CableTest Systems Inc. HORIZON SERIES TESTER

H1500 PROGRAMMER'S MANUAL v 4.5.xx





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1 INTRODUCTION



1-2 Horizon Series Tester: Programmer's Manual

1.1 Welcome

Thank You. Congratulations and thank you for purchasing your Horizon Series Tester. CableTest Systems Inc. is proud of its Horizon line of testers and warranty's them for one (1) full year parts and labour (please see our complete Warranty at the beginning of this manual).

Where to get more help:

Check out our web site: Email our Support Team: Call Toll Free in the US and Canada: International: Fax: www.CableTest.com service@CableTest.com 800.495.1998 +1 905.475.2607 +1 905.475.2609

1.2 Abbreviations and Symbols

	•
i	Important: Additional User Information
$\bigvee!$	Caution: Indicates how to avoid potential damage to parts/components or loss of data.
\checkmark	Warning: Indicates how to avoid potential bodily harm.
к	Keyboard Shortcut – Horizon Lite user navigation information
S	Examples of Horizon Script Language
EPO	Emergency Power Off
EXP	Expansion
FER	Faulty End Recognition
HCS	High Current Source
HiPot	High Potential Test
HV	High Voltage
LV	Low Voltage
MSR	Measurement Board
NetList	Groups of test points, sorted by their connections (Nets).
PUT	Product Under Test
TCL	Tool Command Language

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1.3 Safety

Warning!

This product generates high potential as a test stimulus when programmed to do so.

To avoid the risk of shock do not attempt to service the supply beyond the described steps in the User's Manual.

To avoid the risk of shock or personal injury, do not remove the product covers while the unit is operating or connected the AC mains.

Use only a power cord rated greater than the input current rating of the external power supplies. Use only a cord in good condition.

If liquid is spilled on the unit, shut it off immediately and disconnect it from the AC mains.

Ensure the unit is properly grounded using a reliably grounded AC mains input at the external power supplies.

Do not touch any exposed wiring on your product under test (PUT) while the High Voltage lamp is illuminated.

For additional safety it is recommended to use an approved EPO (Emergency Power Off) switch during High Voltage testing.

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1.4 Built-In Safety

The Horizon Series Tester has built-in safety systems:

Interlock:

EPO (Emergency Power Off) switch connected to the Horizon's I/O can be used as emergency high voltage shut off.

Software Safety:

The H1500 will not perform a High Voltage test on a product that has failed either continuity or isolation.

By default, the software pauses before running a High Voltage test. The operator is prompted to continue.

(i) The operator prompt before High Voltage tests can be disabled – enabling it allows an immediate High Voltage test to follow a passed Low Voltage test. CableTest Systems Inc. does not take responsibility for injury caused by the 'Autohipot' option.

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2 GETTING STARTED

How to create and test your first product



2-2 Horizon Series Tester: Programmer's Manual

2.1 Overview

Welcome to the 'Getting Started' guide for the Horizon Series Testers. The Horizon can be used right out of the box, so as soon as you have unpacked it you can begin creating test programs. No system setup is required to begin testing basic product. If you wish to explore the 'System Setup' options at this time, please see Section 3.

Install the Horizon as per instructions detailed in the Horizon Operator's Manual.

2.1.1 Turning on the System

Turn on your Horizon by toggling the power switch located on the rear panel. The system will perform a complete self-test and then display the *Main Menu*.

If, at the end of the sequence, the *Main Menu* is not displayed, or if you see any error messages, contact CableTest or an Authorized Representative immediately.

2.1.2 Screen Navigation

You may navigate the Menus of the Horizon LV and HV testers by selecting options on the touch screen or by using an installed keyboard to select the underlined characters using the Alt key.

Horizon Lite (H1500-LV2) users must use an installed keyboard and can navigate using the Alt key and the underlined characters.

Example:

For "<u>Iest</u>" select <Alt-T>

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By default all affirmative buttons (**Ok** and **Yes**) can be selected by pressing **<Enter** → and all **Cancel** or **No** buttons can be selected by pressing **<Esc>**.

1. Main Menu 🔳 U4.5.52		
Sun, Sep 29, 2002 12:37 PM		
<u>T</u> est	<u>S</u> elf-Test	
System Setupî <u>P</u> rogram Cable		
<u>B</u> ackup ⁱ <u>E</u> dit Adapter ⁱ		
▲ Contrast ▼ Shut <u>D</u> own		
anata ata al a a	the all a set and leave	

A detailed tour of the *Main Menu* will be provided in the following section. The only two selections you will need for this 'Getting Started' exercise are the **Test <Alt-T>** button and the **Programming Cable <Alt-P>** button.

Contrast Shut <u>Pown</u> Please note that **Programming Cable** <**Alt-P>** is password protected as indicated by the small key symbol to the right of the button display. Most companies want to restrict the ability to perform these types of operations to a selected few, so a complete, multilevel password protection capability is provided.

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The factory installed Password is "1234".

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2.2 Learning Your Cable

The easiest and most straightforward method of programming the Horizon is to use a known good sample or "Golden" cable for each type of cable to be tested. The parametric model for this cable is then stored internally in a simple ASCII file and used as the basis for testing all cables or harnesses of the same type and configuration. For that reason, the first time you "learn" a given cable, care should be taken to use a known good sample. However, once a cable is "learned", all of its parameters are retained in file until deleted, so this process needs to be performed only one time for any given cable. For more information regarding test programs as ASCII files, see Section 9.

The following procedure assumes that you are using standard CableTest adapters. If you are not, then you must first program, or "learn", the adapter using the procedures defined in section 6. Adapter characteristics are also stored in a simple ASCII file.

TO LEARN YOUR CABLE

Ent	er your	. passi	word 🔳
(****)			
1	2	3	<u>C</u> lear
4	5	6	BS
7	8	9	Enter
0		Esc	Encer

On the *Main Menu*, select **Program Cable <Alt-P>**. The Horizon will ask for a Password. The factory installed Password is "1234". Type in the Password and select **Enter <Enter .**]>. The *Programming Cable* dialog appears.

- (i) As soon as you feel comfortable with the operation of the Horizon, and before you put it onto the production line, you should change the Password to one of your choice using the procedure outlined in Section 3. This will prevent unauthorized personnel from altering setup information or the cable and adapter databases.
- (i) For the following exercise, it is assumed that you are using a simple end-toend cable with no embedded components and no free ends or "flying leads". The Horizon can easily handle complex cables and harnesses with any or all of these elements, but it is strongly suggested that you start with a simpler type of cable until you feel comfortable with the system's standard mode of operation.

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Figure 2-1: Example Cable (One to One, 25 Conductors)

1 .	Programming Cable	1
	<u>M</u> odify Existing Cable	
	<u>L</u> earn New Cable - Defau	1t
	Learn New Cable - C <u>u</u> st	om
	Advanced <u>N</u> etlist Editor	r
_	<u>C</u> ance l	

Several methods of programming cables are provided in your new Horizon. These are discussed in detail in the following sections. For this exercise, we are going to learn a new cable using the standard method.

Using this method, the Horizon will learn all of the cable's resistance and capacitance parameters, and generate a complete NetList for the cable.

It will then store all of the information in a database, and build a test procedure to be used for testing cables of the same type in the future. The **Modify Existing Cable <Alt-M>** selection allows you to easily change these parameters should you desire, quickly implementing ECO's to already learned cables, or building up families of similar cables without always going through the learn process for each one.

Select Learn New Cable – Default <Alt-L>. The Insert Adapter(s) dialog appears.

Inse	rt The	Adapte	r(s)	
	HA	116		
J1	J2_	J3	J4	Ъ
	_			1
				ы
				目
				目
HA		HA		
116		116	J	
	· · · · · · · · · · · · · · · · · · ·			<u> </u>
<u>s</u>	elect	<u>C</u> ance	21 <u>C</u>	<u>j</u> k

The top of the Horizon is divided into two sections, each of which has four grey connectors. The left most set of connectors (top and bottom) constitutes J1, as can be seen from the label at the top. The two to the right make up J2, and so forth. Adapters that use a single set of connectors are referred to as a "Single".

Adapters that use all four connectors are referred to as a "Double". The combination of four connectors on the left, make up J5, while those on the right make up J6. An Adapter that uses both sections is called a "Quad "; all eight connectors together make up J7.

The example shows two "Single" HA116's mounted, but yours may be different. Note that a given adapter covers the "J" designator in each section. "Single" and "Double" adapters may be used in any combination and in any location, except that a "Double" cannot span across two sections.

Insert your adapters in the position(s) of choice and select Ok <Alt-O or Enter .- >.

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Getting Started

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You are prompted to connect your cable to the adapters. Make sure the connections are secure and that the cable is hooked up properly. The system is about to learn exactly what constitutes a good cable of this type and configuration.

Any mistakes at this stage will be treated by the system as a good cable and may affect the accuracy of later testing.

If everything is correct, select **Ok <Alt-O or Enter**

 to begin the learning process. Some progress bars will appear briefly indicating that the Horizon is analyzing your cable and storing its NetList and parameters in a uniquely named product file.

1] Enter Part Number
TEST CABLE #\$%
1234567890 &*()/,:4 #5()/,:4 #5()// Exc Enter <u>6Z</u> Space Bar Clear
& * <) / , : -
\$ < > × " / Esc
AZ Space Bar Clear

The *Enter Part Number* dialog will then appear. Type a unique name for your cable. This may be the actual part number or any other name of your choice. You can use any combination of alpha (upper and lower case) and numeric characters, as well as other valid ASCII symbols such as parentheses. *, &, ^,

etc. (Numbers and symbols are accessed from the alpha screen by selecting the "**0..9**" key at the lower left hand corner; from the numeric/symbol screen, alpha characters are accessed by selecting the "**A..Z**" button in the lower left.) The name or part number may be up to 30 characters in length.

)] Set Test Parameters 🔲		
Name / <u>P</u> rompt	<u>A</u> dapters	
Low Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>Cancel</u> <u>O</u> K	
harness may have.		

Under Set Test Parameters you can customize your test by specifying or modifying your products tolerances. You can set up DC and/or AC HiPot testing (if your system is equipped to perform these tests), and declare any embedded components (resistors, capacitors, and/or diodes) that your cable or

Another unique feature of the Horizon is that you can apply natural language labels of up to 30 characters in length not only to each net in your cable, but also to each node, pin, or connector. This feature can be invaluable in helping the re-work station troubleshoot and re-work bad cables. All of these will be explained in detail in the next section. At this point, however, we simply want to show you how to use the NetList to help verify that the cable you just learned is, in fact, a "golden" cable.

Select **Net List <Alt-N>** and the *Edit Net* display will appear.

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One obvious use of the NetList is to help verify that the cable you are learning is a good one (also known as a sanity check). Reading the NetList is simple and straightforward.

In the example shown, the first entry states that Net 1 starts at J1, connector 1, pin 1 and goes to J3, connector 3, pin 1.

Examining the rest of the NetList clearly shows that this is a one to one cable. If the result is not what is expected, based on the cable design criteria, it would be one indication that the cable being learned was not, in fact, "golden". If a given net has more elements, such as is common in a harness, or there is more information available, two periods will appear at the end of the net entry.

Selecting the **Open <Alt-P>** button would show these additional elements. The **Edit** <**Alt-E>** button allows you to specify exactly on which nets to perform certain additional tests, such as a HiPot test, if you do not want to perform these tests on the whole cable. This will be explained in detail in the next chapter. The **Edit <Alt-E>** function will also be explained in detail in the following sections.

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The single arrow keys move the cursor one line at a time, while the double arrow keys move it a page at a time.

C	Edit	Net	н
DOTEST C	ABLE #	\$%	
A VELLOWZGRE	i Moline)
Net(J1.	či:5;	J3:č1:3)	
Net(J1.	<u>c1.4</u> ,	13.51.55	
Net(J1.	č1'č'	J3:či:čí	
Net (J1.	C1.7;	J3:C1:7)	
± • F	Edit	Labe 1	
			<u>o</u> x
	0 <u>p</u> en	T <u>w</u> isted	

The Label <Alt-L> button allows you to replace any or all the standard NetList descriptors with natural language descriptors of your choice. Selecting Label <Alt-L> in the *Edit Label* dialog (also accessed with the **Open** <**Alt-O**> button) allows you to rename the individual elements of the net (such as connectors and pins), while selecting Label <Alt-L> in the *Edit*

Net dialog allows you to rename the entire net.

For example, you might name an element "red wire" or "red wire with white stripe", and name the entire net "signal 1". You can use any alpha, numeric, or symbolic character so long as the name does not exceed 30 characters in length. **Label <Alt-L>** will also be discussed in detail in the following section. When finished entering any desired labels, select **Ok <Enter** L> twice and the *Save Cable Record* dialog appears.



Select **Yes <Enter** ,J> to save your cable record. The *Save To Directory* dialog appears. The Horizon does not rely on the computer operating system for its directory naming conventions, so you can create directory names that are meaningful to your operation.

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Congratulations, you have successfully learned your first cable!

Although you can continue the learning process and program as many cables as you like by simply repeating these steps, it is strongly recommended that you complete this Getting Started Tutorial by testing the cable you have just learned.

Select Cancel <Alt-C or Esc> and you will return to the Main Menu.

2.3 Testing Your Cable

Many types of operations can be performed with your new Horizon Analyzer, including testing for shorts, opens, mis-wiring and many other cable faults. If any of these types of faults are detected, the system will not only report their presence, it will tell you exactly where they are. For example, "Short between Net#11 and Net#22 at J1, Connector 1, pin 3", or "J2, Connector 1, Pin 6 wired to J2.C1.17 instead of J1.C1.6". In fact, if, during the learning process, you labelled your wires and nets, the diagnostics will be in natural language! For example, "Short between Red Wire and Blue Wire at Round Connector, pin 3". For now, we will simply perform a set of tests on the cable you learned in the previous section.

To test your cable

On the Main Menu, select Test <Alt-T>. The Test Configuration dialog appears.

10	Tes	t Configurat	ion 🖽
Fil dat	- Man	ly Selected	
L Par TES Rev	t Numi T CABI	ber: LE #\$%	
To	00 <u>1</u> 5	<u>Reports</u>	Select
Tes	t Now	Batches	<u>C</u> ance 1

The display shows the Directory and the Part Number for the cable you just learned.

If you do not see the correct information you will have to press **Select <Alt-S>** to select your cable. The *Select Part Number* dialog appears.



Select the part number for your cable, using the arrow keys if necessary, and select **Ok <Enter** ,J>. The *Test Configuration* dialog reappears with your cable as the Currently Selected Cable.

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Only one product is available, since only one product has been learned.

(i) This selection process is only necessary if you want to test a cable other than that shown as the Currently Selected Cable, and will only need to be performed in the future whenever you need to change the type of cable being tested.



Too<u>l</u>s <u>R</u>eports <u>S</u>elect Test Now Batches Cancel [] Insert the Adapter(s)

JЗ

HA 116

Accept Cancel

J2_

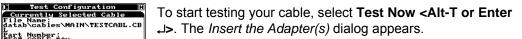
II.

-J7

Part Number: TEST CABLE #\$%

HA

The Horizon loads the selected product.



Insert the adapters required to test your cable. Make sure that you insert them in the same order and position as they were mounted when you learned the cable. Note that the system will prompt you for any missing, mis-positioned, or incorrect adapters by flashing an outline in the appropriate position and

by flashing the part number. As soon as all of the proper adapters are mounted, the Connect Product to Start dialog appears. TEST CORLE #5

Connect Product	to Start
Tested : 0 Passed : 0 Failed : 0	
Error <u>S</u> tatistics	<u>D</u> iagnose
Start <u>T</u> est	<u>C</u> ance l
I TEST CARLE Test in Prov	a krimana
) Test Rela Relay Tes 34%	
Error <u>Statistics</u>	Làssose
Start <u>T</u> est	Cancel
1] TEST CABLE Test in Prov	
I. Performing Continuit 68%	
Error <u>S</u> tatistics Start <u>T</u> est	<u></u>

Mount your cable on the adapters. As soon as the cable is mounted, the low voltage portion of the tests automatically starts.

The relays are tested and cleaned.

The system will indicate testing progress by displaying a horizontal bar graph that visually tracks the continuity and isolation tests as they are performed.

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If you do not see the progress bar, then it may be disabled on your Horizon. See section 3: **System Setup** for more details on enabling the progress bar.

Assuming that you are testing the same cable learned in the previous section, you will be returned to the *TEST CABLE* menu after testing is completed, the green PASS light will be lit, and a flashing message will instruct you to *Disconnect the Product*.



Note that the display has changed to indicate that you have tested one product and that one passed. At this point, you may want to experiment with cables containing different kinds of faults to fully explore how the **Diagnose** <**Alt-D**> button will track all fault locations, and how the **Error Statistics** <**Alt-S**> key reports cumulative statistics on type and number of faults

found. (The **Retest <Alt-T or Enter** ,)> button allows you to perform the same series of tests in the event that you discovered some problem in the test setup.)

(i) The act of fully connecting a cable automatically starts the test, while disconnecting the cable automatically re-arms the system to start the next test. If you are having trouble getting your test sequence to start or sequence properly, refer to the section on Scan Delay in Section 3.5.

HiPot testing was not discussed at this time since it was not set up as part of the learning process for your cable in this initial exercise. If you went ahead and set up the Horizon to perform High Voltage testing when you learned your cable, then, for safety reasons, the High Voltage tests would not have been performed unless the product first passed the low voltage testing.

Congratulations! You have successfully tested your first cable.

When you are finished experimenting, remove the cable and select **Cancel <Alt-C or Esc>**. This will return you to the *Test Configuration* menu. You can select another cable for testing, or, if you are through for the moment, select **Cancel <Alt-C or Esc>** again and you will be returned to the *Main Menu*.

To turn off the Horizon, select **Shut Down <Alt-D>** from the *Main Menu*. You will be asked to confirm your decision **<Alt-Y or Enter** \downarrow >; then, when instructed, turn off the power. To cancel shut down select **No <Alt-N or Esc>**.

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	you reall to shut do	wn?	. <u>*</u> .
S J.LS"	<u>Y</u> es <u>N</u>	0	ني. توريد

√!∕

It is very important you follow the proper shut down sequence. Failure to do so may corrupt your adapter/cable database.

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3 SYSTEM SETUP



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3.1 Introduction

Each cable-testing environment is unique incorporating a different set of requirements. Many of these requirements are built around your testing philosophy and the way you have setup your production flow, and have little to do with the actual testing process. The Horizon allows you to make these decisions once for your shop (although you can change them at any time the need arises), and once they are set, a password protects them so that they cannot be changed casually.

0. Main Menu I V4.5.52	
Sun, Sep 29, 2	2002 12:37 PM
<u>T</u> est	<u>S</u> elf-Test
S <u>y</u> stem Setup ^î	<u>P</u> rogram Cable ^ĝ
<u>B</u> ackup ^î	<u>E</u> dit Adapter ^î
🔺 Contrast 🔻	Shut <u>D</u> own

From *Main Menu*, select **System Setup** to access the *System Setup* menu.

3.2 Inputs

The Horizon has three isolated inputs available through ports on the left side. In addition, the same port may be used to attach optional Palm Switch(es).

)) System	Setup 🖸
<u>I</u> nputs	0 <u>u</u> tputs
<u>T</u> ime and Date	<u>P</u> asswords
<u>G</u> eneral	Boxes
Scan <u>D</u> elay	Palm <u>S</u> witches
S <u>e</u> rvice	<u>0</u> k

Select **Inputs** and the *Isolated Inputs* dialog is displayed.

	Isolated	Inputs E
Inpu	t <u>1</u>	Unused
Inpu	t <u>2</u>	Unused
Inpu	t <u>3</u>	Unused
Palm <u>S</u> u	witch	Hipot Only
	[<u>0</u> k

Using these isolated inputs, the Horizon can be incorporated into a PLC or automatic tester. Or, they can be used to implement external control. The Palm Switch is also programmed from this same menu.

Selecting Input 1 (or Input 2 or Input 3) toggles the setting through the 3 options.

