ProTrack I
Model: M-10

Operator's Guide

HUNTRON

HUNTRON INSTRUMENTS, INC.

ProTrack I
Model: M-10

OPERATOR'S GUIDE

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HUNTRON INSTRUMENTS, INC.

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CONTACTING HUNTRON

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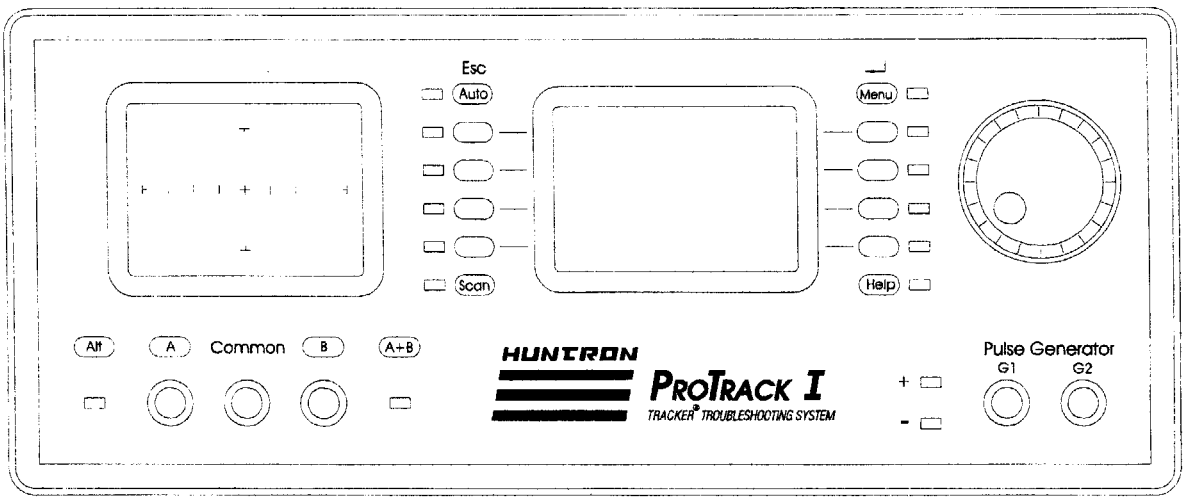


Figure 1-1. Huntron ProTrack I.

1-1. INTRODUCTION

Welcome to the ProTrack I operator's guide. The ProTrack I model 10 is a modified curve tracer designed to allow nondestructive viewing of the quality of electronic components. In simple terms, a known stimulus is injected at two points, either in or out of circuit. The device, or devices between the two injection points react to this stimulus. The resultant voltage and current (V/I) characteristic is displayed on the ProTrack CRT (Cathode Ray Tube). Voltage produces a horizontal deflection of the electron beam and current flow causes a vertical deflection. If the material between the injection points is degraded or defective the V/I characteristic will differ from a device that has no degradation.

1-2. IMPORTANT NOTE

The ProTrack I Model 10 LCD screen may be dim when first powered up and darken as the unit reaches operating temperature. This effect is magnified by temperature extremes. Compensating for this effect may require frequent adjustment of the **LCDConβ** control until the ProTrack temperature stabilizes.

IMPORTANT: The MENU1 screen displays a **Calibrate** selection. Do not enter or tamper with this selection item. This menu item contains no "user settable options" and requires a factory adjustment if disturbed.

Notes:

SECTION 2
PROTRACK OPERATING INSTRUCTIONS
Model 10

2-1. Introduction

The Huntron ProTrack I, shown in Figure 2-1, is a versatile troubleshooting tool having the following features:

- Backlit Graphic LCD with contrast control
- LED indicators for currently active functions
- Over 6,000 possible ranges (V_S x R_S x F_S)
- 100 storable user defined ranges
- 40 frequencies
- Dual channel capability for easy comparison
- Large CRT display
- Displays two signatures simultaneously on the CRT
- FLASH memory for storing user configurations
- Electronic circuit protection from overvoltage
- Encoder knob for quick access of user defined options

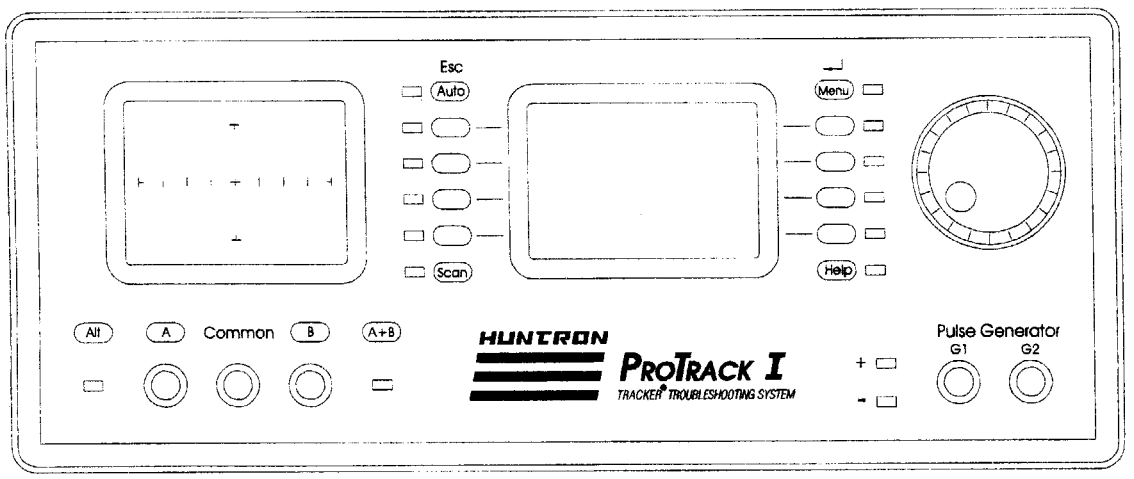


Figure 2-1. Huntron ProTrack I.

2-2. SPECIFICATIONS

The specifications for the ProTrack I are listed in Table 2-1.

Table 2-1
ProTrack I Specifications

ELECTRICAL

Test Signal:
Sine wave

Open Circuit Voltage (V_S):
24 peak voltage selections:
200 mV, 400 mV, 600 mV, 800 mV
1 Volt to 20 Volts in 1 Volt steps
including 10V (LOW), 15V (MED1), 20V (MED2)

Source Resistance (R_S):
13 resistance selections:
10 Ω, 20 Ω, 50 Ω, 100 Ω, 200 Ω, 500 Ω
1 kΩ, 2 kΩ, 5 kΩ, 10 kΩ, 20 kΩ, 50 kΩ, 100 kΩ
plus
54 Ω (LOW), 1.24 kΩ (MED1), 26.7 kΩ (MED2)

Note: short circuit current is V_s divided by R_s

maximum	10 V / 50 Ω = 200 mApk
minimum	200 mV / 100 kΩ = 2 mApk

Frequency (F_S):

40 frequency selections:
20 Hz to 190 Hz in 10 Hz steps
200 Hz to 1.9 kHz in 100 Hz steps
2k Hz to 5 kHz in 1 kHz steps

Channels:

Number	2
Display modes	A, B, Alternating, A+B
Overvoltage Protection	Electronic

Table 2-1 (cont)
ProTrack I Specifications

ELECTRICAL (continued):

Pulse Generator:

Level	0 to ±10 Volts
Width (pulse mode)	2% to 50% duty cycle
Source resistance	100 Ω
Short circuit current	100 mA max.

Displays:

CRT	monochrome, 2.8" (7 cm) diagonal
LCD	full graphic, 128 x 64 pixels

Power Requirements:

Line Voltage	90 V AC to 250 V AC
Frequency	47 Hz to 63 Hz
Power	35 Watts

GENERAL

Dimensions	11.6" W x 4.5" H x 15" D (30 cm W x 11.5 cm H x 38 cm D)
Weight	13 lb.
Temperature	
Operating	0°C to +50°C (32°F to 122°F)
Storage	-20°C to +60°C (-4°F to 140°F)
Humidity	0 to 70% R.H.

2-3. SAFETY CONSIDERATIONS

This manual contains information, cautions and warnings the user must follow to ensure safe operations, and to keep the instrument in safe condition.

WARNING

A warning denotes a hazard. It calls attention to a procedure or practice which, if not correctly performed or adhered to, could result in personal injury.

CAUTION

A caution also denotes a hazard. It calls attention to a procedure or practice which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the instrument.

2-4. UNPACKING YOUR INSTRUMENT

Your instrument was shipped with the following items:

Huntron Part #	Description	Qty.
98-0249	Huntron Microprobes MP20	1 pair
98-0043	Ground Clip	2
98-0036	Blue Clip Leads	2

Check the shipment carefully and contact the place of purchase if anything is missing or damaged in shipment. If shipment is necessary, please use the original shipping carton and packing foam. If these are not available, be sure that the instrument is packed in a box with a minimum of two inches (5 cm) of cushioning material on all sides

2-5. GENERAL OPERATION

Components are tested by the ProTrack I using a two terminal system (three terminal system when the built-in pulse generator is used), where two leads are placed on the leads of the component under test. The ProTrack I tests components in-circuit, even when there are several components in parallel.

The ProTrack I is only intended for use on boards and systems with all voltage sourced in a power-off condition. Electronic protection is connected in series with the channel A and B test terminals. Accidental contact of the test leads to active voltage sources (e.g. line voltage, powered-up boards or systems, charged high voltage capacitors, etc.), may cause circuit protection to trip. A tripped circuit protector is indicated by channel A and / or B indicator LED flashing rapidly in unison accompanied by an OVERVOLTAGE message on the LCD screen.

When this condition occurs, press one of the channel selection buttons. This will reset the electronic circuit protection.

CAUTION

The device to be tested must have all power turned off, and have all high voltage capacitors discharged before connecting the ProTrack I to the device.

The line fuse should only open when there is an internal failure inside the instrument. Therefore the problem should always be located and corrected before replacing this fuse.

2-6. PHYSICAL FEATURES

Before you begin to use the ProTrack I, please take a few minutes to familiarize yourself with the instrument. All of the externally accessible features are discussed in Sections 2-7 and 2-8.

2-7. FRONT PANEL

The front panel of the ProTrack I is designed to ease access to its many features. All push buttons are momentary action and have LED indicators to show which functions are active. Refer to Figure 2-2 and Table 2-2 for a detailed description of each item on the front panel.

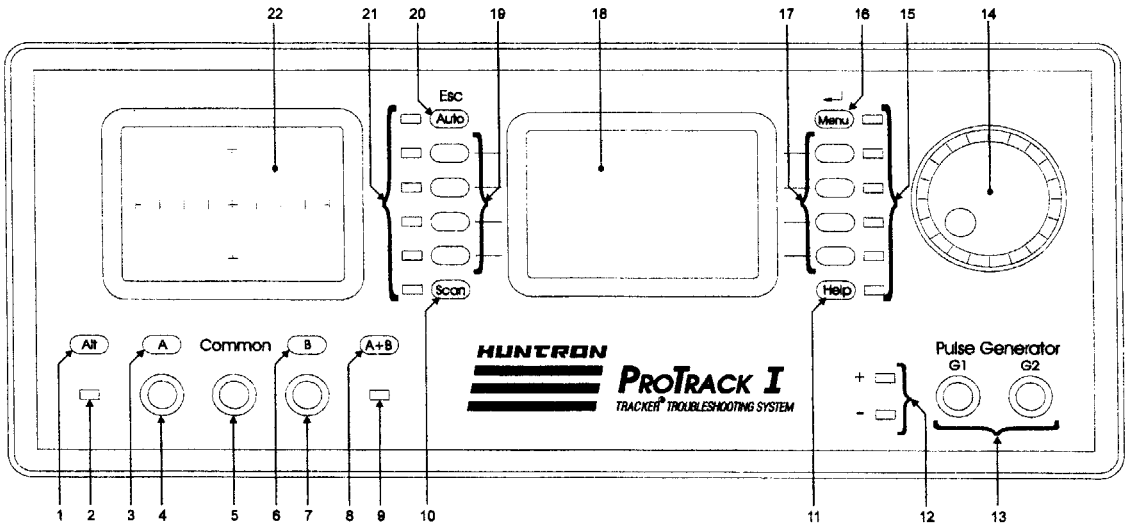


Figure 2-2. Front Panel.

Table 2-2
Front Panel Controls and Connections

Item No.	Name	Function
1	ALT Button	Causes the ProTrack I to alternate between channel A and channel B at a speed determined by setting the Rate (LCD menu item).
2	Channel A LED	Channel A is being displayed when lit.
3	Channel A Button	Selects channel A for output.
4	Channel A Test Terminal	Protected test lead connector that is displayed when channel A is selected.
5	Common Test Terminal	Test lead connector that is instrument common and the common reference point for both channel A and channel B.
6	Channel B Button	Selects channel B for output.
7	Channel B Test Terminal	Protected test lead connector that is displayed when channel B is selected.
8	A+B Button	Displays both channel A and B on the CRT at the same time.
9	Channel B LED	Channel B is being displayed when lit.
10	Scan Button	Scans through specified ranges.
11	Help Button	Provides on screen help.
12	Pulse Generator Polarity LEDs	Indicates the polarity settings for the Pulse Generator.
13	G1 & G2 Terminals	Pulse Generator outputs.
14	Encoder Knob	Knob used for scrolling through LCD menu items.
15	Active Item LEDs	LEDs used to indicate the active items.
16	Menu Button	Displays menu.
17	Selection Buttons	Buttons used to select LCD menu items.
18	LCD Display	Displays the ProTrack I menus and Help.
19	Selection Buttons	Buttons used to select LCD menu items.
20	ESC/Auto Button	To leave a screen or discard changes / Auto scan
21	Active Item LEDs	LEDs used to indicate the active item.
22	CRT Display	Displays the component signatures produced by the ProTrack I.

