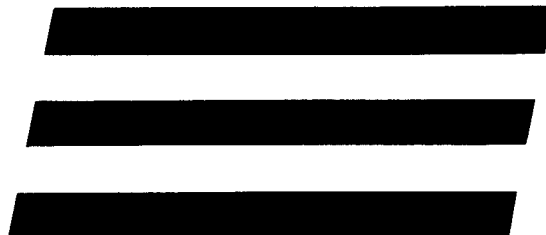# Switcher 640

Users' Manual

HUNTRON

HUNTRON®
SWITCHER

LIMITED WARRANTY

For a period of one year from the date of its purchase new and undamaged from Huntron Instruments, Inc. HUNTRON INSTRUMENTS, INC. will without charge, repair or replace, at its option, this product if found by it to be defective in materials or workmanship. Products purchased in the United States are to be returned to Huntron Instruments, Inc. at its factory, transportation prepaid. Products purchased outside the United States are to be returned to the source of purchase. This limited warranty is expressly conditioned upon the product having been used only in normal usage and serviced in accordance with instruction of HUNTRON INSTRUMENTS, INC. and not having been altered in any way or subject to misuse, negligence or damage, and not having been repaired or attempted to be repaired by anyone other than HUNTRON INSTRUMENTS, INC. or its authorized agents. **EXCEPT FOR THE FOREGOING EXPRESS WARRANTY OF REPAIR OR REPLACEMENT, HUNTRON INSTRUMENTS, INC. MAKES NO WARRANTY OF ANY KIND, INCLUDING BUT NOT LIMITED TO, ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, AND HUNTRON INSTRUMENTS, INC. SHALL NOT BE LIABLE FOR ANY DAMAGES, WHETHER DIRECT OR INDIRECT, CONSEQUENTIAL OR INCIDENTAL, FORESEEABLE OR NOT, OR OTHERWISE, BEYOND REPAIRING OR REPLACING THIS PRODUCT. THIS WARRANTY IS NOT APPLICABLE TO EXTERNAL CABLES, CLIPS, WIRING OR POWER SUPPLY.**

HUNTRON SWITCHER 640

USER'S MANUAL

June 1991
P/N 21-1188

CONTACTING HUNTRON

For technical support or to obtain information about service, accessories, and other products, contact Huntron Instruments, Inc., 15720 Mill Creek Blvd., Mill Creek, WA 98012. In the United States, call (toll-free) 800-426-9265. Huntron is also accessible by fax at 206-743-1360 or telex at 152951. Outside the United States, call your local distributor for assistance or service.

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INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

The Huntron Switcher 640 has been designed as a compatible accessory for the Huntron Tracker 2000. Together, they create an effective component troubleshooting system. The Switcher 640 allows faster troubleshooting of components with the use of automatic signature comparison which points out differences in analog signatures.
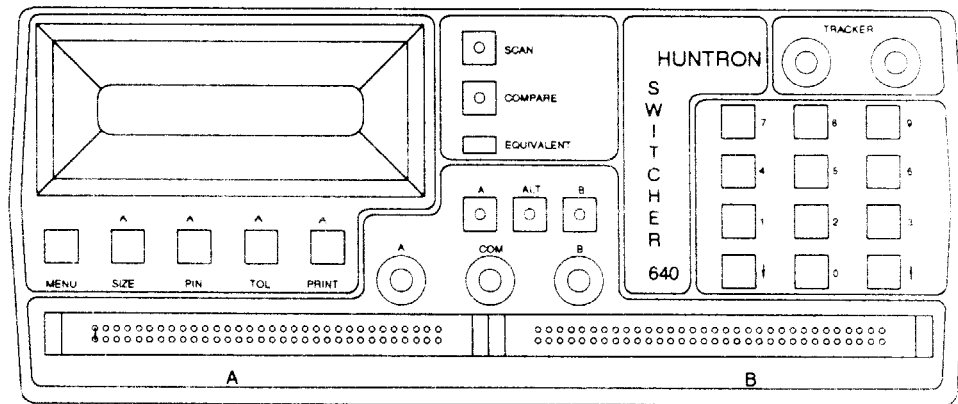
Figure 1-1. Huntron Switcher 640.

1-2. SPECIFICATIONS

Table 1-1
Switcher 640 Specifications

ELECTRICAL

Interconnections

Discrete Components:

Channel A, B, and COM front panel jacks are provided for use with probes.

Number of Test Pins . . . . 64(maximum)
(per channel)

Connectors:

(2) 64 pin IDC (for devices of 64 pins or less)

Display:

16 character x 2 line LCD

Input Voltage:

± 12 VDC (supplied by the Tracker 2000)

ENVIRONMENTAL

Operating Temperature:	15° C to 30° C (+59° F to +86° F)
Storage Temperature:	-20° C to +60° C (-4° F to +140° F)
Humidity:	0 to 50 % R.H.

Mechanical

Size:	9"W x 4"H x 11"D (23cm W x 10cm H x 28cm D)
Weight:	4.0 lbs (1.8kg)
Shock and Vibration:	will withstand shock and vibration encountered in commercial shipping and handling.

OPERATIONAL

Main Function:	Can compare two 64 pin devices automatically or manually for any range of the Tracker 2000. Compare mode supports 50/60 Hz test signal from the Tracker 2000.

1-3. SAFETY CONSIDERATIONS

This manual contains information, cautions, and warnings the user must follow to ensure safe operation, 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.

1-4. ACCESSORIES

The Switcher 640 is compatible with most of the cabling accessories of the Huntron Tracker 5100DS. In addition, a foot switch and a printer are available as optional accessories.

ITEM NUMBER	DESCRIPTION	P/N
1	Switcher 640 Foot Switch	98-0314
2	Switcher 640 Printer	98-0340
3	Universal Edge Connector Adaptor (UECA)	98-0086
4	Surf Probe	98-0093

To order any of the above items or for further information on other accessories, please contact Huntron.

Notes:

SECTION 2
OPERATING INSTRUCTIONS

2-1. INTRODUCTION

This section describes the basic operation of the Switcher 640. Throughout the rest of this manual the Switcher 640 will be referred to simply as a 640 and the Tracker 2000 as a 2000. Take time to read this section carefully so that you can take full advantage of all of the features of the 640.

2-2. UNPACKING YOUR INSTRUMENT

Your instrument was shipped with two 40 pin DIP (dual in-line package) clip cables, two 40 pin DIP clips, two 20 pin DIP clip cables, two 16 pin DIP clips, two 10kΩ resistor jumpers, a red banana cable, a black banana cable, a power/clock cable, and this manual. Check the shipment carefully and contact the place of purchase if anything is missing or damaged in shipment. If reshipment is necessary, please use the original shipping carton and packing foam. If these are not available, be sure that adequate protection is provided to prevent damage during shipment.

2-3. PHYSICAL FEATURES

Before you begin to use the 640, please take a few minutes to familiarize yourself with the instrument.

2-4. Front Panel

The front panel of the 640 is designed to make function selection easy. All buttons are momentary action and some have integral LED indicators that show which functions are active.
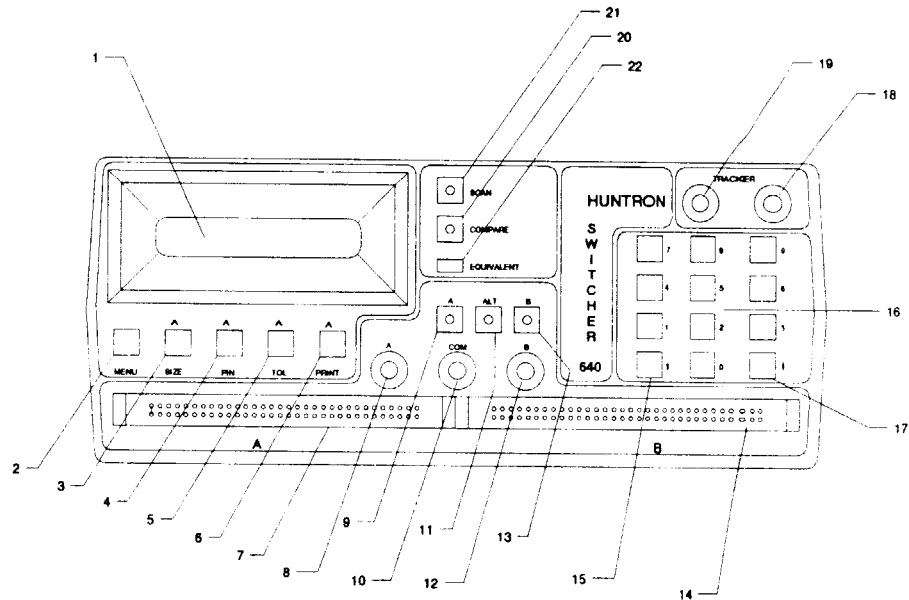
Figure 2-1. Switcher 640 Front Panel.

Table 2-1
Front Panel Controls and Connectors

1	LCD	Displays the current status or menus of the 640.
2	MENU button	Manual Mode: selects the Main menu. Menu Mode: selects the previous menu or exits the menu mode.
3	SIZE button	Manual Mode: selects the Component Size entry display. Menu Mode: selects the left choice of a menu.
4	PIN button	Manual Mode: selects the Pin Number entry display. Menu Mode: selects the left middle choice of the menu.
5	TOL button	Manual Mode: selects the Tolerance entry display. Menu Mode: selects the right middle choice of the menu.
6	PRINT button	Manual Mode: selects the manual print display. Menu Mode: selects the right choice of the menu.
7	Channel A IDC socket	Socket for cable connection when channel A is active.
8	Channel A Probe jack	Test lead connector that is active when channel A is selected.

Table 2-1 (con't)
Front Panel Controls and Connectors

9	Channel A button	Selects channel A and cancels the channel B and ALT functions.
10	Common Probe jack	Test lead connector that is instrument common and the common reference point for both channel A and channel B.
11	ALT button	Causes the 640 to alternate between channel A and channel B at a speed controlled by the RATE control on the 2000.
12	Channel B Probe jack	Test lead connector that is active when channel B is selected.
13	Channel B button	Selects channel B and cancels the channel A and ALT functions.
14	Channel B IDC socket	Socket for cable connection when channel B is active.
15	↓ button	Decrements numeric and alpha entries. Decrements the current pin. Also, used to change to the next most different pin in Recall mode.
16	0-9 buttons	Buttons that enter the digits 0-9 in numeric entry fields.
17	↑ button	Increments numeric and alpha entries. Increments the current pin. Also, used to change to the next less different pin in Recall mode.
18	Common Lead jack	Common lead connector used to connect the 2000 common (COM) to the 640.
19	Signal Lead jack	Signal lead connector used to connect channel A of the 2000 to the 640.
20	COMPARE button	Scans through the pins and automatically compares the device connected to channel A with the one connected to channel B using the tolerance selected by the user. If the 640 stops on a pin that is different, pressing the COMPARE button again continues pin scanning.
21	SCAN button	Scans through the pins so that signatures can be viewed on the 2000's CRT and visually compared by the user. If the 640 is scanning, pressing SCAN will stop pin scanning. If pin scanning has been stopped, pressing SCAN again will restart scanning from the current position.
22	EQUIVALENT LED	Indicates that the signatures on channel A and channel B are the same within the selected tolerance.