- **Start Test** Selected, in order for testing to start, this control line must be externally activated, usually by applying a 12VDC 24VDC stimulus.
- **Reset Fail** If a product fails during a test, this line must be reset before further testing can occur. One possible application is to verify the test fixture setup.
- **Retest** In the event of a failed test, retest the product.

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Unused Input disabled.

Palm Switch Toggles the Palm Switch function between Start Test and Start HiPot.

Ok returns you to System Setup.

 \overline{V}

Make sure that all three inputs are set to 'Unused' unless you actually plan to make use of them. Failure to do so could cause your Horizon to "hang" unexpectedly because it might be waiting for one of these inputs to be actuated.

3.3 Time and Date

This button allows you to set the Horizon's internal clock and calendar.

Set	Time	&	Date
<u>T</u> IME			14:26
		_	
<u>D</u> ATE		L	10/09/97
	OK	; -	

Selecting **Time and Date** on the *System Setup* menu displays the *Set Time & Date* dialog.

Select Ok to return to System Setup.

Select **Time** and the *Set Time* dialog appears. Enter the time of day in hh:mm format using the 24 hour clock convention. For example, 2:20 pm would be entered as 14:20.

Select Enter to return to the *Time and Date* menu.

Select **Date** to display the *Set Date* dialog. Dates are entered using the mm/dd/yyyy convention/format. For example, October 16, 1997 would be entered as 10/16/1997.

Select Enter to return to the Set Time & Date menu.

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3.4 General Setup Functions

These functions allow you to customize the Horizon to your preferences.

C Genera	al Setup 🖪
<u>V</u> olume 7	Progress J
<u>R</u> eset Fail	F <u>a</u> il *PROMPT*
Relay <u>T</u> est √	Opt. Pac <u>k</u> age
▲Sleep Mode▼	15 Min.
<u>S</u> mart Probe R <u>e</u>	emote Opt. <u>O</u> K

Select **General** to enter the *General Setup* dialog. All settings in this module are accessed by repeatedly pushing the button until the desired parameter is set.

Volume Sets the internal speaker volume; '0' is softest, '7' is loudest.

- **Reset Fail** If a product fails, an acknowledgement will have to be entered before testing can proceed (with passwords enabled the acknowledgement is the supervisor's password). A check mark means that the feature is activated.
- **Relay Test** The internal relays are normally tested and cleaned as a part of selftest and before every testing session. You can choose to have them tested and cleaned at the start of every test. A check mark means that the feature is activated.
- **Sleep Mode** If there is no activity on the Horizon for the programmed amount of time, it will go into power save mode with the touch screen turned off and the front panel lights flashing. Simply touching the screen reactivates the system. The up arrow increments the timer in one minute intervals, while the down arrow decrements it.
- **Progress** The progress bar of the test will be displayed on the screen. A check mark means that the feature is activated.
- **Fail** Toggles between four options:
 - Abort Should a product with multiple states (switches) have a failure the test will abort and the product will fail.
 - **Retry** Should a product with multiple states (switches) have a failure the user will be prompted to try the same position again until the position passes or **Cancel** is selected.

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- **Ignore** Should a product with multiple states (switches) have a failure the failure will be logged and the user will be able to continue testing the product.
- **Prompt** During a test with multiple states (switches) a failure will cause the Horizon to prompt the user to select either Abort, Retry or Ignore.

Opt. Package Setup option for additional packages and language control.

Smart Probe Setup options for the Digital Hand Held Probe.

Remote Opt. Setup options for Horizon Control using RS232.

Select **Ok** to return to System Setup.

3.4.1 Installing software Options

C Genera	l Setup 🖸
<u>V</u> olume Ø	Progress J
<u>R</u> eset Fail	F <u>a</u> il *PROMPT*
Relay <u>T</u> est	Opt. Pac <u>k</u> age
▲Sleep Mode▼	15 Min.
<u>S</u> mart Probe R <u>e</u>	mote Opt. <u>O</u> K

Opt. Package - Installation of optional software packages (TCL, Advanced NetList Editor) or changing the default language for the Horizon.

3.4.1.1 Install Advanced NetList Editor



To install the Advanced NetList Editor, select Install Netlist Editor.

Select **Yes** to continue to install the Advance NetList Editor. The *Package Installation Warning* menu will appear.

No will return you to the previous menu

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Package Installation Warnink This package was previously uninstalled from the system. To continue the installation process you have to provide the registration key, than the registration key, than An override key may be obtained by contacting the factory.	You must contact the factory to get the Override Key. The Registration Key was provided at the time of purchase to active the Advanced NetList Editor.
<u> </u>	(i) You must provide the unit's serial number as well as Uninstall Verification Key.
Enter Override Key H 0 1 2 3 BS 4 5 6 7 Esc 8 9 A B Enter C D E F Enter	Enter the Override Key, which is provided by the factory.
Di Registration ⊨ The provided override key is not valid. Try again. 	If there is an error when entering the Override Key, this message will appear. Select Ok and try again. If it persists, call the Horizon Technical Support.
Image: Second system Image: Second system 0 1 0 1 2 3 4 5 6 7 8 9 A B C D E F	Enter the Registration Key.
1] Registration H The provided registration key is not valid. Try again.	If there is an error when entering the Registration Key, this message will appear. Select Ok and try again.
<u>×0</u>	If it persists, call the Horizon Technical Support.
3.4.1.2 Install TCL Scr	ipting Package
General Setup Install Metlist Editor Install <u>TCL</u> Package Uninstall Netlist Editor Uninstall TCL Package Language	To install the TCL Package, select Install TCL Package.
I General Setup I Do you want to prime to install package?	Select Yes to continue to install the TCL Package. The <i>Package Installation Warning</i> menu will appear.
Yes No w Ummscarr tvL raurage Laurage QK	No will return you to the previous menu.

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System Setup

<u>Deckage installation Warning</u> This package was previously To continue the installation process you have to provide an override key other than the override key may obtained by contacting the factory.	You must contact the factory to get the Override Key. The Registration Key was provided at the time of purchase to active the TCL Package. Vou must provide the unit's serial number as well as Uninstall Verification Key.
Enter Override Key H 0 1 2 3 BS 4 5 6 7 Esc 8 9 A B Enter C D E F Enter	Enter the Override Key, which is provided by the factory.
<mark>U Registration ⊭</mark> The provided override key is not valid. Try again.	If there is an error when entering the Override Key, this message will appear. Select Ok and try again.
<u>ين</u>	If it persists, call the Horizon Technical Support.
Enter Registration Key H 0 1 2 3 BS 4 5 6 7 Esc 8 9 A B C D E F	Enter the Registration Key.
D <mark>Registration H</mark> The provided registration key Is not valid. Try again.	If there is an error when entering the Registration Key, this message will appear. Select Ok and try again.
<u></u>	If it persists, call the Horizon Technical Support.
3.4.1.3 Uninstall Advar	nced NetList Editor or TCL Package
I General Setup It Install Metlist Editor Install ICL Package Uninstall Netlist Editor Uninstall TCL Package Language OK	To uninstall the Advanced Netlist Editor or the TCL Scripting Package, select Uninstall for the specific option.

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y Uninstall Varning ⊨ You are about to permanently uninstall coff or more of the Parter dismissing this screen you will be given the option to coore to coore if you choose to proceed with the uninstall, the package the uninstall, the package the uninstall, a validation be proceed with a validation A ▼ ★	Read this warning carefully. Use the up and down arrows to scroll through the warning message. Select Ok to continue.
Durinstall Warning H key.refund, where applicable, higt be accompanied by the validation key. A T \$ F	
General Setuy General Setuy Do you want to Permanently uninstall package Yes No Guttomodatt tvy ratsage	Select Yes to permanently uninstall the Editor or the TCL Package. No will abort the uninstall process and return to the <i>General</i>
Language <u>QK</u>	Setup menu. Write down the displayed the validation key. CableTest will require this key if the Editor or the TCL Package is re- installed.
3.4.1.4 Default Langua	Select Enter to return to the <i>General Setup</i> menu.
General Setup M Install Metlist Editor Install ICL Package Uninstall Netlist Editor Uninstall CL Package Uninstall TCL Package OX	Language – Select the default language of the Horizon.
Select Language Deutsch Francals Monana Español L *	 The Select Language menu will allow the user to select the language of choice. The selected language will only change the operator's menus. These menus are Main Menu and Test. All other screen will remain in English.

(i) Available languages at the time of publication: German, French, English, Romanian, Swedish, and Spanish

3.4.2 Digital Hand Held Probe (Smart Probe)

System Setup

The Digital Hand Held Probe (DHHP) is automatically detected when connected to COM 1 of the Horizon. To set the probes available options, select **Smart Probe** from the *General Setup* menu.

 (\mathbf{i})

For more details regarding functions and features of the Digital Hand Held Probe, refer to the documentation shipped with the unit.

1 Smart Prob	e Setup
<u>E</u> nable J	1
Left Hand	1
<u>T</u> race Cable]
	ок

Η

Smart Probe Setup menu:

Enabled Activated the DHHP is enabled. The probe will display 'Enabled' when activated. Otherwise the DHHP will display 'Disabled'.

Left Hand Activated a left-handed user can easily read the display message. If the box is not checked, then a right-handed user can read the display.

Trace Cable Activated the DHHP can be used to trace a failed product.

3.4.3 Remote (RS232) Options / Bar Code Reader Setup

1] General Setup [
<u>V</u> olume	0	<u>P</u> rog	ress	J
<u>R</u> eset Fail		F <u>a</u> il	*PROM	PT*
Relay <u>T</u> est	J	Opt.	Pac <u>k</u> a	ge
▲Sleep Mod	e▼	1	5 Min.	
<u>S</u> mart Probe	Rem	ote O	pt. [<u>j</u> k

t: Set Remote Options H <u>R</u>\$232 Control <u>N</u>etBlOS Control <u>B</u>ar Code Options <u>O</u>K

R\$232

<u>Remote Control</u> Remote <u>D</u>ata <u>Port Settings</u> <u>Enable Remote</u> Select **Remote Opt.** Button for the Set Remote Option menu.

Press **OK** to return to the *System Setup* menu.

Select **RS232 Control** to externally control the Horizon.

Select Bar Code Options for the setting up a reader.

Press **OK** to return to the *General Setup* menu.

Remote Options	[[
te Control	
mote <u>D</u> ata	

(i) **NetBIOS** is currently unavailable.

The RS232 Remote Options menu has four (4) options.

Remote Control	Select control items
Remote Data	Test results
Port Settings	Communications Settings
Enable Remote	Enables/disables the remote interface.

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11 RS232 C	ontr	ol Options	Н
S <u>c</u> reen	1	<u>P</u> ass	J
Start <u>T</u> est	J	F <u>a</u> il	J
<u>R</u> eset Fail	J	<u>H</u> i9h Volta9e	J
R <u>e</u> test	J	Test O <u>v</u> er	J
Reset <u>U</u> nit		<u>о</u> к	

The individual options enable/disable the following functions as described in the *Horizon TCL and Remote Options Programming Guide*.

Screen Controls the *ClickButton* and *TypeButton* commands.

- **Start Test** Controls the *StartTestON* and *StartTestOff* commands.
- Reset Fail Controls the ResetFailOn and ResetFailOff commands.
- **Retest** Controls the *RetestOn* and *RetestOff* commands.
- **Reset Unit** Controls the ResetUnitON and ResetUnitOff commands. The reset unit command family requires additional conditions to be enabled.
- Pass Controls the PassOn and PassOff commands.
- **Fail** Controls the FailOn and FailOff commands.
- High Voltage Controls the HighVoltageOn and HighVoltageOff commands.

Test Over Controls the TestOverOn and TestOverOff commands.

1) <u>RS232 Data Transfer Options[1</u> Test <u>Results</u> J <u>O</u> K	Remote Data Host PC at the	
1) RS-232 Settings H Port COM1 Bits 8	Port Settings	
Speed 115200 Stop 2 Elow Hardware Parity None	Port	Select between COM1 and COM2. The Horizon 1500 only uses COM1.
Ūĸ	Speed	Available speeds are: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.
	Flow	The only available selection is Hardware.
	Bits	Although words of 5, 6, 7 and 8 bits are theoretically supported, only 8 bits is

	supported at this time.
Stop	1 or 2 stop bits are supported.
Parity	Options are: None, Even, Odd, Zero and One

Select OK to return to RS232 Remote Options.

)] Bar Code Reader Options [] Separator String	Bar Code Rea	der Options
▲ Header Code ▼ STX ★ Reader Port ¥ Disabled	Separator Str	ing Select your part number separator
<u> O</u> K	Header Code	Select barcode reader programmed prefix.
	Reader Port	Only Keyboard emulators are supported

at this time.

3.5 Scan Delay

These functions control the Horizon's automatic "start of test".

)] Scan Delay	Settings [
<u>A</u> uto Extract	
<u>I</u> nsert Delay	0.0 5
<u>E</u> xtract Delay	0.0 5
	<u>о</u> к

In order to optimize production flow, the Horizon is designed to begin testing as soon as it detects that most of the available pins on the cable or harness are inserted in the adapter or fixture. It can't wait for 100% since there may be one or more opens in the product.

When inserting larger connectors, the operator sometimes uses a rocking motion to more easily mount the product. As a result, it can happen that the Horizon will be falsely triggered and start the test cycle early. The Scan Delay feature is designed to deal with this situation. Select **Scan Delay** to enter the *Scan Delay Settings* menu.

Insert Delay Allows you to program a delay between the automatic start of test trigger event and the actual start of test to allow for the cable to be fully inserted in the adapter or fixture. The allowable range is 0.1 seconds to 60.0 seconds.

Select Enter to accept the input and return to the Scan Delay Settings menu.

Select **Ok** to return to the *System Setup* dialog unless you also want to program an extract delay.

Extract Delay The Horizon computes all Pass/Fail statistics and re-arms itself for the next test as soon as it detects that the product has been extracted. If you have a product that is difficult to extract, you may want to program a delay between extraction and re-arming in order to prevent erroneous results.

Extract Delay allows you to program this time. The allowable range is 0.1 seconds to 60.0 seconds. Select **Enter** to accept your input and return to the *Scan Delay Settings* menu, then select **Ok** to return to the *System Setup* dialog.

- (i) Another case in which the extract delay is useful is if you are testing a product composed mostly of components. In this case, the Horizon could mistakenly think that the product has been disconnected at the conclusion of the test and automatically re-arm for the next test immediately, before you have time to examine the diagnostics. Programming an extract delay will give you time to review any diagnostics.
- Auto Extract Resets the Horizon for the next tested product if the Diagnose screen is showing when the current product is removed.

3.6 Service

The Service button allows access to the Service Settings module.

Print Setup

1] Service Settings [
Print Setup Res Tare		
C <u>a</u> p Tare	Update	
Conf i <u>g</u>	I <u>s</u> olation	
<u>L</u> V Tests	<u>H</u> V Tests	
<u>T</u> ouchscreen	<u>0</u> ĸ	

Once you have setup the Horizon as per your requirements it is a good idea to print the setup for future reference.

Cap Tare: This feature tares out the capacitance of the Installed switching modules on the Horizon. Should cards be changed or expansion boxes added, this service must be implemented.

System Setup

J] Perform a Capacitive Tare of the System Remove all adapters from system and press OK to perform tare. <u>OK</u> <u>Cancel</u>

Select **Ok** to perform the Tare

\!/

\!/

Make certain no Horizon adapters or interface materials are connected to the system.

Touch Screen: Enables the user to test each of the possible touch screen positions to make sure they are working correctly. Select Keys to activate this function.

TOENDITHE
T E S T F I L L
JUSTIWAIT
30 SECONDS

Touch each of the displayed positions in turn. As you touch it, its tone will change and it will black out.

If you have a bad position, or if you wait more than 30 seconds between button pushes, an error message will be displayed. After a few seconds, you will automatically be returned to *System Setup*.

Res Tare: This feature tares out the resistance of the installed switching modules on the Horizon. Should cards be changed or expansion boxes added this service must be implemented.

[] Perform Resistance Tare 🔳 of the System Insert tare adapter(s) sequentially in all positions to run tare. <u>o</u>ĸ <u>C</u>ance 1

Select **Ok** to perform the tare.

In order to perform the Resistance Tare, users must have a special tare adapter as designed by CableTest International Inc. Contact your sales representative for more details.

Update: Horizon client software updates can be inserted using the update feature. By selecting Update, the user is prompted whether to perform the update. Insert the first of the provided diskettes (this disk will be labelled 1 of n) and select OK.

1] Perform Update of the [] Software Upgrade done succesfully!	Once complete, select Cancel to exit the Update module.	
Press CANCEL to exit!	i If your system is operating through a network, the	
<u>O</u> K <u>C</u> ance l	update will only update the local Horizon. You will need to update the files located on the network	

Isolation: Tests the isolation of all installed test points in your Horizon system.

server manually.

C Action Required Remove all adapters, CVT or MUX cards!	F
MUX cards! An isolation test for all the available points of the system will be performed.	S
<u>о</u> к	
1 Service Settings N 1 Counting Test Points N 1 Test Points N 00/ Found: 20 N 1 Touchscreen HU Tests	٦
)] Minimum Isolation Resistance [KΩ]	-
	c
1 2 3 Clear 4 5 6 BS 7 8 9 Enter 0 Esc Enter	S
Service Settings I Isolation Test I Isolation I Touchsoreen HU Tests	ŝ
1: Test Report I Reported Results: Fail	I
Test Program: 01/01/1970 00:00:00 *Net(C1.Card0-Sys14)Shorted: to Net(C1.Card0-Sys15): 000m	t
to Net(C1.Card0-Sys15): 00hm *Net(C1.Card0-Sys15)Shorted: to Net(C1.Card0-Sys14): 00hm *The constant of the second s	S
Print OK	

(i)

Remove all adapters and products from the Horizon.

Select Ok to continue.

The Horizon learns the number of available test points.

The isolation resistance between points is verified at a default level of $100k\Omega$.

Select Enter to continue.

Switchcard isolation is being verified.

If a fault is found, the *Test Report* window lists the points that failed.

Select **Ok** to return to the Service menu.

LV Tests: An in depth method of verifying the LV measurement circuitry of the Horizon 1500.

The LV Tests cannot be performed without the special simplex and Kelvin

test adapters. Contact your sales representative for more details.

Action Required Remove any adapter, test fixture, Tool or test plugst A system wide isolation test will be performed.	Remove all adapters/fixtures/product from the switching of the Horizon.
Service Settings No Service Settings No Counting Test Points No Test Points No Found: 148 No LU Tests No Touchsoreen No	Horizon performs a standard isolation test on the switching network. Follow the on screen prompts.
Service Settings N Pr Do you have the N C Simplex test plug? Q Yes Yes No 1d0 rests Yourbasereen DB	Once complete, you are prompted whether you have the simplex test card. If you have it, select Yes . Otherwise select No and skip the next three screens.
Action Required Insert the simplex test card in Box 1 J5	The Horizon will prompt you to insert the card into the first Quad position of the first Box (J5).
<u>OK</u> <u>Cance1</u>	Select Ok to continue.
Service Settings 1 Testing Resistors 1 Resistors 1 LU Tests LU Tests Touchspreen 0	Simplex LV test in progress. Once complete the Horizon will prompt you to move the card to the next position. Repeat until all Quad positions have been tested.
Ladersecters 200 I. Test Report I Reported Results: Pass/Fail 04718/2001 11:1412 Variation of the sector of the se	At the end of the Simplex LV test, the report is shown. Any faults will be listed. If a fault is reported, contact CableTest's Customer Support Group.
Service Settings N Print Do you have the N C Relvin test plug? Vests No Lo rests EV rests Yourbscreen BR	Once the Simplex LV tests are done or skipped, you are prompted whether you have the Kelvin test card. If you have it, select Yes . Otherwise select No to return to the <i>Service</i> menu dialog.