2-8. BACK PANEL

Secondary controls and connectors are on the back panel. Refer to Figure 2-3 and Table 2-3 for a detailed description of each item on the back panel

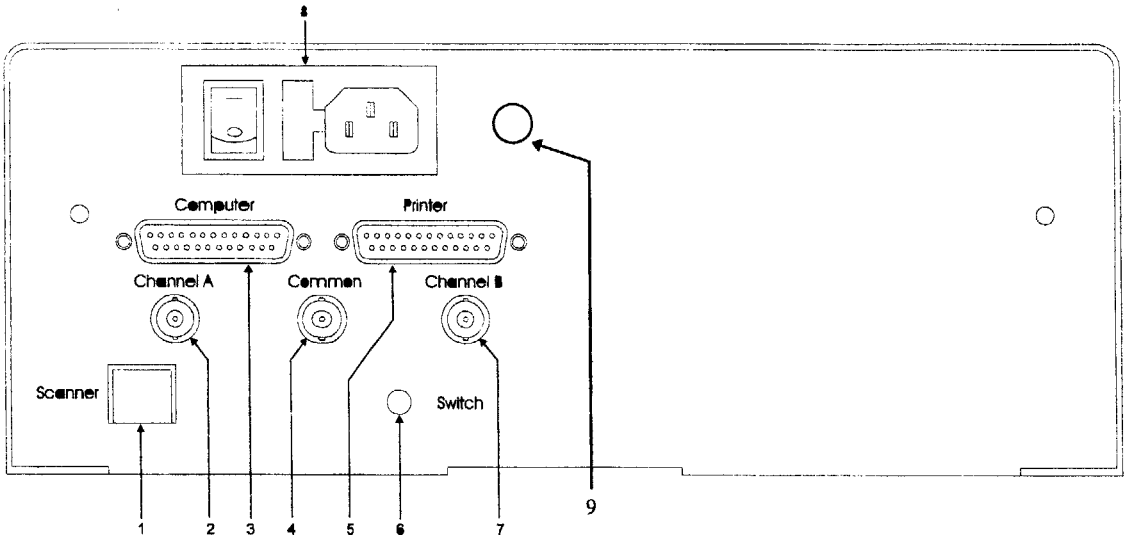


Figure 2-3. Back Panel.

Table 2-3. Back Panel Connections

Item No.	Name	Function
1	Scanner Connector	Control interface to Scanner.
2	Channel A BNC *	Channel A connection for accessory.
3	Computer *	High speed parallel PC interface.
4	Common BNC *	Common Connection for accessory.
5	Printer *	Parallel port loop through to PC printer.
6	Foot Switch Connector	Plug for foot switch.
7	Channel B BNC *	Channel B connection for accessory.
8	Power Entry Module	AC power cord connection and power switch.
9	Common Fuse	Common - ground fault protection.

* Available on Model 20 only

2-9. CRT DISPLAY

The CRT displays the signature of the component being tested. The display has a graticule consisting of a horizontal axis which represents voltage, and a vertical axis which represents current. The axis divide the display into four quadrants. Each quadrant displays different portions of the signatures. Quadrant 1 displays positive voltage (+V) and positive current (+I), quadrant 2 displays negative voltage (-V) and positive current (+I), quadrant 3 displays negative voltage (-V) and negative current (-I), and quadrant 4 displays positive voltage (+V) and negative current (-I). See figure 2-4.

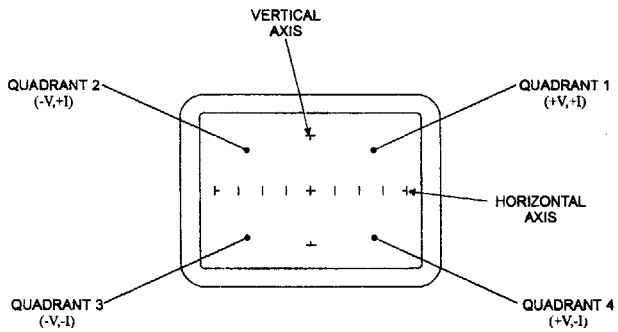


Figure 2-4. CRT Display.

Horizontal Sensitivities (Factory Range Group)
Table 2-3

Range	Volts/Div
HV20	5.0
MED2	5.0
MED1	3.75
LOW	2.5

2-10. INITIAL SETUP

Turn the power on using the power switch on the power entry module. The LCD screen will display the boot screen information showing the firmware version number and the ID number. After the power on diagnostics have been run, the ProTrack will go to the Main Menu, Channel A will be selected, and the first range of the power-up default ranges will be selected.
If the LCD contrast requires adjustment, press the **Menu** button once and then press **Prefs**. Press the **LCDCon** button and rotate the encoder for the desired amount of contrast. Press **Store** and wait for the clock ◴ indicator to disappear. Press **Esc** to return to Menu 1.

Aligning the trace is important in determining which quadrants the portions of a signature are in. From the Menu 1 screen press the **Display** button. This will give you the CRT adjustment menu. Select **Intensity** from the LCD menu screen to adjust the intensity of the CRT to a comfortable viewing level using the **rotary encoder**. Plug the **red probe** into channel **A**. Touch channel A to the black common banana recepticle, now select and adjust the **CRTVert** alignment using the encoder knob until the trace is even within the vertical axis. Remove the channel A probe from common and select **CRTHorz** to adjust the horizontal alignment of the trace using the encoder knob.

Press the **TraceSep** button and adjust the separation between the two channels until you are comfortable with the amount of separation (approximately 1/16 in.). Press **Esc** to bring up Menu 1. Press **Menu** to bring up the Main menu. Press "**A**" to turn off the TraceSep and display one channel. After the CRT has been setup, you should not need to adjust during normal operation.

2-11 MENU SELECTION

The ProTrack I has two primary selection menus, Main menu and menu 1. These are accessed by pressing the Menu button. The Main menu is displaying the factory group of ranges after a power-up. The power-up group is user definable at the Group Edit menu.

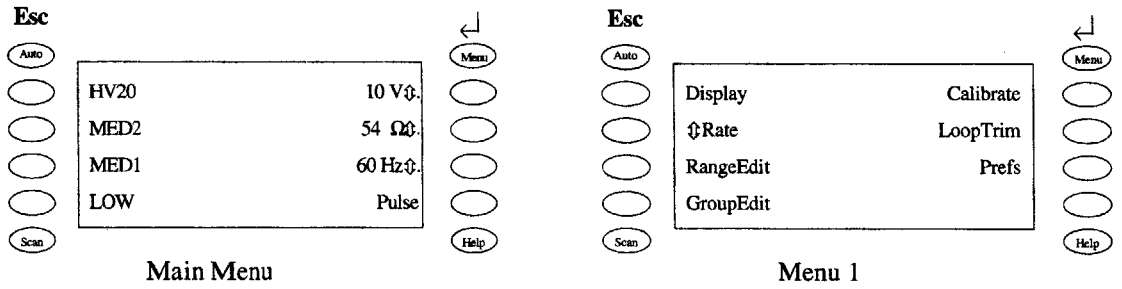


Figure 2-5. Menu Displays

See Appendix B for more menus.

2-12. RANGE AND GROUP SELECTION

The ProTrack I is capable of producing many different ranges, but the user is only able to select one range from one group of 4 ranges at any given time. These ranges are selected by pressing the appropriate button beside the range name on the LCD menu screen after the desired Group has been selected. When a range is selected the yellow LED to the left glows. If a parameter, for example Ω β, is changed, the LED will extinguish. To reset to the default range parameter simply press the range button again.

The Group is selected from the GroupEdit menu. There are six factory preset permanent groups listed in Section 2-15. There are twenty user definable groups that the operator may assemble according to personal preference.

The ProTrack I Model 10 is designed to allow a user quick access to valuable ranges within a group. A group consists of any four ranges. The ProTrack comes with the "Factory" as the default PowerUp group (LOW, MED1, MED2, HV20). When used properly, the range and group settings can be a powerful tool in quickly distinguishing the good, the bad, and the ugly.

2-13. RANGE EDITING

When a good range combination is found it is desirable to store the settings. The ProTrack allows editing and storing of 100 user definable ranges. To define a range go to the Menu1 screen and select **RangeEdit** to access the RangeEdit screen. The screen will show the currently selected range name in square braces and the voltage, resistance, and frequency of the range. In addition to the parameters there are selections **Name** and **Store**, which are used for re-naming the range and storing the name and parameters in non-volatile memory.

To change the currently active range, use the select button next to the range name and the encoder to dial through the selections. After selecting a range, edit the parameters by selecting the range parameter (voltage, resistance, or frequency) and dial a new value with the encoder.

NOTE: If the currently active range is one of the 24 factory default ranges, pressing the select button next to the range will immediately force the currently active range to a user-defined range.

In the Tracker 2000, each range corresponded to only a voltage and resistance change. In contrast, the ProTrack allows a range to be defined by voltage, resistance, and frequency, thus changing ranges will change all three parameters. However, the ProTrack also makes provision for changing a range without changing the frequency parameter (see sub-section below)

Frequency: Defined and Undefined

The frequency is used to enhance or reduce the capacitive and inductive characteristics of a signature. There are 40 defined frequencies to choose from and one additional value, "*-*", that is used to indicate the frequency is not defined. An undefined frequency means that when a range is selected at the Main screen the frequency that the ProTrack is set to will not change. Conversely, if a range is given a defined frequency, then selecting that range will force the ProTrack to change to the defined frequency.

To name a range use the **Name** select button. The screen will then show the range name in square brackets, left and right arrows, a position marker, and **SAVE** selection. Use the rotary encoder to dial in new alpha-numeric characters and the arrow selections to move between positions in the name. When a satisfactory name is entered, use the **SAVE** selection to store the new name (using the **Esc** button will exit and restore the name to its original value).

NOTE: A factory default range cannot be re-programmed or re-named, however, the parameters of a factory range can be altered in RangeEdit for the purpose of determining a good combination of voltage, resistance, and frequency.

2-14. GROUP EDITING

There are 26 groups in the ProTrack I Model 10. Of these 26 groups, 20 of them are user-definable. User-defined groups make accessing your favorite ranges simple. A user-

defined group can be any combination of 4 of the 124 ranges (100 user-defined, 24 factory defaults).

To edit a group use the **GroupEdit** select button from the Menu1 screen. The GroupEdit screen displays the four range selections, the group name (in square braces), the **PowerUp** status, the **Name** selection, and the **Store** selection.

To edit the ranges in a group select the range location you wish to edit then use the rotary encoder to dial a new range. When changing a range, the parameters will be shown at the center-bottom of the LCD.

NOTE: When changing a range in GroupEdit, the parameters are displayed but the tracker signal does not change. Therefore, the displayed values are only the parameters corresponding to the range and have no effect on the currently active range.

After defining a group of ranges use **Name** to change the group name (group naming is like range naming - above). **Name** will not work for the 6 factory default groups. When the naming process is complete use the **SAVE** selection to store the changes (the **Esc** button will discard any changes). Then you may **Store** the group (factory default groups cannot be permanently changed).

NOTE: A factory group may be temporarily modified, however, when the ProTrack is turned off and then back on the factory groups will be reloaded.

An additional feature of the ProTrack I Model 10 is the ability to power up in any of the 26 groups. In the GroupEdit screen the **PowerUp** indicator show a filled square to indicate that the current group is the power up default and a hollow square to indicate that the group is not the power up default. To make a group the power up default, select the group by pressing the button adjacent to the group name and using the rotary encoder to change between groups. Then press the **PowerUp** selection (the indicator square will then be filled showing that the current group is the power up default).

To select the current group use the **GroupEdit** selection from the Menu1 screen. When in the GroupEdit menu, select the button adjacent to the group name and use the rotary encoder to dial in the desired group. Press the ↵ (**Menu**) button to use the current group and return to the Main screen or use **Esc** to exit without changing the current group.

NOTE: If the group is edited while in GroupEdit then the last edited group will become active regardless of whether ↵ or Esc is used to exit.

2-15. FACTORY GROUPS

Huntron has determined that several range and group settings are especially valuable for troubleshooting and therefore has included those groupings as factory default settings. This section shows these settings and explains their intended usage. All of the factory groups and ranges are permanently stored and cannot be permanently altered by a user.

Stealth Group (200 mV)

The "Stealth" group is valuable when a silicon junction needs to be ignored. These ranges can be used to check input impedance of devices without activating the silicon junctions.

Range	Voltage (Vs)	Resistance (Rs)	Frequency (Fs)
ST4	200 mV	100 kΩ	*-* Hz
ST3	200 mV	10 kΩ	*-* Hz
ST2	200 mV	1 kΩ	*-* Hz
ST1	200 mV	10 Ω	*-* Hz

SMT Group (3 V)

Many of our customers are using ICs that operate at 3.3V and below. Huntron deemed it neccessary to add Surface Mount Technology (SMT) ranges for troubleshooting these newer ICs.

Range	Voltage (Vs)	Resistance (Rs)	Frequency (Fs)
SMT4	3 V	100 kΩ	*-* Hz
SMT3	3 V	10 kΩ	*-* Hz
SMT2	3 V	1 kΩ	*-* Hz
SMT1	3 V	20 Ω	*-* Hz

MOS Group (10 V)

The "MOS" group is optimized for troubleshooting Metal Oxide Semiconductors (MOS).

Range	Voltage (Vs)	Resistance (Rs)	Frequency (Fs)
MOS4	10 V	100 kΩ	*-* Hz
MOS3	10 V	10 kΩ	*-* Hz
MOS2	10 V	1 kΩ	*-* Hz
MOS1	10 V	50 Ω	*-* Hz

TTL Group

The "TTL" group is optimized for troubleshooting circuits employing TTL (Transistor-to-Transitor Logic) ICs.

Range	Voltage (Vs)	Resistance (Rs)	Frequency (Fs)
TTL4	20 V	100 kΩ	*-* Hz
TTL3	20 V	20 kΩ	*-* Hz
TTL2	15 V	1 kΩ	*-* Hz

TTL1	10 V	50 Ω	*-* Hz

Caps Group

The "Caps" group is used for checking capacitors. Select a range closest to the capacitance you wish to check and use the frequency control to enhance or retard capacitive effects.

Range	Voltage (Vs)	Resistance (Rs)	Frequency (Fs)
1kuF	2 V	10 Ω	*-* Hz
10uF	10 V	500 Ω	*-* Hz
10nF	15 V	10 kΩ	*-* Hz
1nF	20 V	100 kΩ	*-* Hz

Factory Group

The "Factory" group of ranges is provided for our customers accustomed to the ranges on our 1000/2000 Trackers. LOW, MED1, MED2 are the same as the 1000/2000 ranges. HV20 range replaces the higher voltage HIGH range from the 1000/2000 Trackers.

Range	Voltage (Vs)	Resistance (Rs)	Frequency (Fs)
HV20	20 V	100 kΩ	*-* Hz
MED2	20 V	27.6 kΩ	*-* Hz
MED1	15 V	1.24 kΩ	*-* Hz
LOW	10 V	54 Ω	*-* Hz

2-16. CHANNEL SELECTION

There are two channels on the ProTrack I (channel **A** and channel **B**) which are selected by pressing the appropriate front panel button. When using a single channel, the red probe should be plugged into the corresponding channel test terminal and the black probe should be plugged into the common test terminal. When testing, the red probe should be connected to the positive terminal of a device (i.e. anode, +V, etc.) and the black probe should be connected to the negative terminal of a device (i.e. cathode, ground, etc.). Following this procedure should ensure that the signature appears in the correct quadrants of the CRT display.

