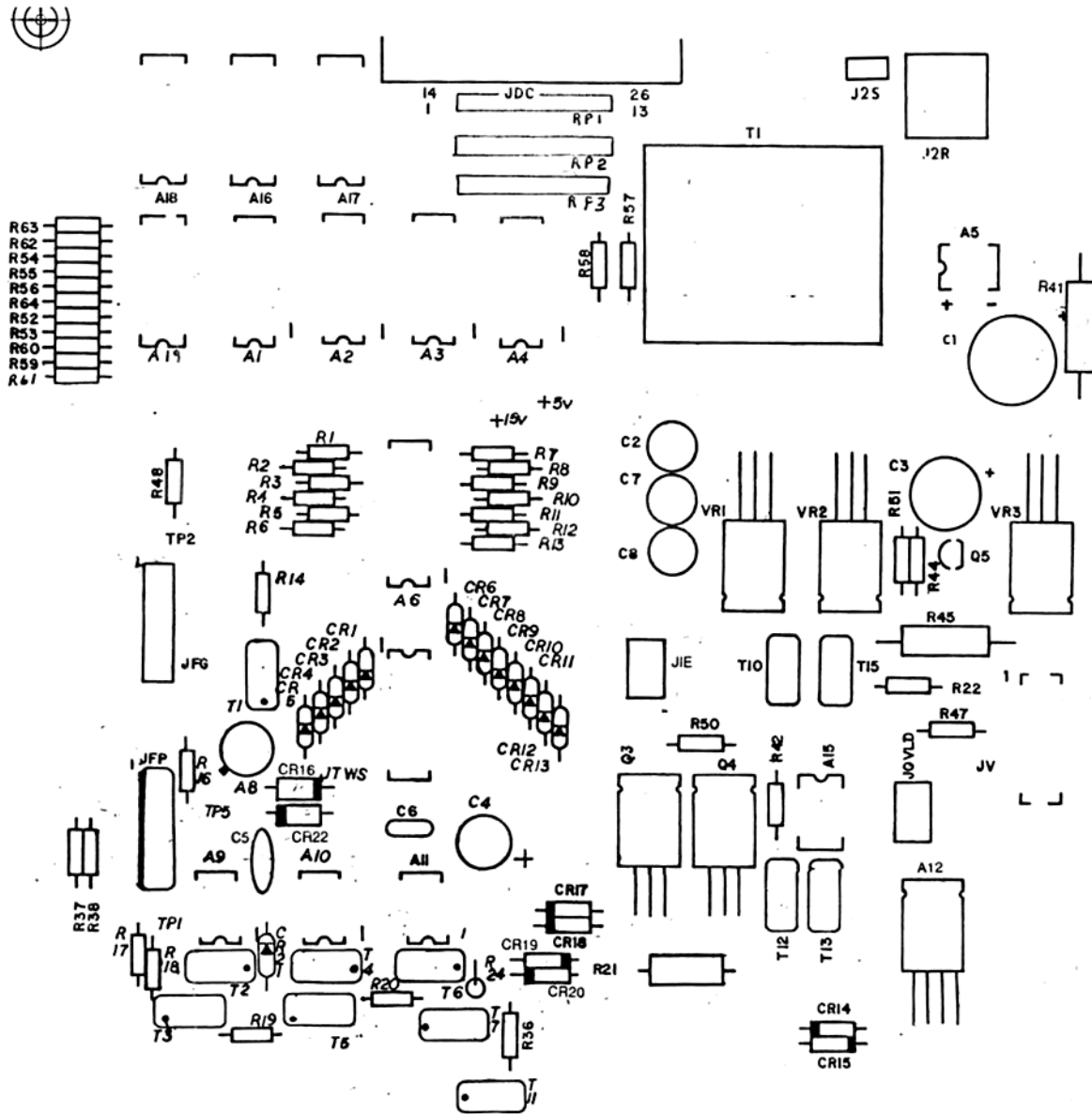


Figure 5.1: Layout for VI-700 Printed Circuit Board

5.3.3 Current calibration

The voltage calibration of the above subsection must be performed before this current calibration. The calibration may be performed using an ammeter or a voltmeter with a precision resistor. This latter method may be preferable since an ammeter with the required accuracy is not as common or convenient as a voltmeter. If the voltmeter method is to be employed, connect a stable 1 k Ω precision resistor, whose value, is known to the required accuracy, securely across the current output binding posts. In the instructions below, follow the items in parentheses for the voltmeter method