1 Action Required Insert the kelvin test card in Box 1 J5	The Horizon will prompt you to insert the card into the first Quad position of the first Box (J5).
<u>D</u> K <u>Cance 1</u>	Select Ok to continue.
Service Settings N Image: Setting Resistors N Resistors N Resistors N LU Tests NU Tests Touchscreen N	Test in progress using the standard LV source.
Service Settings N Resistors N Image: Setting setti	Test in progress using the optional High Current Source (if not installed will be skipped).
(Service Settings A Resistors Test w/FixHCS Resistors Zouobscreen BB	Test in progress using the Fixed High Current Source.
Test Report It Reported Results: Pass/Fail Test Program: Open Product (4/18/2001 11:14:12 *R1(sys64, sns65; sys66, sus65, sys66, sns67; css64 snc65/ too low: 654.8m0hm *R1(sys64, sns67; sys64, sns67; sys64, sns67; sys64, sns67; sys64, sns67; sys64, sns67; sys64, sns65; sns65) *R1(sys66, sns67; sys64, sns67; sns64; sns67; sns67; sns64; sns67; sns67; sns64; sns67; sns66; sns67; sns67; sns66; sns66; sns66; sns67; sns66; sns67; sns66; sns66; sns67; sns66; sns	At the end of the Kelvin LV tests, the report is shown. Any faults will be listed. If a fault is reported, contact CableTest's Customer Support Group.

HV Tests: If the user suspects a faulty HiPot or High Current Source during testing, they use this built in feature.

 (\mathbf{i})

This option will only be enabled if a HiPot or HCS is installed in the Horizon.



For the High Voltage sources, select **AC Hipot Test** or **DC Hipot Test**.

System Setup

Action Required Remove all adapters, CUT or MUX cards! An isolation test for all the available points of the system will be performed.	Remove all adapters or product for the Horizon.
Ωk 3] Minimum Isolation M Resistance (KΩ) 100.0 12.3 100.0 1 2.3 Clear 4 5 6 BS 7 8 9 Enter 0 Esc Enter	A safety isolation test is performed – follow the procedure shown above.
Input DC hipot # test voltage [U] 500 1 2 3 Clear 4 5 6 BS 7 8 9 Enter 0 Esc Enter	If the isolation test passes, you are prompted to enter the voltage you wish to test at. Enter the voltage, AC or DC depending on which source you are testing and select Enter to continue.
Service Settings Image: Service Settings	Select whether you wish to perform a linear or mass high voltage test. See Appendix C for more details regarding Mass HiPot.
Service Settings Perform the DC Hipot Test? Yes	You are prompted whether you wish to perform the HiPot prior to High Voltage being applied to the switching.
I Test Report H Reported Results: Pass/Fail Test Program: 0:00 uff of the formation of the	If the test fails, contact the Horizon Technical Support
j Service Settings AC Hipot Test DC Hipot Test HC Hipot Test QK	To run a service test on the programmable and/or fixed High Current sources, select HC HiPot Test .

C MUX Card	
Please insert th Card(s)!	e MUX Test
·	<u>0</u> ĸ

 (\mathbf{i})

The High Current Source test cannot be performed without a special test adapter. Contact your sales representative for more details.

Insert the special test adapter and select OK.

) MUX Menu 滕 Setup Menu			
First/Last 0 1			
Re <u>l</u> ays	J	<u>H</u> C Test	J
Resistors	J	Fixe <u>d</u> HCS	1
<u>Cancel</u> <u>T</u> est			

- **First/Last:** This feature allows the user to select the first switchcard and the last switchcard to be tested.
- **Relays:** When enabled, the relays on the switchcards will be tested.
- **Resistors:** When enabled, the resistors on the switchcards will be tested for the correct resistance value.

1] Testing the MUX Cards Testing MUXRLY card# 0 Testing MUXRLY card# 0 NI3 = 0.117 Ohm The last error message is: R13 = 0.117 Ohm too jow 444 test point# 49, card# 0		
Repeat	<u>C</u> ance l	Ωĸ
	ing the MUX (7/22
Kelvin MU The last R13 = 0.1	UX test faile error messa 08 Ohm too 1t# 49, card#	edt reis: cow. 4W
<u>R</u> epeat	<u>Cancel</u>	<u>о</u> к
	ing the MUX (
<u>R</u> epeat	Cancel	<u>о</u> к

 (\mathbf{i})

Test: Start test

During the test, each test point's results are displayed.

HCS Service Test Failed.

HCS Service Test Passed.

The option **Config** is reserved for CableTest service personnel.

3.7 Outputs

The Horizon has three contact closures that are tied to specific internal events and are made available at the port on the side. As with the Inputs, these are designed for use in setting up external indicators, or for incorporating the Horizon into an automatic system.

1] Isola	ited Outputs 🛛
Output <u>1</u>	Unused
Output <u>2</u>	Unused
Output <u>3</u>	Unused
	<u>0</u> k
	Ūĸ

The outputs are actuated by successive pushes of the Output 1, Output 2, or Output 3 buttons, and are mutually exclusive. The related functions that cause the contact closure are:

UnusedNone of the outputs are active.PassThe product passed all required tests.FailThe product failed one or more required tests.HV OnThe high voltage power supply is active.Test OverThe testing cycle is completed.

Select **Ok** to return to System Setup.

3.8 Passwords

All of the modules on the *Main Menu* that have a small key $\boxed{1}$ on the button are password protected. Three types of passwords are provided so that you can grant access privileges to people with different skill levels.

3.8.1 Setting Up Passwords



Select **Passwords** to display the *Password Settings* dialog.

(i) The default password is 1234. It is highly recommended that you change this as soon as you put the Horizon into use on your production floor.

The **Delete** key will delete the highlighted password. Use the arrow keys to highlight the one to be deleted.

Cancel returns you to System Setup with no action taken.

Make sure that you always leave at least one password active or you will be locked out of password protected modules.

C Enter Password				d 🔳
$(\ $	5678			
	1	2	з	Clear
	4	5	6	BS
	7	8	9	Enter
ø		Esc	Encer	

\!∕

If you want to add a new password, select **Add** to enter the *Enter Password* dialog. Input a password of four numbers. Make sure that you either carefully memorize it, or write it down and put it in a safe place. Select **Enter** and you will go to the *Enter Password Type* dialog.

(i)

Valid passwords: 1000 – 9999



Horizon currently supports three levels of passwords: **Operator**, **Service**, and **Supervisor**. Select the type you want for this password and you will return to the *Password Settings* menu.

Repeat these steps as necessary to set up the passwords you want. When you are finished, select **Ok** to return to *System Setup*.

3.8.2 Disabling Passwords

By default, the Horizon system prevents unauthorized operation by requiring an operator or user to enter a valid password when accessing certain of the system's functions. Menu items that are password protected display a small key in the upper right corner. The password system is designed to prevent untrained or unauthorized people from inadvertently modifying test programs or vital system parameters.

If desired, however, you can disable password protection.

1.] Main Menu 🔲			
Wed Mar 19 1997 09:53 AM			
<u>T</u> est	<u>S</u> elf-Test		
S <u>y</u> stem Setupî	<u>P</u> rogram Cableî		
<u>B</u> ackup î	<u>E</u> dit Adapterî		
🔺 Contrast 🔻	Shut <u>D</u> own		

From the *Main Menu*, select **System Setup**; then select Passwords.

System Setup

1] Password Password 1234 9999	Settings Privilege Supervisor Service
★ ▲ ¥ <u>D</u> ele ⁴	te <u>E</u> nable J <u>Cancel O</u> K
1. Password Password 1284 9999	Settings Privilege Supervisor Service
▲ ▼ <u>D</u> ele	te <u>E</u> nable <u>C</u> ancel <u>O</u> K
)) Main	Menu 🖸
(Wed Mar 19 19	997 09:55 AM
	<u>S</u> elf-Test
System Setup	Program Cable
Backup	<u>E</u> dit Adapter
🔺 Contrast 🔻	Shut <u>D</u> own

Enable can then be selected to enable or disable password protection. An associated box displays the status of password protection. A checkmark indicates that password protection is enabled.

When password protection is disabled, the box beside the **Enable** button is empty.

In addition, when passwords are disabled, the key symbol is no longer displayed on any of the buttons on the *Main Menu*.

3.9 Adding Expansion Boxes

As described in the introduction, a standard Horizon has 128 test points, enough to fully test a double-ended cable with 64 wires. The Horizon can be expanded to be able to test up to 1024 points by adding extra switching boxes in 128 point increments.



When you do this, you must not only install the hardware, but you must configure the system to detect the extra test points. This is done from the *System Setup* by selecting **Boxes**. The *Box Settings* menu will be displayed. **Cancel** returns to *System Setup* with no action being taken.

Select **Add** to add a new box; the *Enter Box Type* menu is displayed. Select **Single** or **Double**, depending on the type of the box being installed, and you will be returned to *Box Settings*, and the new box will be added to the list.

Single:64 test pointsDouble:128 test points

Edit allows you to change the box type. Use the arrow keys to highlight the box of interest, and then select **Edit**. The *Enter Box Type* menu appears. Select the correct box type and you will return to *Box Settings*.

Select Ok when you are through to go back to System Setup.

If you are adding or removing expansion boxes from the Horizon, it is imperative you comply with the systems power requirements.

If you are adding or removing expansion boxes from the Horizon, it is imperative a capacitance tare is performed. Normally when editing the Boxes setting in the *System Setup*, Cap Tare and Res Tare will automatically be initiated.

3.10 Palm Switches

Palm switches can be of several varieties, and they can have different functions. If you have purchased palm switches, or are implementing an enclosure switch or other safety device, set up their function by selecting **Palm Switches** from the *System Setup*.

<u>S</u> tart Test	5		
<u>A</u> utohipot			
<u>U</u> se Palm Swit	ches	J	
▲ Select ▼	One	Palm	Sw.
		Ok	

The Palm Switch Settings menu will be displayed.

Start Test links to the *Isolated Inputs* menu described above and sets the Palm Switch to 'Start Test'. Selecting **Ok** on that menu returns you to this menu and a check mark in the small box will show the change.

To disable this feature, reset it in the *Isolated Inputs* menu.

Autohipot Enables HiPot testing to start automatically as soon as the cable has passed all of the low voltage tests.

A check mark in the small box indicates the feature is active. To disable it, select **Autohipot** again.

 $\overline{\mathcal{M}}$

\!/

\!/

Selecting **Autohipot** will cause HiPot testing to start automatically as soon as the cable has passed all of the low voltage tests – caution should be taken to prevent shock.

(i)

HiPot tests will not be performed if any low voltage test fails.

In order to use Palm Switches activate the feature by selecting Use Palm Switches.

A check mark appears and **Select** becomes active. Use **Select** to indicate the type of Palm Switch you have:

- One Palm Sw. A single switch
- **Two Synchro.** Two switches that must be pushed at the same time;
- Two Asynchro. Two switches that can be pushed in any order;
- **One Temporary** A switch that only needs to be pushed momentarily;
- **Two Temporary** Two switches that only need to be pushed momentarily in any order; and
- **Enclosure Sw.** A switch associated with an enclosure that covers the top of the Horizon.

All of the Palm Switches, with the exception of the two temporary configurations, must be pressed and held closed for the duration of HiPot testing or the high voltage source will turn off. In addition, the Horizon checks the condition of the switches at the start of the test, if they are already closed, such as might happen if they were taped down, the high voltage tests will not start.

Select **Ok** to return to the System Setup menu.

)) System	Setup 🖸
<u>I</u> nputs	0 <u>u</u> tputs
Time and Date	<u>P</u> asswords
<u>G</u> enera l	Boxes
Scan <u>D</u> elay	Palm <u>S</u> witches
S <u>e</u> rvice	<u>0</u> k

This completes the system setup procedures. Don't forget that you can return here any time to change any of the setup parameters.

4 PROGRAMMING AND TESTING

"Wire Only" Cables and Harnesses



4.1 Introduction

Most cables and harnesses are composed of wires of various types originating at or terminating to any of a variety of connectors. These cables also do not typically contain any embedded components, such as resistors, diodes and capacitors. As a result, the most common set of test requirements are for the test operator to determine, as quickly as possible, whether or not the cable or harness has any shorts or opens, or if any wires are connected to the wrong pins. It would also be desirable if the tester, and the test equipment used, could provide additional information, such as the location of the fault, to the rework technician. The Horizon was designed with these facts in mind. The default learning path and the resulting tests are fast; easy to use and understand; and provide the needed information for most applications.

4.2 Learning the Cable

CableTest refers to the process of programming the Horizon to test a cable as "learning" the cable. The reason for this term is that this is almost literally what the operator does. Starting with a known good, or "golden" cable or harness, the user is guided through a series of simple steps during which a parametric profile is made of the cable that is then stored as a simple ASCII file. After that, anytime an operator wants to test an identical cable or harness, these parameters are loaded from the file and are used as the basis for the test.

C] Programming Cable
<u>M</u> odify Existing Cable
<u>L</u> earn New Cable - Default
Learn New Cable - C <u>u</u> stom
Advanced <u>N</u> etlist Editor
<u>C</u> ance l
i If this is the fire

On the *Main Menu*, select **Program Cable**. The Horizon will ask for a Password. (The factory installed Password is "1234".) Enter the Password and the *Programming Cable* dialog appears. Select **Learn New Cable – Default**. The *Insert Adapter(s)* dialog appears.

If this is the first time you have used the Horizon and you have not yet gone through the getting started exercise, it is highly recommended that you do so at this time (please see section 2: Getting Started).

0	Inse	rt The		er(s)	Η
L			116		
	J1	J2_	13	J4	1
	HA 116	-	HA 116	- _{J7}	
	<u>_</u> S	elect	<u>C</u> ance	∍1 <u>0</u> k	

Insert your adapters in the position(s) of choice. The example shows two "Single Wide" HA116's mounted, but yours may be different.

Select **Ok** after all adapters are properly mounted.

Cancel returns to Programming Cable.

(i)

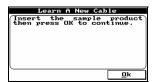
It is acceptable to have adapters that are not needed for the specific product

being tested mounted on the Horizon. It will not interfere in any way with proper testing, but, in the future, the Horizon will need all of the same adapters mounted in exactly the same positions before testing can proceed. Also, the more test points the greater the length of time is required by the Horizon to perform a test. Therefore, it is recommended that you do this only in situations in which the adapter setup is not expected to change from cable to cable.

Sometimes, adapter(s) are not automatically detected. This can happen if a cable is already connected to the adapter. It may also happen if a test fixture is connected to the adapter, or if the adapter is a 'huge' adapter. In this case, the desired adapter(s) may be selected directly from the Horizon's internal library using the **Select** button.



If you use the **Select** function, the Horizon will attempt to "place" the selected adapter in the first open position. If this is impossible, a warning message will be generated. In the example shown, a double wide was selected and cannot be used since both sections are already occupied by "Single Wide" adapters. Selecting **Ok** returns you to *Insert The Adapter*, while **Cancel** sends you to *Programming Cable*.



Insert your "golden" product, cable or harness, into the adapters and select **Ok** to begin the learning process.

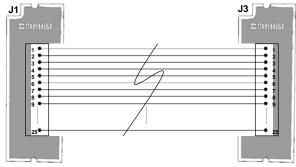


Figure 4-1: Product Under Test (PUT)

⁴⁻⁴ Horizon Series Tester: Programmer's Manual

I Learn F Learning Test P 16 Found	oints %
1] Enter Par	t Number 🔲
& * () / # \$ <) x <u>A</u> Z Space Bat	67890 4 Enter r Clear
)] Set Test P	arameters [
Name / <u>P</u> rompt	<u>A</u> dapters
<u>L</u> ow Voltage	Components
<u>H</u> igh Voltage	<u>N</u> et List
More Op <u>t</u> ions	P <u>r</u> int

T<u>e</u>st Now

<u>Cancel</u> <u>O</u>K

As the Horizon learns your product, a status screen keeps you informed about its progress. The NetList for the cable is learned.

After the NetList has been learned, you are asked to *Enter the Part Number*, and a keyboard is displayed. You can use any combination of alpha and numeric characters as well as other valid ASCII symbols, such as parentheses, *, &, ^, etc., for your part number.

At this point, your cable is completely programmed to test all standard low voltage tests (shorts, opens, and mis-wires) using the quick scan method. You do not need to specify anything else. However, the Horizon has significantly greater capabilities as well.

These include: generating an in depth capacitance and resistance profile of your product, performing AC or DC HiPot testing, testing for/with embedded components, and the ability to perform each or all of these tests on selected nets. Each of these functions is described in depth in a separate section of this manual. Consult the appropriate section if you want to set up any of these additional or extended tests.

Select Ok and the Save Cable Record dialog appears.

	Nex 2	Torn (;	Karea	بللمعاليما		
	1 Sau	e Cab	le R	ecord	1?	
ek <u>il</u>		<u>Y</u> es		•		S
Star		<u>632</u>		5 <u>5</u> 2006 j		OX 1
C	0	pen D			6	
C Dire ⊐MA		pen D y Nam	ireci			
C Dire DMA			ireci		6	
	etor IN		ineci e			<u>ox</u>

Select **Yes** to save your cable record. The *Save To Directory* dialog appears. **No**, returns you to the *Set Test Parameters* menu.

Move the cursor until the directory in which you want to save the cable is highlighted, then select **OK**. The cable record is saved, and you are returned to the *Programming Cable* menu. (If you want to store your cable in a new directory, select **New**, and you will be prompted to enter the new name. Select **Enter** when done. You can use any combination of up to 32 characters.

You can continue the learning process and program as many cables as you like by simply repeating these steps. When you have finished, select **Cancel** and you will return to the *Main Menu*.

Test Program as CBL File

Test Pl	rogram as CBL File	
(SCRIPT		
\bigcirc	\datab\cables\main\testcabl.cbl	For greater detail see section 9 .
CARLE	,TEST CABLE #\$%,1	*NET*,,
	CRONTINUITY*	J1.C1.12,,
	KISOLATION*	J3.C1.12,,
*STAR		*NET*,,
	SHOLD*,61	J1.C1.13,,
	2TER*,HA 116,	J3.C1.13,,
	DSITION*,J1	*NET*,,
	PTER*, HA 116,	J1.C1.14,,
	DSITION*,J3	J3.C1.14,,
NET		*NET*,,
	C1.1,,	J1.C1.15,,
	C1.1,,	J3.C1.15,,
NET		*NET*,,
	C1.2,,	J1.C1.16,,
	C1.2,,	J3.C1.16,
NET		*NET*,,
	C1.3,,	J1.C1.17,,
	C1.3,,	J3.C1.17,,
NET		*NET*,,
	C1.4,,	J1.C1.18,,
	C1.4,,	J3.C1.18,,
NET		*NET*,,
	C1.5,,	J1.C1.19,,
	C1.5,,	J3.C1.19,,
NET		*NET*,,
	C1.6,,	J1.C1.20,,
J3.	C1.6,,	J3.C1.20,,
NET		*NET*,,
J1.	C1.7,,	J1.C1.21,,
	C1.7,,	J3.C1.21,,
NET		*NET*,,
J1.	C1.8,,	J1.C1.22,,
J3.	C1.8,,	J3.C1.22,,
NET	· · ·	*NET*,,
J1.	C1.9,,	J1.C1.23,,
J3.	C1.9,,	J3.C1.23,,
NET		*NET*,,
J1.	C1.10,,	J1.C1.24,,
J3.	C1.10,,	J3.C1.24,,
NET		*NET*,,
J1.	Cl.11,,	J1.C1.25,,
J3.	C1.11,,	J3.C1.25,,
		END

4.3 Testing Your Product

On the *Main Menu*, select **Test**. The *Test Configuration* dialog appears. Note that this module is not password protected since it is a "run only" function; system and/or test parameters cannot be modified, added or deleted.

1. Test Configuration Currently Selected Cable File Name: datab\cables\MAIN\TESTCABL. L Part Number: TEST_CABLE #5%	св
Rev.1	
Too <u>l</u> s <u>R</u> eports <u>S</u> elec	t
Test Now Batches Cance	1

The display shows the Directory location and the Part Number for the cable you just learned or the last cable tested (depending which happened more recently). If this is the product you want to test, select **Test Now**; otherwise, press **Select**. The *Select Part Number* dialog appears.