The Alternate mode of the ProTrack I is provided to automatically switch back and forth between channel A and channel B. This allows easy comparison between two devices or the same points on two circuit boards. The Alternate mode is selected by pressing the **Alt** button on the front panel, and the alternation frequency is varied by the control **RATE** (Menu 1 selection). One of the most useful features of the ProTrack I is using the Alternate mode to compare a known good device with the same type of device that is of unknown quality.

The ProTrack I also allows the user to view both channel A and channel B at the same time by using the A+B feature. By selecting **A+B** from the front panel, the user will be able to view both channel A and channel B on the CRT.

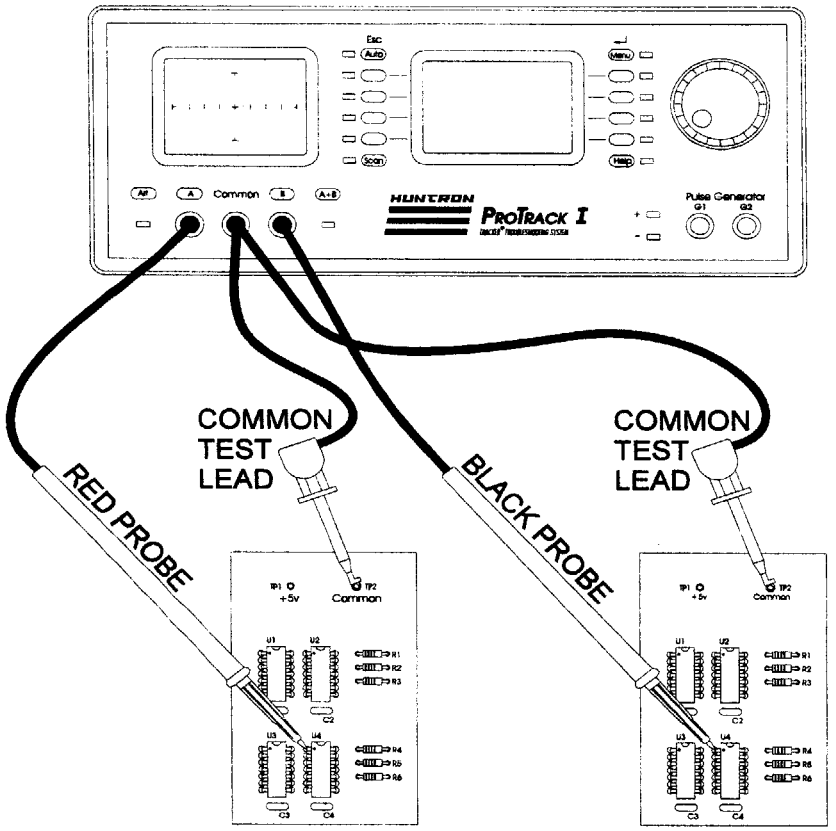


Figure 2-6. Alternate and A+B Mode Setup

2-17. FREQUENCY SELECTION

The ProTrack I has 40 test signal frequencies: 20 Hz to 190 Hz in 10 Hz steps, 200 Hz to 1.9k Hz in 100 Hz steps, and 2k Hz to 5k Hz in 1kHz steps. These frequencies are selected by using the encoder knob after pressing the Hzβ button.

2-18. PULSE GENERATOR

The built-in pulse generator of the ProTrack I allows dynamic, in-circuit testing of certain devices in their active mode. In addition to using the red and black probes, the output of the pulse generator is connected to the control input of the device to be tested with one of the blue micro clips provided. The pulse generator has two outputs (G1 and G2) so that three terminal devices can also be tested in the Alternate mode or the A+B mode. The figure 2-7 demonstrates how to connect the ProTrack I in either the Alternate or A+B mode using the pulse generator.

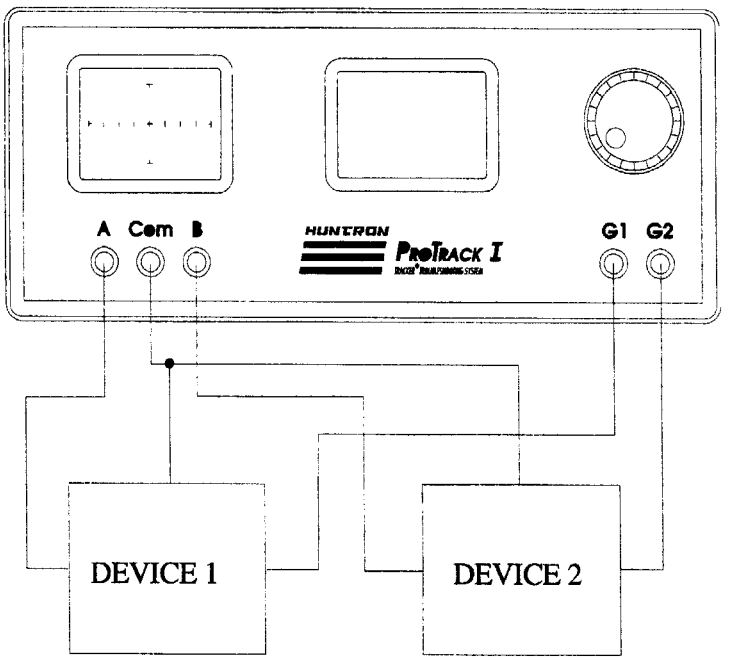


Figure 2-7. Pulse Generator Comparison Mode.

SECTION 3
BASIC PROTRACK THEORY

3-1. INTRODUCTION

The ProTrack I is an electronic troubleshooting instrument that can visually display the health of an electronic component or circuit. It is always used with the circuit being tested in a power-off condition. The term used for this type of troubleshooting is Analog Signature Analysis or **ASA**. The analog signature is the current vs. voltage pattern generated on the instrument CRT when an AC sine wave is applied to an electronic component or circuit.

CAUTION

The device to be tested must have all power turned off, and have all high voltage capacitors discharged before connecting the ProTrack to the device.

The ProTrack outputs a sine wave (AC) stimulus to an electronic component or component group and displays the resulting current flow, voltage drop and phase difference in that circuit. The display shows the simultaneous result of the voltage across the circuit under examination and the induced current through it. Since the induced current is a function of the impedance of the circuit, the ProTrack display can be thought of as a visual representation of Ohm's Law (E=IR) where E = voltage, I = current, and R = resistance. In the following text, voltage will be referred to as V.

3-2. PROTRACK RANGES

The ProTrack can output various AC (Alternating Current) sine wave signals to the test probes. These are called "Ranges", and are accessed by the selection buttons adjacent to the LCD on the ProTrack front panel. Each sine wave generated by the ProTrack has three operator-controlled variable factors. The variable factors allow the technician to focus on a specific component family (e.g., capacitors, TTL logic, CMOS, surface mount, etc.) and also screen out unwanted portions of a composite signature (e.g., caps across diodes in power supplies, semiconductor manufacturing differences).

Table 3-1 is a break-out of the three sine wave variables available at the probes.

PROTRACK RANGE VARIABLES

Table 3-1

V_s	R_s	F_s
200 mV to 800 mV in 200 mV steps 1 V to 20 V in 1 Volt steps	10, 20, 100, 200, 1k, 2k, 10k, 100k	20 to 190 Hz in 10 Hz steps 200 to 1.9 kHz in 100 Hz steps 2k Hz to 5 kHz in 1 kHz steps

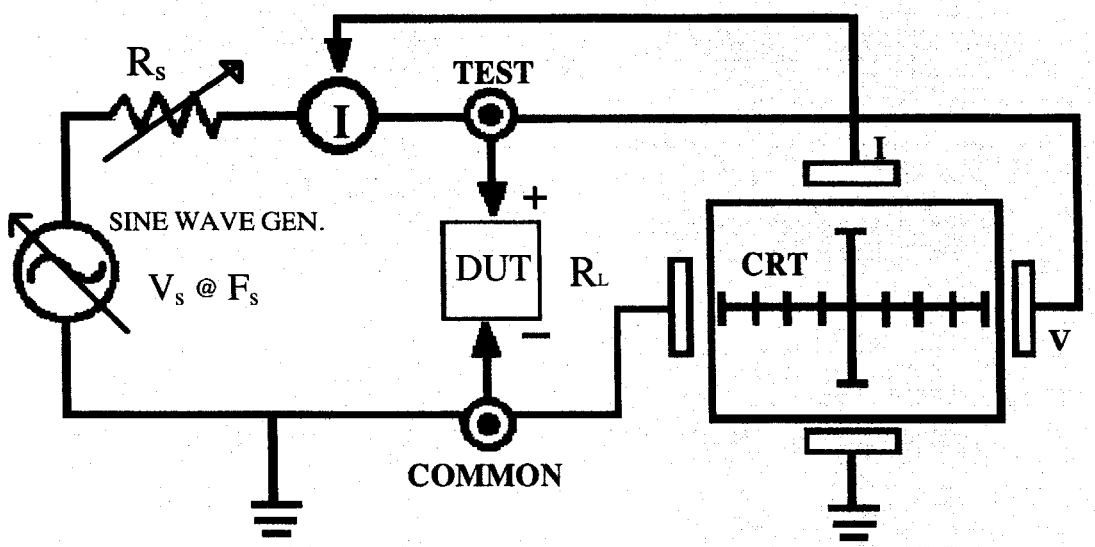
$\mathbf{V_s}$ = Source Voltage, $\mathbf{R_s}$ = Source Resistance, $\mathbf{F_s}$ = Source Frequency

Each output range will have three factors: source voltage (V_s), source frequency (F_s) and source resistance (R_s). The goal is to generate the sine wave (range) that will display the desired

information by changing the proper variable. The R_s or ProTrack internal resistance is used to enhance or disregard the impedance (resistance) of the device or fault to be viewed. The F_s or frequency of the ProTrack sine wave is used to enhance or disregard the reactive factor (capacitance or inductance) of a component. The V_s or voltage amplitude of the ProTrack sine wave is used to enhance or disregard semiconductor switching and avalanche characteristics.

ProTrack Operational Theory

Figure 3-1. ProTrack I Display Block Diagram.



R_s = Source Resistance, **V_s** = Source Voltage, **R_L** = Load Resistance, **F_s** = Source Frequency, **DUT** = Device Under Test

3-3. DISPLAY CIRCUIT

Understanding the display circuit is the key to understanding how the ProTrack reacts to different kinds of circuit components. Figure 3-1 shows a block diagram of the ProTrack display circuit. It is drawn as a voltage divider. The load impedance (R_L) is the impedance of the device under test (DUT). This impedance is in series with the internal, or source impedance R_s of the ProTrack. Because R_s is constant, both the voltage across the load, and the amount of current through it is a function solely of R_L.

The voltage across the DUT controls the amount of horizontal movement of the display. When the DUT is removed, creating an open circuit, the voltage at the probe leads is maximum and thus the horizontal line is at maximum.

When the sine wave is positive, the trace is on the right hand side of the display. When the sine wave is negative, the trace is in the left hand side of the display. When it is at 0V, the trace is in the middle.

The horizontal axis is divided by small graticule lines like an oscilloscope. Each mark is approximately 1/4 of the peak voltage. In LOW Range (Factory Group), for example, since V_s =

The horizontal axis is divided by small graticule lines like an oscilloscope. Each mark is approximately 1/4 of the peak voltage. In LOW Range (Factory Group), for example, since V_s = 10 V Peak, each division is approximately 2.5 V. You can use these graticule marks to get a rough estimate of the amount of voltage that is being dropped across the R_L.

The amount of vertical deflection is controlled by the voltage dropped across the internal impedance R_s of the ProTrack. Because R_s is in series with the load, this voltage will be proportional to the current flowing through R_L.

When the R_L is a short (0 Ω) there is no voltage dropped across R_L, so there is no horizontal component to the display. All the voltage is dropped across R_s, so the trace is a vertical line on the display.

3-4. "FACTORY" DEFAULT RANGE GROUP

The ProTrack Firmware is set up so that the ranges are arranged in fixed and user selectable groups, with four ranges per group. The ProTrack has four permanent default ranges that are under the group named "Factory". These are shown in Table 3-2. They are the same as the three lowest ranges available on the Model 2000 Tracker. The LOW and MED2 are the same Vs as the LOW and MEDIUM on the Model 1000. The model *1000/2000 High Range* is not present. *The High Range can be simulated at a 20 Vs value with 100kΩ of Rs and placed above the MED2 range in the factory group.*

FACTORY GROUP (MODEL 2000) DEFAULT RANGES

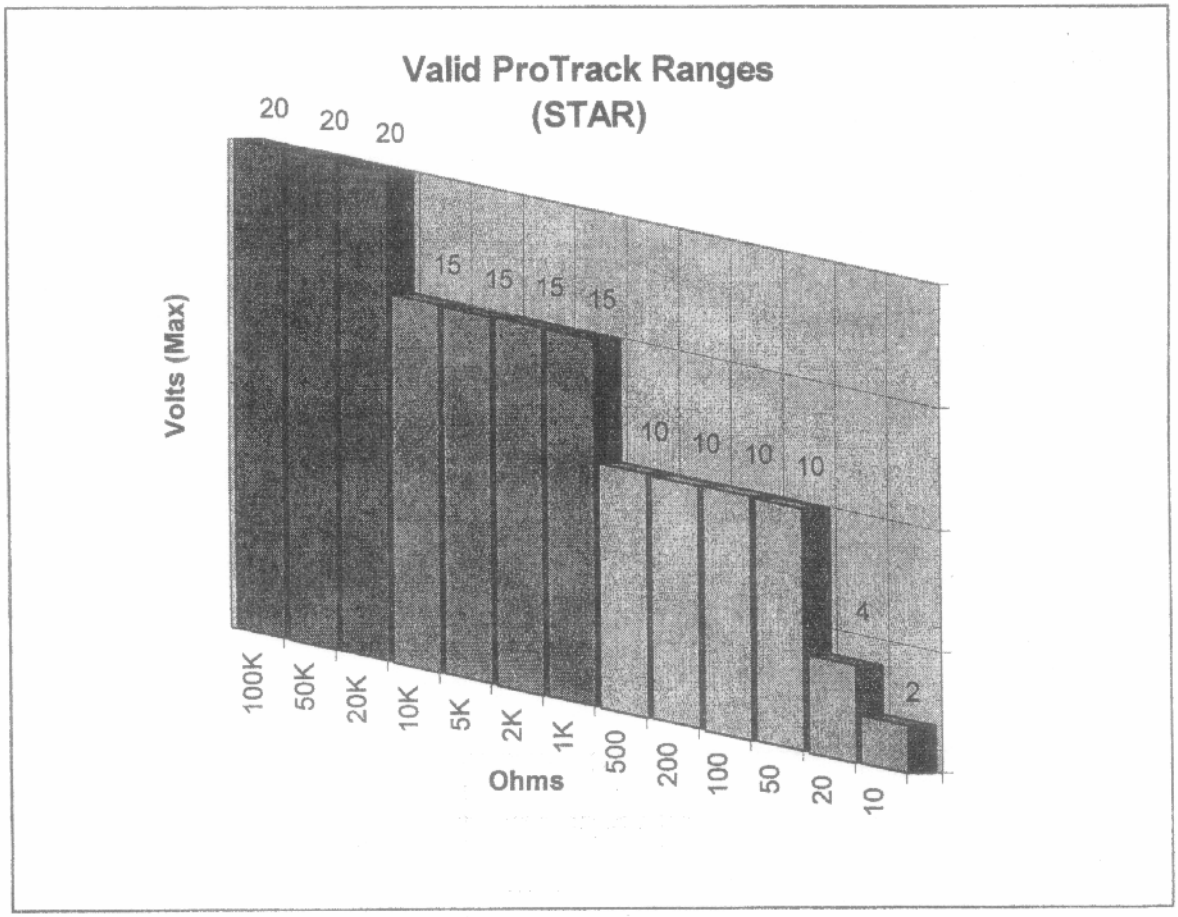
Table 3-2.