2-5. Back Panel

Secondary connectors are on the back panel.
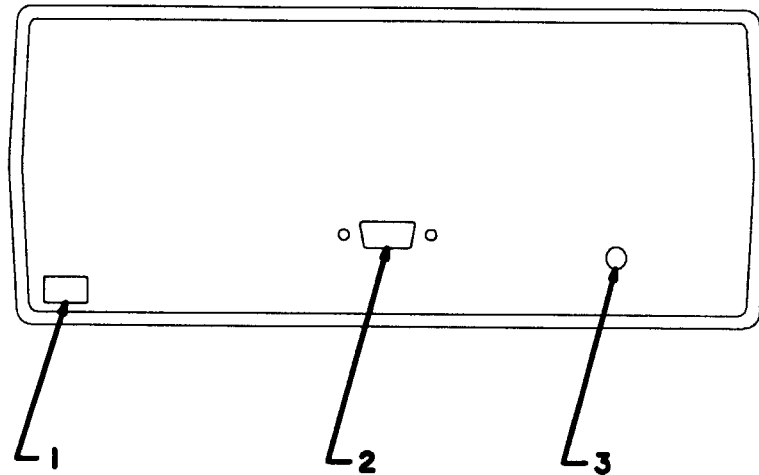
Figure 2-2. Switcher 640 Back Panel.

Table 2-2
Back Panel Connectors

1	Power/Clock Input Connector	Connector which accepts power and rate clock from a 2000.
2	Printer Connector	Connector for the optional printer.
3	Foot Switch Connector	Connector for the optional foot switch.

2-6. OPERATION

The following sections detail how to setup and operate the 640 with a 2000. The examples will use two 16 pin DIP components in-circuit. The known-good component will be connected to channel A and the suspect component will be connected to channel B.

2-7. Tracker 2000 Setup

Follow the INITIAL SETUP instructions in the 2000 manual to adjust the CRT properly. The 2000 must have channel A, 50/60 Hz, and a single range selected. The Pulse Generator and ALT functions of the 2000 are not compatible with the 640. The AUTO, 400Hz and 2000Hz features of the 2000 are not compatible with the Compare mode of the 640.

2-8. Tracker 2000 Connection

The 640 should be placed underneath the 2000.
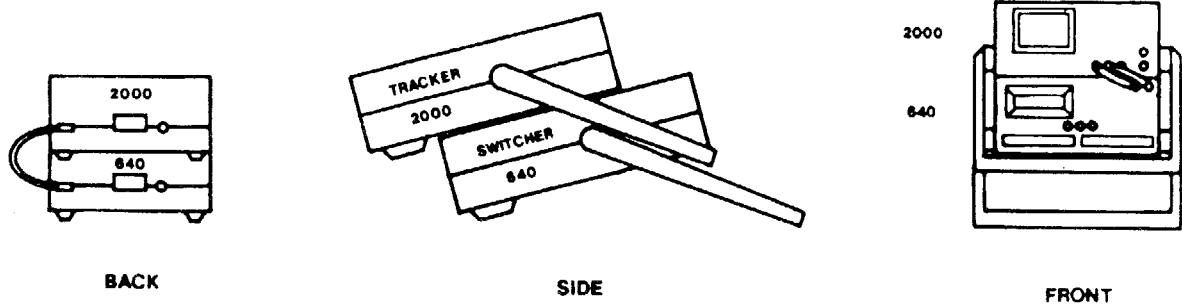
Figure 2-3. Stacking the 640 and the 2000.

Connect one end of the supplied red banana cable to the channel A jack of the 2000. Connect the other end to the red TRACKER jack of the 640. Connect one end of the supplied black banana cable to the COM jack of the 2000. Connect the other end to the black TRACKER jack of the 640.

The 640 is powered by the 2000. Connect one end of the supplied power/clock cable to the Accessory output connector (ACC) on the back panel of the 2000. Connect the other end of the power/clock cable to the POWER input connector on the back panel of the 640.

When the power/clock cable is connected and the 2000 is turned on, the 640 should turn on. All of the LEDs should come on and the LCD should show the power up display.


```
SWITCHER 640
F/W VER 1.0
```

Figure 2-4. Power Up Display.

Then all LEDs should turn off except for the channel A LED and the LCD should show the Main display. The Main display shows the test count, the currently activated pin, the number of pins on the device, the tolerance, and the package type.

```
1    PIN  0 OF 16
T:    5         DIP
```

Figure 2-5. Main Display.

2-9. Accessory Connections

Printer: (refer to the following figure)
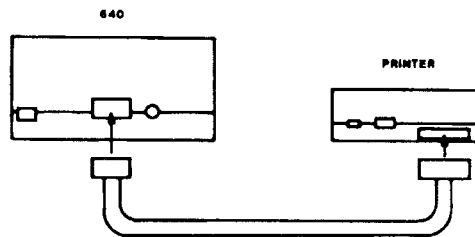
Figure 2-6. 640 to Printer Connection.

Connect one end of the printer cable to the Printer connector on the rear of the 640. Connect the other end of the cable to the printer. Plug the printer line cord in. Make sure the 640 is powered up, then switch the printer power on. Push the SEL button on the printer and verify the SEL status LED is on. The 640 printer is now ready for use.

Note: Always turn the 640 power on first, then turn on the printer. If this power on sequence is not observed, the printer may not function properly. If the printer does not work, turn the printer to off and follow the proper connection and power up sequence. If you encounter further difficulties, please contact Huntron Technical Support.

Foot switch: (refer to the following figure)
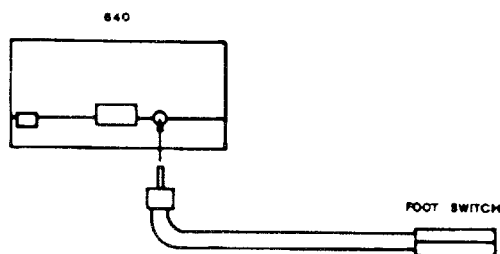
Figure 2-7. 640 to Foot Switch Connection.

With the 640 turned off, insert the foot switch plug into the foot switch connector on the rear of the 640. Turn the 640 power on and the foot switch is ready for use.

Note: The foot switch must be connected to the 640 while the power is off. The 640 checks for the presence of the foot switch only during initial power up. If the foot switch is plugged in while the 640 is on, it will not work. Turn the 640 power off then on to activate the foot switch.

2-10. Channel Selection

There are two channels in the 640 (channel A and channel B) which are selected by pressing the appropriate front panel button. Channel selection determines which probe jack and IDC connector are active.

The ALT button causes the 640 to alternate between channel A and channel B at a speed set by the 2000 RATE control.

The three channel controls are mutually exclusive i.e. each button cancels the other buttons.

2-11. Manual Mode

The Manual mode is active when the SCAN and COMPARE LEDs are off. The ↑ and ↓ buttons will increment and decrement the pin number respectively. The foot switch will increment the pin number if it is connected. The ALT button will alternate between channel A and channel B at a speed set by the 2000 RATE control. When in ALT mode, the Equivalent LED will be enabled if ALT COMPARE = ON is selected. The Equivalent LED is off when the signatures on channels A and B are different by more than the set tolerance. The channel A and B buttons will lock on the respective channel disabling the Equivalent LED and the ALT mode.

The functions that are accessible while in the Manual Mode are SIZE, PIN, and TOL (tolerance). Other modes that can be activated from this mode are SCAN, COMPARE, PRINT, and MENU.

2-12. Component Size

The SIZE button activates the Component Size entry display. Use the numeric buttons (0-9) to enter the number of pins on the component from 1 to 64. You can also press the ↑ and ↓ buttons to increment and decrement the size respectively.

After the correct number of pins are selected, select the package type by pressing the button under one of the package choices on the display. DIP (dual in-line package) must be an even number of pins up to 64. SIP (single in-line package) may be an even or odd number of pins up to 64. F&B (front and then back) must be an even number of pins up to 64. FRT (front only) may be an even or odd number of pins up to 32 pins. The power up default is a 16 pin DIP.

```
┌──────────────────────┐
│SIZE = 16      DIP│
│DIP SIP F&B   FRT│
└──────────────────────┘
```
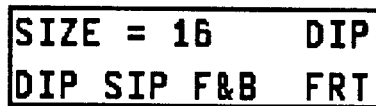
Figure 2-8. Component Size Entry Display.
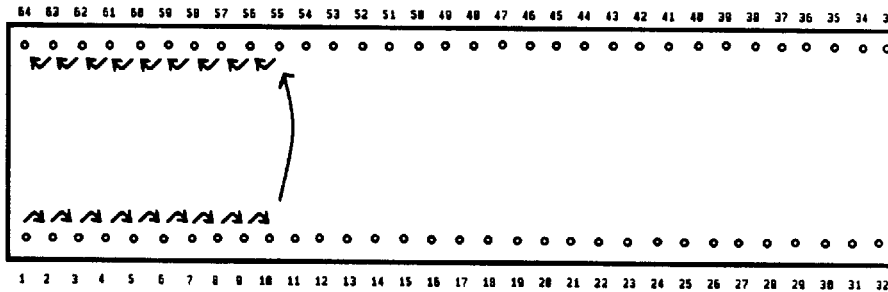
Figure 2-9. Relay Scanning Sequence for a 20 pin DIP.
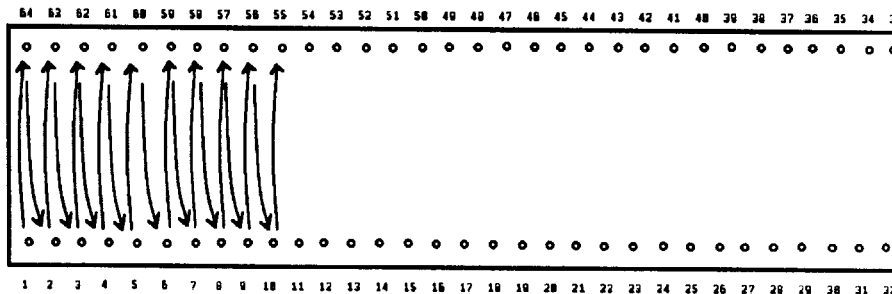
Figure 2-10. Relay Scanning Sequence for a 20 pin SIP.
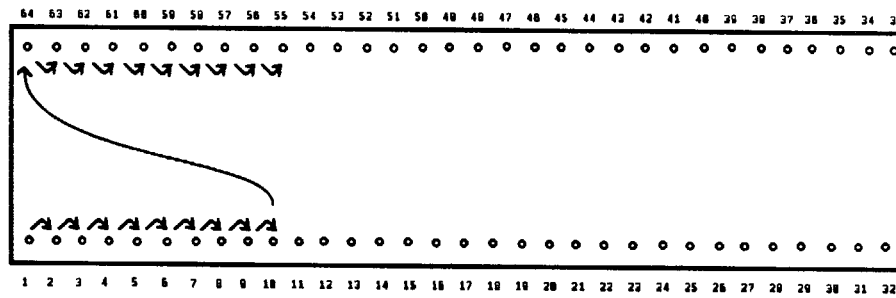
Figure 2-11. Relay Scanning Sequence for a 20 pin F&B.
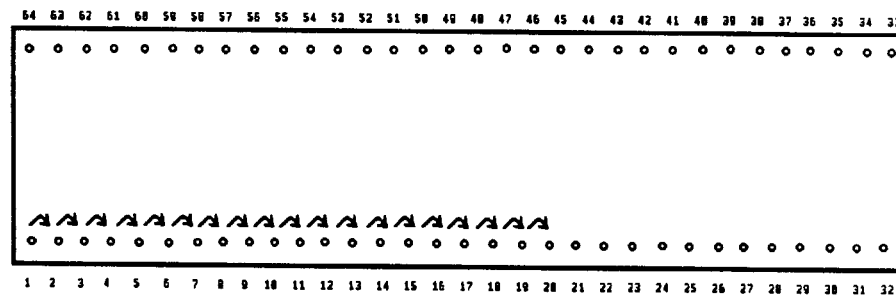
Figure 2-12. Relay Scanning Sequence for a 20 pin FRT.