)C	Open Directory	54
i n tre	ctory Name IN	
<u> SE</u>	COND	
± ·	¥ Re <u>f</u> resh <u>D</u> elete	
•	' 🕨 <u>C</u> ancel <u>O</u> K	
★ · •	The Refresh Delete Delete Delete Delete Delete	_

A list of directories is displayed. Use the arrow keys to move the cursor to the desired directory. Select **Open** to see a list of product part numbers contained in that Directory. **Cancel** returns you to the *Main Menu*.

) Select Part Number	ē
Part Numbers	١
04SECOND TEST Rev.1 20TOST CABAD #57 Rev.1	l
	I
	I
★ ► Refresh Delete	1
◀ ▼ ▶ <u>Back</u> <u>Cancel</u> <u>O</u> K	l

Use the arrow keys to move the cursor to the proper Part Number. Select **Ok** to select the desired product to be tested. **Refresh** re-loads the directory from file. **Delete**, removes part numbers. **Back** returns you to *Open Directory*, while **Cancel** returns you to *Test Configuration*.

)] Select element by typing 🔲
TEST CABLE #\$% REV.1
1234567890
1234567890 & * ()/,:4 # \$ () / , :4
\$ < > × " / Esc
A.Z Space Bar Clear

Fast Load: To alleviate searching through long lists of files for your test program, simply touch the center of the screen and type the name of the file to load it quickly. You can also type in partial names to get a list of matching files.



(i)

You can also use the Space Bar on a keyboard to use the **Fast Load** feature.

	t Configuration
File Name datab\cal L	bies\MAIN\TESTCABL.CB
Part Numl TEST CABI Rev.1	ĽĒ [*] #\$%
Too <u>l</u> s	<u>Reports</u> <u>S</u> elect
<u>T</u> est Now	Batches Cancel

The new Part Number is now displayed as the *Currently Selected Cable*. Select **Test Now** to start the testing process. The function of **Reports** is described in section 7.1, while **Batches** is described in section 7.2. **Cancel** returns you to the *Main Menu*.

Inse	rt the	Adapte	er(s) 🗄
J1	J2_	13	^{J4} Ì
HA 116		HA 116	- _{J7}
	<u>A</u> c	cept	<u>C</u> ance l

The first step in the testing process is to insert the proper adapter(s). All adapters installed when the cable was learned must also be installed when it is tested. The Horizon will display the part number of the first adapter required, starting from left to right, and will flash its outline at the required location.

If the wrong adapter is inserted, or if it is inserted in the wrong location, the Horizon will continue to indicate the correct part number and location by flashing them on the display. Once the proper adapter is inserted, the display will go on to the next needed adapter to the right, then to any installed extra boxes. After the proper adapters are all installed, the system automatically sequences to *Connect Product To Start*. **Accept** forces the Horizon to *Connect Product To Start*, while **Cancel** returns to *Test Configuration*.



Insert your product in the appropriate connectors. The Horizon will detect when the product is inserted and automatically start the test. If your product passes, the green Pass light will be lit. If it fails, the red Fail light will be lit.

Special circumstances may prevent the Horizon from automatically starting. One example is that you may have a single ended cable. Another is that you may have disabled the automatic start feature. In these cases, selecting **Start Test** will force the test process to start.

See Section 4.6 for automated start test details.

(i) If you are getting inconsistent or unexpected results, especially on cables that are hard to insert, you can program a delay before the start of test in the system setup menu (see Section 3.5).

1. TEST CAB	LD H
Tested: 1 Passed: 1 Failed: 0	
Error <u>S</u> tatistics	<u>D</u> iagnose
Re <u>t</u> est	<u>C</u> ance l

At the completion of the test, the display will change instructing you to disconnect the product. The act of disconnecting the product updates the statistics database and automatically re-arms the system to test the next product.

(If you have set up reports to be printed, they will be sent to the printer depending on the conditions set). Inserting the next cable starts the process again. Selecting **Retest** without removing the cable will retest the same cable. This is useful in the event that a reported fault is obvious and can be easily repaired, or if you are unsure of the results and want to try again.

1. Test Report	Ð
Reported Results: All	
Test Program: TEST CABLE #\$% 04/06/2000 14:37:43	1
Net(J1.C1.1, J3.C1.1) res: 592m0hm	I
Net(J1.C1.2, J3.C1.2) res: 542mOhm	I
Net(J1.C1.3, J3.C1.3) res: 465m0hm	I
Net(J1.C1.4, J3.C1.4) res:	Į,
▲ ▼ ± ¥ <u>P</u> rint <u>O</u> K	
	-

If you have specified a specific conductor resistance for the continuity test (i.e. it is not set on Quick Scan), then you can select **Diagnose** at the end of the test to view the measurements.

(i) The Reported Results is set to ALL. See Section 4.4 for greater detail.

Cumulati	ive Fault Report	[
Opens	: 0	
Shorts	: 0	
Miswired	: 0	
AC Hipot	: 0	
DC Hipot	: 0	
	<u>0</u> k	

Selecting **Error Statistics** will show the *Cumulative Fault Report*. In the example shown, only one cable has been tested, and it was good, so the report shows all 0's.

Selecting **Ok** returns you to *Connect Cable To Start* (assuming that you have disconnected the previous test product).

(i) Consult section 7.2 for details regarding Batches.

4.4 Controlling the Diagnostics

There are five options available for diagnostic display.

None:	No results are displayed.
Fail:	Only failed results are displayed.
Pass:	Only pass results are displayed.
Pass/Fail:	For on-screen diagnostics this behaves the same as Fail (see section
	7.1 for greater details on Pass/Fail and reports).
All:	All results are displayed.

You can select the results to be displayed either before running a test or 'on-the-fly' while results are being displayed.

4.4.1 Altering the results displayed before testing.

Currently Selected Cable
File Name: datab\cables\MAIN\TESTCABL.CB
Part Number: TEST CABLE #\$% Rev.1
Too <u>l</u> s <u>R</u> eports <u>S</u> elect
Test Now Batches Cancel

To alter the results displayed before testing, select **Reports** from the *Test Configuration* menu.

Report Settings

]
]
-

[] Test Report Setting	s
<u>S</u> erial Number Option	ns
Test <u>R</u> esults Fa	il I
<u>A</u> uto Diagnose No	ne
Header <u>F</u> oote	∍r
<u>T</u> est Parameters	<u>o</u> ĸ

Selecting **Test Results** toggles between the four options. Reports are discussed in greater detail in section 7.1. The option also exists to automatically display results after each test (Auto Diagnose). See Section 7.1.3 for details.

4.4.2 Alter the results 'On-the-Fly'

Altering the results displayed in the diagnostic dialogue during the test cycle can be done by touching the center of the display or using the Space Bar.

Select Test Reports.

Touching the display toggles between the five options: None, Pass, Fail, Pass/Fail, and All.



SHORTCUT

Altering the Reported Results from the Test Report dialog will alter the Test Results setting on the Test Reports Settings menu.

Horizon Lite user may also do this by using the space bar on their keyboard.

Modifying Your Test Program 4.5

C	Programming Cable	10
	Modify Existing Cable	
	<u>L</u> earn New Cable - Default	
	Learn New Cable - C <u>u</u> stom	
	Advanced <u>N</u> etlist Editor	
	<u>C</u> ance l	

At any point you wish to alter the parameters of a test you may do so by selecting Modify Existing Cable from the Programming Cable menu.

You can open this menu by selecting Program Cable from the Main Menu.

 (\mathbf{i}) To utilize the optional Advanced Netlist Editor refer to Section 4.8.

) Open Directory Directory Name MAIN SECUND Highlight the directory containing the test program you wish to modify and select Ok. ★ ★ **F**Re<u>f</u>resh <u>D</u>elete <u>C</u>ancel <u>O</u>K Select Part Number Highlight the test program you wish to modify and select **Ok**. Part Numbers DoTEST CABLE #\$% Rev.1

Adapters

Components

<u>N</u>et List

Print

<u>Cancel</u> <u>O</u>K

★ ★ **Re<u>f</u>resh** <u>D</u>elete ◀ ▼ ▶ <u>B</u>ack <u>C</u>ancel <u>O</u>K Set Test Parameters

Name / Prompt

<u>L</u>ow Voltage

<u>H</u>igh Voltage

More Options..

T<u>e</u>st Now

Tested:

Passed:[Failed:[

TEST CABLE #\$%

0

0 0

) Set Test Parameters

Start <u>T</u>est

Name / <u>P</u>rompt

<u>L</u>ow Voltage

<u>H</u>igh Voltage

More Op<u>t</u>ions.

T<u>e</u>st Now

Error <u>S</u>tatistics Diagnose

<u>C</u>ance l

Adapters

Components

<u>N</u>et List

P<u>r</u>int

<u>Cancel</u> <u>O</u>K

The Set Test Parameters menu appears. You can modify all the parameters of the test program from this menu.

(i) Select Test Now to test any changes you make to the test program.

If the product does not automatically test, select Start Test to run the test.

Select **Cancel** to return to the Set Test Parameters menu.

If you are satisfied with the modifications, select Ok.

Set Test Faraseters Nampisauc cole Record in a set of the	You are prompted to confirm that you wish to save. Select Yes to continue.
1] Open Directory Directory Name HAIN SECOND	Select a directory to save the file within or select New to create a new directory.
± ▲ ¥ <u>N</u> ew <u>Refresh</u> ↓ ▶ <u>Cancel</u>	Select Ok to continue.
Image: Directory Directory Name 1 Cable exists! Save as next revision? Yes No ************************************	If you are saving the file into the directory that it originated you now have the option of saving the file as a next revision or overwriting the existing file.
1 Select Part Number Part Numbers Part Numbers <td< td=""><td>If you select Yes to next revision a new record is created with the same part number and an incremented revision number.</td></td<>	If you select Yes to next revision a new record is created with the same part number and an incremented revision number.
Image: Spen Directory Directory Name MAIN Yes No Yes No Xes Yes	If you select No , you are prompted whether you wish to overwrite the existing file. Select Yes to do so.
1 Set Test Parameters H Name / Prompt Adapters Low Uoltage Components High Uoltage Met List More Options Print Test Now Cancel	If you do not wish to save your modifications, then simply select Cancel from <i>Set Test Parameters</i> .
Set Test Farameters Name Name State Law Yes High Yes Start Law Test Now Cancel	Then confirm you wish to abandon the changes.

4.6 Automated Start Test

By default the Horizon is setup to begin testing once a product is inserted in the required adapters.

The default setting is 61% of product insertion.

At the start of a test (when no external controls are in use) the system is scanning the test points for product insertion. Once 61% of the product is detected the test begins.

The 61% value is an arbitrary number that is less then 100% and greater than 50%. If the test were not to start until 100% of the product was inserted, then damaged cables would not trigger the start of the test.

If the test were to start when 50% or less of the product was inserted, then the test may complete (and fail) before the product is fully inserted.

)] Set Test F	'arameters	• E
Name / <u>P</u> rompt	<u>A</u> dapters	
<u>L</u> ow Voltage	Compone	ents
<u>H</u> igh Voltage	<u>N</u> et L	ist
More Op <u>t</u> ions	P <u>r</u> in	t
T <u>e</u> st Now	<u>C</u> ance 1	<u>o</u> ĸ
1] Set Test F S <u>t</u> art % <u>M</u> ax Errors	Parameters 61% 0	5
	<u>0</u> K	

If you wish to adjust the Start % value, the option is found on the Set Test Parameters Menu.

Select **More Options** \rightarrow **Start** % to enter a new value for the percent of product insertion that triggers the start of test.

Do not use 100% since a cable with a fault will never be completely inserted and the test will never begin.

If you find that your product is hard to insert and, for example, requires the user to rock the connectors for proper insertion, you can utilize the Scan Delay feature of the Horizon to delay the start of test once it is triggered.

See Section 3: System Setup for details.

4.7 Preventing Runaway Tests: Max Errors

The Horizon's determination to discover all faults in a cable can sometimes create long test times while the operator waits for all the faults to be diagnosed.

One way to prevent this is to specify the number of errors the Horizon should find before aborting the test sequence and failing the product.



To enable this feature select **More Options** \rightarrow **Max Errors** from the *Set Test Parameters* menu.

Enter the number of maximum number of errors and select **Ok** to continue.

4.8 Advanced NetList Editor (Optional)

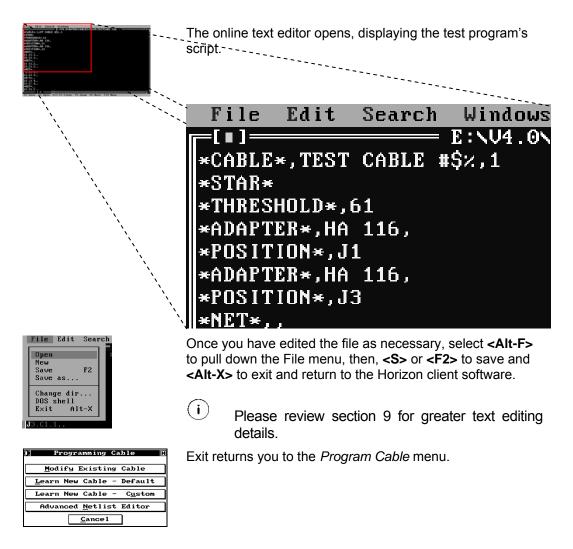
An available option for the Horizon is an onboard script editor. To edit script from the Horizon you will need to have a VGA monitor and an AT keyboard attached to the system.

1] Programming Cable	Ш
Modify Existing Cable	
<u>L</u> earn New Cable - Default	
Learn New Cable - C <u>u</u> stom	
Advanced <u>N</u> etlist Editor	
<u>C</u> ance l	
C Open Directory	54
Discotory, Namo	



Select Advanced Netlist Editor to open the text editor.

Open the desired directory and select the product you wish to edit.



4.9 Basic Low Voltage Testing Options – Continuity and Isolation

The low voltage parameters of your product can be tested either by the default Quick Scan method or using a Measured method.

4.9.1 Quick Scan

The Horizon Quick Scan method is the default learning and measurement method for both Continuity and Isolation tests.

The method utilizes a hardware scan to determine whether any opens or shorts exist within the product you are testing. It is because of this hardware scan that Quick Scan is 'quick'. The effective thresholds for the tests are as follows:

Continuity:	less than ~300 Ω
Isolation:	greater than ~80k Ω

Should you wish different thresholds than listed above, you must change the Low Voltage settings to the Measured method.

4.9.2 Measured Scan

1 Programming Cable H Modify Existing Cable Learn New Cable - Default Learn New Cable - Custom Advanced Metlist Editor Cancel	At any point you wish to alter the parameters of a test you may do so by selecting Modify Existing Cable from the <i>Programming Cable</i> menu. You can open this menu by selecting Program Cable from the <i>Main Menu</i> .
Open Directory Image: Second state s	Highlight the directory containing the test program you wish to modify and select Ok .
Select Part Number Image: Select Part Numbers Part Numbers Select Part Numbers Select Part Numbers Image: Select Part Part Part Part Part Part Part Par	Highlight the test program you wish to modify and select Ok .
Set Test Parameters F Name / Prompt Adapters Low Voltage Components High Voltage Net List More Options Print Test Now Cancel	From the Set Test Parameters menu, select Low Voltage.
J Low Voltage Settings 1 Flex Dis. Scan Star Conductor Res Quick Scan @ 5mf Stimulus N / A Isolation Min Res Quick Scan More Options. QK	The default settings of Quick Scan are displayed. To select a measured value for the Isolation test, select Isolation Min Res .

). Minimum Isolation Resistance [KΩ]		
100.0		
З	<u>C</u> lear	
6	BS	
9		
Esc	Enter	
	nce []K 0.0 3 6 9	

Enter the minimum resistance measurement for the Isolation test in $k\Omega$.

Select Enter to continue.

To restore the Quick Scan setting, simply select **Isolation Min Res** again. Select **Conductor Res** to select a measured value for the Continuity measurement.

k Scan
Sample
ed HC

Select the desired Continuity Type.

For this exercise, select Resistance @5mA.

Resistance @5mA	MSR measured scan.
Quick Scan	As described above.
HC Resistance	Programmable HCS measured scan. (Resistance reference)
Voltage Drop	Programmable HCS measured scan. (Voltage reference)
From Sample attache	Uses the MSR to measure the maximum resistance for the ed nets. Set the Maximum Conductor Resistance accordingly.
Fixed HC	Measured scan using the Fixed HCS (Voltage or resistance

Fixed HC Measured scan using the Fixed HCS. (Voltage or resistance reference).

The Fixed HC option can only be used for 4-wire measurements.

)] Maximum Conductor 🗱 Resistance [Ω]				
5.000				
	1	2	3	<u>C</u> lear
	4	5	6	BS
	7	8	9	
		0	Esc	Enter

(i)

Enter the maximum conductor resistance (measurements made higher than the value entered will be considered opens).

Select Enter to continue.

C		nimum (Resista		
\square		0.0	000)
	1	2	3	<u>C</u> lear
	4	5	6	BS
	7	8	9	
		0	Esc	Enter

 Low Uoltage Settings
 μ

 Flex
 Dis.
 Scan
 Star

 Conductor Res
 5Ω Max

 0 5mA Stimulus
 0Ω Min

 Isolation Min Res
 Quick Scan

 More Options.
 <u>D</u>K

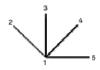
Enter the minimum conductor resistance (the ideal is 0Ω). If your test requires a minimum conductor resistance and the test measures lower than the threshold value, the fault will be reported as Wrong Gauge).

Select Enter to continue.

The settings are updated.

4.9.3 Star or Chain Scan

The Horizon provides two methods for continuity scanning The default method is the **Star** scan. The star scanning method selects the first point in a net and measures continuity from that point to all other points.

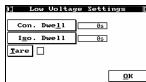


The second method is the **Chain** scan. The chain scanning method selects the first point in a net and measures continuity to the second point in a net. Next, the second point is select and continuity is measured to the third etc...

ttings [
Chain
5Ω Μαχ
<u>OΩ Min</u>
uick Scan
<u>о</u> к

Toggle the **Scan** button from the *Low Voltage Settings* menu to change between the two scan options.

4.9.4 Tare



The Tare values can be added directly to a test program without performing a full System Tare or an Adapter Tare.

The tare is performed from the Low Voltage Setting menu.

Select More Options → Tare.

 Adaptor Capacitive 1) Remove shorting pl all adaptors connec 2) Press UK to perfor oitive tare. 	ugs from tors.
	<u>о</u> к
1) Adapter Resistive (1) Flug adapters in t test posisions in pl 2 all used connectors: 3) All plugs must be massive; OA Connet! 4) Press OK to perfor tive tare.	he final ugs in electri- in a
	<u>о</u> к

Remove the shorting connectors and select **OK** to start the capacitive tare.

In order to perform the tare, you must short all points together that are contained on each connector. Each connector must be then be shorted together. All connections will be tared in a single pass.

Select **OK** to start the resistive tare.

When the tare is complete, **Tare** will be checked.

To disable the tare, select **Tare** again to remove the checkmark.

4.9.5 Improving Accuracy with High Capcitive Loads (Long Cables)

In order to improve measurement accuracy it may be beneficial to add a delay to continuity or isolation measurements. To add a delay to your test program, select **More Options** from the *Set Test Parameters* menu.

C Low Voltage S	ettings [
Con. Dwe <u>l</u> l	Øs
I <u>s</u> o. Dwell	Øs
Tare	
	<u>o</u> x

Select **Con. Dwell** to add a delay to the continuity measurement.

Select **Iso. Dwell** to add a delay to the isolation measurement.

4.9.6 Customize Conductor Tests by Nets

J. Set lest rarameters	
<u>A</u> dapters	
Components	
<u>N</u> et List	
P <u>r</u> int	
<u>Cancel</u>	

10	Edit	Net	H
Dotest 4	.4.11		
~Net(J1	<u>č1.2</u> ,	J3.C1.2)	
~"Net(J1	C1:3;	33:61:33	
~~Net(J1 ~Net(J1	C1.5;	J3.C1.5)	
-Net(J1	C1.7;	J3.C1.7)	
±▲∓	Edit	Label	
			<u>o</u> x
1 I L	Open	T <u>w</u> isted	

From the Set Test Parameters menu, select Net List.