RANGE	SINE WAVE V_s	R_s
HV20	20 V	100 kΩ
MEDium 2	20 V	27.6 kΩ
MEDium 1	15 V	1.24 kΩ
LOW	10 V	54 Ω

3-5. S.T.A.R. AND MAXV

Two advanced features of the ProTrack are the Smart Tracker Active Range feature or (**S.T.A.R.**- Table 3-3) and the **MaxV** selection. These features protect components from extreme range settings (e.g., 20 Volts at 10 ohms). The S.T.A.R. settings were adopted from previous Tracker ranges that have proved safe over the last two decades. The MaxV setting is user definable in the Preferences screen (accessed from Menu 1 screen). When the MaxV is set to limit voltage, a limited range will be displayed with a tilde character in front of the range name (e.g., ~HV20, indicates that HV20 range is modified from it's programmed voltage to the MaxV setting).

Table 3-3



3-6. POSSIBLE PROTRACK RANGES

With the ability to change any of the three range variables, the possible number of ranges will be over 6000.

POSSIBLE PROTRACK RANGES

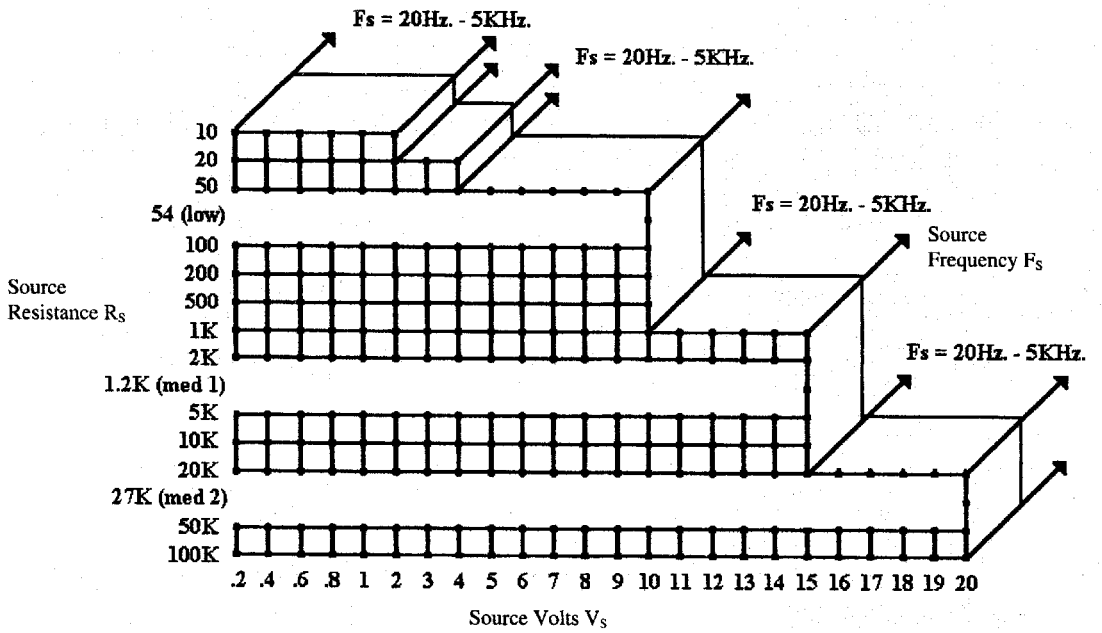


Table 3-4

In Table 3-4 the ProTrack source resistance (R_s) is on the vertical axis, the source voltage (V_s) is on the horizontal axis, and the 40 available source frequencies are on the Z axis. The LOW, MED1 and MED2 represent the traditional Model 2000 Tracker ranges. Next we will determine what effect each variable factor has on the basic component types.

3-7. HORIZONTAL AXIS

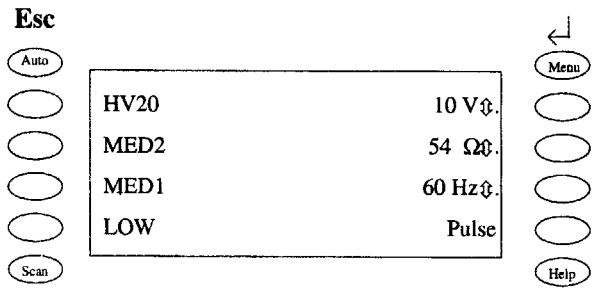


Fig. 3-2 Main Menu

1. **Turn on** the ProTrack and **observe the display**. The first LCD screen gives the firmware level. After a short moment the firmware screen will clear itself and the screen in Fig. 3-2 will appear. To adjust the LCD level push **Menu, Prefs, LCDCon** and adjust the **Rotary Encoder** until satisfactory.

Push **Store, Esc** and then **Menu** and you should see the screen in Fig. 3-2.

2. You will see a horizontal line in the middle of the CRT screen. This displays maximum voltage.

3-8. VERTICAL AXIS

1. **Connect** the red microprobe to the "**A**" jack on the ProTrack and the black microprobe to the **Common** jack.

2. **Touch** the **probes together** and **observe** the CRT.

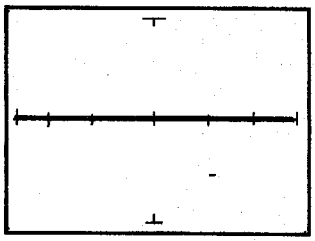
3. You will see a vertical trace in the middle of the CRT screen. This displays maximum current.

3-9 OPEN AND SHORT

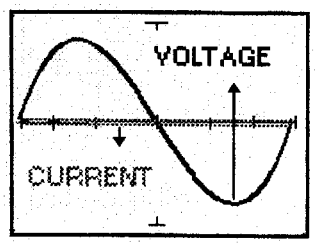
The two simplest ASA signatures are the open and the short. In figure 3-3 the screen on the left represents the ProTrack CRT and the screen on the right is an equivalent display of the sine wave showing current and voltage.

OPEN AND SHORT INDICATION
Figure 3-3.

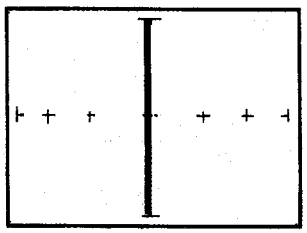
OPEN



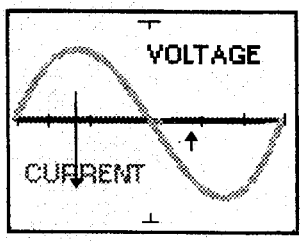
- **MAXIMUM VOLTAGE**
- **MINIMUM CURRENT**



SHORT



- **MAXIMUM CURRENT**
- **MINIMUM VOLTAGE**

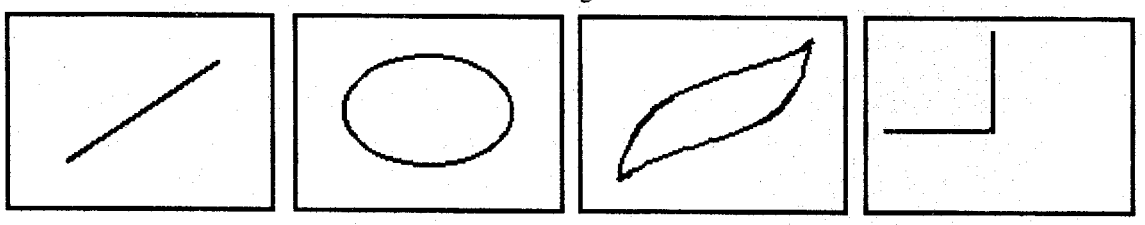


3-10. FOUR BASIC COMPONENT SIGNATURES

There are only four basic electronic properties that the ProTrack displays: resistance, capacitance, inductance and semi-conductance. Each of these behaves differently as the sine wave is applied, so each shows a different waveform on the display. Because of the unique display created by each of the different electronic properties, these displays are referred to as signatures. Multi-component circuits have signatures that are composites of the elements in that circuit. All signatures will be one of the four or a composite made up of two or more of the four. For example, a circuit with both resistance and capacitance will have a signature that mixes the characteristic signatures of resistance and capacitance. Resistance is always indicated by an angle. Capacitance will be a circle or ellipse pattern. Inductance will also be a circle or ellipse, probably distorted by internal resistance or inductive action. Last , there is the diode junction (semi-conductor) that forms an angle.

FOUR BASIC ASA SIGNATURES

Figure 3-3.



RESISTOR CAPACITOR INDUCTOR SEMI-CONDUCTOR

Notes:

APPENDIX A
Good and Bad Signatures

The following signatures are from actual good and faulty electronic components. These were generated on a Huntron Tracker Model 5100DS at a frequency of 200 Hz. The "good signature" is above the "bad signature". The signatures were arranged so that the differences can be easily seen.

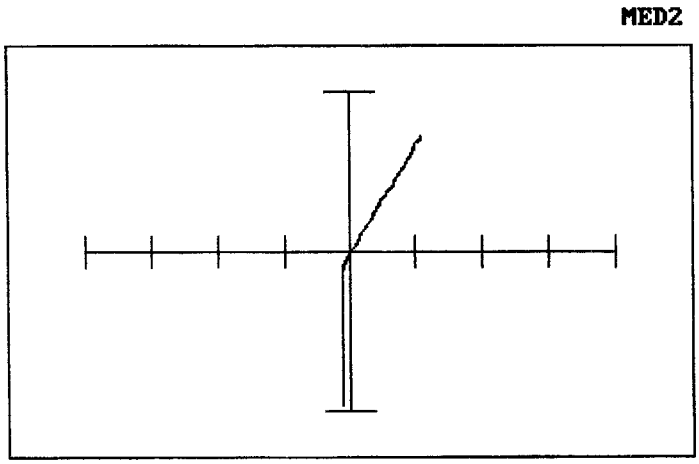


Figure A-1. Good Bus Signature with 10k Pull-up Resistor.

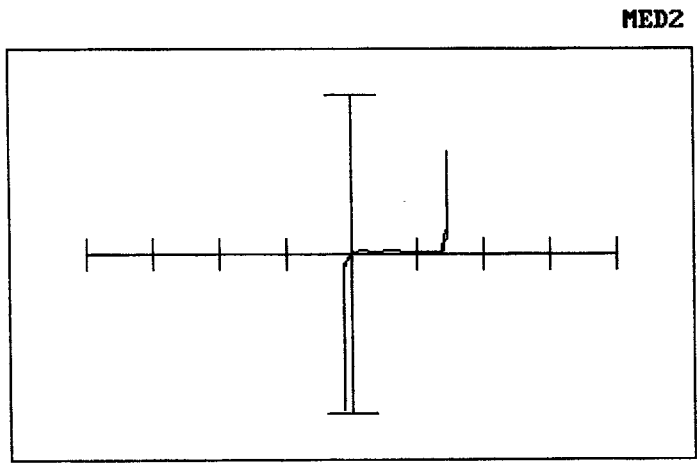


Figure A-2. Bad Bus Signature with an Open 10k Pull-up Resistor.

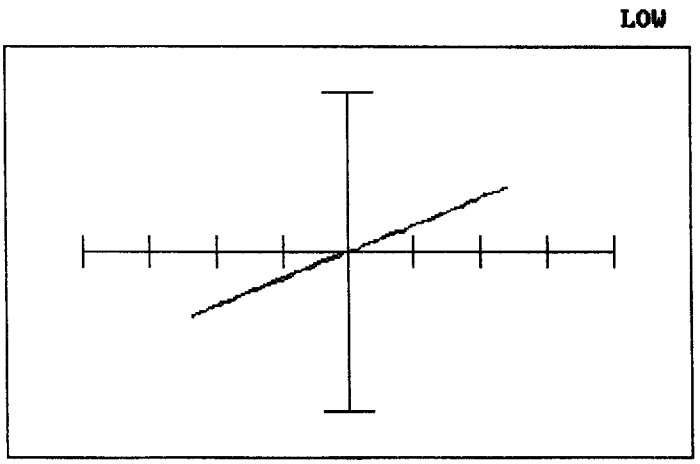


Figure A-3. Good Potentiometer

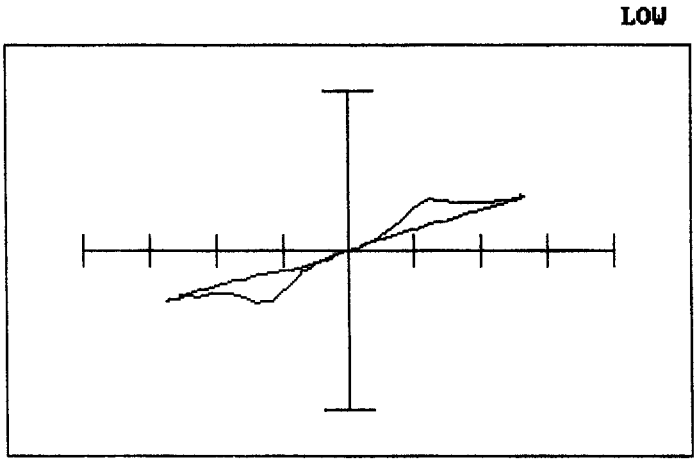


Figure A-4. Bad Potentiometer, Noisy.

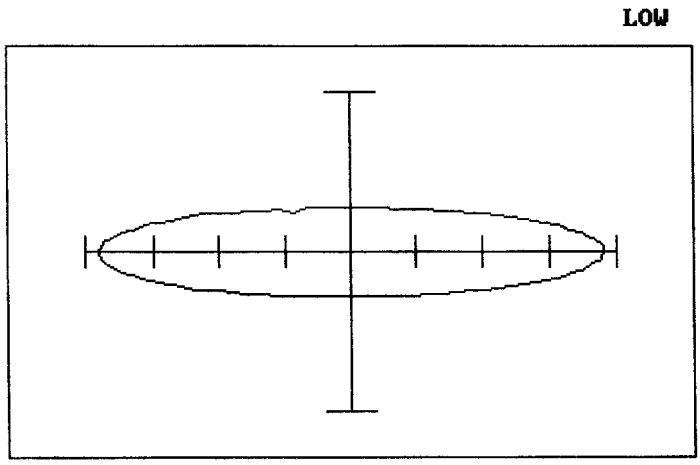


Figure A-5. Good 4.7μF Capacitor.