2-13. Pin Number

The PIN button activates the Pin Number entry display. Use the numeric buttons (0-9) to select the desired Pin Number up to and including the Component Size setting. Setting the Pin Number to zero will disable the IDC sockets. This means that the component under test is disconnected from the Tracker signal. You can also press the ↑ and ↓ buttons to increment and decrement the Pin Number respectively. After the correct Pin Number is selected, press the button under ENTER (SIZE) on the display. Pin Number 0 is the power up default.

```
PIN NUMBER =    0
ENTER
```

Figure 2-13. Pin Number Entry Display.

2-14. Tolerance

The TOL button activates the Tolerance entry display. Use the numeric buttons (0-9) to select the desired tolerance from 0 to 99. You can also press the ↑ and ↓ buttons to increment and decrement the tolerance respectively. Tolerance is the amount of allowable difference between the channel A and channel B signatures before they are considered different. After the correct tolerance is selected, press the button under ENTER (SIZE) on the display. Tolerance of 5 is the power up default.

```
TOLERANCE = 5
ENTER
```
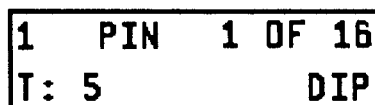
Figure 2-14. Tolerance Entry Display.

2-15. Scan Mode

The Scan mode is activated by pressing the SCAN button. When active, the SCAN LED is on. The Scan mode increments through the pins of the component continuously displaying the signatures based on several conditions. The channel A and B buttons allow scanning in each respective channel. The ALT button allows the channels to be displayed alternately. The number of times that the 640 alternates between channel is controlled by ALT TIMES. ALT TIMES = 3 is the power up default. The Equivalent LED is disabled in all SCAN modes. To stop Scan mode at the current pin, press the SCAN button.

Note: If the foot switch is held down while holding down the SCAN button, the scanning will not start until the foot switch is released. This facilitates "hands-free" scanning.

The Scan mode display shows the Test Count, the currently activated pin, the number of pins on the device, the tolerance, the number of times channels A and B will toggle between pins (if ALT was active when SCAN was pressed), and the package type.

```
1    PIN    1 OF 16
T: 5              DIP
```

Figure 2-15. Scan Mode Display.

2-16. Compare Mode

The 640 performs comparison testing by first digitizing the signatures of both a known good (reference) component and the suspect one into samples. Then, the 640 performs a sample by sample comparison of these signatures.

The Compare mode is activated by pressing the COMPARE button. When active, the Compare LED is on. The Compare mode increments through the pins of the components displaying the signatures based on several conditions in two different modes: STOP and ALL.

The Compare mode display shows the Test count, the current pin, the number of pins on the device, the tolerance, the word COMPARE, and the current 2000 impedance range.

```
1   PIN  1 OF 16
T: 5 COMPARE  LO
```

Figure 2-16. Compare Mode Display.

Note: If the foot switch is held down while holding down the COMPARE button, the comparison will not start until the foot switch is released. This facilitates "hands-free" operation.

STOP Mode: the Compare mode setting of STOP compares the pins of the components and stops when a difference is found or the last pin has been compared. While stopped at a pin that is different, the 640 goes into ALT mode and the channel A, channel B and ALT buttons are active. Pressing the COMPARE button again continues the comparison process after stopping at a different pin. A CYCLE setting of ONE allows the pins of the components to be scanned once. A CYCLE setting of LOOP allows the pins of the components to be scanned continuously which is useful for finding intermittent failures. If CYCLE = ONE, after the last pin of the component has been compared, the Recall mode is entered if differences were found.

ALL Mode: the Compare mode setting of ALL compares all of the pins of the component without stopping. A CYCLE setting of ONE allows the pins of the component to be scanned once. A CYCLE setting of LOOP is ignored with the ALL setting. After the last pin of the component has been compared, the Recall mode is entered if differences are found.

The A, ALT, and B buttons are disabled during the actual comparisons. Pressing the COMPARE button, while Compare is running, stops the Compare mode.

The Recall mode allows the user to review the signatures of the pins that are different. The Recall mode displays shows the Test count, the current pin, the tolerance, the DIF number and the IDX number.

```
1   PIN   1  T: 5
DIF:10   IDX:110
```

Figure 2-17. Recall Mode Display.

The DIF (Difference) number is the amount that tolerance would need to increase by to have the pin be equivalent (e.g. TOL = 5 and DIF = 10 for pin 3 means that TOL = 15 will make pin 3 equivalent).
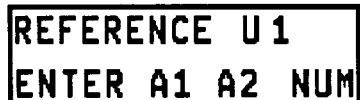
The IDX (Index) number is based on the sum of the differences for all the digitized samples of the two signatures. It increases as the visual difference between the two signatures increases. The 640 uses the IDX number to sort and display the different pins when differences are found.

The pins are displayed in order from most different to least different by pressing the ↑ and ↓ buttons. The foot switch has the same function as the ↑ button in this mode. The Recall mode starts in the ALT mode for each pin that is different. Pressing the channel A and B buttons lock on the respective channel. Pressing the ALT button alternates between channel A and channel B at a speed set by the 2000 RATE control. Pressing the MENU button will exit the Recall mode. If PRINT MODE = AUTO, Print mode is activated. The 640 then returns to the Manual mode.

2-17. Print Mode

The Print mode prints the results of the comparison for the last component based on several conditions. If the component was equivalent, no information is printed. In the Print mode, the MANUAL setting allows printing of the difference information by pressing the PRINT button, and the AUTO setting prints the difference information when the Recall mode is exited. The information printed is determined by the Print style setting. The SIMPLE setting will list the components, their maximum difference, and the Sorting Index (IDX) in each range compared. The Sorting Index is a parameter used to sort the pins in descending order from most different to least different. The DETAIL setting will list the components and each of their pins with their difference and index. The REFERENCE setting, OFF or ON, determines the method of identifying the components being compared. The OFF setting lists the components on the printout by number in the order they were compared (the TEST COUNT) and provides a space to write in a reference designator. The TEST COUNT should be reset using TEST COUNT RESET before each board is compared. The ON setting lists the components on the printout by the TEST COUNT and a user-entered reference designator.

When the Print mode is activated, the Component Reference entry display will prompt for the Reference designator if the REFERENCE = ON setting has been selected. The first two positions of the designator are alpha only. A1 selects the first position and A2 selects the second position. The letters are set with the ↑ and ↓ buttons. The characters are A-Z and space. NUM allows the entry of a number from 1 to 999. The numeric buttons (0-9) are used to enter the number. The previous value is cleared after first digit is entered. After the designator is set (A-Z, A-Z, 1-999), press the button under the ENTER (SIZE) on the display to start printing the results. While printing is occuring, the Print Status Display will allow exit from the Print mode by pressing the button under ABORT (SIZE) which stops the printout. "U1" is the power up default.

```
┌─────────────────────┐
│REFERENCE U1         │
│ENTER A1 A2 NUM      │
└─────────────────────┘
```

Figure 2-18. Component Reference Entry Display.

When a report is being printed, the following Print displays will be shown. Each display shows what part of the report is currently being printed. To stop the printing, press the button under the ABORT (SIZE) on the display.

```
┌─────────────────────┐
│PRINT HEADER         │
│ABORT                │
└─────────────────────┘
```

Figure 2-19. Print Header Display.

```
┌─────────────────────┐
│PRINT COLUMN         │
│                     │
└─────────────────────┘
```

Figure 2-20. Print Column Display.

```
┌─────────────────────┐
│PRINT RESULTS        │
│ABORT                │
└─────────────────────┘
```

Figure 2-21. Print Results Display.

2-18. Using Menus

The Menu features of the 640 are accessed by pressing the MENU button. To exit from a menu, press the MENU button, and you will return to the previous display. Select menu features by pressing the button under each menu selection.

```
┌─────────────────────┐
│  MAIN MENU          │
│SCAN COMPARE PRT     │
└─────────────────────┘
```

Figure 2-22. Main Menu Display.

The Main menu options are: SCAN, COMPARE and PRT (Print). To select an option, press the button under SCAN, COMPARE or PRT on the display.

The SCAN/ALT menu options are MODE (ALT COMPARE mode) and TIMES (SCAN/ALT TIMES). Press the button under the desired option to select it. Press the MENU key to return to the previous display.

```
 _____
| SCAN/ALT MENU      |
|MODE          TIMES|
 _____
```

Figure 2-23. SCAN/ALT Menu Display.

The ALT COMPARE mode selection display consists of ON (enabling the Equivalent LED during ALT mode) or OFF (disabling the Equivalent LED during ALT mode). Press the button under the desired option to select it. ALT COMPARE = OFF is the power up default.

```
 _____
|ALT COMPARE  =OFF|
|ON              OFF|
 _____
```

Figure 2-24. ALT Compare Mode Selection Display.