Select the Net you wish to customize, and select Edit.

<u>D</u> C Hipot		= =		D <u>e</u> fau		1
<u>A</u> C Hipot Conduc		┛		De <u>f</u> au D efa u		
	ault	1		Defai		
<u>K</u> elvin		<u>S</u> hiel	d		<u>о</u> к	
1 Snooi	Fu Co	ntinu	i tu	u Tu	ъe	Ĥ

<u>R</u> esistance @5mA	Qariok Soan
<u>H</u> C Resistance	From Sample
Voltage Drop	Fixed HC

Select **Conductor Res** to set a custom setting for the selected net.

Specify the continuity type and set the preferences as described above.

(i) If the net you have selected is a Ground or Chassis, and you have other nets that are ground as well, you may want to designate each net as 'Shield' by selecting **Shield** from the *Edit Net's Settings* menu. If two nets, each designated as 'Shield', are shorted together during a test, they **will not** fail.

4.10 Common Cable Faults & Faulty End Recognition (FER)

4.10.1 Opens

Common errors or faults reported by the Horizon for a cable during a low voltage test are; opens, shorts, and miswiring faults.

Should the low voltage test fail, before removing the product from the adapters, selecting **Diagnose** will report the cause of the cable failing.



Figure 4-2: PUT with Open J3.C1.6



The first example is an open connection. The cable is reported to fail, **Diagnose** is selected, and the screen to the left is displayed. The Horizon reports that the cause of the fail condition is an open connection and it is located at pin 6 of the first connector on the adapter mounted in the J3 position. Note the fault is at the adapter level.