1. Attach the digital ammeter (voltmeter) leads securely to the current output binding posts.
2. Set the VI-700 to 0.000 on the X0.1 range.
3. Adjust trimmer 1-T6 to obtain a current (voltage) reading as close to zero as possible. 0.05 μ A (50 μ V) or less is satisfactory.
4. Set the VI-700 to 1.799 on the X10 range.
5. Adjust trimmer 1-T11 to obtain a current of 17.990 mA (voltage of 17.990 V).
6. Set the VI-700 to 1.799 on the X0.1 range.
7. Adjust trimmer 1-T7 to obtain a current of 179.90 μ A (voltage of 179.90 mV).

5.3.4 High Current Output Calibration - Optional

1. Attach the digital ammeter leads securely to the current output binding posts.
2. Set the VI-700 to the X10 range.
3. Set the 200 mA pushbutton ON.
4. Set the thumbwheel switch to 1000.
5. Adjust trimmer 1-T16 to obtain a current reading of 100 mA.

5.3.5 Current Overload Indicator Setting

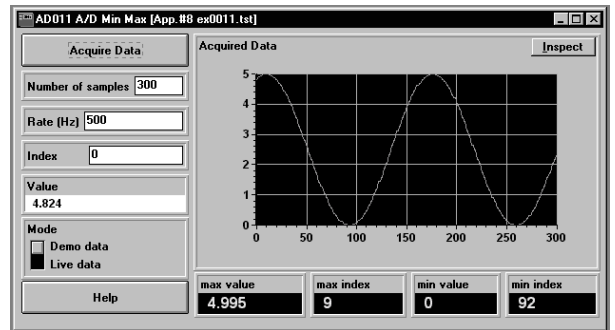
This is not a critical adjustment and may be bypassed unless a problem is suspected.

1. Set the front panel to 1.999 on the X10 range.
2. Connect a 1 k Ω resistor whose value is precisely known to the current output connectors.
3. Adjust trimmer 1-T12 so that the current **OVLD** indicator is just about to come on.

TESTPOINT TESTPOINT SUITE p. 1 of 2

TestPoint Suite is a complete set of tools for data acquisition, instrument control, analysis, remote (including over the internet) instrument monitoring, and data presentation.

- Data acquisition
- Instrument control
- No Windows programming
- Drag and Drop
- Remote control
- Presentation
- Analysis
- IEEE-488 and RS-232



Hundreds of professional, ready to run applications or data acquisition and instrument control are available to you free.

TESTPOINT SUITE

7 powerful tools, plus over 150 ready-to-run applications and 16 video tutorials.

- Testpoint
- Database Toolkit
- Windows API
- JavaScript Remote Control
- Internet Toolkit
- Statistical Process Control
- Runtime Builder

Testpoint

The proven power platform for test development. **TestPoint** software provides a contemporary, drag-and-drop interface for acquisition from IEEE-488 instruments, data acquisition boards and RS-232/485 instruments and devices. This integrated tool is a self-contained environment that incorporates many commonly used math, analysis, report generation and graphics functions.

TestPoint is a unique alternative to conventional programming languages. Create custom applications from a set of tools (icons) by using drag and drop operations. Test designers find this suite of professional applications easier to use, more reliable and more versatile than any other software. TestPoint sets the direction for the future of object-oriented programming.

Internet Toolkit

The **Internet Toolkit** provides the ability to view and control remote applications using an internet browser or a TestPoint application. Remote sites can send e-mail to address lists based on test status and conditions and communicate with any TCP/IP client. Just build your application in TestPoint and load our WebServer on the remote computer and without editing or changes, your applications are ready to broadcast to the web.

Database Toolkit

The **Database Toolkit** provides fast, high-level functions for industrial-strength database control. The ability to create, select, insert, update and delete records is ideal for any application that requires sorting, searching or organizing large data sets. Microsoft Access, Oracle, SQL Server and other ODBC compliant programs are supported.