The ALT (alternate) TIMES selection display allows the selection of the number of times channels A and B are toggled before going to the next pin during SCAN+ALT. Use the numeric buttons (0-9) to select the desired number of times from 1 to 99. Also, you can press the ↑ and ↓ buttons to increment and decrement ALT TIMES respectively. After the ALT TIMES has been entered, press the button under the ENTER (SIZE) on the display. ALT TIMES = 3 is the power up default.

```
 _____
|ALT TIMES = 3   |
|ENTER             |
 _____
```

Figure 2-25. ALT TIMES Selection Display.

The Compare menu options are: MODE (Compare mode), CYCLE (Compare cycles) which control the comparison features. Press the button under the desired option to select it. Press the MENU button to return to the previous display.

```
 _____
| COMPARE MENU       |
|MODE          CYCLE|
 _____
```

Figure 2-26. Compare Menu Display.
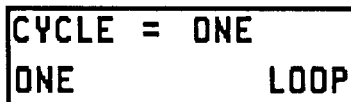
The COMPARE MODE selection display options are: STOP (stopping the automatic comparison at every difference) and ALL (compare all of the pins without stopping). Press the button under the desired option to select it. Press the MENU button to return to the previous display. ALL is the power up default.

```
MODE = ALL
ALL        STOP
```

Figure 2-27. Compare Mode Selection Display.

The COMPARE CYCLE selection display options are: ONE and LOOP. ONE scans through the component pins only once and then goes into Recall mode if there are differences. LOOP scans through the pins until a difference is found (this could be used to find intermittent failures). The LOOP setting is ignored when COMPARE MODE = ALL. Press the button under the desired option to select it. Press the MENU button to return to the previous display. ONE is the power up default.

```
CYCLE = ONE
ONE        LOOP
```

Figure 2-28. COMPARE CYCLE Selection Display.

The Print menu options are: REF (Reference designator), RST (Reset Test Count), STY (printout style), and MODE (Print Mode). Press the button under the desired option to select it. Press the MENU button to return to the previous display.

```
  PRINT MENU
REF RST STY MODE
```

Figure 2-29. Print Menu Display.

The Component Reference (REF) selection display allows the selection of the method of identifying the components being compared on the printed report. OFF lists the components on the printout by number in the order they were compared (the TEST COUNT) and leaves a space for a reference designator to be written in by the user. ON lists the components on the printout by the TEST COUNT and a user-entered reference designator. The user will be prompted to enter the reference designator before component results are printed. Press the button under the desired option to select it. Press the MENU button to return to the previous display. OFF is the power up default.

```
REFERENCE = OFF
ON          OFF
```

Figure 2-30. Component Reference Selection Display.

The RESET TEST COUNT display allows the resetting of the Test sequence number for the printout. Test Count is also shown in the Main display. RESET sets the Test Count back to the default of one. This should be done before starting to compare devices on a new pair of boards. To reset the Test Count, press the button under RESET (SIZE) on the display.

```
TEST COUNT
RESET
```

Figure 2-31. RESET TEST COUNT Display.

The PRINT STYLE selection display options are: SIMPLE and DETAIL. SIMPLE lists the components, 2000 range, tolerance, and the most different pin number with it's difference and sorting index. DETAIL lists the components, 2000 range, and tolerance, and each different pin with it's difference and sorting index. Press the button under the desired option to select it. Press the MENU button to return to the previous display. SIMPLE is the power up default.

```
STYLE = SIMPLE
SIMPLE    DETAIL
```
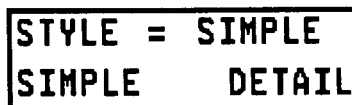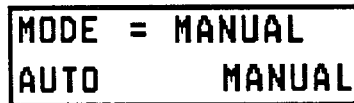
Figure 2-32. PRINT STYLE Selection Display.

The PRINT MODE selection display options are: AUTO and MANUAL. AUTO automatically prints after every compare where differences were found. MANUAL allows the user to control the printout. Press the button under the desired option to select it. Press the MENU button to return to the previous display. MANUAL is the power up default.

```
MODE = MANUAL
AUTO     MANUAL
```

Figure 2-33. PRINT MODE Selection Display.

2-19. Error Messages

When an error occurs, pressing the MENU button will exit from the error display.

The NUMBER OF PINS INCORRECT error is displayed when the number of pins entered does not match the selected package type or when a number of pins greater than 64 is entered.

The NUMBER>SIZE error is displayed when the pin number entered exceeds the number of pins.

The PRINTER PROBLEM error is displayed when an error condition is encountered while attempting to print.

The NUMBER OF TIMES INCORRECT error is displayed when a zero is entered under the ALT TIMES display.

The TRACKER FREQ TOO LOW error is displayed when the test signal frequency is below the 50/60 Hz needed for the COMPARE mode.

The TRACKER FREQ TOO HIGH error is displayed when the test signal frequency is above the 50/60 Hz needed for the COMPARE mode.

The TRACKER SIGNAL OUT OF CAL error is displayed when the voltage on the inputs is not a proper Tracker voltage.

The TRACKER SIGNAL NOT PRESENT error is displayed when the Tracker is not connected to the 640.

The AUTO ERROR SELECT ONE RANGE error is displayed when the 2000 is in AUTO and COMPARE or SCAN/ALT is selected.

The RANGE CHANGED INVALID COMPARE error is displayed when the user changes the 2000 range during Compare.

2-20. EXTERNAL CLEANING AND LUBRICATION

WARNING

To avoid electric shock or instrument damage, never get water
inside the case. To avoid instrument damage, never apply solvents
to the instrument.

Should the 640 case require cleaning, wipe the instrument with a cloth that is lightly dampened
with water or a mild detergent solution. The 640 requires no lubrication.

2-21. STORAGE INSTRUCTIONS

For optimum protection, store the unit indoors in a dry place.

2-22. SERVICE INFORMATION

The conditions of the 640 Warranty are given at the front of this manual. Malfunctions that
occur within the limits of the warranty will be corrected at no cost to the purchaser exclusive of
one-way shipping costs to Huntron Instruments, Inc. Huntron service is also available for repair
of instruments that are beyond the warranty period. In either case, please describe clearly the
problems encountered with the instrument.

For in-warranty or out of warranty service in the United States, call (800) 426-9265 and request
an RMA number and shipping instructions prior to shipment. This number must be clearly
displayed on the exterior of the shipping carton. Only parcels displaying an RMA number will
be accepted. For service outside the United States, contact your local Huntron distributor for
information.

SECTION 3
USING IC DIP CLIPS

3-1. COMPARING INTEGRATED CIRCUITS

This tutorial provides you with examples of how to use the 640 in some typical testing situations. This example will show you how to setup for comparison testing and highlight some of the many features of the 640.

This example shows you how to use the 640 with IC clip cables to compare integrated circuits in dual inline packages (DIP) and other components that can be connected to using IC clip cables. This example is described from the power up condition. To use this example after trying other features, turn off the power, then turn it back on.

You'll need the following:

Two black clip leads
Two 20 pin IC clip cables
Two 16 pin IC clips

Setup Procedures: refer to the following illustration for the proper connections.
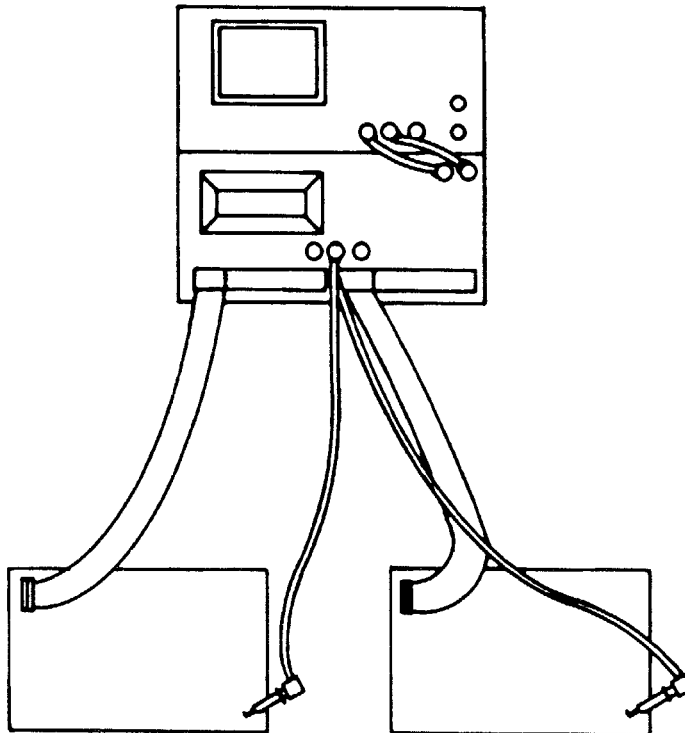
Figure 3-1. 640, DIP Clips Connection.

First the 2000's output signal has to be routed to the 640's input. Plug the two short dual banana plug leads between the 2000 channel A and COM jacks to the 640's TRACKER red and black jacks respectively.

Connect each black clip lead to the 640's COM jack. Then connect the clip leads to a common point (such as ground) on the known good board and the suspect one.

Note: It is very important that you choose the same point on each board to ensure that the comparison will be valid between identical boards.

All necessary connections are now completed so we can proceed to the next part of this example.

— Push a range button (i.e. LOW, MED1, MED2 or HIGH) on the 2000 that is appropriate for the component you wish to examine. For this example, push the MED1 range button on the 2000.

Note: For more information on how to select ranges for components refer to the Tracker 2000 Operation and Maintenance Manual.

Plug an IC clip cable (20 pin for this example) into the channel A IDC socket. Put an IC clip (16 pin for this example) on the other end of the cable. Clip the IC clip onto a known-good 14 pin DIP component. Plug the other 20 pin IC clip cable into the channel B IDC socket. Put a 16 pin IC clip on the other end of the cable. Clip the second IC clip on the suspect component.

Note: To compare CMOS ICs, connect one of the 10K resistor jumpers across the power supply of each of the two components being compared. This helps stabilize the signatures of CMOS ICs.

The 640 allows the entry of component reference designators which will be shown on the printout. When PRINT REFERENCE = ON, the 640 will prompt for a reference designator before printing comparison results. When PRINT REFERENCE = OFF, the 640 prints a blank space to write in a reference designator. For this example we will use PRINT REFERENCE = ON. To change the setting of PRINT REFERENCE:

— Press the MENU button to display the MAIN MENU.

```
┌─────────────────────┐
│   MAIN MENU         │
│ SCAN COMPARE PRT    │
└─────────────────────┘
```

Figure 3-2. Main Menu Display.

— Select the PRINT MENU by pressing the button under PRT (PRINT) on the menu.

```
┌─────────────────────┐
│    PRINT MENU       │
├─────────────────────┤
│REF  RST  STY  MODE  │
└─────────────────────┘
```

Figure 3-3. PRINT MENU Display.