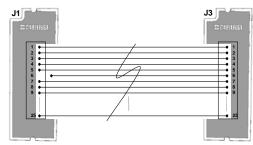


Figure 4-3: PUT with Open J1.C1.6

	t Report	Ξ
Reported Test Program		
04/06/2000 1 *Net(J1.C1.6	6.11.01	
lat 16% from	J1.C1.6	open ///
~~~~ End of	Report ~~	
		J
	Print	ок
	_	

Reversing the cable with the open connection and re-testing it reveals the Horizons ability to locate the position of the open net. Note the same fault now appears at J1 instead of J3.

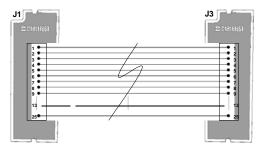


Figure 4-4: Open at 30%.



In this example the open has occurred at 30% the distance from the first adapter.

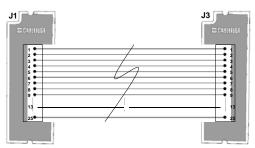


Figure 4-5: Open at 47%.



In this example the open has occurred at 47% the distance from the first adapter.

### 4.10.2 Miswires

Miswire reports are extremely accurate as well. A miswire error is reported when the Horizon tests a cable and the nets do not match the configuration of the original 'golden' sample.



Figure 4-6: PUT Miswired

)) Te	st Report	F
Reporte	d Results:	Fail
	15:17:07 6 miswire stead of 6 miswire stead of 6. J3.C1.0	1 to J3.C1.6 1 to J3.C1.6 J3.C1.6 b) open
	<u>P</u> rint	<u>o</u> x

In the example to the left, the Horizon cable is miswired and notes the current wrong configuration and the correct configuration it expected.

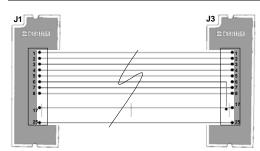


Figure 4-7: PUT Miswired – reversed



Reversing the cable and re-testing, the Horizon reports the same net to be faulty but points to the correct adapter at which the fault can be located.

### 4.10.3 Shorts

One of the unique features of the Horizon is its ability to pin point the location of shorts on a test cable.

With regards to low voltage tests, shorts can be detected and located by the Horizon.

		Perfo	ormin	g Te	sts	29
		Find	ing 3 0%	Short	<b>`</b>	
Ex-x	ner .	§€a €	lstic	s [	∑iagno	3582 3582

(i)

During the isolation test of a cable, the Horizon can diagnose shorts and the location of the fault relative to its position from the adapters. If a short is detected, the system will display an active icon to tell the user it is still working and diagnosing faults.

It is important to remember that the Horizon can only detect and will not pin point the location of a short (arc) that is a result of a high voltage test.



Figure 4-8: Short at J1

1. Test Report	Η
Reported Results: Fail	
Test Program:TEST_CABLE #\$% 04/06/2000 16:51:58 #Net(11.21.13.	1
J3.C1.I3)Shorted: to Net(J1.C1.24, J3.C1.24) at J1.C1.13: 38m0hm	
*Net(J1.C1.24, J3.C1.24)Shorted: to Net(J1.C1.13, J3.C1.13) at	J
▲▼★¥ <u>Print</u> <u>O</u> K	Ĵ

In the example above, the cable is tested and it fails as a result of a short very close to the adapter at J1. Use the Down arrow button to see the remainder of the error message.

(i) Asterisks always precede faults.

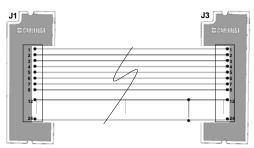


Figure 4-9: Short at 81%

1 Test Report	
Reported Results:	Fail
Test Program:TEST CAB 04/06/2000 16:54:57 *Net(J1.C1.12 J3.C1.12)Shorted: to Net(J1.C1.24, J3.C1.22 22%, from_J1.C1.12:	
*Net(J1.C1.24, J3.C1.24)Shorted: to Net(J1.C1.12, J3.C1.1	



In the next example the same cable has failed as a result of a short, not at either end of the cable, but 81% of the distance from the first adapter. In this manner, one can easily locate the fault to be dealt with at the re-working station.

Use the down arrow button to see the remainder of the error message.

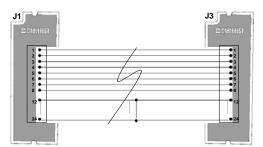


Figure 4-10: Short at 55%



1] Test Report Reported Results:	E Fail
<pre>%Net(J1.C1.12 J3.C1.12)Shorted: to Net(J.C1.24CJ3C1.2 Sox.from J1.21.12: %He(J1.25)Acted: to J3t(J1.25)Acted: to J3t(J1.25)Acted: to Sox.from J1.C1.24: Sox.from J1.C1.24: Sox.from J1.C1.24: Sox.from of Report ~~</pre>	
▲▼±¥ <u>P</u> rint	<u>о</u> к

In this example the short has occurred at 55% the distance from the first adapter.

Use the down arrow button to see the remainder of the error message.

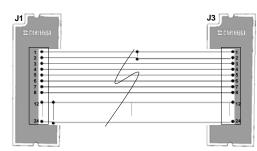


Figure 4-11: Multiple Shorts



Test Report Reported Results: Fail

M.3.6.1.2. 27mOhm M.3.6.1.2. 27mOhm C1 12)Shorted: to (J1.6124, J3.61.24) at Korm J3.41.12: 23mOhm (J1.24)Shorted: to (J1.24)Shorted: to (J1.24)Shorted: 23mOhm From J3.61.24: 23mOhm

▲▼±¥ <u>P</u>rint

It is not unusual to find a cable or harness that has more than one fault. The Horizon will report all faults found.

The only exceptions are those cases where one type of fault is masking another type of fault when an open circuit is sitting behind a short on the same wire. The only other exception is a case in which the cable is removed before the **Diagnostics** button is selected. In this case, the Horizon simply shows the cable as failed and does not retain diagnostics.

Use the down arrow button to see the remainder of the error message.

#### 4.10.4 Shorts and Opens with a Test Fixture

Η

ок

If you are using a test fixture with your Horizon, that is, a fixture a particular distance from the adapter level of the Horizon; then, the cable length, or 100%, is will be measured from adapter to adapter unless you perform both a capacitive and resistive tare on the

fixture (see Section 6.3 for details). If you do not wish to do this the length of cabling from the Horizon to the test fixture is part of the distance calculation. Consider the following setup:

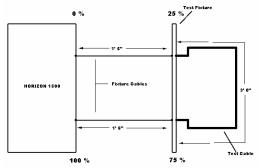


Figure 4-12: Example of a Test Fixture Setup

The above setup demonstrates the notion of faulty end recognition when a test fixture is being used with the Horizon. In the case above, should a short occur on the test cable during a low voltage test, then, the short would be reported between 25% and 75%. The front of the cable is located at 25% of the total length and the rear of the cable is located at 75% of the total length.

Adapter level shorts will be reported at 25% or 75%, respectively, from a particular adapter, and a short along the cable would fall in between those two percentages.

### 4.11 Flex Test

#### 4.11.1 Testing for Intermittent Low Voltage Faults

The Flex test is a method of testing a cable or harness for intermittent shorts or opens. Since these usually occur at or near a connector, the Flex test is a quick, easy, and economical method of locating these problems.

0. Set Test Parameters		
Name / <u>P</u> rompt	<u>A</u> dapters	
<u>L</u> ow Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>Cancel</u>	

The Flex test is set up from the Set Test Parameters menu. This menu is displayed as the last programming step when learning a cable either under the Default path or under the Customized path in the Programming Cable menu. Program Cable menu is accessed by selecting **Program Cable** from the Main Menu and then entering your password. Set Test Parameters can also be reached directly for a cable already programmed into the database by selecting **Modify Existing Cable**.

[C] Low Voltage S	ettings [
<u>F</u> lex <u>Dis.</u> <u>S</u> car	n Star
Co <u>n</u> ductor Res	Quick Scan
0 5mA Stimulus	N / A
<u>I</u> solation Min Res	Quick Scan
More Op <u>t</u> ions	<u>о</u> к

In Set Test Parameters, select **Low Voltage** to display the *Low Voltage Settings* menu. Select **Flex** to toggle between the three settings:

#### Dis. (Disabled)

**Perm. (Permanent)** Flex the cable until you select **Ok** from the touch screen.

A fixed time-out value (1 – 99.9 seconds) Flex the cable for the programmed duration.

Select **Ok** and you will be returned to *Set Test Parameters*. Select **Ok** again and you will go through the *Save Cable Record* dialog.

# Test Program as CBL File

(datab\cables\main\flextest.cbl For greater detail see section 9.

*CABLE*,FLEX TEST,1	*NET*,,
*QUICKCONTINUITY*	J1.C1.12,,
*QUICKISOLATION*	J3.C1.12,,
*FLEX*,10	*NET*,,
*STAR*	J1.C1.13,,
*THRESHOLD*,61	J3.C1.13,,
*ADAPTER*,HA 116,	*NET*,,
*POSITION*,J1	J1.C1.14,,
*ADAPTER*,HA 116,	J3.C1.14,,
*POSITION*,J3	*NET*,,
*NET*,,	J1.C1.15,,
J1.C1.1,,	J3.C1.15,,
J3.C1.1,,	*NET*,,
*NET*,,	J1.C1.16,,
J1.C1.2,,	J3.C1.16,,
J3.C1.2,,	*NET*,,
*NET*,,	J1.C1.17,,
J1.C1.3,,	J3.C1.17,,
J3.C1.3,,	*NET*,,
*NET*,,	J1.C1.18,,
J1.C1.4,,	J3.C1.18,,
J3.C1.4,,	*NET*,,
*NET*,,	J1.C1.19,,
J1.C1.5,,	J3.C1.19,,
J3.C1.5,,	*NET*,,
*NET*,,	J1.C1.20,,
J1.C1.6,,	J3.C1.20,,
J3.C1.6,,	*NET*,,
*NET*,,	J1.C1.21,,
J1.C1.7,,	J3.C1.21,,
J3.C1.7,,	*NET*,,
*NET*,,	J1.C1.22,,
J1.C1.8,,	J3.C1.22,,
J3.C1.8,,	*NET*,,
*NET*,,	J1.C1.23,,
J1.C1.9,,	J3.C1.23,,
J3.C1.9,,	*NET*,,
*NET*,,	J1.C1.24,,
J1.C1.10,,	J3.C1.24,,
J3.C1.10,,	*NET*,,
*NET*,,	J1.C1.25,,
J1.C1.11,,	J3.C1.25,,
J3.C1.11,,	*END*

#### 4.11.2 Testing the Cable - Flex Test

<b>(C</b> )		t Configura	
Cu		ly Selected	
ĝat.	ab\cab	ies\MAIN\FI	LEXTEST.CB
Par	t Numb K TEST	er:	
Rev	.1		
To	0 <u>1</u> 5	<u>Reports</u>	<u>S</u> elect
Tes	t Now	Batches	Cance 1

To actually perform the Flex test on a product is easy and straightforward. Select **Test** on the *Main Menu* to bring up the *Test Configuration* menu, press **Select** to select the product for testing (unless it is already displayed), then select **Test Now**. You will be instructed to insert the necessary adapters, and then to connect the cable for testing.



 f)
 TEST CAGLE M6%
 [5]

 f)
 Perforning Tests

 C:11:2

 OK

 Error Startistics
 Start Lest

 Start Lest
 Samel

The *Flex Test* display appears and the Horizon automatically enters a continuous scan loop looking for faults. At this point, you need to manually Flex or stress the cable, typically by moving it back and forth or wiggling it at each connector. Any detected faults will be logged and totalled at the top of the display, with **C** standing for continuity and **I** for Isolation. If a fault of any type is detected in a given net, that net is removed from the scan list for the duration of the test.

The test is terminated either by a time-out, specified when the product was learned, or by selecting **Ok**.



Selecting **Diagnose** for a failed flex test will reveal the same detailed results as expected from a standard or 'default' test of a product.

## 4.12 Assembly Aid Tools

Assembly Aid allows the operator to randomly populate one end of cable product, and then use the tool to test and populate the remaining end(s) of the product.



For details on the Horizon's **Build Aid** capabilities, please see Section 9.1.5.

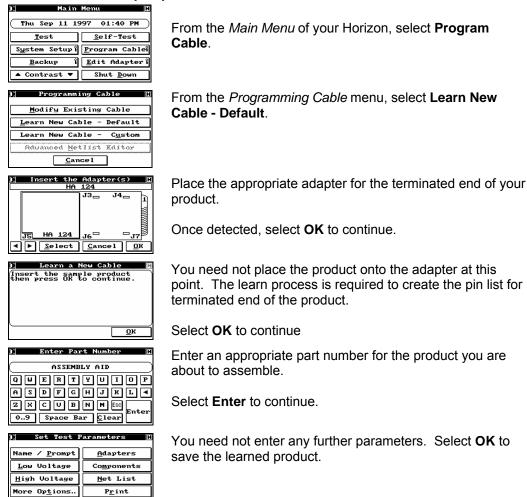


The following is a step by step example using a cable terminated at one end with a DB50 connector and not terminated at the other.



The following example makes use of the standard Horizon ground probe as well as a cup of ordinary unsalted water.

#### STEP 1: Learn the open product.



4-30 Horizon Series Tester: Programmer's Manual

<u>Cancel</u>DK

Test Now

Set Test Parameters     Name       Name     Name       J.Save     Cable Record?       Log     State       Mark     No       State     No       Test Nov     Cancel	Confirm with <b>Yes</b> .
t] Open Directory [] Directory Name AMAIN	Select the directory you wish to save the file within, or create a new one by selecting <b>New</b> .
± ▲ ∓ <u>N</u> ew Refresh ④ ► <u>Cance</u> 1	Select <b>OK</b> to save.
I Programming Cable H Modify Existing Cable Learn New Cable - Default Learn New Cable - Custom Advanced Metlist Editor Cancel	Select <b>Cancel</b> to return to the <i>Main Menu</i> .
Main Menu     H       Thu Sep 11 1997 01:40 PM       Test     Self-Test       System Setupi     Program Cablei       Backup i     Edit Adapter i       ▲ Contrast ▼     Shut Down	From the <i>Main Menu</i> , select <b>Test</b> to enter the <i>Test Configuration</i> menu.
Test Configuration Currently Selected Cable File Name (atab)Cables WAINNASSEMBLY.cb Part Number: ASSEMBLY AID Nev.1	The last loaded product (in this case the product we just learned) is displayed. If it is not the correct product, choose <b>Select</b> to load the correct one.
Too <u>ls R</u> eports <u>Select</u> Test Now Batches <u>Cancel</u>	Select <b>Tools</b> to begin the Assembly Aid process.
J5 HA 124 J6 Jancel	The system prompts for the adapter needed. Place the adapter to continue.
Select Tool     I       Pin Locator       Group Sorting       Group Scan	The Select Tool menu appears.

Step 2: Group Scan Before you begin, it is recommended to verify the continuity of all conductors that are terminated within the connector.



To perform Group Continuity, place the Horizon Probe within the glass of water. (Ensure the probe is connected to **I/O#2** on the Horizon)

Connect the terminated end of the product to the Horizon.

Place the non-terminated end into the glass of water.

Select Tool From the Selector Tool menu, select Group Scan. <u>P</u>in Locator <u>G</u>roup Sorting Group Scan Cance l Enter pins that belong to first group Enter a range that includes all the conductors. -50 For this example we enter 1-50. 1234567890 Select Enter to continue. A.Z Space Bar Clear Select Tool The scan will begin as soon as the conductors are ]Finding Pins in Range: 1-50 submerged in the grounded water. Scanning 1 Skip <u>C</u>ance l Cancel Scan Group Result 54 If all the conductors are continuous the group scan will pass. PASSED * Select **OK** to continue. <u>o</u>κ Select Tool If a conductor is open the scan will pause. Select Skip to 1]Finding Pins in Range: continue scanning or **Cancel** to exit the scan. nning 11 <u>C</u>ance l Canoel following pins The end of the scan will display the conductor/pin not probed. This conductor is most likely open. Select **OK** to continue. <u>ο</u>κ



Select ESC to return to the Select Tool menu.

#### Step 3: Group Sorting



The next step involves separating the loose ends of the product into groups for easy connector assembly.

Group 1: 1 - 17 Group 2: 18 - 33 Group 3: 34 - 50 For the DB50 connector an ideal method would be to separate the conductors into the 3 rows of the DB50 connector.

1. Select Tool
<u>P</u> in Locator
<u>G</u> roup Sorting
Group <u>S</u> can
<u>Cancel</u>
1] Enter pins that belong
to first group
# \$ < > // // Esc Enter
A.Z Space Bar Clear
Select Tool
J Select 1001
1-17
Cance 1
T T T T T T T T T T T T T T T T T T T
1] Select Tool []
1] Finding Pins in Range: [
1-17 Last Probed:
8
<u>C</u> ance l
<u>Cance</u> 1

From the Select Tool menu, select Group Sorting.

Enter the pins that belong to Group 1 (1 - 17)

Select Enter to continue.

Using the ground probe, touch the conductors to isolate group 1.

As you probe the conductors, the pin you last probed is displayed. Conductors that do not belong to the group will not respond to the probe's touch.

Fi	nding			Range :	н
		1-1	7		
	Las	st Pro	obec	1:	
		17			
		-			
		<u>D</u> one	2		

Once you have probed all the conductors the **Done** is displayed.

At this point you can continue to probe to verify the group.

Select **Done** to continue.

1] Enter pins that belong	H)				
to next group					
( 18-33 )					
1234567890					
** < > / , : 4	ן				
# \$ < > % " / Esc	J				
A.Z Space Bar Clear					

Select Tool

1] Finding Pins in Range: 18-33 Last Probed: 33

Done

Enter the pins for the second group and begin probing the remaining conductors.

Probe until done.

Select Done to continue.



three sets of conductors.

Upon completion of the second group, you will now have

	41							
)C	En			s tł ext :			ng	Н
æ	×	•	Ы	5 e	וו	הו	-	<u>ା</u>
#	\$	<	D	Bar	<u>.</u>	ESC	Ent	
A.	.z	Sp	ace	Bar	וסך	ear	Ent	er

Select **ESC** to continue.

### Step 4: Group Verification (group continuity)

It is highly recommended, once the groups are separated, to perform a group scan on each of the groups.

0	Select Tool	Η
	<u>P</u> in Locator	
	<u>G</u> roup Sorting	
	Group <u>S</u> can	
	<u>C</u> ance l	

From the Select Tool menu, select Group Scan.

1] Enter pins that belong [ to first group
( 1-17 )
1234567890 & * () /, : 4 # \$ () / , : 4 # \$ () / , : 4 # \$ () / , : 4
)] Scan Group Result
PASSED ?
Į į

Enter the pins of Group One.

Place the Probe and Group One into the water and select **Enter** to continue (see step 2 for details).

Repeat the scan for Group Two and Group Three.

Once all three groups have been verified you can move to connector population.

#### Step 5: Assembling the product

The three verified groups can now be populated within the connector.

)] Select Tool					
Pin Locator					
<u>G</u> roup Sorting					
Group <u>S</u> can					
<u>C</u> ance l					
1] Enter pin or pin range					
to be found					
( 1-17 )					
1234567890					
**<>/					
# \$ < > % " / Esc Enter					
A.Z Space Bar Clear					

From the Select Tool menu, select Pin Locator.

Enter the pin range for the first Group.

Pin ranges can be ascending or descending depending on your preference or need. If you wish to select non-sequential pins you can do so by separating them with commas (e.g. 1,3,5,7). You may also select ranges that are non-sequential you need only separate the ranges with a comma (e.g. 1-5, 8-20).

Select Enter to continue.

( The second sec	Locatin 1	ng Pin	Η
	A <u>uto</u>	<u>C</u> ancel <u>N</u> ext >	_
	<u>C</u> aw	e i	

There are two methods to sequence through a range of pins: Automatic or Manual.

By selecting **Auto** (check mark present), once a pin is successfully probed the scan sequences to the next pin. Be aware this may cause problems should you probe the pin and loose its location - you will then need to select **Prev** to return scanning that pin.

In the manual mode, once you have located the required pin, select **Next** to sequence to the next pin in your selected

range.

1] Enter pin or pin range [] to be found
1234567890 &*()/,:<
<b>#</b> $\$ \land > \land " ' Ess$ A.Z Space Bar <u>C</u> lear

Once you have probed the final pin in the range, if you select **Next**, or if you are automatically sequencing, you will return to the range entry dialog.

Enter the range for the next group of pins you wish to locate and select **Enter** to continue.

Continue until you have fully assembled the product.

#### **Step 6: Final Verification**

Once all the pins are populated in the connector, it is recommend to perform a final verification that the product is correctly assembled.

1. Enter pin or pin range [] to be found
1234567890
1234567890 &*()/,:4
#   \$   <   >   %   '   Esc
A.Z Space Bar Clear

After the last pin is probed, if you select **Next**, or if you are automatically sequencing, you will return to the range entry dialog.

If you select **Enter** <u>without</u> entering a range you will enter the Probe any Pin mode.

2	Pro	be A	ny P	in	Н
		Cano	el	٦	

Select

robe Any Pir

Last Probed:

<u>C</u>ancel

At this point probe each pin on the assembled connector noting the connector position and the pin displayed on the screen.

Probing pins on the newly assembled connector will display the pins as they are populated at the original terminated end.

Verify that the pin and displayed pin are matching.

## 4.13 DC HiPot Testing

#### 4.13.1 Introduction

The Horizon can be set up to perform a DC HiPot test on any cable or harness, provided that it has a high voltage DC source installed. HiPot testing can be done on the entire cable, or only on selected nets within the cable.

(i) If your product has embedded resistors or diodes and these components are learned when the cable is learned, the Horizon will automatically exclude the nets connected to these components. Nets with components connected to them are automatically grouped for isolation and HiPot testing, and the group of nets is treated as a single net while these tests are running. You do not need to worry about manually excluding them.

#### 4.13.2 Safety

Your Horizon has the capability of allowing you to set up a number of safety procedures. Which of these you use depends on local regulations, your philosophies, and the training level of your personnel.

(i) To use Palm Switches with your High Voltage Test, see Section 3, System Setup.

#### 4.13.3 Program the Horizon to Hipot the Entire Cable or Harness

The main location for setting up HiPot testing is the *Set Test Parameters* menu. This menu is always displayed after a cable has been learned through either the Default or the Customized path. It is also directly accessed after selecting a previously learned cable in *Modify Existing Cable*.

Name / <u>P</u> rompt <u>A</u> dapters				
<u>L</u> ow Voltage	Components			
<u>H</u> igh Voltage	<u>N</u> et Li	ist		
More Op <u>t</u> ions	Prin	t		
T <u>e</u> st Now	<u>Cancel</u>	<u>0</u> ĸ		

Hipot Nets Only

Password Protected

Di<u>s</u>charge Delay

<u>DC</u> Hipot Settings <u>AC</u> Hipot Settings Selecting **High Voltage** displays the *High Voltage Settings* dialog.

Selecting **Hipot Nets Onl**y, (a check mark is visible), means that the Horizon will only perform a HiPot test on complete nets.

This is done for two reasons:

J

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1) To speed up the test, since the system doesn't have to consider open nets; or 2) to prevent the programmed high voltage from possibly being present at open leads. It is important to remember that the Horizon can perform a HiPot test on flying leads; in fact, this is quite common in many applications testing isolation. Just remember not to select this option unless it is needed.

Selecting **Password Protected** (a check mark is shown) means that an operator level password must be entered before high voltage testing can proceed. **Cancel** returns to *Set Test Parameters* with no action taken, while **Ok** implements the desired setup.

**Discharge Delay** affects both AC and DC HiPot testing. Selecting this option allows the user to control the discharge of the PUT. By default the Horizon discharges the PUT as fast as possible.

Programmable Discharge Delay values: .1s to 1200s.



This option is only available after an AC or DC HiPot has been programmed.

Selecting **DC Hipot Settings** brings up the *DC HiPot Settings* menu. AC HiPot testing is discussed section 4.14.

[] DC Hipot Settings [					
Hipot Dwell					
Hipot <u>V</u> oltage	]				
<u>L</u> eakage Limit	]				
Hipot <u>D</u> uration	]				
<u>S</u> can	<u>R</u> amp <u>O</u> K				

1] DC Hipot Se	ttings 🖸
Hipot J Dwe	11 Regular
Hipot <u>V</u> oltage	
<u>L</u> eakage Limit	Αų 0.001
Hipot <u>D</u> uration	0.01 5
Scan Mass	<u>R</u> amp <u>O</u> K

<u>)</u>		nput D st vol		
572				
	1	2	3	<u>C</u> lear
	4	5	6	BS
	7	8	9	Enter
		»	Esc	Enter

For safety reasons, DC high voltage testing cannot even be setup until the **HiPot** button is selected. As soon as it is selected, and the check mark appears, the rest of the menu becomes active and is no longer greyed out. Selecting **Ok** incorporates the DC HiPot test that was specified into the cable's test setup.

Now that the Horizon has been instructed to perform HiPot testing, the test parameters can be defined. Select **HiPot Voltage** and the *Input the DC HiPot test voltage in Volts* dialog is displayed.