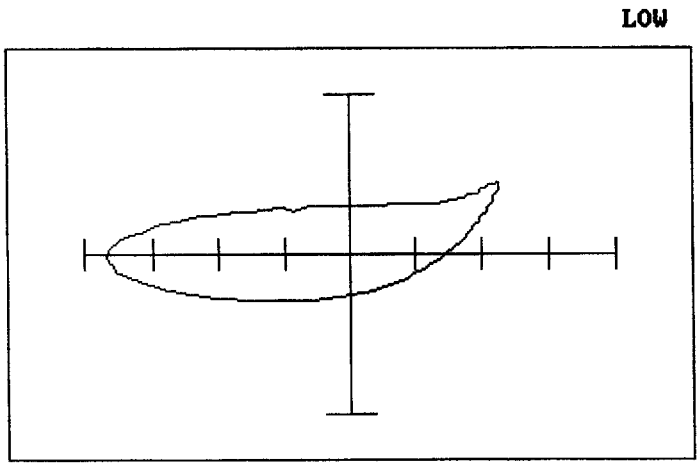


Figure A-6. Bad 4.7μF Capacitor, Electrolytic Abnormality.

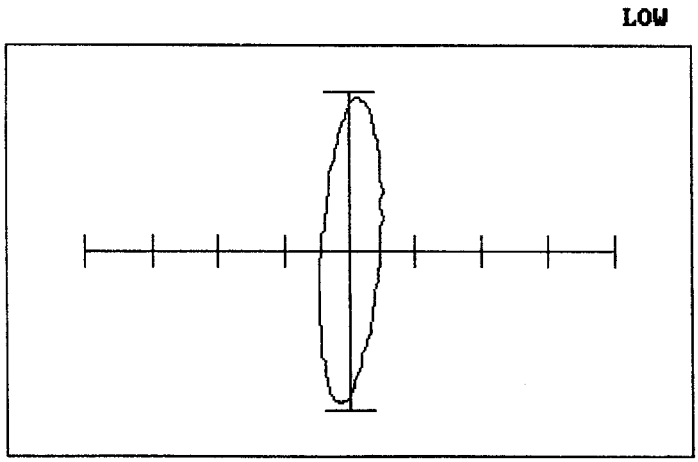


Figure A-7. Good 68µF Capacitor.

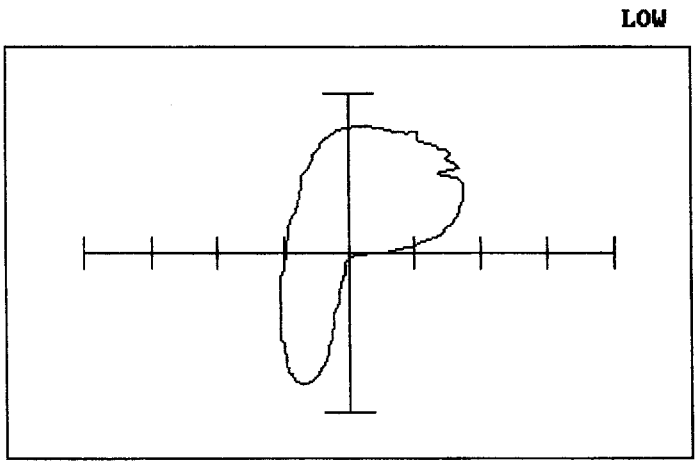


Figure A-8. Bad 68µF Capacitor, Breakdown with Current.

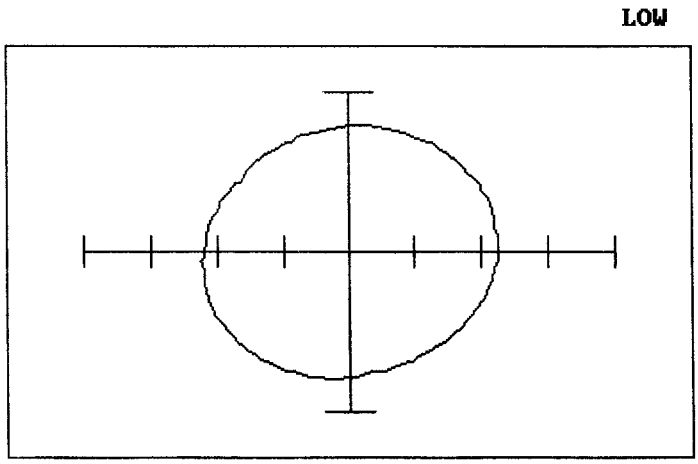


Figure A-9. Good 22μF Capacitor.

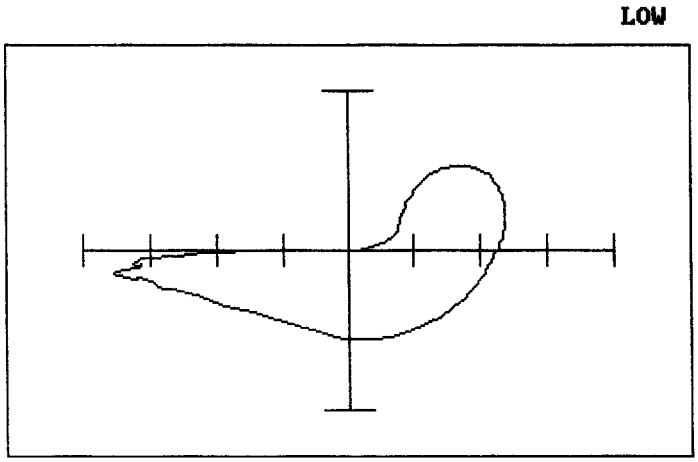


Figure A-10. Bad 22μF Capacitor.

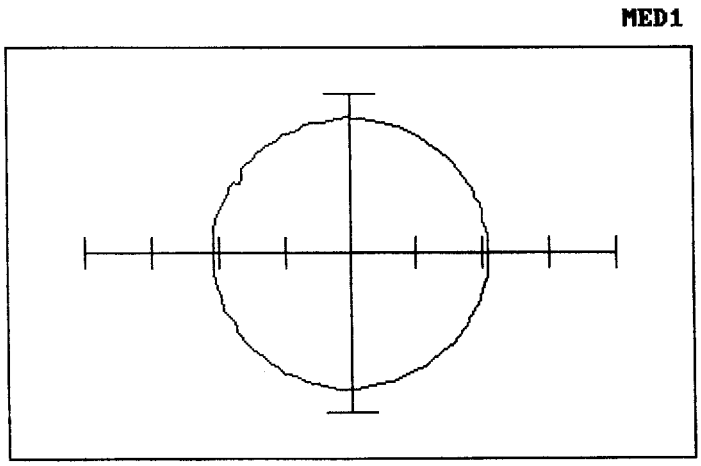


Figure A-11. Good 1µ Capacitor.

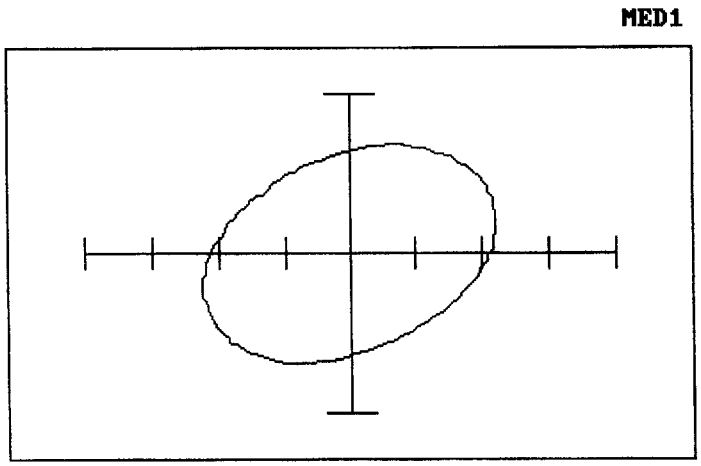


Figure A-12. Bad 1µF Capacitor, Leakage.

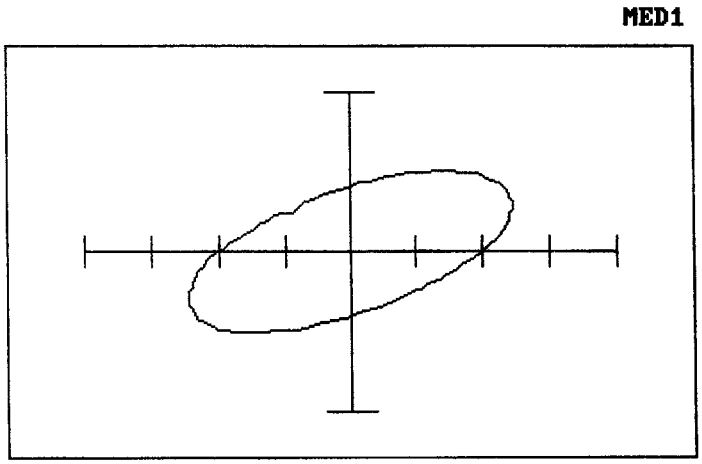


Figure A-13. Bad 1μF Capacitor.

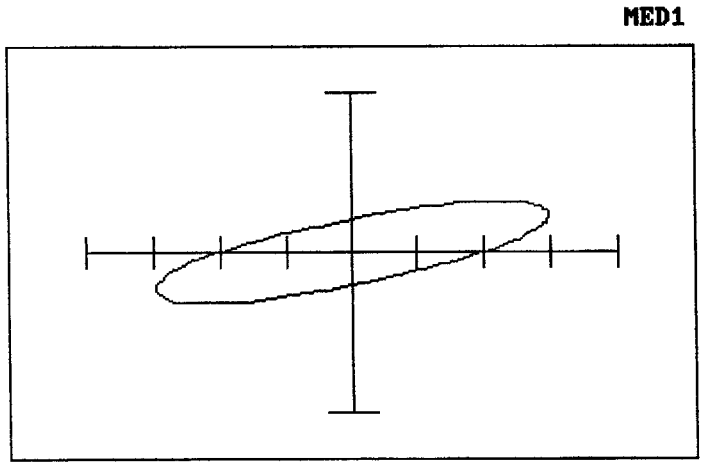


Figure A-14. Bad 1μF Capacitor.

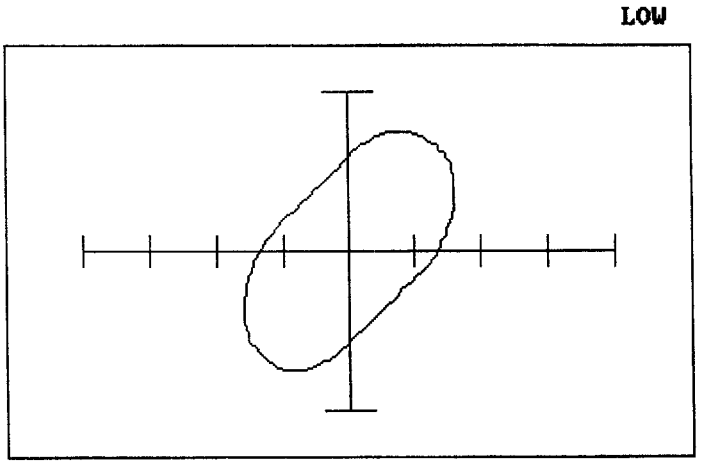


Figure A-15. Good 9.5mH Coil.

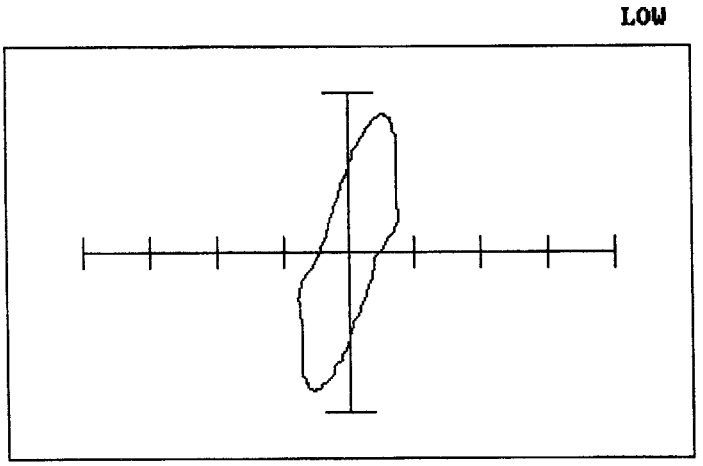


Figure A-16. Bad 9.5mH Coil, Damaged Core.

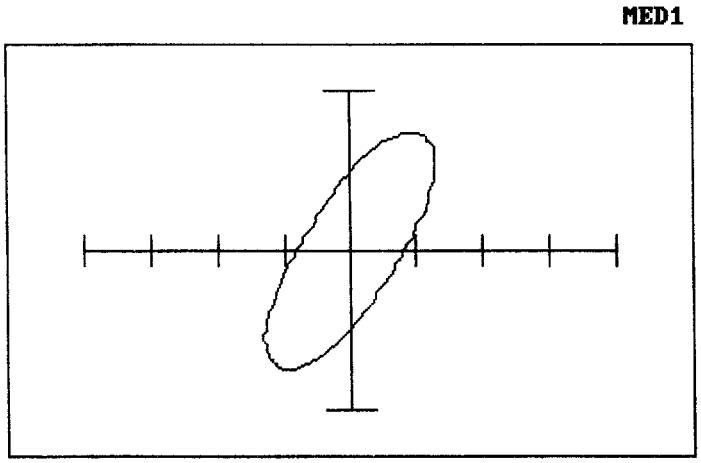


Figure A-17. Good 243mH Inductor.

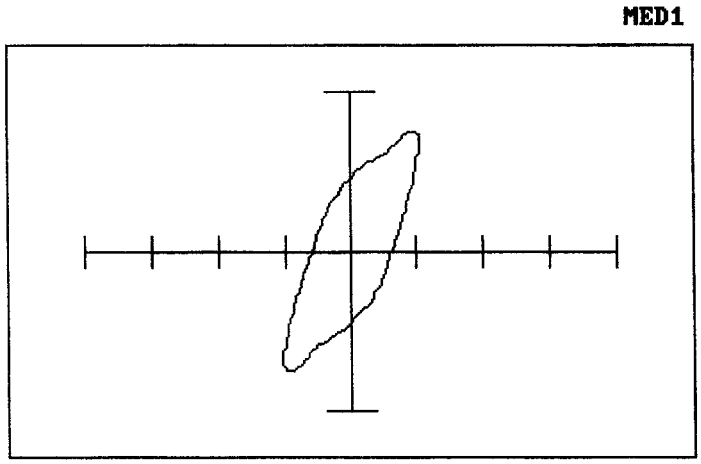


Figure A-18. Bad 243mH Inductor, Shorted Windings.