— Select the PRINT REFERENCE selection display by pressing the button under REF (SIZE) on the menu .

```
┌─────────────────────┐
│REFERENCE  =  OFF    │
├─────────────────────┤
│ON              OFF  │
└─────────────────────┘
```

Figure 3-4. PRINT REFERENCE Selection Display (OFF).

— Select ON or OFF by pressing the button under the desired option on the menu. For this example, press ON (SIZE).

```
┌─────────────────────┐
│REFERENCE  =  ON     │
├─────────────────────┤
│ON              OFF  │
└─────────────────────┘
```

Figure 3-5. PRINT REFERENCE Selection Display (ON).

— Press the MENU button three times to return to the Main display.

The 640 allows automatic or manual printing of differences. When PRINT MODE = AUTO, differences are automatically printed before returning to the Main display. When PRINT MODE = MANUAL, the 640 only prints the differences upon demand. For this example we will use PRINT MODE = AUTO. To change the setting of PRINT MODE:

— Press the MENU button to display the MAIN MENU.

```
┌─────────────────────┐
│    MAIN MENU        │
├─────────────────────┤
│SCAN  COMPARE  PRT   │
└─────────────────────┘
```

Figure 3-6. Main Menu Display.

— Select the PRINT MENU by pressing the button under PRT (PRINT) on the menu.

```
PRINT MENU
REF RST STY MODE
```

Figure 3-7. PRINT MENU Display.

— Select the PRINT MODE selection display by pressing the button under MODE (PRINT) on the menu.

```
MODE = MANUAL
AUTO      MANUAL
```

Figure 3-8. PRINT MODE Selection Display.

— Press the button under AUTO (SIZE) on the menu.

```
MODE = AUTO
AUTO      MANUAL
```

Figure 3-9. PRINT MODE Selection Display (AUTO).

— Press the MENU button three times to return to the Main display.

The 640 allows the entry of the component size (number of pins on the component) and the package type such as DIP, SIP, F&B, and FRT (the sequence in which the pins are scanned-for complete details refer to Section 2-12: Component Size in this manual). For this example, we will use a 14 pin DIP.

To select the number of pins (14 for this example) and package type (DIP for use with IC clip cables):

— Press the SIZE button.

```
SIZE = 16      DIP
DIP SIP F&B   FRT
```

Figure 3-10. Component Size Entry Display (default).

— Press the 1 button followed by the 4 button. You can also set 14 by using the ↑ and ↓ buttons.

— Select the package type by pressing the button under one of the package types on the menu. For this example, press the button under DIP (SIZE).

```
┌─────────────────┐
│SIZE = 14     DIP│
│DIP SIP F&B   FRT│
└─────────────────┘
```

Figure 3-11. Component Size Entry Display (14 pin DIP).

— Press the MENU button to return to the Main display.

The 640 performs comparison testing by digitizing the signatures of both the known good (reference) component and the suspect one and then performing a point by point comparison. During the point by point comparison, the 640 factors in an additional tolerance value when determining whether the two components are equivalent or different.

Note: The tolerance is not a percentage of the reference but an actual number that is added to and subtracted from each point of the reference signature to create an equivalence window around it. The signature of the suspect component is compared to this window.

IMPORTANT NOTE:

Signatures of good components will often vary. A majority of this is due to differences in manufacturing process between different manufacturers as well as the same manufacturer for identical (i.e. part number) components. Tolerance is necessary to account for these differences between good components and allow these to compare equivalent while still being able to find truly defective components with differences caused by physical failures.

On power up, the default tolerance is 5. This value is a useful starting value that may be adequate for much of your testing. The TOL button allows you to change tolerance from 0 to 99.

To start the comparison of the components:

— Press the COMPARE button.

```
┌─────────────────┐
│1    PIN   1 OF 16│
│T: 5 COMPARE   LO│
└─────────────────┘
```

Figure 3-12. Compare Mode Display.

The 640 will compare the signatures of each pin of the two components. After all of the pins have been compared, the Recall mode is entered if signature differences are found.

```
1  PIN   1 T: 5
DIF:10  IDX:110
```

Figure 3-13. RECALL Mode Display.

The Recall mode displays the amount of difference for each of the *different* pins. The pins are displayed in order based on the IDX (index) number. The pin with the highest IDX number is shown first followed by each pin down to the one with the smallest IDX number. Press ↑ button or the foot switch to change to the next less *different* pin. The ↓ button will change to the next most *different* pin. When done reviewing the differences press the MENU button. The 640 will prompt you to enter a reference designator.

```
REFERENCE U1
ENTER A1 A2 NUM
```

Figure 3-14. Component Reference Display (default).

Enter the reference designator for the component. For this example, use U9.

— Press the button under A1 (PIN). Use ↑ ↓ buttons to select the letter 'U'.

— Press the button under NUM (PRINT).

— Press the 9 button.

— Press the button under ENTER (SIZE).

```
REFERENCE U9
ENTER A1 A2 NUM
```

Figure 3-15. Component Reference Display (U9).

— Press the MENU button.

If the printer is connected, the 640 will print the differences.

```
┌─────────────────────┐
│PRINT RESULTS        │
│ABORT                │
└─────────────────────┘
```

Figure 3-16. Print Results Display.

Notes:

SECTION 4
USING HUNTRON MICROPROBES

4-1. COMPARING DISCRETE COMPONENTS

This tutorial provides you with examples of how to use the 640 in some typical testing situations. This example will show you how to setup for comparison testing and highlight some of the many features of the 640.

This example shows you how to use the 640 with probes to compare discrete components like transistors, diodes, passive components, and other components that can not be easily accessed with IC test clips. This example is described from the power up condition. To use this example after trying other features, turn off the power, then turn it back on.

You'll need the following:

A red microprobe
A black microprobe
Two black clip leads

Setup Procedures: refer to the following illustration for the proper connections.
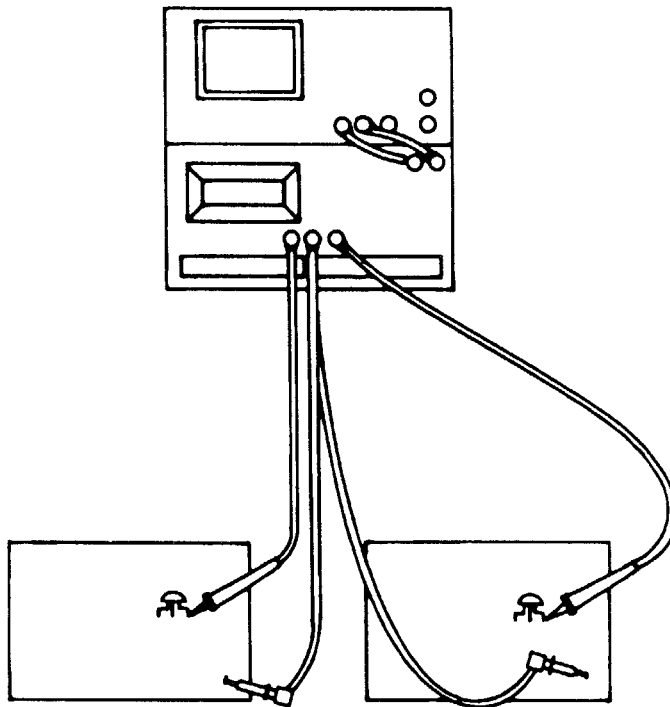
Figure 4-1. 640, MicroProbes Connection.

First the 2000's output signal has to be routed to the 640's input. Plug the two short dual banana plug leads between the 2000 channel A and COM jacks to the 640's TRACKER red and black jacks respectively.

Connect each black clip lead to the 640's COM jack. Then connect the clip leads to a common point (such as ground) on the known good board and the suspect one.

Note: It is very important that you choose the same point on each board to ensure that the comparison will be valid between identical boards.

Next, plug the red microprobe into the 640's channel A jack and the black one into the channel B jack. You will be using these probes to make contact with specific components of the circuit board.

All necessary connections are now completed so we can proceed to the next part of this example.

Push a range button (i.e. LOW, MED1, MED2 or HIGH) on the 2000 that is appropriate for the component you wish to examine. For this example, push the MED1 range button on the 2000.

Note: For more information on how to select ranges for components refer to the Tracker 2000 Operation and Maintenance Manual.

To avoid erroneous results when using probes, make sure that no pins are activated and disconnect all ribbon cables from your 640's front panel. This is because the 640's channel A and B probes are wired in parallel with the scanner's pin relays. The 640 powers up with no pins activated. Make sure the display shows pin 0, which means all pin relays are off. If the pin number is not equal to zero, then do the following:

— Push the PIN button to activate the PIN NUMBER entry display.

```
PIN NUMBER =    1
ENTER
```

Figure 4-2. PIN Entry Display.

— Push the 0 button.

— Push the button under ENTER (SIZE) on the display.

Look at the display to see that pin 0 is now selected.

```
┌──────────────────┐
│1    PIN   0 OF 16│
│T:    5        DIP│
└──────────────────┘
```

Figure 4-3. Main Display (PIN = 0).

Before you can begin comparison testing using the 640, you need to activate the ALT mode so that the A and B channels are alternately switched by the 640 and displayed on the 2000's CRT. The rate at which the A and B channels are switched can be set by the RATE control on the 2000.

The 640 allows the EQUIVALENT LED located just above the channel A button to be enabled (ALT COMPARE = ON) or not (ALT COMPARE = OFF). When ALT COMPARE = ON, the comparison will cause an open circuit signature to be displayed momentarily between the channel A and channel B signatures. When ALT COMPARE = OFF, there is no open circuit signature displayed between the channel A and channel B signatures. For this example we will use ALT COMPARE = ON. To change the setting of ALT COMPARE:

— Press the MENU button to display the MAIN MENU.

```
┌──────────────────┐
│   MAIN MENU      │
│SCAN COMPARE PRT  │
└──────────────────┘
```

Figure 4-4. Main Menu Display.

— Select the SCAN/ALT MENU by pressing the button under SCAN (SIZE) on the menu.

```
┌──────────────────┐
│  SCAN/ALT MENU   │
│MODE        TIMES │
└──────────────────┘
```

Figure 4-5. SCAN/ALT Menu Display.

— Select the ALT COMPARE MODE selection display by pressing the button under MODE (SIZE) on the menu.

```
┌─────────────────────┐
│ALT COMPARE =OFF│
│ON              OFF│
└─────────────────────┘
```

Figure 4-6. ALT COMPARE MODE Selection Display (OFF).

— Select ON or OFF by pressing the button under the desired option on the menu. For this example, press ON (SIZE).

```
┌─────────────────────┐
│ALT COMPARE = ON│
│ON              OFF│
└─────────────────────┘
```

Figure 4-7. ALT COMPARE MODE Selection Display (ON).

— Press the MENU button three times to return to the Main display.