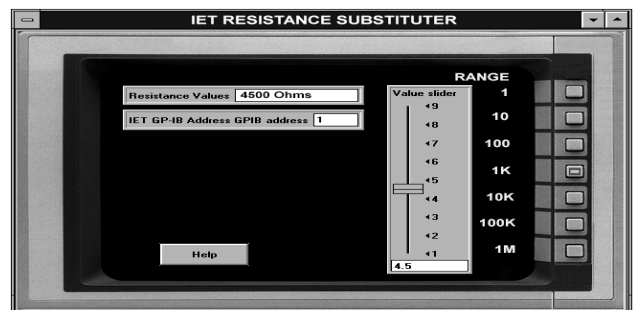
Statistical Process Control

Statistical Process Control supports real-time charting of process data, automatically derives control limits, monitors process quality, tests for limits and trends, gathers statistics and offers a wide range of report generation options.

Windows API - this new object provides easy access to many internal features of Windows. This includes the ability to control the attributes of the user interfaces, play sounds, control mouse, keyboard, and many other functions.

Runtime Builder provides rapid deployment of your applications without license fees. Your applications are professionally packaged so that they install, run and look as good as any commercially available program.

JavaScript and LiveConnect applications are included to get you up and running with these great new features supported by TestPoint's WebServer.



A TestPoint application for the IET PRS Series

- IEEE-488
- OCX
- Runtime
- E-Mail
- OLE2
- RS-232
- VBX
- A/D - D/A
- Math
- SQL



SYSTEM FEATURES

Data acquisition

Analog input and output (A/D, D/A), digital I/O, and custom I/O port devices

High-speed background A/D

Strip charts, bar indicators, numeric displays

Alarm limits and displays

High speed disk data logging

Instrument control

Supports all IEEE-488 (GPIB), RS-232 and RS-485 devices

Supports VXI devices through a GPIB controller

Analysis

FFT, IFFT, digital filtering, waveform smoothing

Curve fitting, polynomials, interpolation ...

Calculus, statistics, trig, log, ...

Input/ output

TestPoint supports multiple boards per system limited only by PC resources imposed, such as DMA channels, interrupt levels, and slots. A combination of IEEE 488, RS-232, and/or data acquisition boards are supported with limits of each type indicated.

A/D, D/A, digital I/O

TestPoint supports a maximum of four A/D boards from several

Vector and array math, including inverse, determinant, transpose, matrix multiplication, waveform generation, ...

Presentation, reports and graphs

Line/symbol graphs, XY graphs, trip charts, bar graphs

Numeric and analog bar displays

Indicators and bitmapped pictures

Printed report generation

User interface

Push-buttons, switches, selectors, sliders, entry fields

Multitasking, multiple panels, multiple applications

Works with custom controls (VBX's)

Dynamic data exchange/object linking and embedding

Complete client/server capability

manufacturers. Supported data acquisition boards and maximum number of each type are listed.

- Thermocouple UDO automatically converts measurements to engineering units.

- Single waveform or continuous strip chart.

- Supports digital I/O strip chart using compatible hardware.

- Data logging to memory or disk; input to file.

SYSTEM FUNCTIONS

Triggers

- By comparison

- Push-button, toggle button pseudo-mechanical switches

- Hardware

Environment control features

- Loops

- Variable input values while running applications

- Lock and unlock UDO's (User-Defined Objects)

- UDO, VBX, OLE, or DLL for additive functions

- Cooperative multitasking

- Debugging tools - single step, stop after n iterations, xref

- Application printout

General style features

- Free run-time distribution

- Clipboard for cut, copy, paste

- Extensive, on-line help system

- Password protection for user code

ANALYSIS AND MATHEMATICS

Analysis functions may be used by name or selected via the Math Wizard point and click operation. Included in these are arrays operations, bitwise operations, string operations, and user defined expressions.

Many data types

General Math

Trigonometry

String operations

Statistics

Multiple graphics options

Vector /Array

Curve fitting

Filter

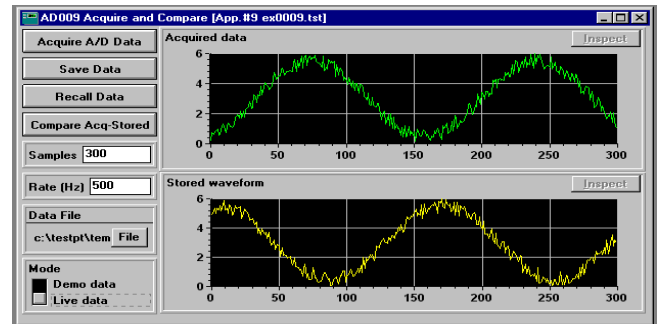
Frequency domain analysis

Time domain analysis

Various display panels

IEEE-488 boards and GPIB instruments

TestPoint contains libraries for hundreds of popular instruments in the package. During installation, you select the specific libraries to copy to hard disk.