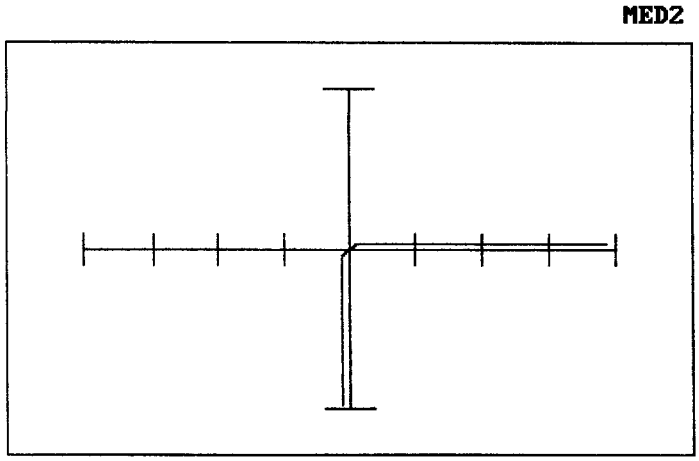


Figure A-19. Good Diode.

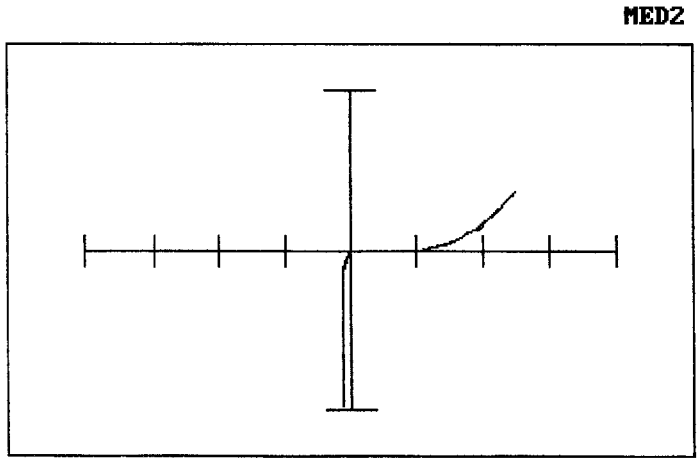


Figure A-20. Bad Diode, Leakage in the Reverse Bias Region.

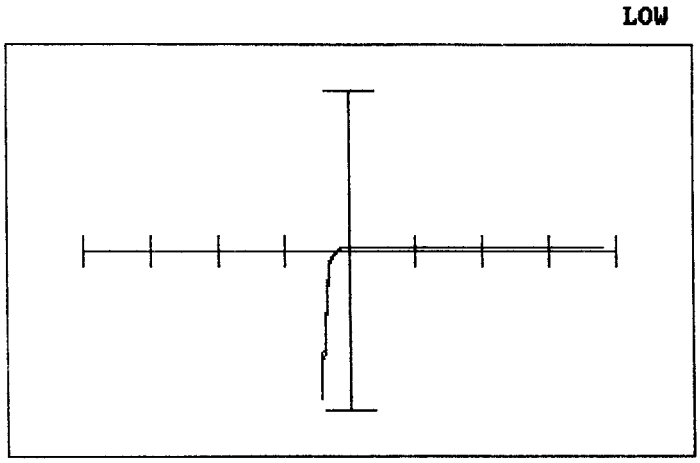


Figure A-21. Good Diode.

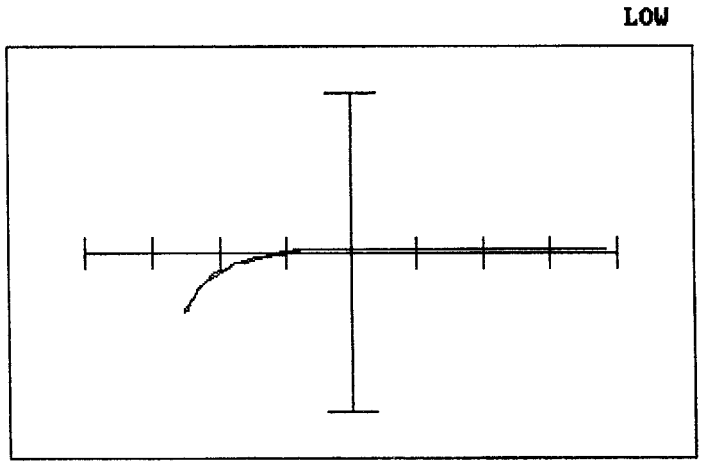


Figure A-22. Bad Diode, Leakage in the Forward Bias Region.

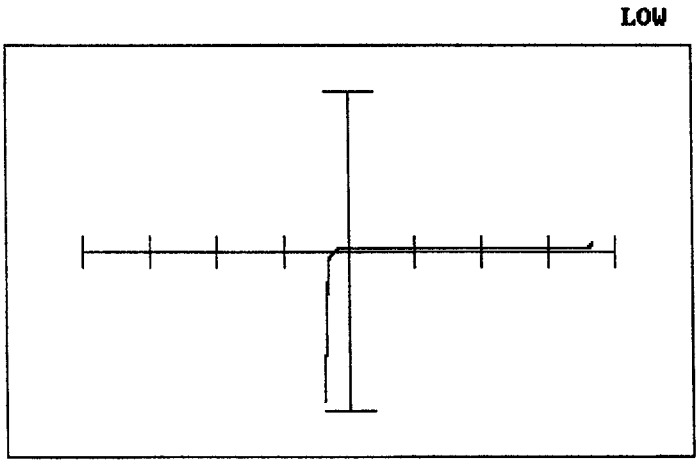


Figure A-23. Good Zener Diode.

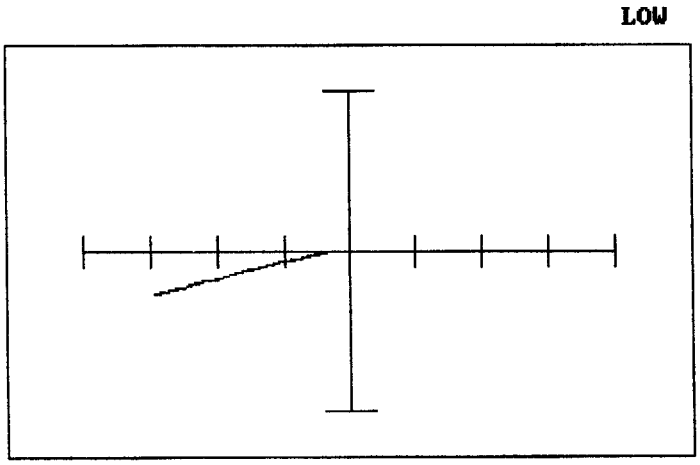


Figure A-24. Bad Zener Diode, Leakage.

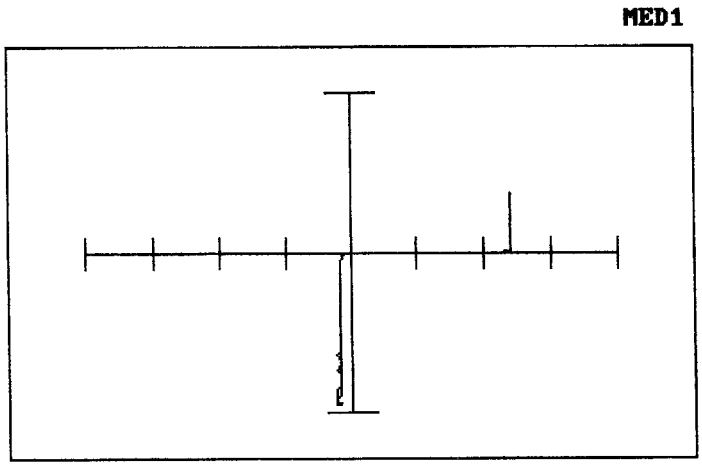


Figure A-25. Good Zener Diode.

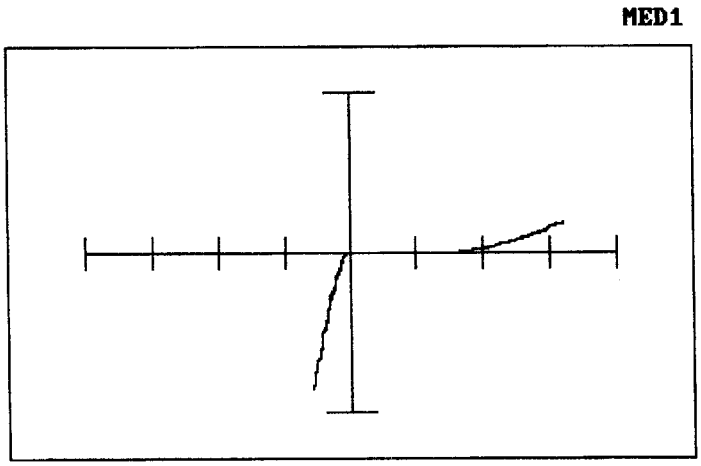


Figure A-26. Bad Zener Diode.

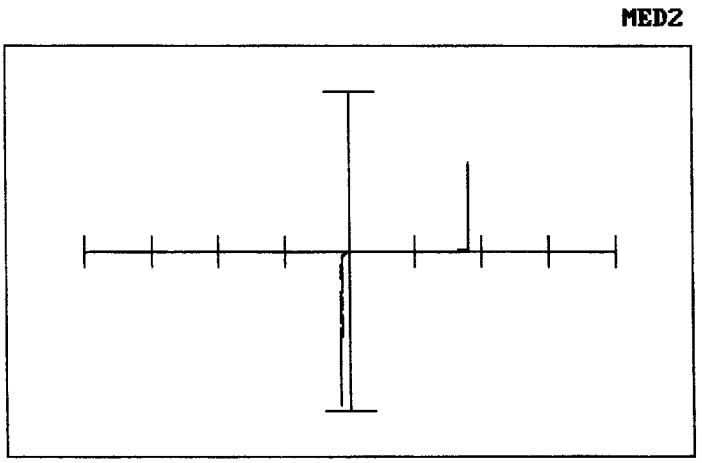


Figure A-27. Good Zener Diode.

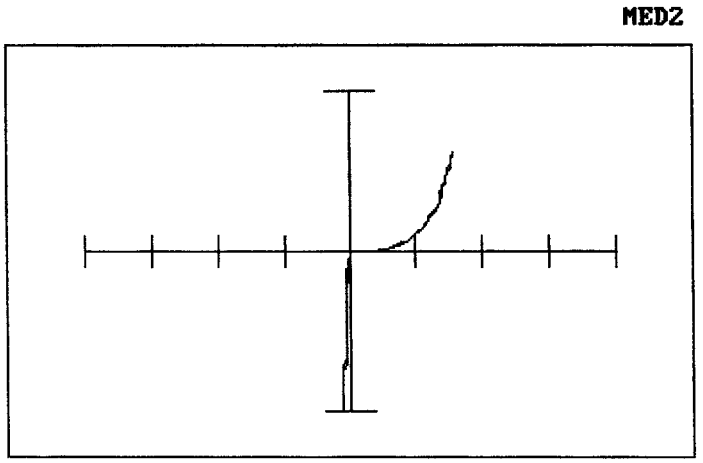


Figure A-28. Bad Zener Diode.

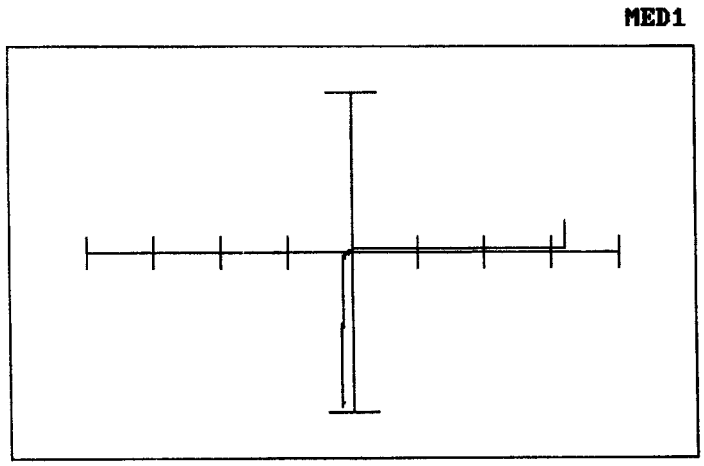


Figure A-29. Good Base-Emitter Junction of a TIP50.

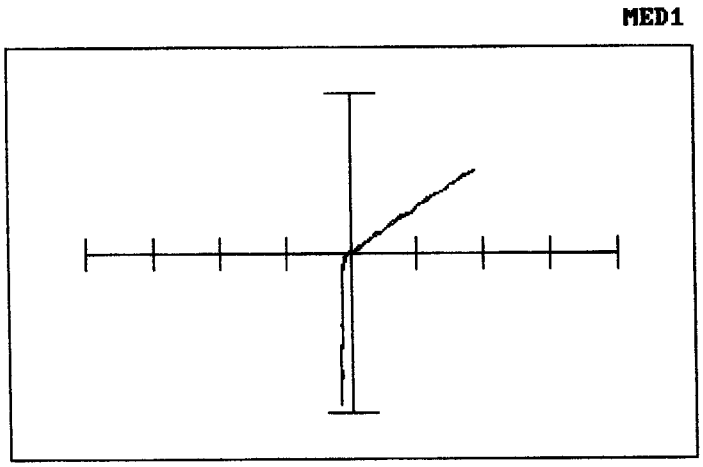


Figure A-30. Bad Base-Emitter Junction of a TIP50.

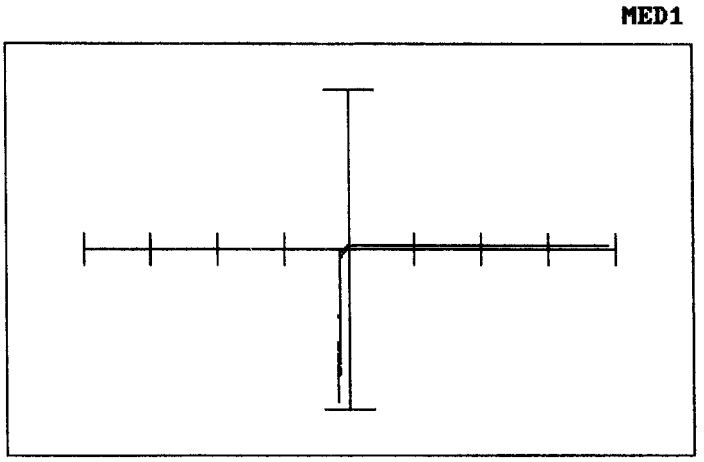


Figure A-31. Good Base-Collector Junction of a TIP50.