The 2000's CRT allows you to manually examine and compare signatures while the 640 does this comparison automatically and shows the results via the EQUIVALENT LED when it is enabled.

— Push the ALT button on the 640 to initiate the alternate mode.

Place the red probe (channel A) on the lead of the known good component and the black probe (channel B) on the lead of the suspect component.

The 640 performs comparison testing by digitizing the signatures of both the known good (reference) component and the suspect one and then performing a point by point comparison. During the point by point comparison, the 640 factors in an additional tolerance value when determining whether the two components are equivalent or different.

Note: The tolerance is not a percentage of the reference but an actual number that is added to and subtracted from each point of the reference signature to create an equivalence window around it. The signature of the suspect component is compared to this window.

IMPORTANT NOTE:

Signatures of good components will often vary. A majority of this is due to differences in manufacturing process between different manufacturers as well as the same manufacturer for identical (i.e. part number) components. Tolerance is necessary to account for these differences between good components and allow these to compare equivalent while still being able to find truly defective components with differences caused by physical failures.

On power up, the default tolerance is 5. This value is a useful starting value that may be adequate for much of your testing. The TOL button allows you to change tolerance from 0 to 99.

Look at the 2000's CRT to see if these components have differences in their signature. The 640's EQUIVALENT LED will be on when the signatures are equal within the set tolerance value. The EQUIVALENT LED is off when the signatures are different.

Here's a general guideline to follow on setting the proper tolerance:

If the signature differences are slight and the EQUIVALENT LED is off, then increase the tolerance until the LED is on. If the signatures differences are significant and the EQUIVALENT LED is on, then decrease the tolerance until the LED is off.

Notes:

SECTION 5
USING HUNTRON UECA BOARDS

5-1. COMPARING EDGE CONNECTORS

This tutorial provides you with examples of how to use the 640 in some typical testing situations. This example will show you how to setup for comparison testing and highlight some of the many features of the 640.

This example shows you how to use the 640 with two Huntron universal edge connector adapters (UECA) to compare two boards. This example is described from the power up condition. To use this example after trying other features, turn off the power, then turn it back on.

You'll need the following:

Two Huntron Universal Edge Connector Adapters (UECA)
Two black clip leads

Setup Procedures: refer to the following illustration for the proper connections.
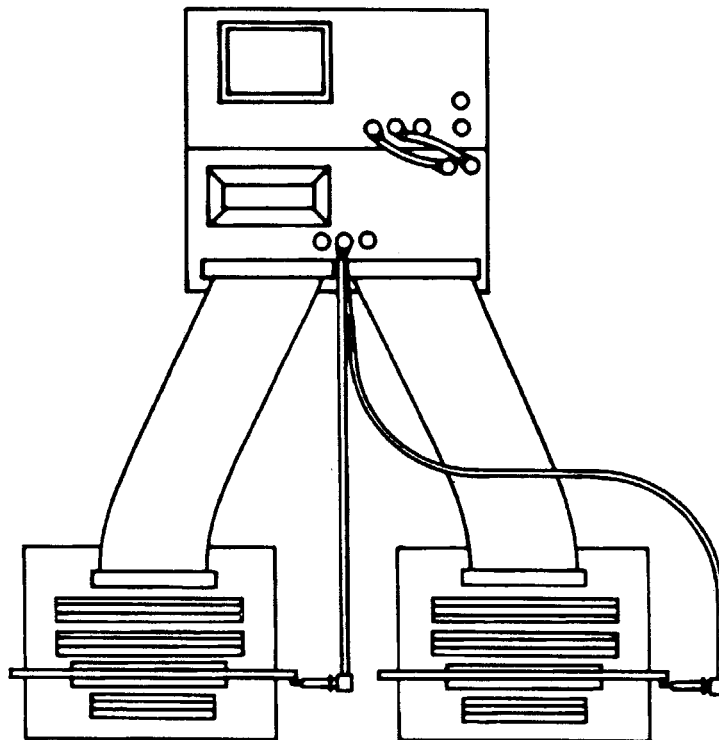
Figure 5-1. 640, 2000, UECA Connections.

First the 2000's output signal has to be routed to the 640's input. Plug the two short dual banana plug leads between the 2000 channel A and COM jacks to the 640's TRACKER red and black jacks respectively.

Connect each black clip lead to the 640's COM jack. Then connect the clip leads to a common point (such as ground) on the known good board and the suspect one.

Note: It is very important that you choose the same common point on each board to ensure that the comparison will be valid between identical boards.

All necessary connections are now completed so we can proceed to the next part of this example.

— Push a range button (i.e. LOW, MED1, MED2 or HIGH) on the 2000 that is appropriate for the component you wish to examine. For this example, push the MED1 range button on the 2000.

Note: For more information on how to select ranges for components refer to the Tracker 2000 Operation and Maintenance Manual.

If this is the first component on the board to be compared, reset the TEST COUNT. When PRINT TEST COUNT is RESET the 640 sets the test count back to one. To reset PRINT TEST COUNT:

— Press the MENU button to display the MAIN MENU.

```
MAIN MENU
SCAN COMPARE PRT
```

Figure 5-2. Main Menu Display.

— Select the PRINT MENU by pressing the button under PRT (PRINT) on the menu.

```
PRINT MENU
REF RST STY MODE
```

Figure 5-3. Print Menu Display.

— Select the PRINT TEST COUNT RESET display by pressing the button under RST (PIN) on the menu.

```
┌─────────────────┐
│TEST COUNT       │
│RESET            │
└─────────────────┘
```

Figure 5-4. Print Test Count Reset Display.

— Press the button under RESET (SIZE) on the menu.

If you have a printer, select PRINT MODE=AUTO:

— Press the button under MODE (PRINT) on the menu.

— Press the button under AUTO (SIZE) on the menu.

— Press the MENU button three times to return to the Main display.

The 640 allows the selection of two modes of comparison, ALL and STOP. For this example, we will use COMPARE MODE = STOP. When COMPARE MODE = STOP, the 640 stops scanning when any different pin is found. To select COMPARE MODE = STOP:

— Press the MENU button to display the MAIN MENU.

```
┌─────────────────┐
│   MAIN MENU     │
│SCAN COMPARE PRT │
└─────────────────┘
```

Figure 5-5. Main Menu Display.

— Select the COMPARE MENU by pressing one of the buttons under COMPARE (PIN or TOL) on the menu.

```
┌─────────────────┐
│   PRINT MENU    │
│REF RST STY MODE │
└─────────────────┘
```

Figure 5-6. Print Menu Display.

— Select the COMPARE MODE selection display by pressing the button under MODE (PRINT) on the menu.

```
MODE = ALL
ALL            STOP
```

Figure 5-7. Compare Mode Selection Display (ALL).

— Press the button under STOP (PRINT) on the menu.

```
MODE = STOP
ALL            STOP
```

Figure 5-8. Compare Mode Selection Display (STOP).

— Press the MENU button three times to return to the Main display.

The 640 allows the selection of two different styles of printouts. Both styles print a first line containing the test count, reference designator (or space for it), and a space to write in the type of component (e.g. 74LS00). When PRINT STYLE = SIMPLE, the 640 then prints one line containing the range, tolerance, pin number, difference, and index of the most different pin of the component. When PRINT STYLE = DETAIL, the 640 prints a line for each different pin of the component. From the third line on, this line contains the pin number, difference, and index. For this example we will use PRINT STYLE = DETAIL. To change the setting of PRINT STYLE:

— Press the MENU button to display the MAIN MENU.

```
  MAIN MENU
SCAN COMPARE PRT
```

Figure 5-9. Main Menu Display.

— Select the PRINT MENU by pressing the button under PRT (PRINT) on the menu .

```
  PRINT MENU
REF RST STY MODE
```

Figure 5-10. Print Menu Display.

— Select the PRINT STYLE selection display by pressing the button under STY (TOL) on the menu .

```
STYLE = SIMPLE
SIMPLE    DETAIL
```

Figure 5-11. Print Style Selection Display (SIMPLE).

— Press the button under DETAIL(PRINT) on the menu.

```
STYLE = DETAIL
SIMPLE    DETAIL
```

Figure 5-12. Print Style Selection Display (DETAIL).

— Press the MENU button three times to return to the Main display.

The 640 allows you to enter the number of pins on the component and the package type (the sequence in which the connector pins are activated). For this example, we will use a 64 pin F&B (see section 2-12 for explanation of F&B).

To select the number of pins (64 for this example) and package type (F&B for use with the UECAs):

— Press the SIZE button.

```
SIZE = 16      DIP
DIP SIP F&B   FRT
```

Figure 5-13. Component Size Entry Display (default).

— Press the 6 button followed by the 4 button. You can also set 64 using the ↑ ↓ buttons.

— Press the button under F&B (TOL) on the menu.

```
SIZE = 64      F&B
DIP SIP F&B   FRT
```

Figure 5-14. Component Size Entry Display (64 pin F&B).

— Press the MENU button to return to the Main display.

The 640 performs comparison testing by digitizing the signatures of both the known good (reference) component and the suspect one and then performing a point by point comparison. During the point by point comparison, the 640 factors in an additional tolerance value when determining whether the two components are equivalent or different.

Note: The tolerance is not a percentage of the reference but an actual number that is added to and subtracted from each point of the reference signature to create an equivalence window around it. The signature of the suspect component is compared to this window.

IMPORTANT NOTE:

Signatures of good components will often vary. A majority of this is due to differences in manufacturing process between different manufacturers as well as the same manufacturer for identical (i.e. part number) components. Tolerance is necessary to account for these differences between good components and allow these to compare equivalent while still being able to find truly defective components with differences caused by physical failures.

On power up, the default tolerance is 5. This value is a useful starting value that may be adequate for much of your testing. The TOL button allows you to change tolerance from 0 to 99.

Plug a 64 pin UECA cable into the channel A IDC socket. Plug the other end of the cable into one UECA board. Plug the known-good board into the edge connector with the appropriate spacing. Plug a 64 pin UECA cable into the channel B IDC socket. Plug the other end of the cable into the other UECA board. Plug the suspect board into the edge connector with the appropriate spacing.

To start the comparison of the edge connectors:

— Press the COMPARE button.

```
1    PIN   1 OF 64
T:  5 COMPARE   LO
```
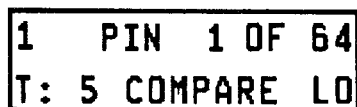
Figure 5-15. Compare Mode Display.

The 640 will compare the signatures of each pin of the two edge connectors. It will stop on any pin that is different. The 640 will be in ALT mode and you can look at the signatures on the 2000. To continue, press the COMPARE button to compare the rest of the pins. After all the pins have been compared, the recall mode is entered if signature differences are found.

```
1   PIN   1  T: 5
DIF:10   IDX:110
```

Figure 5-16. Recall Mode Display.