Enter the desired DC HiPot voltage. You can specify any value you want from 50V up to either 1000 or 1500 Volts, depending on the high voltage source installed. The voltage can be specified in single (1) volt increments. When the proper voltage has been entered, select **Enter** and you will be returned to the *DC Hipot Settings* menu. Select **Leakage Limit** and you will enter the *Specify Leakage Type* dialog.

) DC Hipst Se ) Specify Leaka	ige Type []
Current	
Resistance	
i <u>A</u> rcs Only	<u>C</u> ance 1
Soan Mass L	ancei <u>D</u> x
Maximum DC leakage curren	
1.0	
µA√ 1 2	3 Clear

	()				
<b>PU</b>	1	2	з	<u>C</u> lear	
[mA]	4	5	6	BS	
	7	8	9	<b>.</b> .	
◄▲		»	Esc	Enter	

Maximum DC hipot leakage resistance in MΩ				
0.1				
1	1 2 3 <u>C</u> lear			
4	4 5 6 BS			
7	7 8 9			
0 Esc				

You can specify the desired leakage limit directly as a **Current**, as a function of **Resistance**, or simply enable the Horizon to detect **Arcs Only**. Select **Current** to enable the *Maximum DC HiPot leakage current* dialog.

Enter the desired leakage current, paying attention to the insulation specifications for the wire being used. The allowable range is from  $1\mu$ A to 5mA. Use the arrow keys to change between ' $\mu$ A' and 'mA' if needed. Select **Enter** to confirm your input and return to the *DC Hipot Settings* menu.

If you would prefer to specify leakage in terms of resistance, select **Resistance** after selecting **Leakage Limit** the *Maximum DC HiPot leakage resistance in M* $\Omega$  dialog will appear. Input a leakage resistance between 0.1M $\Omega$  and 1000M $\Omega$  and then select **Enter** to confirm your input and return to the *DC Hipot Settings* menu.

[]]	Specify Leaka	ge Type [	
	C <u>u</u> rrent		
	<u>R</u> esistance	01	
	<u>A</u> rcs Only	<u>C</u> ance l	
Soa	Masss 1	awei ji 👳	K.

The last choice is **Arcs Only** (The Horizon will still automatically test for arcs if leakage is specified. If an arc is detected, testing is immediately suspended, the arc is reported, and no further high voltage testing is performed on that cable.) This test will rapidly check for any insulation or other breakdowns. **Cancel** returns to *Set Test Parameters* with no changes made.

	Input the DC hipot test duration in seconds				
$\square$	0.10				
	1 2 3 <u>C</u> lear				
	4 5 6 BS			BS	
	7 8 9				
	0		Esc	Enter	

Selecting **Hipot Duration** displays the *Input the DC HiPot test duration in seconds* dialog. Enter the length of time that you would like the DC high voltage be applied, from 0.01 to 600 seconds. Select **Enter** to return to *DC Hipot Settings.* 

)) DC Hipo	t Sett	ings 🛛
Hipot J	D <u>w</u> ell	Regular
Hipot <u>V</u> oltage		οU
<u>L</u> eakage Limit		100.0 μA
Hipot Duration		0.01 s
<u>S</u> can Linear	Ra	imp <u>O</u> K

**Scan** switches between the 'Mass' scan and the 'Linear' scan methods. Although the linear method is more traditional, it is highly recommended that you leave it in Mass scan unless your test requirements specifically dictate otherwise. Mass HiPot testing is much faster with no loss in accuracy. **Ok**, adds the DC HiPot tests to the cable record and returns to the *Set Test Parameters* dialog.



Refer to Appendix C for Mass HiPot examples.

1. Set Test Parameters		
Name / <u>P</u> rompt	<u>A</u> dapte	ers
<u>L</u> ow Voltage	Compone	ents
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>C</u> ance l	<u>0</u> ĸ

Select **Ok** to save the record for this cable in the internal database.

#### Test Program as CBL File S \datab\cables\main\testca~1.cbl For greater detail refer to section 9. *NET*,, *CABLE*,TEST CABLE #\$%,2 *QUICKCONTINUITY* J1.C1.11,, *QUICKISOLATION* J3.C1.11,, *NET*,, *STAR* *THRESHOLD*,61 J1.C1.12,, *DCHIPOT*,572 J3.C1.12,, *LEAKAGE*,0.0001 *NET*,, *DWELL*,0.1 J1.C1.13,, *REGULAR* J3.C1.13,, *MASS* *NET*,, *ADAPTER*, HA 116, J1.C1.14,, *POSITION*,J1 J3.C1.14,, *ADAPTER*, HA 116, *NET*,, *POSITION*,J3 J1.C1.15,, *NET*,, J3.C1.15,, J1.C1.1,, *NET*,, J3.C1.1,, J1.C1.16,, *NET*,, J3.C1.16,, J1.C1.2,, *NET*,, J3.C1.2,, J1.C1.17,, *NET*,, J3.C1.17,, *NET*,, J1.C1.3,, J3.C1.3,, J1.C1.18,, *NET*,, J3.C1.18,, J1.C1.4,, *NET*,, J3.C1.4,, J1.C1.19,, *NET*,, J3.C1.19,, J1.C1.5,, *NET*,, J3.C1.5,, J1.C1.20,, *NET*,, J3.C1.20,, *NET*,, J1.C1.6,, J3.C1.6,, J1.C1.21,, *NET*,, J3.C1.21,, J1.C1.7,, *NET*,, J3.C1.7,, J1.C1.22,, *NET*,, J3.C1.22,, J1.C1.8,, *NET*,, J3.C1.8,, J1.C1.23,, *NET*,, J3.C1.23,, J1.C1.9,, *NET*,, J3.C1.9,, J1.C1.24,, *NET*,, J3.C1.24,, *NET*,, J1.C1.10,, J3.C1.10,, J1.C1.25,, J3.C1.25,, *END*

#### 4.13.4 Customize DC Hipot by Nets

You can choose to perform HiPot testing on only a portion of your cable by performing a HiPot test on the entire cable except for certain nets. In which case, you select those nets you do not wish to perform a HiPot test on.

C Set Test F	arameters	0
Name / <u>P</u> rompt	Adapters	
<u>L</u> ow Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>Cancel</u>	<
Test Now Cancel OK		

0	Edit	Net	H
Dotest 4	.4.11		
-Net(J1.	C1.1,	J3.C1.1)	
Net(J1.	či:ś:	13.51.3(	
Net(J1.	č1:4:	J3:č1:45	
-~Net(J1.	C1:5;	J3.C1.5)	
~Net(J1.	çi. <u></u> ;	33:81:93	
	<u> </u>	03.01.77	
	Edit	Label	
	2410	<u>n</u> eme r	<u>o</u> x
	Open	Twisted	<u> </u>
ك ت ت	OFC.	1 million of the	

C Edit Net's	s Settings 🛛 🕻
DC Hipot Custom	DC D <u>e</u> fault 🚽
<u>A</u> C Hipot Custom	AC De <u>f</u> ault
Co <u>n</u> ductor Res <u>Default</u>	
Default Default	
<u>K</u> elvin 🗌 <u>S</u>	hield 🗌 <u>O</u> K

To program nets to be excluded from the HiPot test, select **Net List** from the *Set Test Parameters* menu. The *Edit Nets* dialog will be displayed.

Using the arrow keys, move the cursor to highlight the net you want to exclude (or include) from HiPot testing.

Select Edit for the Edit Net's Settings menu.

Note that the display shows that this net is currently set to assume the default settings for both DC and AC HiPot tests. In the example cable being used, DC HiPot has been learned per the settings above, but no AC HiPot testing has been defined. Therefore, if no changes were made, this net would be subjected to a DC HiPot test, but not to an AC HiPot test. Select **DC Hipot Settings**, to display *Edit the Net's DC Hipot Settings*.

(i)

If the net you are selecting is a Ground or Chassis point in your product, you may designate it as a 'Shield' by selecting **Shield** from the *Edit Net's Settings* menu. This net will no longer be charged during the High Voltage test, though it will still remain as a common point.



If from the *Set Test Parameters* you set up High Voltage settings with **Scan** set to MASS, you will be prompted with this message.

Select **Ok** to acknowledge the conflict.

L GING	inge r	now t	he D(	<u>hir</u>	ot
S	can t	ype 1	to Li	near	?
			N-	n –	
	2	les	<u>N</u> o		

You are now given the option to alter the global settings to Linear, should you wish to continue editing the local High Voltage variable.

Select Yes to accept the change.

C] DC Hi	pot Sett	ings [
Hipot J	D <u>w</u> ell	Regular
Hipot <u>V</u> ol	tage [	0 U
<u>L</u> eakage L	imit [	100.0 µA
Hipot <u>D</u> ura	tion [	0.01 s
<u>S</u> can Linea	<u>r R</u> a	imp <u>O</u> K

Selecting **Hipot** will remove the check mark and this net will not be HiPot tested. Notice, however, that you can actually specify different HiPot test settings for different parts of the cable! In the example cable, that's exactly what we chose to do, setting a different voltage and duration to be used for this net and this net only, but leaving the leakage limit the same.

Select **Ok** to return to *Edit Net's Settings*. **Cancel** returns with no action taken.

) Edit Net'	s Se	tting⊴	5 E
DC Hipot Custom	J	DC D <u>e</u> fa	ult 🗌
<u>A</u> C Hipot Custom		AC De <u>f</u> a	ult √
Co <u>n</u> ductor Re	·s (	Defa	ult
Default		Defa	ult
Xelvin 🗆 S	hiel	a 🗆	<u>o</u> x
			<u> </u>

	Edit Net	1949
DOTEST C	CABLE #\$%	
~ Net1:	J1.C1.1J3.C1.1	
$\approx \frac{\text{Net2}}{\text{Net3}}$	J1.C1.2.J3.C1.2 J1.C1.3.J3.C1.3	
$\approx$ Net3	J1.C1.4.J3.C1.4	
e Netsi	J1.C1.5.J3.C1.5	
-~ Net6:	J1.C1.6J3.C1.6	
~ Net7:	JI.CI.7J3.CI.7	
		<u> </u>
E E E	<u>E</u> dit <u>L</u> abel	I
		ок
	Upen	

The display has now changed to indicate that this net is using 'Custom' settings to define its HiPot test parameters.

Select **Ok** to go back to the *Edit Net* menu. **Cancel** returns with the previous parameters intact.

You may wish to use the **Label** function to document the changes you have made to this net. Repeat these steps as necessary to modify the required nets. When you have finished, select **Ok** to return to *Set Test Parameters*. As before, select **Ok** from this menu to save your cable record.

### Test Program as CBL File

(s)						~
	es\main\testca~2.cbl		r detail	see	section	9.
*CABLE*, TEST CABLE	‡\$₹,3	*NET*,,				
*QUICKCONTINUITY*		J1.C1.11,,				
*QUICKISOLATION*		J3.C1.11,,				
*STAR*		*NET*,,				
*THRESHOLD*,61		J1.C1.12,,				
*DCHIPOT*,572		J3.C1.12,,				
*LEAKAGE*,0.0001	L	*NET*,,				
*DWELL*,0.1		J1.C1.13,,				
*REGULAR*		J3.C1.13,,				
*LINEAR*		*NET*,,				
*ADAPTER*,HA 116,		J1.C1.14,,				
*POSITION*,J1		J3.C1.14,,				
*ADAPTER*,HA 116,		*NET*,,				
*POSITION*,J3		J1.C1.15,,				
*NET*,,		J3.C1.15,,				
*DCHIPOT*,0		*NET*,,				
J1.C1.1,,		J1.C1.16,,				
J3.C1.1,,		J3.C1.16,,				
*NET*,,		*NET*,,				
J1.C1.2,,		J1.C1.17,,				
J3.C1.2,,		J3.C1.17,,				
*NET*,,		*NET*,,				
J1.C1.3,,		J1.C1.18,,				
J3.C1.3,,		J3.C1.18,,				
*NET*,,		*NET*,,				
J1.C1.4,,		J1.C1.19,,				
J3.C1.4,,		J3.C1.19,,				
*NET*,,		*NET*,,				
*DCHIPOT*,0		J1.C1.20,,				
J1.C1.5,,		J3.C1.20,,				
J3.C1.5,,		*NET*,,				
*NET*,,		J1.C1.21,,				
J1.C1.6,,		J3.C1.21,,				
J3.C1.6,,		*NET*,,				
*NET*,,		J1.C1.22,,				
J1.C1.7,,		J3.C1.22,,				
J3.C1.7,,		*NET*,,				
*NET*,,		J1.C1.23,,				
J1.C1.8,,		J3.C1.23,,				
J3.C1.8,,		*NET*,,				
*NET*,,		J1.C1.24,,				
J1.C1.9,,		J3.C1.24,,				
J3.C1.9,,		*NET*,,				
*NET*,,		J1.C1.25,,				
		J3.C1.25,,				
J1.C1.10,, J3.C1.10,,	יד <b>י *</b>	03.CI.25,, ND*				
03.01.10,,	<u>г</u> .					

#### 4.13.5 Cable Testing Using the DC Hipot

To perform a DC HiPot test on a cable as part of the test specification, simply follow the same procedures as for low voltage testing.

1] Test Configuration
Currently Selected Cable
File Name: datab\cables\MAIN\TESTCA~1.cb
Part Number: TEST_CABLE #\$%
Rev.2
Too <u>l</u> s <u>R</u> eports <u>S</u> elect
Test Now Batches Cancel
1. Test Report
Reported Results: ALL
Test Program: TEST CABLE #\$% 02/11/1999 14:51:00
*Short between Net1 and Net2
at 51% from J1.C1.2 *Short between Net12 and
at 51% from J1.C1.2 *Short between Net12 and Net24 at J3.C1.24
at 51% from J1.C1.2 *Short between Net12 and
at 51% from J1.C1.2 *Short between Net12 and Net24 at J3.C1.24

Select **Test** on the *Main Menu*. Select the cable to be tested, if it is not the cable displayed, and select **Test Now**. You will then be instructed to insert the adapters and to connect the product for testing.

The Horizon will first perform all of the specified low voltage tests. If any of the tests fail, the Fail light will turn on and you will have the opportunity to select **Diagnose**. The low voltage faults will be shown in a display similar to that shown.

(i) If a product fails any of the low voltage tests, HiPot testing will not be performed.



After the product has passed all of its low voltage tests, it can now be tested with high voltage. If you set up Autohipot during the system setup, HiPot testing will proceed automatically. If not, the *Perform DC Hipot Test*? dialog will appear.

In either case, if you specified Password Protected when the cable was learned, an Operator level password will have to be entered before testing will start. Select **Yes**, HiPot testing will start, and the *Performing Tests* dialog appears. (Selecting **No** will return you to the *Test Statistics* window, and the Fail light will be lit. Selecting **Diagnose** will show a message indicating that all tests have passed; what has happened, in essence, is a forced failure of the HiPot test.)

In all of these cases, if you have installed and programmed any type of Palm Switch protection, it will also have to be activated as programmed before HiPot testing will start.



 $(\mathbf{i})$ 

The display shows the progress of DC HiPot testing.



Should the product fail or if the HiPot was a linear scan, select **Diagnose** on the *Statistics* window to view the diagnostics.

A linear HiPot was performed and passed. The diagnostics reports the measurements made during the test. For the PUT the IR is extremely high. The Horizon reports "----" should the measurement be over range.

#### 4.13.6 Error Reporting

In addition to the standard Error Reports, three additional ones are associated with DC HiPot tests.

1] Test Report [ Reported Results: FAIL	н		
*DC overload Net19 *DC overload Net25 ~~~~ End of Report ~~~~			
<u></u>			
<u>P</u> rint <u>O</u> K	<u>]</u>		

The sample *Test Report* indicates that, during the DC HiPot test, a fault occurred at nets 19 and 25.

'DC Overload' is reported when an arc or excessive current leakage occurs during the charging cycle of the DC HiPot test. The message is used to differentiate between arcs during the HiPot test duration and during the time the cable is being charged to the HiPot voltage level.



arc during mass hip arc Net6 arc Net14 'End of Report ~~~~

<u>P</u>rint <u>O</u>K

This sample report indicates that, during the DC HiPot test, there was current leakage at nets 19 and 25. The Horizon measures and reports the level of leakage.

In this example an arc occurred during a MASS HiPot test.

1	Test Report
	Reported Results: ALL
•DC	arc during mass hipot ~ End of Report ~~~~
	End of heport
	Print OK
	Print <u>U</u> K

Arc locations can only be reported during a MASS HiPot if the fault is reoccurring. If the arc occurs only once, the system will report it but will not give a location. If you run a LINEAR HiPot the location will always be identified.



In this example the arc occurred during a LINEAR HiPot test.

All failures are identified with an asterisk (*).

### 4.13.7 Setting Various DC Hipot Cycle Times

 $(\mathbf{i})$ 

The Horizon has the capabilities of setting the DC HiPot dwell cycle types. Access the *DC Hipot Settings* menu as described above. Selecting the **Dwell** button cycles through the various dwell options as follows:

)] DC Hipot Se	ttings 🔲		
Hipot J Dwe	ll Regular		
Hipot <u>V</u> oltage	0 0		
<u>L</u> eakage Limit	Au 0.001		
Hipot <u>D</u> uration	0.01 5		
<u>S</u> can Linear	<u>R</u> amp <u>O</u> K		

During the 'Regular' dwell cycle, the programmed leakage current or IR is measured and, as soon as it exceeds the limit, the dwell is terminated immediately.

This is intended as a safety feature. In the unlikely situation where an operator touches a live wire, and the arc detecting circuit is not tripped, the software that monitors leakage current shuts down the output voltage. If the leakage current is smaller than the limit (or the IR higher than the limit) for the entire duration of the dwell cycle, the test passes. Otherwise it fails with a DC Leakage error.

Use this dwell option when the product exhibits a weak soaking characteristic or no soaking at all.

**Bypass** When using the 'Bypass' dwell cycle, the programmed leakage current or IR is measured at the end of the cycle. The safety feature is bypassed. This type of dwell is useful when the product exhibits a soaking characteristic. The leakage current must drop below the limit by the end of the dwell cycle in order for the test to pass.

Use this dwell option when the product exhibits a moderate soaking characteristic, and you don't want to extend the HiPot duration past the programmed value.

Adaptive When the 'Adaptive' dwell cycle is enabled, the programmed leakage current (or IR) is monitored. As soon as it decreases below the limit (or the IR increases over the limit), the test is passed. If the leakage current stays above the limit (or the IR stays below the limit) for the whole duration of the dwell cycle, the test fails.

Use this dwell option when the product exhibits a moderate to high soaking characteristic, and the shortest possible HiPot duration is desired. This type of dwell may actually speed up the HiPot test in some cases since the test immediately terminates when the product passes. Remember that, although the exact duration of the dwell cycle is unknown, it will be between 0 and the programmed duration.

**Soak** The Soak dwell cycle type is used to define a maximum soaking time before the actual dwell cycle starts.

To program a soaking time, toggle the Dwell key until the *Input DC Hipot Soak Duration* dialog appears. Enter the time in seconds (maximum 59999).

Using a programmed Soak time guarantees that the HiPot cycle will last at least the amount of time programmed as HiPot Duration. The programmed leakage current (or IR) is monitored during the soaking time and, if it drops below the limit (or the IR increases over the limit), the programmed HiPot duration time is entered immediately. The soaking time is a maximum limit that will only be used when the leakage current doesn't decrease fast enough. Use this option for applications where the product exhibits moderate to high soaking characteristic but the dwell time must be guaranteed.

Test Program as CBL File	
(\$) \datab\cables\main\testca~3.cbl	For greater detail see section 9.
*CABLE*,TEST CABLE #\$%,4	*NET*,,
*QUICKCONTINUITY*	J1.C1.12,,
*QUICKISOLATION*	J3.C1.12,,
*STAR*	*NET*,,
*THRESHOLD*,61	J1.C1.13,,
*DCHIPOT*,500	J3.C1.13,,
*LEAKAGE*,0.0001	*NET*,,
*DWELL*,0.1	J1.C1.14,,
*SOAK*,5	J3.C1.14,,
*MASS*	*NET*,,
*ADAPTER*, HA 116,	J1.C1.15,,
*POSITION*,J1	J3.C1.15,,
*ADAPTER*, HA 116,	*NET*,,
*POSITION*,J3	J1.C1.16,,
*NET*,,	J3.C1.16,,
J1.C1.1,,	*NET*,,
J3.C1.1,	J1.C1.17,,
*NET*,,	J3.C1.17,,
J1.C1.2,,	*NET*,,
J3.C1.2,,	J1.C1.18,,
*NET*,,	J3.C1.18,,
J1.C1.3,,	*NET*,,
J3.C1.3,,	J1.C1.19,,
*NET*,,	J3.C1.19,,
J1.C1.4,,	*NET*,,
J3.C1.4,,	J1.C1.20,,
*NET*,,	J3.C1.20,,
J1.C1.5,,	*NET*,,
J3.C1.5,,	J1.C1.21,,
*NET*,,	J3.C1.21,,
J1.C1.6,,	*NET*,,
J3.C1.6,,	J1.C1.22,,
*NET*,,	J3.C1.22,,
J1.C1.7,,	*NET*,,
J3.C1.7,,	J1.C1.23,,
*NET*,,	J3.C1.23,,
J1.C1.8,,	*NET*,,
J3.C1.8,,	J1.C1.24,,
*NET*,,	J3.C1.24,,
J1.C1.9,,	*NET*,,
J3.C1.9,,	J1.C1.25,,
*NET*,,	J3.C1.25,,
J1.C1.10,,	*END*
J3.C1.10,,	
*NET*,,	
J1.C1.11,,	
J3.C1.11,,	

#### 4.13.8 DC Hipot Ramp Up / Ramp Down

The slope of the charge and discharge of a PUT can be controlled by selecting **Ramp** from the *DC Hipot Settings* menu.

Select either Ramp Up or Ramp Down to enter the desired value.

Programmable range: .01V to 10kV per second for both Ramp Up and Ramp Down.

### 4.14 AC HiPot Testing

#### 4.14.1 Introduction

The Horizon can be set up to perform an AC HiPot test on any cable or harness, provided that a high voltage AC source is installed. HiPot testing can be done on the entire cable, or only on selected nets within the cable.

 $(\mathbf{i})$ 

 $(\mathbf{i})$ 

If your product has embedded resistors or diodes, and these components are learned when the cable is learned, the Horizon will automatically exclude the nets connected to these components. Nets with components connected to them are automatically grouped for isolation and HiPot testing, and the group of nets is treated as a single net while these tests are running. You do not have to worry about manually excluding them.

#### 4.14.2 Safety

Your Horizon has the capability of numerous safety procedures. Which of these you use depends on local regulations, your philosophies, and the training level of your personnel.

To use Palm Switches with your High Voltage Test, see Section 3, System Setup.

#### 4.14.3 Programming the Horizon to Hipot the Entire Cable or Harness

The main location for setting up HiPot testing is the *Set Test Parameters* menu. This menu is always displayed after a cable has been learned through either the Default or the Customized path. It is also directly accessed after selecting a previously learned cable in *Modify Existing Cable*.

Name / <u>P</u> rompt	<u>A</u> dapters
<u>L</u> ow Voltage	Components
<u>H</u> igh Voltage	<u>N</u> et List
More Op <u>t</u> ions	P <u>r</u> int
T <u>e</u> st Now	Cancel OK

Password Protected

Di<u>s</u>charge Delay

<u>DC Hipot Settings</u> <u>AC Hipot Settings</u> Selecting **High Voltage** displays the *High Voltage Settings* dialog.

Selecting **Hipot Nets Only**, (a check mark is visible), means that the Horizon will only perform a HiPot test on complete nets.

This is done for two reasons:

0.05

Ωк

1) To speed up the test, since the system doesn't have to consider open nets; or 2) to prevent the programmed high voltage from possibly being present at open leads. It is important to remember, however, that the Horizon can perform HiPot tests on flying leads. Just remember not de-select this option.

Selecting **Password Protected** (a check mark is shown) means that an Operator level password must be entered before high voltage testing can proceed. **Cancel** returns to *Set Test Parameters* with no action taken, while **Ok** implements the desired setup.

**Discharge Delay** affects both AC and DC HiPot testing. Selecting this option allows the user to control the discharge of the PUT. By default the Horizon discharges the PUT as fast as possible.

Programmable Discharge Delay values: .1s to 1200s.

(i)

This option is only available after an AC or DC HiPot has been programmed.

Selecting **AC Hipot Settings** brings up the *AC Hipot Settings* menu. DC HiPot testing is discussed in section 4-36.

AC Hipot Set Not Insta	
<u>H</u> ipot <u>F</u> requ	uency
Hipot <u>V</u> oltage	
<u>L</u> eakage Limit	(]
Hipot <u>D</u> uration	(]
<u>S</u> can <u>C</u>	ancel <u>O</u> k

If you do not have a high voltage AC source installed, or if it is installed incorrectly, the *AC Hipot Settings* menu will indicate "Not Installed". Contact your authorized CableTest representative if you are supposed to have the AC HiPot testing capability and you get this message.

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)] AC Hipot Se	ttings	H
Hipot 🗌 <u>F</u> req	uency	(
Hipot <u>V</u> oltage	C	
<u>L</u> eakage Limit	] [	
Hipot <u>D</u> uration	C	
<u>S</u> can Mo <u>r</u> e	Opt.	<u>о</u> к

Hipot J Frequency 60 Hz		
Hipot <u>V</u> oltage	0 U	
Leakage Limit	1000 μA	
Hipot Duration	0.40 s	
<u>S</u> can <u>Mass</u> Mo <u>r</u> e O	pt. <u>O</u> K	

[] AC Hipot Settings	H
Hipot J Frequency	50 Hz
Hipot <u>V</u> oltage 0	U
Leakage Limit 1000	Αų€
Hipot <u>D</u> uration 0.4	0 5
<u>S</u> can <u>Mass</u> Mo <u>r</u> e Opt.	<u>о</u> к

Input the AC hipot test voltage in Volts rms

(	456			
1	2	3	<u>C</u> lear	
4	5	6	BS	
7	8	9		
G			Enter	

For safety reasons, AC high voltage testing cannot even be setup until the **Hipot** button is selected. As soon as it is selected, and the check mark appears, the rest of the menu becomes active. Selecting **Ok** incorporates the AC HiPot test that has been specified into the cable's test setup.