Acquire, store, recall and compare waveforms with this real time data acquisition application

ORDERING INFORMATION

TP-10100 TestPoint Professional Single User

TP-10500 TestPoint Professional 5 Pack

TP-16000 TestPoint Development Suite

TP-14010 Internet Toolkit

TP-14020 Database Toolkit

TP-14030 SPC Toolkit



IET LABS, INC.

534 Main Street, Westbury, NY 11590

www.ietlabs.com

TEL: (516) 334-5959 • (800) 899-8438 • FAX: (516) 334-5988

HI-488 SERIES

The HI-PCI488 combines high-speed and easy programming with practical examples that let you complete data acquisition, measurement and analysis tasks faster than ever before. The hardware, software and documentation have all been carefully designed and written to dramatically improve your productivity.

- Very fast data transfers
- Compatible with most popular industry software
- Complete IEEE-488.2 compatibility
- For laboratory, test, and production applications
- PCI slots or ISA slots
- Plug-and-Play controls for all '488 and HP-IB instruments

HARDWARE

Computers: HI-PCI488 works in any computer with one or more PCI slots and controls all '488, GP-IB and HP-IB instruments. The HI-PC488 works in any computer with one or more ISA slots.

The HI-488 series implements all required and optional features of the IEEE-488.2 standard in controller or device mode as a talker and listener.

SOFTWARE

PCI Plug-and-Play software with auto addressing provides instant-on switchless configuration

Commands: All IEEE-488.2 functions and commands are supported. These include listen, talk, device, clear, group execute trigger, go to local, interface clear, local lockout, parallel poll configure or disable, remote enable, selected device clear, serial poll, pass control, take control, unlisten, and untalk.

Commands and data can be combined into a single statement (macro commands) and assigned a user defined name.

Addressing: The IEEE-488 address of the HI-488 series is programmable. The board can listen or talk to any device.

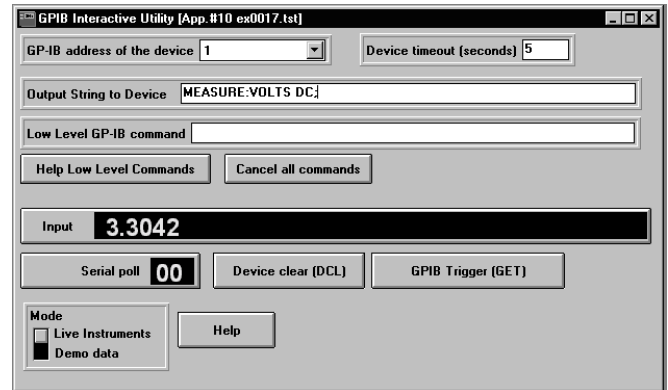
Modes: The HI-488 series supports system controller and device mode programming. Modes are software selectable.

ORDERING INFORMATION

HARDWARE

HI-PCI488EX 16 bit GPIB interface card and software for the PCI bus
HI-488EX 16 bit GPIB interface card and software for the ISA bus
HI-PC488 8 bit GPIB interface card and software for the ISA bus
PCI Data Acquisition Boards Consult IET

*IEEE-488 Interface boards for
the PCI bus and the ISA bus.*



Control any GPIB (IEEE-488) instrument with this interactive front panel

The hardware is 100% compatible with existing applications currently running on our other IEEE-488 cards. It uses industry standard IEEE-488 cables.

Supported Languages: BASIC, QBASIC, Professional BASIC7, QuickBASIC, Visual BASIC for DOS and Windows, Quick Pascal, TurboPascal, Delphi, Quick C for DOS and Windows, C, C++, Visual C\C++, Watcom C, FORTRAN, hpVEE, LabVIEW, LabWindows CVI, TestPoint, TestPoint Internet Toolkit for remote monitoring and control. Note: Universal language driver provides support for languages not listed.

Operating Systems: DOS, Windows 3.x, 95/98 and NT, OS/2, UNIX.

Additional Features: parallel port emulation, serial port emulation, IEEE-488.2 subroutines, interactive test utility, IEEE-488 debug utility, data transfer between computers, device emulation, hardware diagnostics, example program library, macro command support and fast array transfers.