The Recall mode displays the amount of difference for each of the *different* pins. The pins are displayed in order based on the IDX (index) number. The pin with the highest IDX number is shown first followed by each pin down to the one with the smallest IDX number. Press the ↑ button or the foot switch to change to the next less *different* pin. The ↓ button will change to the next most *different* pin. When done reviewing the differences press the MENU button. If the printer is connected, the 640 will print the component-differences.

```
PRINT RESULTS
ABORT
```

Figure 5-17. Print Results Display.

Notes:

APPENDIX A
MENU MAPS

The following Menu Maps have been provided to help you find your way through the menus and features of the Switcher 640.

LEGENDS:

640 LCD DISPLAY

INPUT OR OUTPUT

MENU ITEM

BUTTON POINTING AT
MENU ITEM

640 BUTTON

```
          ┌──────────────────┐
          │ SWITCHER  6 4 0  │
          │ F / W    VER 1.0 │
          └──────────────────┘
                   │
                   ▼
          ┌──────────────────┐
          │ 1  PIN  0 OF 16  │
          │ T:5         DIP  │
          └──────────────────┘
                   │
                   ▼
  ┌────────┬────────┬────────┬────────┬────────
  ▼        ▼        ▼        ▼        ▼
┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐ ┌───────┐
│ MENU │ │ SIZE │ │ PIN  │ │ TOL  │ │ PRINT │
└──────┘ └──────┘ └──────┘ └──────┘ └───────┘
   │        │        │        │         │
   ▼        │        ▼        │         ▼
┌──────────────┐  ┌────────────────┐ ┌──────────────────┐
│ MAIN  MENU   │  │ PIN NUMBER = 0 │ │ P R I N T        │
│ SCAN COMPARE │  │ E N T E R      │ │ HEADER  COL  RES │
│ PRT          │  └────────────────┘ └──────────────────┘
└──────────────┘
            │               │
            ▼               ▼
   ┌──────────────────┐  ┌──────────────────┐
   │ S I Z E = 1 6 DIP│  │ TOLERANCE = 5    │
   │ DIP  SIP  F&B FRT│  │ E N T E R        │
   └──────────────────┘  └──────────────────┘
```

```
   │            │            │            │            │
   ▼            ▼            ▼            ▼            ▼
SEE PAGES   SEE PAGE    SEE PAGE     SEE PAGE    SEE PAGE
A-4, A-5, A-6   A-7        A-8          A-8         A-9
```

```
┌─────────┬──────────┬──────────┬──────────┬──────────┬──────────┐
│          │          │          │          │          │          │
▼          ▼          ▼          ▼          ▼          ▼

┌─────────┐ ┌────────┐ ┌────────┐ ┌────────┐ ┌────────┐ ┌────────┐
│ COMPARE │ │   A    │ │  ALT   │ │   B    │ │   ↓    │ │   ↑    │
└─────────┘ └────────┘ └────────┘ └────────┘ └────────┘ └────────┘
```


```
     │                          │                          │
     ▼                          ▼                          ▼
╭─────────────────╮     ┌──────────────────┐     ╭─────────────────╮
│ 1    PIN XX OF 16│     │   A    ALT    B   │     │ 1    PIN 16 OF 16│
│ T:5  COMPARE  M2 │     │  [ ○ ] [ ● ] [ ○ ] │     │ T: 5         DIP │
╰─────────────────╯     └──────────────────┘     ╰─────────────────╯
```

```
              │                          │                          │
              ▼                          ▼                          ▼
     ┌──────────────────┐     ┌──────────────────┐     ╭─────────────────╮
     │   A    ALT    B   │     │   A    ALT    B   │     │ 1     PIN  1 OF 16│
     │  [ ● ] [ ○ ] [ ○ ] │     │  [ ○ ] [ ○ ] [ ● ] │     │ T: 5         DIP │
     └──────────────────┘     └──────────────────┘     ╰─────────────────╯
```

```
     │              │              │              │
     ▼              ▼              ▼              ▼
SEE PAGE       SEE PAGE       SEE PAGE       SEE PAGE
  A-10           A-12           A-12           A-12
```

```
                    ┌─────────────────────┐
                    │     MAIN MENU       │
                    │  SCAN COMPARE PRT   │
                    └─────────────────────┘
                               │
                               ▼
                       ┌──────────────┐
                       │     SCAN     │
                       ├──────────────┤
                       │     SIZE     │
                       └──────────────┘
                               │
                               ▼
                    ┌─────────────────────┐
                    │   SCAN/ALT MENU     │
                    │  MODE       TIMES   │
                    └─────────────────────┘
                               │
              ┌────────────────┴────────────────┐
              ▼                                  ▼
        ┌──────────┐                       ┌──────────┐
        │   MODE   │                       │  TIMES   │
        ├──────────┤                       ├──────────┤
        │   SIZE   │                       │  PRINT   │
        └──────────┘                       └──────────┘
              │                                  │
              ▼                                  ▼
     ┌──────────────────┐             ┌──────────────────┐
     │ ALT COMPARE = OFF│             │   ALT TIMES = 3  │
     │ ON          OFF  │             │   ENTER          │
     └──────────────────┘             └──────────────────┘
              │                                  │
       ┌──────┴──────┐                           ▼
       ▼             ▼              ┌──────────────────────┐
  ┌────────┐    ┌────────┐          │        USE           │
  │   ON   │    │  OFF   │          │  NUMERIC BUTTONS     │
  ├────────┤    ├────────┤          │   TO INPUT DATA      │
  │  SIZE  │    │ PRINT  │          └──────────────────────┘
  └────────┘    └────────┘                      │
       │             │                          ▼
       ▼             ▼                     ┌──────────┐
┌───────────────┐ ┌───────────────┐        │  ENTER   │
│ALT COMPARE= ON│ │ALT COMPARE=OFF│        ├──────────┤
│ON        OFF  │ │ON        OFF  │        │  SIZE    │
└───────────────┘ └───────────────┘        └──────────┘
```

```
                    ┌─────────────────────┐
                    │     MAIN MENU       │
                    │  SCAN COMPARE PRT   │
                    └─────────────────────┘
                              │
                              ▼
                    ┌─────────────────────┐
                    │     COMPARE         │
                    ├─────────────────────┤
                    │   PIN  or  TOL      │
                    └─────────────────────┘
                              │
                              ▼
                    ┌─────────────────────┐
                    │  COMPARE MENU       │
                    │  MODE       CYCLE   │
                    └─────────────────────┘
                              │
           ┌──────────────────┴──────────────────┐
           ▼                                      ▼
    ┌──────────────┐                       ┌──────────────┐
    │    MODE      │                       │    CYCLE     │
    ├──────────────┤                       ├──────────────┤
    │    SIZE      │                       │    PRINT     │
    └──────────────┘                       └──────────────┘
           │                                      │
           ▼                                      ▼
    ┌──────────────────┐                   ┌──────────────────┐
    │ MODE - ALL       │                   │ CYCLE - ONE      │
    │ ALL        STOP  │                   │ ONE        LOOP  │
    └──────────────────┘                   └──────────────────┘
           │                                      │
      ┌────┴────┐                          ┌──────┴──────┐
      ▼         ▼                          ▼             ▼
 ┌────────┐ ┌────────┐              ┌────────┐     ┌────────┐
 │  ALL   │ │  STOP  │              │  ONE   │     │  LOOP  │
 ├────────┤ ├────────┤              ├────────┤     ├────────┤
 │  SIZE  │ │  PRINT │              │  SIZE  │     │  PRINT │
 └────────┘ └────────┘              └────────┘     └────────┘
      │         │                        │             │
      ▼         ▼                        ▼             ▼
┌──────────┐ ┌──────────┐        ┌──────────┐   ┌──────────┐
│ MODE-ALL │ │ MODE-STOP│        │CYCLE-ONE │   │CYCLE-LOOP│
│ALL   STOP│ │ALL   STOP│        │ONE   LOOP│   │ONE   LOOP│
└──────────┘ └──────────┘        └──────────┘   └──────────┘
```

```
                        ┌─────────────────────┐
                        │     MAIN MENU       │
                        │  SCAN COMPARE PRT   │
                        └─────────────────────┘
                                  │
                                  ▼
                        ┌─────────────────────┐
                        │         PRT         │
                        ├─────────────────────┤
                        │        PRINT        │
        ┌───┐           └─────────────────────┘
        │ A │──────────────────►
        └───┘                   ┌─────────────────────┐
                                │     PRINT MENU      │
                                │   REF RST STY MODE  │
                                └─────────────────────┘
                                          │
         ┌────────────────┬───────────────┴───────────────┬────────────────┐
         ▼                ▼                                ▼                ▼
   ┌──────────┐     ┌──────────┐                     ┌──────────┐    ┌──────────┐
   │   REF    │     │   RST    │                     │   STY    │    │   MODE   │
   ├──────────┤     ├──────────┤                     ├──────────┤    ├──────────┤
   │   SIZE   │     │   PIN    │                     │   TOL    │    │  PRINT   │
   └──────────┘     └──────────┘                     └──────────┘    └──────────┘
         │                │                                │                │
         ▼                ▼                                ▼                ▼
┌──────────────────┐ ┌──────────────────┐      ┌──────────────────┐ ┌──────────────────┐
│ REFERENCE = OFF  │ │   TEST COUNT     │      │ STYLE = SIMPLE   │ │  MODE = MANUAL   │
│ ON          OFF  │ │   RESET          │      │ SIMPLE   DETAIL  │ │ AUTO     MANUAL  │
└──────────────────┘ └──────────────────┘      └──────────────────┘ └──────────────────┘
         │                │                                │                │
     ┌───┴────┐           ▼                           ┌────┴────┐           ▼
     ▼        ▼     ┌──────────┐                      ▼         ▼      
┌────────┐ ┌────────┐│  RESET   │              ┌──────────┐ ┌──────────┐   ┌──────────┐ ┌──────────┐
│   ON   │ │  OFF   │├──────────┤              │  SIMPLE  │ │  DETAIL  │   │   AUTO   │ │  MANUAL  │
├────────┤ ├────────┤│   SIZE   │              ├──────────┤ ├──────────┤   ├──────────┤ ├──────────┤
│  SIZE  │ │ PRINT  │└──────────┘              │   SIZE   │ │  PRINT   │   │   SIZE   │ │  PRINT   │
└────────┘ └────────┘     │                    └──────────┘ └──────────┘   └──────────┘ └──────────┘
     │        │        ┌──┴──┐                      │            │
     ▼        │        │  A  │                      ▼            │
┌──────────────┐│      └─────┘          ┌──────────────────┐     │
│ REFERENCE = ON││                      │ STYLE = SIMPLE   │     │
│ ON       OFF ││                      │ SIMPLE   DETAIL  │     │
└──────────────┘│                      └──────────────────┘     │
               ▼                                                ▼
     ┌──────────────────┐                          ┌──────────────────┐
     │ REFERENCE = OFF  │                          │ STYLE = DETAIL   │
     │ ON          OFF  │                          │ SIMPLE   DETAIL  │
     └──────────────────┘                          └──────────────────┘
```