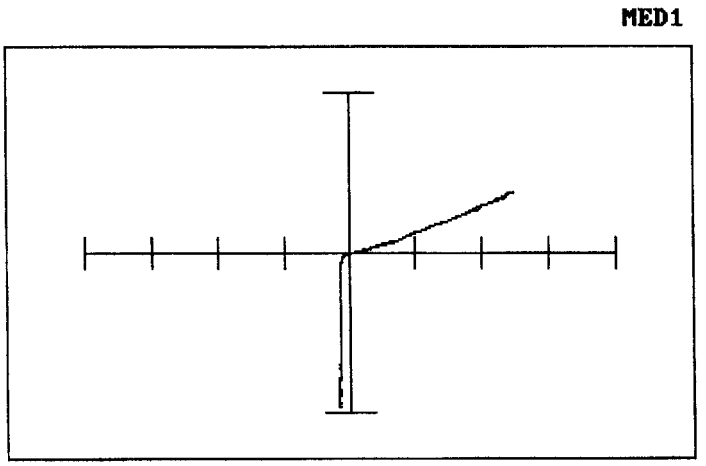


Figure A-32. Bad Base-Collector Junction of a TIP50.

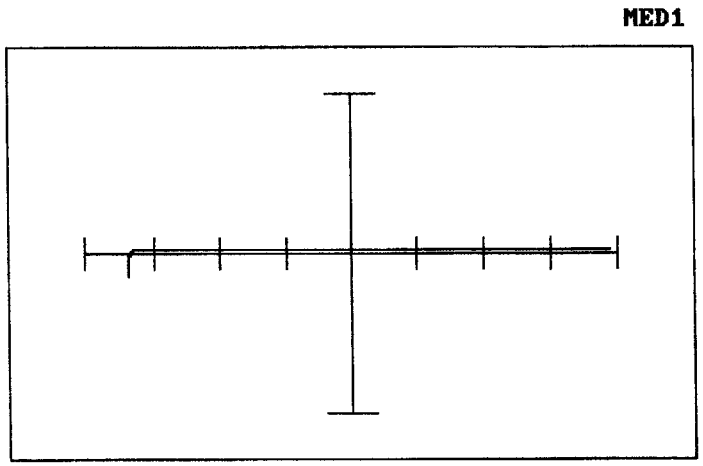


Figure A-33. Good Emitter-Collector Junction of a TIP50.

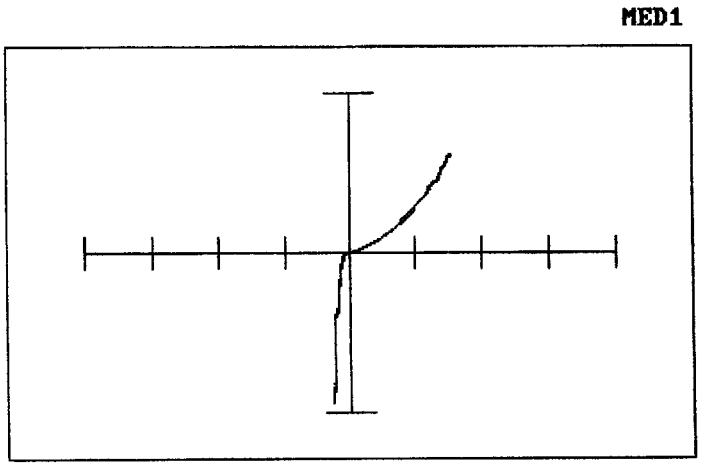


Figure A-34. Bad Emitter-Collector Junction of a TIP50.

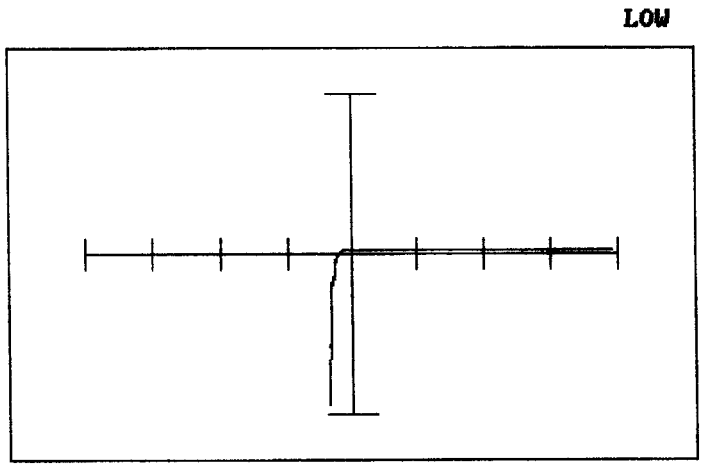


Figure A-35. Good Base-Emitter Junction of a 2N3055.

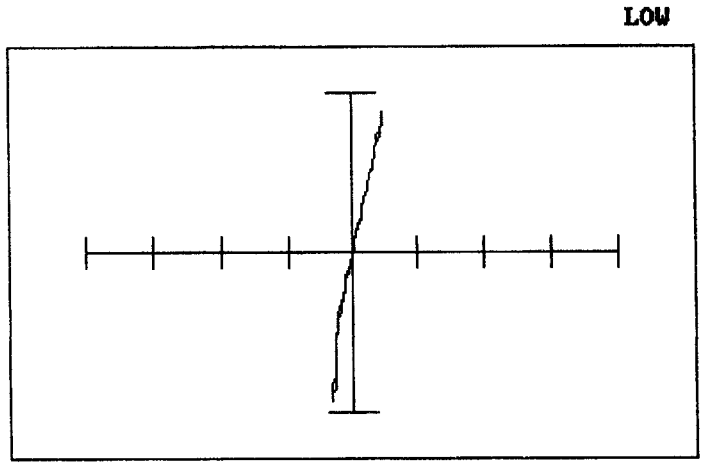


Figure A-36. Bad Base-Emitter Junction of a 2N3055.

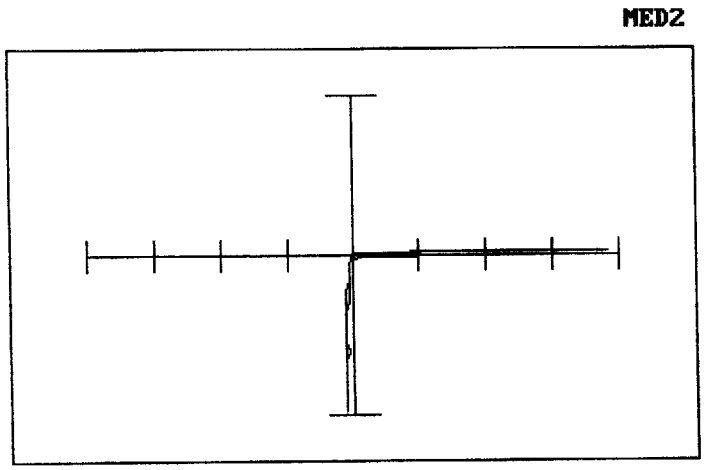


Figure A-37. Good Base-Collector Junction of a 2N3055.

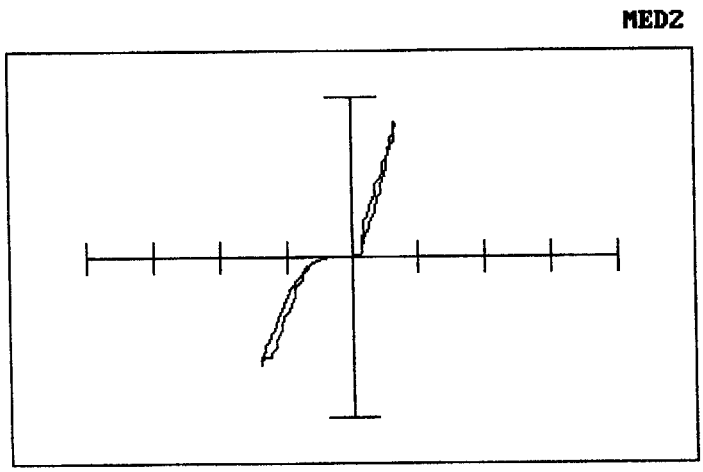


Figure A-38. Bad Base-Collector Junction of a 2N3055.

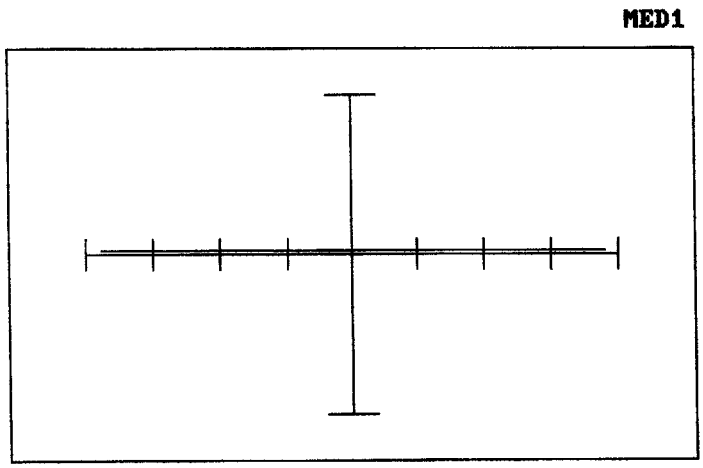


Figure A-39. Good Emitter-Collector Junction of a 2N3055.

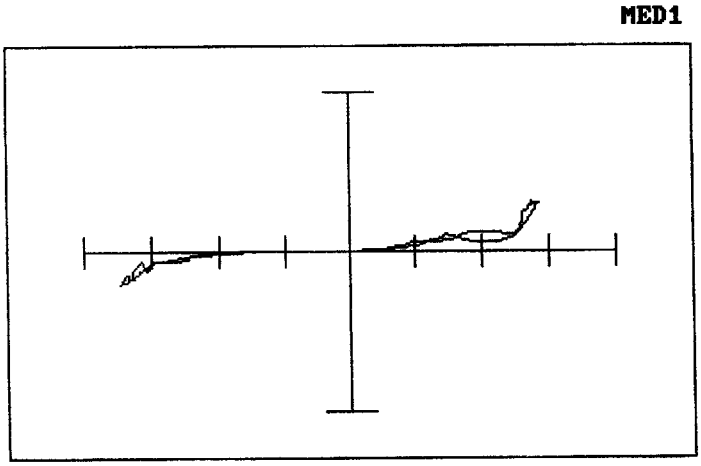


Figure A-40. Bad Emitter-Collector Junction of a 2N3055.

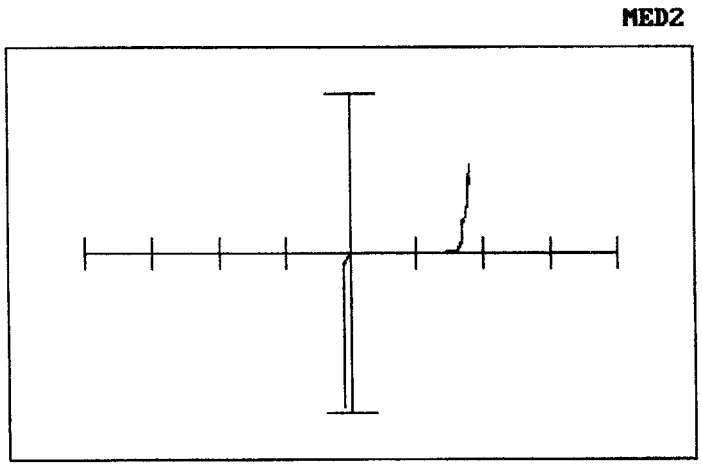


Figure A-41. Good 7400, Pin 10.

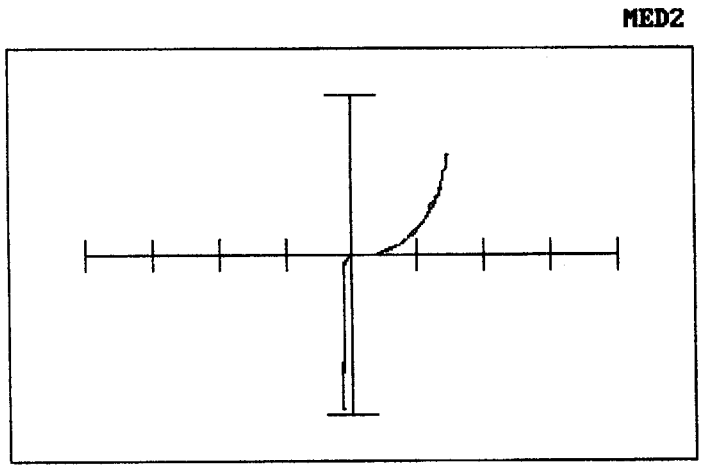


Figure A-42. Bad 7400, Pin 10.

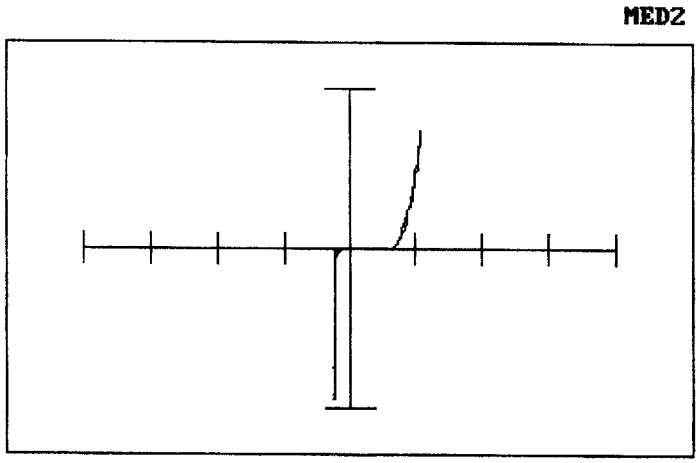


Figure A-43. Good CD4011, Pin 4.