ACCESSORIES

CBL-488-1 1 meter IEEE-488 cable
CBL-488-2 2 meter IEEE-488 cable
CBL-488-4 4 meter IEEE-488 cable
CBL-488-X Custom cables any length



IET LABS, INC.

534 Main Street, Westbury, NY 11590

www.ietlabs.com

TEL: (516) 334-5959 • (800) 899-8438 • FAX: (516) 334-5988

SI-488 SERIES

The SI-488 interface software offers you more programming methods, more languages, and more operating systems than you will find anywhere else. The software is fast and easy-to-use and supports all IEEE-488 (HP-IB, GP-IB, 488.2) applications.

OVERVIEW

Several software options are available. These include drivers that run under either DOS or Windows and a number of utilities such as the powerful SI-488 software bus analyzer. In combination with the HI-488 Series of hardware interfaces, this software provides an economical and efficient solution to '488 application requirements.

Software compatibility

The '488 products run with all the popular languages and operating systems. Software support for DOS, Windows, OS/2, GW-BASIC, BASICA, compiled BASIC, Turbo BASIC, QBASIC, Quick BASIC, Visual BASIC, Turbo Pascal, Microsoft C, Quick C, Microsoft FORTRAN, Ryan McFarland FORTRAN, Lahey FORTRAN, Turbo C, Turbo C++, Turbo Pascal for Windows, and assembly language is included. If the language you would like to use is not listed here, the Universal Language Driver is designed to meet your needs. The IEEE-488 interfaces include a driver that is compatible with National Instruments GPIB interfaces, saving program conversion time and effort. And last, the software is compatible with industry's most popular software packages including LABTECH NOTEBOOK, LabWindows, LabView, VIEWDAC, HP ITG and TestPoint.

DOS AND WINDOWS PLATFORMS

Control IEEE-488 instruments with Visual BASIC

It is easy to control any IEEE-488 instrument using responsive IEEE-488 hardware and software for Visual BASIC. Complete example programs and a tutorial provide in-depth coverage of all the advanced features. An interactive test program is included which significantly reduces coding time.

Control IEEE-488 instruments from Windows using Visual BASIC, C, Turbo C++, or Turbo Pascal for Windows

Writing a Windows application using the Windows Dynamic Link Library (DLL) provided by CEC is easy. You simply write the program using our

- Supports Windows 95 and NT
- Included with all IEEE-488 interface boards
- Runs with all popular languages and operating systems

SOFTWARE ANALYSIS

The SA-488 Software Analyzer tracks down hard-to-find programming errors, bus time-outs, and bad data.

The SA-488 Software Analyzer is a memory-resident pop-up program that stores and displays IEEE-488 function call history, data and bus status conditions. It lets you set breakpoints on any IEEE-488 function and monitors the number of times a function is called. You can break on an instruction before or after it executes to determine exactly what is happening on the bus at any point in your program. In addition to instruction, you can also set breakpoints on status conditions and serial poll values.

The SA-488 Software Analyzer imposes no speed penalty on your programs, so that what you see with the analyzer is what you see under real-time conditions.

The **Software Analyzer** displays function names, the current active talk and listen addresses, data that was transferred on the bus and bus status in a convenient pop-up screen. The pop-up screen lets you jump quickly to the top or bottom of the history log, page up or down or scroll through the entire function list. You can also write the complete history to a file for later analysis.

standard IEEE-488 functions. When the program is written, you link it using the DLL and the program is ready to run under Windows.

Developers can include our Windows DLL with any application that uses CEC's IEEE-488 interface boards.

All IEEE-488 functions are supported under Windows. The benefits of dynamic data exchange make graphing, analysis, and access to '488 data easier and better than ever before. Advanced commands allow you to transfer large arrays using direct memory access, set timeouts, handle multiple CEC 488 cards, or handle nonstandard message terminators.

ORDERING INFORMATION

SI-488 Software for IEEE-488 interfacing, including firmware, example utilities, and technical reference, on 3.5" diskettes (included with Models **HI-PC488** or **HI-488EX** interface boards).



IET LABS, INC.

534 Main Street, Westbury, NY 11590

www.ietlabs.com

TEL: (516) 334-5959 • (800) 899-8438 • FAX: (516) 334-5988