┌──────────────────┐   ┌──────────────────┐
│ MODE = AUTO   │   │ MODE = MANUAL   │
│ AUTO   MANUAL │   │ AUTO   MANUAL │
└──────────────────┘   └──────────────────┘

```
                          ┌──────────┐
                          │   SIZE   │
                          └────┬─────┘
                               │
                               ▼
                   ┌───────────────────────┐
                   │  SIZE - 16      DIP    │
                   │  DIP  SIP  F&B  FRT    │
                   └───────────┬───────────┘
                               │
     ┌───────────┬─────────────┼─────────────┬─────────────────┐
     ▼           ▼             ▼             ▼                 ▼
┌─────────┐ ┌─────────┐ ┌─────────┐ ┌─────────┐ ┌──────────────────────┐
│   DIP   │ │   SIP   │ │   F&B   │ │   FRT   │ │ USE NUMERIC BUTTONS   │
├─────────┤ ├─────────┤ ├─────────┤ ├─────────┤ │ (0-9) TO SET THE      │
│  SIZE   │ │   PIN   │ │   TOL   │ │  PRINT  │ │ NUMBER OF PINS A      │
└────┬────┘ └────┬────┘ └────┬────┘ └────┬────┘ │ DEVICE HAS  (E.G. 40) │
     │           │           │           │      └──────────┬───────────┘
     │           ▼           │           ▼                 │
     │    ┌──────────────┐   │    ┌──────────────┐         │
     │    │ SIZE - 16 SIP│   │    │ SIZE - 16 FRT│         │
     │    │ DIP SIP F&B  │   │    │ DIP SIP F&B  │         │
     │    │        FRT   │   │    │        FRT   │         │
     │    └──────────────┘   │    └──────────────┘         │
     ▼                       ▼                             ▼
┌──────────────┐    ┌──────────────┐          ┌──────────────┐
│ SIZE - 16 DIP│    │ SIZE - 16 F&B│          │ SIZE - 40 DIP│
│ DIP SIP F&B  │    │ DIP SIP F&B  │          │ DIP SIP F&B  │
│        FRT   │    │        FRT   │          │        FRT   │
└──────────────┘    └──────────────┘          └──────────────┘
```

```
         ┌──────────┐                    ┌──────────┐
         │   PIN    │                    │   TOL    │
         └────┬─────┘                    └────┬─────┘
              │                               │
              ▼                               ▼
    ╭───────────────────╮          ╭───────────────────╮
    │ PIN NUMBER = 0    │          │ TOLERANCE = 5     │
    │ ENTER             │          │ ENTER             │
    ╰─────────┬─────────╯          ╰─────────┬─────────╯
              │                               │
              ▼                               ▼
    ┌───────────────────┐          ┌───────────────────┐
    │ USE NUMERIC BUTTONS│         │ USE NUMERIC BUTTONS│
    │ (0-9) TO ACTIVATE A│         │ (0-9) TO ENTER THE │
    │ SPECIFIC PIN OF A  │         │ TOLERANCE (E.G. 15)│
    │ DEVICE (E.G. 21)   │         │                    │
    └─────────┬─────────┘          └─────────┬─────────┘
              │                               │
              ▼                               ▼
    ╭───────────────────╮          ╭───────────────────╮
    │ PIN NUMBER = 21   │          │ TOLERANCE = 15    │
    │ ENTER             │          │ ENTER             │
    ╰─────────┬─────────╯          ╰─────────┬─────────╯
              │                               │
              ▼                               ▼
       ┌──────────┐                    ┌──────────┐
       │  ENTER   │                    │  ENTER   │
       ├──────────┤                    ├──────────┤
       │  SIZE    │                    │  SIZE    │
       └────┬─────┘                    └────┬─────┘
            │                               │
            ▼                               ▼
 ╭───────────────────╮          ╭───────────────────╮
 │ 1      PIN 21 OF 40│         │ 1      PIN 21 OF 40│
 │ T: 5        D I P  │         │ T: 15       D I P  │
 ╰───────────────────╯          ╰───────────────────╯
```

```
                              ┌──────────┐
                              │  PRINT   │
                              └────┬─────┘
                          ╭────────┴────────╮
                          │ PRINT           │
                          │ HEADER COL RES  │
                          ╰────────┬────────╯
          ┌──────────────────────┼──────────────────────┐
    ┌───────────┐          ┌───────────┐          ┌───────────┐
    │  HEADER   │          │    COL    │          │    RES    │
    ├───────────┤          ├───────────┤          ├───────────┤
    │   SIZE    │          │ PIN or TOL│          │   PRINT   │
    └─────┬─────┘          └─────┬─────┘          └─────┬─────┘
          │                      │                      │
   ╭──────┴──────╮        ╭──────┴──────╮        ╭──────┴──────╮
   │PRINT HEADER │        │PRINT COLUMN │        │PRINT RESULTS│
   │ABORT        │        │             │        │ABORT        │
   ╰──────┬──────╯        ╰──────┬──────╯        ╰──────┬──────╯
```

PRINT HEADER ABORT

PRINT ONE LINE OF HEADER

PRINT COLUMN

PRINT RESULTS ABORT

PRINT ONE LINE OF RESULTS

NO — DONE ? — YES

ABORT / SIZE

NO — DONE ? — YES

ABORT / SIZE

```
                  ╭──────────────────╮
                  │1        PIN 0 OF 16│
                  │T: 5           D I P│
                  ╰──────────────────╯
```

```
                          ┌──────────────┐
                          │   COMPARE    │
                          └──────┬───────┘
                                 │
                                 ▼
                    ╭────────────────────────╮
                    │ 1     PIN    0 OF 16   │
                    │ T: 5   COMPARE  M2     │
                    ╰────────────┬───────────╯
                                 │
                                 ▼
            ALL            ◇ COMPARE ◇      STOP              ┌──────────────┐
      ◄─────────────────── ◇  MODE   ◇ ──────────────────────►│   COMPARE    │
      │                    ◇         ◇                        └──────┬───────┘
      │                                                              │
      │                              ┌────────────────┐              │
      │                              │  INCREMENT     │◄─────────────┤
      │                              │    PIN #       │              │
      │                              └───────┬────────┘              │
      │                                      │                       │
      │                                      ▼                       │
      │                             ◇   IS   ◇   YES                 │
      │                             ◇ PIN #  ◇ ────►                 │
      │                             ◇ >SIZE  ◇              ┌────────┴────────┐
      │                              │                      │   STOP ON       │
┌─────┴────────┐                    │ NO                    │    PIN          │
│ COMPARE ALL  │                     ▼                      └────────┬────────┘
│ PINS WITHOUT │              ┌──────────────┐                       │
│  STOPPING    │              │  COMPARE     │                       │
└─────┬────────┘              │  EACH PIN    │                       │
      │                       └──────┬───────┘                       │
      │                              │                               │
      │                              ▼                               │
      │                       ◇   IS   ◇     NO                      │
      │                       ◇  PIN   ◇ ──────►                     │
      │                       ◇DIFFERENT◇                            │
      │                              │                               │
      │                              │ YES                           │
      │                              ▼                               │
      └──────────────►◄──────────────┴───────────────────────────────┘
                      │
                      ▼
               ◇  ALL    ◇   YES         ┌──────────────┐
               ◇  PINS   ◇ ─────────────►│  EQUIVALENT  │
               ◇  EQUIV. ◇               │ LED STAYS ON │
               ◇    ?    ◇               └──────┬───────┘
                      │                          │
                      │ NO                       ▼
                      ▼                   ╭──────────────────╮
               ┌──────────────┐           │ 1     PIN 0 OF 16│
               │  GO TO       │           │ T: 5        DIP  │
               │ RECALL MODE  │           ╰──────────────────╯
               │ SEE PAGE A-11│
               └──────────────┘
```

```
                          ┌─────────────┐
                          │   RECALL    │
                          │    MODE     │
                          └──────┬──────┘
                                 │
                                 ▼
                   ╭─────────────────────────╮
                   │ 1    PIN   10    T: 5    │
                   │ DIF:  49      IDX:101    │
                   ╰─────────────┬───────────╯
                                 │
     ┌───────────────────────────┼──────────────────────────┐
     │                           │                          │
     │        ┌─────────┐   ┌─────────┐              ┌─────────┐
     │        │    ↑    │   │    ↓    │              │  MENU   │
     │        └────┬────┘   └────┬────┘              └────┬────┘
     │             │             │                        │
     │    ┌────────────────┐ ┌────────────────┐           ▼
     │    │   SET PIN #    │ │   SET PIN #    │      AUTO ◇ MAN
     │    │   TO NEXT      │ │   TO NEXT      │     ┌─── PRINT ───┐
     │    │   LESS DIFF.   │ │   MORE DIFF.   │     │    MODE     │
     │    └───────┬────────┘ └───────┬────────┘     │             │
     │            │                  │              ▼             │
     └────────────┴──────────────────┘      ┌──────────────┐     │
                                             │   PRINT      │     │
                                             │ 1. HEADER    │     │
                                             │ 2. COLUMN    │     │
                                             │ 3. RESULTS   │     │
                                             └──────┬───────┘     │
                                                    │             │
                                                    └──────┬──────┘
                                                           │
                                                           ▼
                                              ╭──────────────────────╮
                                              │ 1      PIN  0  OF 16  │
                                              │ T: 5           D I P  │
                                              ╰──────────────────────╯
```

```
┌─────┐          ┌─────┐          ┌─────┐
│  A  │          │ ALT │          │  B  │
└─────┘          └─────┘          └─────┘
   │                │                │
   ▼                ▼                ▼
```

| A | ALT | B | | A | ALT | B | | A | ALT | B |

```
   │                │                │
   ▼                ▼                ▼
┌──────┐         ┌──────┐         ┌──────┐
│ SCAN │         │ SCAN │         │ SCAN │
└──────┘         └──────┘         └──────┘
   │                │                │
   ▼                ▼                ▼
```

| SCAN PINS OF CHANNEL A | | SCAN PINS ALTERNATE CHANNEL A/B | | SCAN PINS OF CHANNEL B |

```
   │                │                │
   ▼                ▼                ▼
```

| 1   PIN XX OF 16
T: 5   DIP | | 1   PIN XX OF 16
T: 5   3X   DIP | | 1   PIN XX OF 16
T: 5   DIP |

A	CANCELS	ALT	OR	B
B	CANCELS	ALT	OR	A
ALT	CANCELS	A	OR	B	EXCEPT WHEN SCAN IS ACTIVE