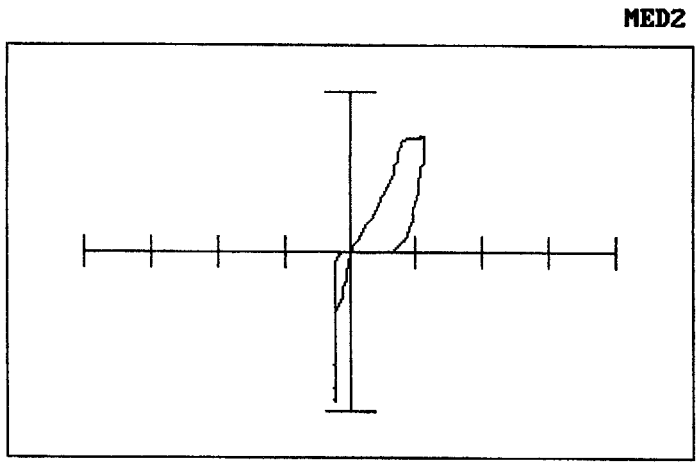


Figure A-44. Bad CD4011, Pin 4.

APPENDIX B
PROTRACK I LCD DISPLAY

INTRODUCTION

The ProTrack I Model 10 has several LCD screens and characters the user must understand to make good use of the advanced troubleshooting functions in the ProTrack. To help with understanding these characters and navigating the screens this appendix should serve as a guide to what the screens look like and what the different select buttons will do.

SPECIAL LCD GRAPHICS

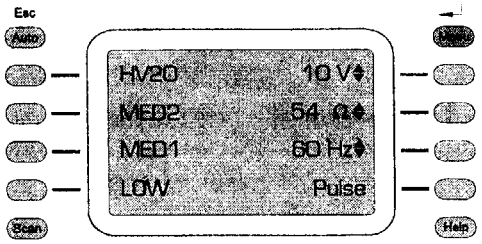
The screens of the ProTrack take advantage of the LCD graphics display by using specially defined characters to convey additional information about a selection. The characters and their meanings follow.

- ▲▼ up/down character is used to show that a parameter can be changed using the encoder.
- ▪▪ multifunction character is used to show that a button toggles more than two selections.
- ~ tilde character is used to show a range voltage is limited by MaxV.

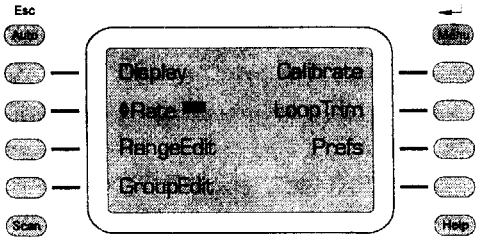
SCREENS

The screens are the key to setting the ProTrack and using all of the capabilities it has to offer. In addition this manual uses screen names to explain tasks. In the text of the manual the screen will be referenced by a Name (using a capital letter) and the word Screen (e.g., GroupEdit Screen, Main Screen, Menu1 Screen). The rest of this appendix will show samples of those screens and will also show where the select buttons of the screen will go.

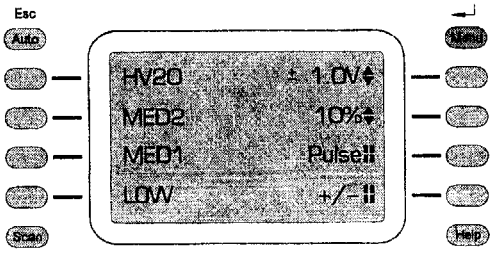
Boot Screen



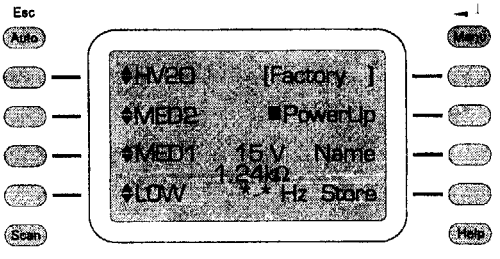
Main Screen



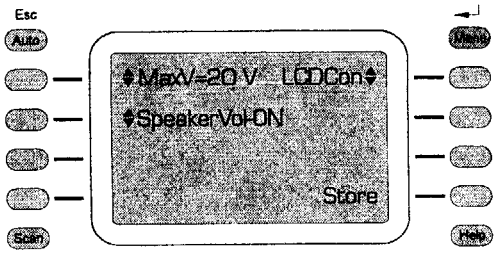
Menu1 Screen



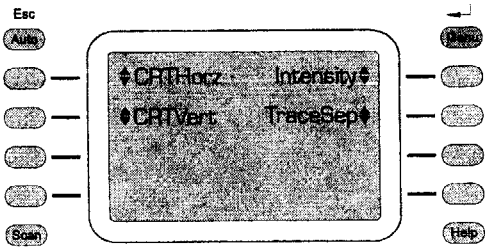
Pulse Screen



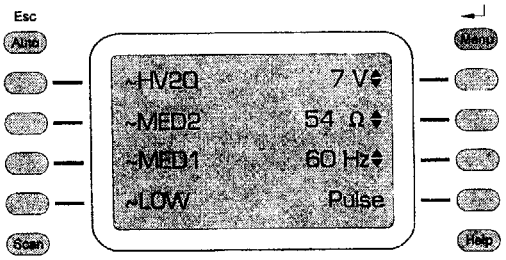
GroupEdit Screen



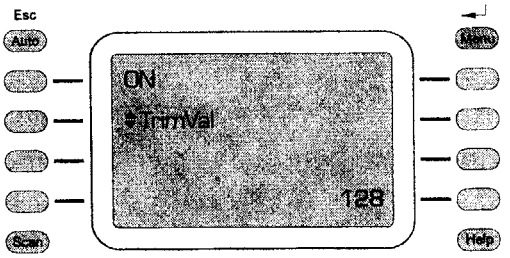
Prefs Screen



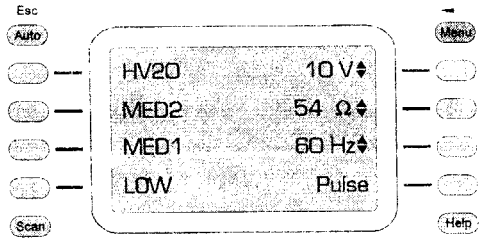
Display Screen



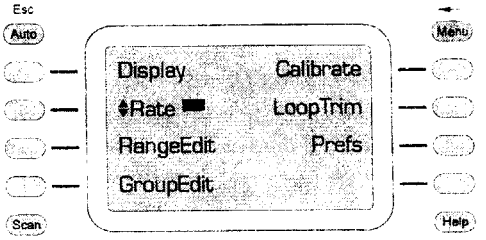
MaxV Limited Ranges



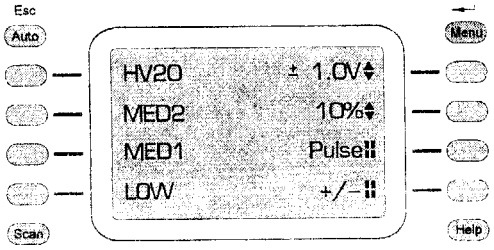
LoopTrim Screen



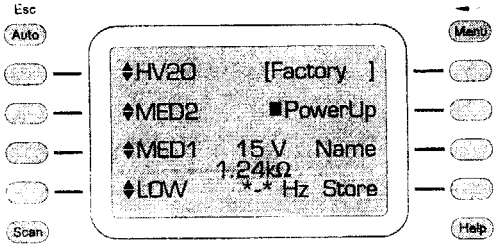
Main Screen



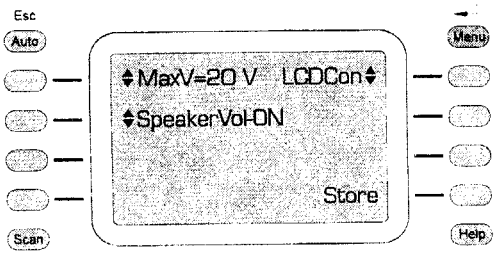
Menu1 Screen



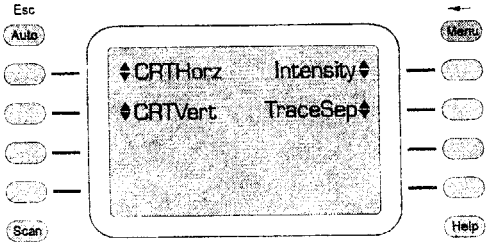
Pulse Screen



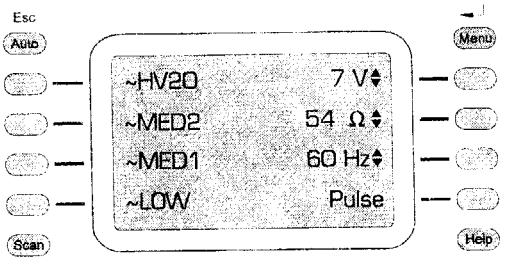
GroupEdit Screen



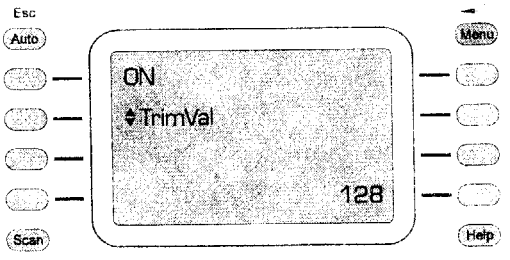
Prefs Screen



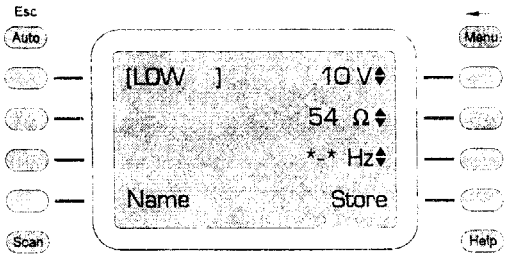
Display Screen



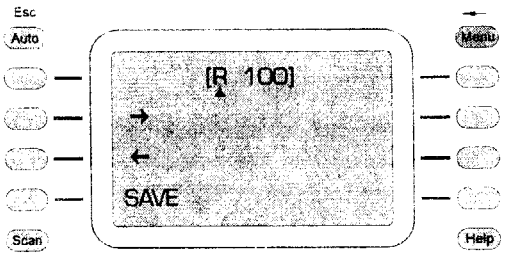
MaxV Limited Ranges



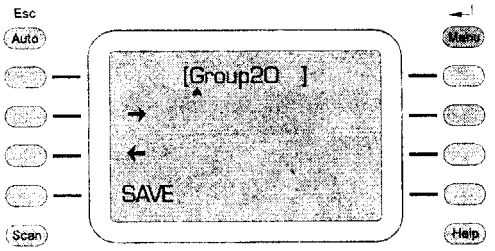
LoopTrim Screen



RangeEdit Screen



RangeName Screen



GroupName Screen

INTRODUCTION

The first menu screen (Menu1) contains many of the links to valuable features in the ProTrack I Model 10. This appendix explains the usage of the Menu1 screen selections. There are 7 selections at the Menu1 screen (**Display**, **LoopTrim**, and **Prefs).**

DISPLAY

Introduction

The Display screen is where CRT adjustments are made. There are four selections in the Display screen (**CRTHorz**, **CRTVert**, **Intensity**, and **TraceSep**). Each of the selections changes a single aspect of the CRT display.

CRTHorz

To adjust the horizontal position of the CRT trace press the **CRTHorz** selection and use the encoder to change the position. Turn the encoder knob clockwise to move the trace to the right and counter-clockwise to move the trace to the left.

CRTVert

To adjust the vertical position of the CRT trace press the **CRTVert** selection and use the encoder to change the position. Turn the encoder knob clockwise to move the trace up and counter-clockwise to move the trace down.

Intensity

To adjust the intensity of the CRT trace press the **Intensity** selection and use the encoder to change the brightness. Turn the encoder knob clockwise to increase intensity and counter-clockwise to decrease intensity.

TraceSep

Trace seperation is a valuable feature used to distinguish one trace from the other when in the A+B mode. By pressing the **TraceSep** selection button the ProTrack immediately forces the A+B mode of operation. Use the encoder to change the distance that the channel B trace moves away from the channel A trace. Turning the encoder knob clockwise moves the channel B trace up and to the left. Turning the encoder knob counter-clockwise moves the channel B trace down and to the right.

LOOPTRIM

A problem that may be encountered is the CRT may display an oval or circular pattern when nothing is connected to the test terminals. Huntron has provided a special screen to remove unwanted ellipses. Press the **LoopTrim** selection from the Menu1 screen this brings up the LoopTrim screen. The LoopTrim screen has an **ON/OFF** selection, and a **TrimVal** selection. The **ON/OFF** selection is used to turn the effects of the trimming circuit on or off. The **TrimVal** selection changes the size of ellipses. Use the encoder to change the TrimVal (displayed in the lower right of the LCD screen as a decimal number: 000-255). Using the loop trimming option is temporary and when a new range is selected or range parameters are edited the loop trim will return to the default state.

PREFERENCES (PREFS)

Introduction

The ProTrack I is designed to be a user-friendly instument. Some of the friendly features are accessed in the Prefs screen. To access the Prefs screen press the **Prefs** selection at the Menu1 screen. There are four selections in the Prefs screen: **MaxV**, **SpeakerVol**, **LCDCon**, and **Store**. Each of these selections is designed to help the user make the most of the ProTrack I.

MaxV

Some users may wish to limit the maximum voltage output that the ProTrack uses. Huntron has added this feature to the ProTrack I and termed that option "MaxV". The default setting of MaxV is 20 Volts, which allows any of the 24 ProTrack voltages. To change the MaxV setting select **MaxV** and use the encoder to change the value. Use the **Store** selection to save changes to the default MaxV setting. Ranges that are affected by MaxV are displayed with a tilde (~) character in front to indicate that the voltage setting has been modified from the range default.

SpeakerVol

The volume of the sound coming from the ProTrack I is a changeable parameter. To change (or turn off) the volume of the sound press the **SpeakerVol** and use the encoder to change the loudness of the sound. By turning the encoder knob clockwise the sound will get louder. By

turning the knob counter-clockwise the sound will get softer and at the lower limit the sound will be turned OFF. Speaker volume can be stored by pressing the **Store** selection.

LCDCon

The LCD is temperature sensitive and may need adjustment for different climatic zones. Since extreme temperature differentials can render the LCD unreadable, this section of the manual will give step-by-step instructions to get to the **LCDCon** selection. If you cannot read the LCD follow the "From power off" procedure. Users who wish to make subtle changes to contrast should use the "Normal power on" procedure.

From power off:

1) Turn power on. Wait five seconds or until a beep is heard.
2) Press the **Menu** button -- selects Menu 1 screen.
3) Press the R2 button (third button below **Menu**) -- selects Prefs screen.
4) Press the R0 button (first button below **Menu**) -- selects LCDCon.
5) Use encoder to change setting. Clockwise to darken, counter-clockwise to lighten.
6) Store

Normal power on:

To change the contrast setting when the LCD is visible, press the **LCDCon** selection (from the Prefs screen) and use the encoder to change the setting. Clockwise darkens the display and counter-clockwise lightens the display.

The LCDCon parameter is not storable in Version 1.00 firmware.