As soon as the Horizon has been instructed to perform HiPot testing, the test parameters can be defined. The first parameter is Frequency. Selecting **Frequency** toggles the frequency of the applied AC voltage between 50 Hz and 60 Hz.

Next select **Hipot Voltage** and the *Input the AC HiPot test* voltage in Volts rms dialog is displayed.

Enter the desired AC HiPot test voltage. You can specify any value you want up to 1000Vrms (optional systems configurations are programmable to 1061Vrms and 1067Vrms). The voltage can be specified in single (1) volt increments.



Remember that you are specifying an RMS voltage. Take this into consideration if the test specification calls for a peak voltage.

When the proper voltage has been entered, select **Enter** and you will be returned to the *AC Hipot Settings* menu. Select **Leakage Limit** and you will enter the *Specify Leakage Type* dialog.

	] Specify Leaka	ge Type 🛙
	C <u>u</u> rrent	
	<u>R</u> esistance	Cance 1
÷	<u>A</u> rcs Only	<u>c</u> ancer
<u>S</u> c7	Mass L	ances J <u>V</u> a
	Maximum AC	hipot

$\square$		10		$ \longrightarrow $
[μΑ][J]	1	2	3	<u>C</u> lear
mA]	4	5	6	BS
	7	8	9	<b>.</b> .
		2	Esc	Enter

You can specify the desired leakage limit directly as a current, as a function of resistance, or simply ask the Horizon to look for arcs only. Selecting **Current** brings up the *Maximum AC HiPot leakage current in µA* dialog.

Enter the desired leakage current, paying attention to the insulation specifications for the wire being used. The allowable range is from  $1\mu A$  to 5mA. Use the arrow keys to change between  $\mu A$  and mA as needed. Selecting **Enter** when done will return you to the *AC Hipot Settings* menu.

Maximum AC hipot leakage resistance in MΩ				
i	1			
1 2	3 <u>C</u> lear			
4 5	6 BS			
7 8	9			
0	Enter Esc			

If you would prefer to specify leakage in terms of resistance, selecting Resistance after selecting Leakage Limit will display the Maximum AC HiPot leakage resistance in  $M\Omega$ dialog. Input a leakage resistance between  $0.1M\Omega$  and 1000M $\Omega$  and then select **Enter** to return to the *AC Hipot* Settings menu.

	C) Specify Leaka		1
	Current		
	<u>R</u> esistance		
ş	Arcs Only	<u>C</u> ance 1	

The last choice is Arcs Only. (The Horizon will still automatically test for arcs if leakage is specified. If an arc is detected, testing is immediately suspended, the arc is reported, and no further high voltage testing is performed on that cable.) This test will rapidly check for any insulation or other breakdowns. Cancel returns to Set Test Parameters with no changes made.

)] AC Hipot Settings [			
ency 50 Hz			
456 U			
1 MΩ			
2.00 s			
Opt. <u>O</u> K			

Selecting **Hipot Duration** displays the *Input the AC HiPot* test duration in seconds dialog.

Input the AC hipot test duration in seconds					
2.00					$\subset$
	<u>C</u> lear	з	2	1	
	BS	6	4 5		
		9	8	7	
	Enter	Esc	0		
	<u>C</u> lear	00 3 6 9	2. 2 5	1 4 7 0	$\cup$

AC Hipot Settings

Hipot <u>V</u>oltage 456 V

Leakage Limit 10 µA

Enter the length of time that you would like the AC high voltage to be applied, from 0.01 to 600 seconds. Select Enter to return to AC Hipot Settings.

Scan switches between the Mass scan and the Linear scan Hipot J Frequency 60 Hz methods. Although the linear method is more traditional, it is highly recommended that you leave it in Mass scan unless your test requirements specifically dictate otherwise. Hipot <u>D</u>uration 2.00 s As detailed in Appendix C, a Mass HiPot test is much faster <u>Scan Linear</u> Mo<u>r</u>e Opt. <u>O</u>K with no loss in accuracy.

> Ok, adds the AC HiPot tests to the cable record and returns to the Set Test Parameters dialog.

)] Set Test Parameters []			
Name / <u>P</u> rompt	<u>A</u> dapte	ers	
<u>L</u> ow Voltage	Components		
<u>H</u> igh Voltage	<u>N</u> et List		
More Op <u>t</u> ions	P <u>r</u> int		
T <u>e</u> st Now	<u>Cancel</u>		

Select **Ok** to save the record for this cable in the internal database.

Test Program as CBL File	
(S) \datab\cables\main\testca~4.cbl	For greater detail see section <b>9</b> .
*CABLE*,TEST CABLE #\$%,5	*NET*,,
*STAR*	J1.C1.12,,
*THRESHOLD*,61	J3.C1.12,,
*ACHIPOT*,456	*NET*,,
*LEAKAGE*,0.001	J1.C1.13,,
*DWELL*,0.4	J3.C1.13,,
*LINEAR*	*NET*,,
*60HZ*	J1.C1.14,,
*ADAPTER*,HA 116,	J3.C1.14,,
*POSITION*,J1	*NET*,,
*ADAPTER*,HA 116,	J1.C1.15,,
*POSITION*,J3	J3.C1.15,,
*NET*,,	*NET*,,
J1.C1.1,,	J1.C1.16,,
J3.C1.1,,	J3.C1.16,,
*NET*,,	*NET*,,
J1.C1.2,,	J1.C1.17,,
J3.C1.2,,	J3.C1.17,,
*NET*,,	*NET*,,
J1.C1.3,,	J1.C1.18,,
J3.C1.3,,	J3.C1.18,,
*NET*,,	*NET*,,
J1.C1.4,,	J1.C1.19,,
J3.C1.4,,	J3.C1.19,,
*NET*,,	*NET*,,
J1.C1.5,, J3.C1.5,,	J1.C1.20,, J3.C1.20,,
*NET*,,	*NET*,,
J1.C1.6,,	J1.C1.21,,
J3.C1.6, ,	J3.C1.21, ,
*NET*,,	*NET*,,
J1.C1.7,,	J1.C1.22,,
J3.C1.7,	J3.C1.22,,
*NET*,,	*NET*,,
J1.C1.8,,	J1.C1.23,,
J3.C1.8,,	J3.C1.23,,
*NET*,,	*NET*,,
J1.C1.9,,	J1.C1.24,,
J3.C1.9,,	J3.C1.24,,
*NET*,,	*NET*,,
J1.C1.10,,	J1.C1.25,,
J3.C1.10,,	J3.C1.25,,
*NET*,,	*END*
J1.C1.11,,	
J3.C1.11,,	

#### 4.14.4 Customize the AC HIPOT by Nets

You can choose to perform HiPot testing on only a portion of your cable by performing a HiPot test on the entire cable except for certain nets. In which case, you select those nets you do not wish to perform a HiPot test on.

Name / <u>P</u> rompt	<u>A</u> dapters	
<u>L</u> ow Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>C</u> ancel	<u>0</u> K

Ogtest	4.4.11		
-Net (J	<u>1.Cl.1,</u>	J3.C1.1)	
- Net(J	1.51.3,	13.61.35	
NetU	1:61:4:	33.61.45	
-~•Net(J	ī.cī.5;	J3.C1.5)	
~~Net(J ~Net(J	1.01.6;	J3:61:63	
(~netta	1.01.7,	J3.01.77	
	Edit	Labe 1	
		<u> n</u> ane i	ок
		Twisted	0.0
	• Open	Imisteu	

C Edit Net's	s Settings 🛛 🛛
DC Hipot Custom	DC D <u>e</u> fault <b>J</b>
<u>A</u> C Hipot Custom	AC De <u>f</u> ault √
Co <u>n</u> ductor Re	5 Default
Default	Default
<u>K</u> elvin 🗌 <u>S</u>	hield 🗌 <u>O</u> K

To program nets to be excluded from the HiPot test, select **Net List** from the *Set Test Parameters* menu. The *Edit Nets* dialog will be displayed.

Using the arrow keys, move the cursor to highlight the net you want to exclude (or include) from HiPot testing. Select **Edit** for the *Edit Net's Settings* menu.

Note that the display shows that this net is currently set to assume the default settings for both DC and AC HiPot tests. In the example cable being used, AC HiPot has been learned per the settings above, but no DC HiPot testing has been defined. Therefore, if no changes were made, this net would be subjected to a AC HiPot test, but not to a DC HiPot test. Select **AC Hipot Settings**, to display *Edit the Net's AC Hipot Settings*.

(i)

If the net you are selecting is a Ground or Chassis point in your product, you may designate it as a 'Shield' by selecting **Shield** from the *Edit Net's Settings* menu. This net will no longer be charged during the High Voltage test, though it will still remain as a common point.



If from the Set Test Parameters you set up High Voltage settings with **Scan** set to MASS, you will be prompted with this message.

Select Ok to acknowledge the conflict.

I Edit Net's Settings	
Change now the AC hipot scan type to Linear?	8
<u>Y</u> es <u>N</u> o	D
<u>Xelvin</u> C QX	
)] Edit Net's AC Hipot Settings	H
Hipot J	
Hipot Voltage 900 U	

Leakage Limit 1000 µA

Mo<u>r</u>e Opt. <u>O</u>K

Hipot Duration 0.40 s

You are now given the option to alter the global settings to Linear, should you wish to continue editing the local High Voltage variable.

Select Yes to accept the change.

Selecting **Hipot** will remove the check mark and this net will not be HiPot tested. Notice, however, that you can actually specify different HiPot test settings for different parts of the cable! In the example cable, that's exactly what we chose to do, setting a different voltage and duration to be used for this net and this net only, but leaving the leakage limit the same.

Select **Ok** to return to *Edit Net's Settings*. **Cancel** returns with no action taken.

I Edit Net'	s 2e	tt	ings	H
DC Hipot Custom	] 🗆	DC	D <u>e</u> fa	ult J
<u>A</u> C Hipot Custom	J	AC	De <u>f</u> a	ult 🗌
Co <u>n</u> ductor Re	s	)	Defa	ult
Default	1	J	Defa	ult
Xelvin 🗆 🙎	hiel	d		<u>о</u> к

C	Edit Net	<b>1</b> 4
$\sim$ Net1	ABLE #\$% J1.C1.1.J3.C1.1 J1.C1.2.J3.C1.2	
$\stackrel{\sim}{\sim}$ Net3 $\stackrel{\sim}{\sim}$ Net4	J1.C1.3.J3.C1.3 J1.C1.4.J3.C1.4	
$\sim$ Net6 $\sim$ Net7	J1.C1.5.J3.C1.5 J1.C1.6.J3.C1.6 J1.C1.7.J3.C1.7	
± + F	<u>E</u> dit <u>L</u> abel	$\neg$
	Open	<u>о</u> к

The display has now changed to indicate that this net is using 'Custom' settings to define its Hipot test parameters.

Select **Ok** to go back to the *Edit Net* menu. **Cancel** returns with the previous parameters intact.

You may wish to use the **Label** function to document the changes you have made to this net. Repeat these steps as necessary to modify the required nets. When you have finished, select **Ok** to return to *Set Test Parameters*. As before, select **Ok** from this menu to save your cable record.

Test Program as CBL File	
(\$) \datab\cables\main\testca~5.cbl	For greater detail see section 9.
*CABLE*,TEST CABLE #\$%,6	*NET*,,
*STAR*	J1.C1.12,,
*THRESHOLD*,61	J3.C1.12,,
*ACHIPOT*,500	*NET*,,
*LEAKAGE*,0.001	J1.C1.13,,
*DWELL*,0.4	J3.C1.13,,
*LINEAR*	*NET*,,
*60HZ*	J1.C1.14,,
*ADAPTER*,HA 116,	J3.C1.14,,
*POSITION*,J1	*NET*,,
*ADAPTER*, HA 116,	J1.C1.15,,
*POSITION*,J3	J3.C1.15,,
*NET*,,	*NET*,,
*ACHIPOT*,0	J1.C1.16,,
J1.C1.1,,	J3.C1.16,,
J3.C1.1,,	*NET*,,
*NET*,,	J1.C1.17,,
J1.C1.2,,	J3.C1.17,,
J3.C1.2,,	*NET*,,
*NET*,,	J1.C1.18,,
J1.C1.3,,	J3.C1.18,,
J3.C1.3,,	*NET*,,
*NET*,,	J1.C1.19,,
J1.C1.4,,	J3.C1.19,,
J3.C1.4,,	*NET*,,
*NET*,,	J1.C1.20,,
*ACHIPOT*,0	J3.C1.20,,
J1.C1.5,,	*NET*,,
J3.C1.5,,	J1.C1.21,,
*NET*,,	J3.C1.21,,
J1.C1.6,,	*NET*,,
J3.C1.6,,	J1.C1.22,,
*NET*,,	J3.C1.22,,
J1.C1.7,,	*NET*,,
J3.C1.7,,	J1.C1.23,,
*NET*,,	J3.C1.23,,
J1.C1.8,,	*NET*,,
J3.C1.8,,	J1.C1.24,,
*NET*,,	J3.C1.24,,
J1.C1.9,,	*NET*,,
J3.C1.9,,	J1.C1.25,,
*NET*,,	J3.C1.25,,
J1.C1.10,,	*END*
J3.C1.10,,	
*NET*,,	
J1.C1.11,,	
J3.C1.11,,	

#### 4.14.5 Cable Testing Using AC HiPot

To perform an AC HiPot test on a cable as part of the test specification, simply follow the same procedures as for low voltage testing.



Select **Test** on the *Main Menu*, **Select** the cable to be tested if it is not the cable displayed, and select **Test Now**. You will then be instructed to insert the adapters and to connect the product for testing.

Since the test specification calls for an AC HiPot test, the Horizon automatically performs a degauss cycle before testing starts.

The Horizon will first perform all of the specified low voltage tests. If any of the tests fail, the Fail light will turn on and you will have the opportunity to select **Diagnose**. The low voltage faults will be shown in a display similar to that shown.

(i)

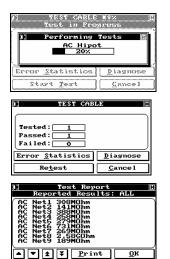
If a product fails any of the low voltage tests, HiPot testing will not be performed.



After the product has passed all of its low voltage tests, it can now be tested with high voltage. If you set up Autohipot during the system setup, HiPot testing will proceed automatically. If not, the *Perform AC Hipot Test?* dialog will appear.

In either case, if you specified **Password Protected** when the cable was learned, an Operator level password will have to be entered before testing will start. Select the **Yes** button, HiPot testing will start, and the *Performing ... Tests* dialog appears. (Selecting **No** will return you to the *Test Statistics* window, and the Fail light will be lit. Selecting **Diagnose** will show a message indicating that all tests have passed; what has happened is, in essence, a forced failure of the HiPot test.)

(i) In all of these cases, if you have installed and programmed any type of palm switch protection, it will also have to be activated as programmed before HiPot testing will start.



The display shows the progress of AC HiPot testing.

Should the product fail or if the Hipot was a linear scan, select **Diagnose** on the *Statistics* window to view the diagnostics.

A linear HiPot was performed and passed. The diagnostics reports the measurements made during the test.

#### 4.14.6 Error Reporting

In addition to the standard Error Reports, additional ones are associated with AC HiPot testing.

Image: Constant and the second sec	The sample <i>Test Report</i> indicates that, during the AC HiPot test, a fault occurred at nets 19 and 25. 'AC Overload' is reported when an arc or excessive current leakage occurs during the charging cycle of the AC HiPot test. The message is used to differentiate between arcs during the HiPot test duration and during the time the cable is being charged to the HiPot voltage level.
Difference     Test Report     H       Reported Results: FAIL     RAC: Leakage Net19 295µA       **AC: Leakage Net25 307µA       **C:	This sample report indicates that there was excess leakage at pin 19 and 25 at connector 1 on J1. The Horizon measures and reports the leakage current.
Image: Tost Report     H       Reported Results: FAIL     Mage: Arc during mass hipot       MAC arc during mass hipot       MAC arc Net14       MAC Arc Net14 </td <td>In this example an arc occurred during a MASS HiPot test.</td>	In this example an arc occurred during a MASS HiPot test.

	est Report	н
	d Results: FAIL	
AC arc dur	ing mass hipot Report ~~~~	)
www End Of	Report Sass	
_		
	Print OK	_

Arc locations can only be reported during a MASS HiPot if the fault is reoccurring. If the arc occurs only once, the system will report it but will not give a location. If you run a LINEAR HiPot the location will always be identified.

 Jest Koport
 H

 AC Net12 212H0hm
 AC Net12 272H0hm

 AC Net12 272H0hm
 AC Net12 2718C0hm

 AC Net12 2718C0hm
 AC Net12 3718C0hm

 AC Net12 3719C0hm
 AC Net12 3719C0hm

 AC Net13 2719C0hm
 AC Net13 3719C0hm

 AC Net19 390H00hm
 AC Net19 390H00hm

 AC Net19 391H00hm
 AC Net19 391H00hm

 AC Net19 391H00hm
 AC Net21 7.26G0hm

 AC Net17 7.26G0hm
 AC Net20 MM

In this example the arc occurred during a LINEAR HiPot test.

All failures are identified with an asterisk (*).

# 4.14.7 AC HiPot More Options: Ramp Up / Ramp Down & Current Neutralization

**Ramp:** The slope of the charge and discharge of a PUT can be controlled by selecting **Ramp** from the *DC Hipot Settings* menu.

Select either **Ramp Up** or **Ramp Down** to enter the desired value.

(i)

Programmable range: .01V to 10kV per second for both Ramp Up and Ramp Down.

**Neutralized**: Enables the Horizon to test the true quality of the cable's insulation despite the presence of a significant reactive (capacitive) current in the circuit. This current approaches zero in a good cable and is an excellent reference for limit setting for a HiPot leakage test.

## 4.15 Fixed High Current Source

As of September 2002, The Fixed HC Source is available on all HV models of the Horizon 1500. For models delivered prior to this date, you can verify if your system has the featured installed simply by checking whether it is enabled in the Low Voltage test parameters menu.

(i) _T

The Fixed High Current Source is only used in the "4-wire measurement" mode.

🗓 Set Test Parameters 🔲			
Name / <u>P</u> rompt	<u>A</u> dapte	ers	
<u>L</u> ow Voltage	Co <u>m</u> ponents		
High Voltage	<u>N</u> et List		
More Op <u>t</u> ions	Print		
T <u>e</u> st Now	<u>Cancel</u>		

From the Set Test Parameters menu, select Low Voltage

<ul> <li>Low Voltage Settings</li> <li>Flex Dis. Scan Star</li> <li>Conductor Res Quick Scan</li> <li>0 5mA Stimulus</li> <li>N / A</li> <li>Isolation Min Res Quick Scan</li> <li>More Options.</li> <li>0K</li> </ul>	Select <b>Conductor Res</b> from the <i>Low Voltage Settings</i> menu.
1. Specify Continuity Type H Resistance @5mA Quick Scan HC Resistance From Sample Uoltage Drop Fixed HC	In the Specify Continuity Type menu select <b>Fixed HC</b> .
Low Voltage Settings     Image: Settings       Eleg:     Do you want     Image: Settings       C     a Voltage Drop Test     Image: Settings       E     Yes     No       Isofactor Him Kes     Image: Settings       Tare     Image: Settings	If you would like to measure the conductor's voltage drop, select <b>Yes</b> . Selecting <b>No</b> will to measure the conductor's resistance.
Maximum Conductor         Maximum Conductor	If <b>No</b> is selected, then set the <i>Maximum Conductor Resistance</i> [ $\Omega$ ] and select <b>Enter</b> .
Minimum Conductor         Minimum Conductor	Enter the <i>Minimum Conductor Resistance [Ω]</i> and select <b>Enter</b> .
1.     Low Uoltage Settings     H       Flex     Dis.     Scan     Star       Conductor Res     5Ω Max       Fixed HC Stimulus     0Ω Min       Isolation Min Res     100KΩ Min       More Options     ΩK	The settings are updated.
1     Low Woltage Settings     1       Elit     Do you want     1       C     Woltage Prop Test     1       P     Yes     No       Isolation Hum Ads     1       Tare     0.8	If <b>Yes</b> is selected, then set the <i>Maximum Conductor Voltage Drop</i> [V].

Maximum Conductor         Maximum Conductor	Select Enter.
Minimum Conductor     Minimum Conductor       Uoltage Drop [U]       0.000       1     2       3     Clear       4     5       6     BS       7     8       9     Enter       0     Esc	Enter the <i>Minimum Conductor Voltage Drop</i> [V].
I     Low Uoltage Settings     H       Flex     Perm.     Scan     Star       Conductor Res     4.2U Max       Fixed HC Stimulus     OU Min       Isolation Min Res     100KR Min       More Options     OK	The settings are updated
Error         M           The fixed IA HC source cannot perform a 2 wire measurement         Image: Compare the source cannot perform a 2 wire measurement	If the test program is set for 2-wire measurement, then this message menu will be displayed.

## 4.16 Programmable High Current Source Capabilities

(If you do not have this feature installed and are interested in it contact your local CableTest Representative.)

#### 4.16.1 Overview of the Programmable High Current Source

The standard Horizon system uses a fixed 5mA current source to perform the continuity tests. However, some applications require that the continuity test to be performed at a higher current.

The continuity test current can be programmed up to 1A and either the conductor's resistance or the voltage drop can be used as qualifying parameters.

#### 4.16.2 Using the Programmable High Current Source

When a cable is learned the continuity test is set by default to 'Quick Scan'. However, the user has the ability to change the type of continuity that will be performed at test time.

N / F

<u>о</u>к

C Set Test P			
Name / <u>P</u> rompt	<u>A</u> dapters		
<u>L</u> ow Voltage	Components		
<u>H</u> igh Voltage	<u>N</u> et L	ist	
More Op <u>t</u> ions	P <u>r</u> int		
T <u>e</u> st Now	<u>Cancel</u> <u>O</u> K		
] Low Voltage Settings [ Flex Dis. Scan Star			
	<u>Flex Dis.</u> <u>S</u> can <u>Star</u> Co <u>n</u> ductor Res Quick Scan		

Isolation Min Res Quick Scan

0 5mA Stimulus

<u>T</u>are

After learning a cable and entering a name for that cable, the *Set Test Parameters* menu is displayed. Select the **Low Voltage** button to change the continuity type.

The default 'Quick Scan' is displayed. To change the setting select **Conductor Res**.

The Specify Continuity Type menu is displayed and the following options are available:

Quick Scan Resistance @5mA HC Resistance Voltage Drop Fixed HC From Sample	MSR MSR Programmable HCS Programmable HCS Fixed HCS MSR
Maximum conductor resistance in 2 0.500 1 2 3 Clear 4 5 6 BS 7 8 9 0 Esc Enter	To utilize the Programmable HCS, select <b>HC Resistance.</b> Enter the <i>Maximum Conductor Resistance</i> ( $\Omega$ )
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	enter the Minimum Conductor Resistance ( $\Omega$ )
Nominal continuity current in A ( 1.000 1 2 3 Clear 4 5 6 BS 7 8 9 6 Esc Enter	and the nominal continuity current must be entered. The continuity test will be performed using the high current programmable source. The maximum resistance entered at the step above will be used to qualify the continuity test.
Image: Description of the section	

[C]			Conduc			
_	Voltage Drop [V] 0.500					
_						
		2	3	<u>C</u> lear		
	4	5	6	BS		
	7	8	9			
			Esc	Enter		
			Conduc			
Voltage Drop [V]						
( 0.000 )						

1 2 3 Clear 4 5 6 BS 7 8 9 Enter Esc

Nominal continuity current in A

1.000

1 2 3 <u>C</u>lear

4 5 6 BS 7 8 9 Enter

Low Voltage Settings

<u>F</u>lex Perm. <u>S</u>can Star

Conductor Res 500mU Max 1A HC Stimulus OV Min Isolation Min Res 100KR Min

Esc

<u>о</u>к

0

ø

More Op<u>t</u>ions..

If Voltage Drop is selected, the dialog at the left is displayed. The Maximum Conductor Voltage Drop (V)...

... enter the Minimum Conductor Voltage Drop (V)...

... and the nominal continuity current must be entered. The continuity test will be performed using the high current programmable source. The maximum voltage drop entered at the step above will be used to qualify the continuity test.

Select Ok to accept the settings and return to the Set Test Parameters menu.

### Test Program as CBL File

*

 ${set}$  \datab\cables\main\testca~6.cbl For greater detail see section 9.

	FOI Greater detail
*CABLE*,TEST CABLE #\$%,7	*NET*,,
*CONTINUITY*,0,0.5	J1.C1.12,,
*HCRES*,1	J3.C1.12,,
*QUICKISOLATION*	*NET*,,
*STAR*	J1.C1.13,,
	J3.C1.13,,
*THRESHOLD*,61 *ADAPTER*,HA 116,	*NET*,,
*POSITION*,J1	J1.C1.14,,
*ADAPTER*,HA 116,	J3.C1.14,,
*POSITION*,J3	*NET*,,
*NET*,,	J1.C1.15,,
J1.C1.1,,	J3.C1.15,,
J3.C1.1,,	*NET*,,
*NET*,,	J1.C1.16,,
J1.C1.2,,	J3.C1.16,,
J3.C1.2,,	*NET*,,
*NET* , ,	J1.C1.17,,
J1.C1.3,,	J3.C1.17,,
J3.C1.3,,	*NET*,,
*NET*,,	J1.C1.18,,
J1.C1.4,,	J3.C1.18,,
J3.C1.4,,	*NET*,,
*NET*,,	J1.C1.19,,
J1.C1.5,,	J3.C1.19,,
J3.C1.5,,	*NET*,,
*NET*,,	J1.C1.20,,
J1.C1.6,,	J3.C1.20,,
J3.C1.6,,	*NET*,,
*NET*,,	J1.C1.21,,
J1.C1.7,,	J3.C1.21,,
J3.C1.7,,	*NET*,,
*NET*,,	J1.C1.22,,
J1.C1.8,,	J3.C1.22,,
J3.C1.8,,	*NET*,,
*NET*,,	J1.C1.23,,
J1.C1.9,,	J3.C1.23,,
J3.C1.9,,	*NET*,,
*NET*,,	J1.C1.24,,
J1.C1.10,,	J3.C1.24,,
J3.C1.10,,	*NET*,,
*NET*,,	J1.C1.25,,
J1.C1.11,,	J3.C1.25,,
J3.C1.11,,	*END*

# 5 ADVANCED PROGRAMMING AND TESTING

Components, Switches and Kelvin Measurement



## 5.1 Introduction

In addition to testing cables and harnesses composed of wires and connectors of different types, the Horizon can test cables that contain certain embedded components, including: diodes, capacitors, resistors, and switches. This section describes the process for learning these types of cables and harnesses. Also, as described in throughout this section, the Horizon can handle a number of special needs you may have, such as Twisted Pair, Kelvin Measurement/Probing and Free Ends.

C Programming	Cable 🗄		
<u>M</u> odify Existi	ng Cable		
<u>L</u> earn New Cable	- Default		
Learn New Cable	- C <u>u</u> stom		
Advanced <u>N</u> etlist Editor			
<u>C</u> ance l			
	ince 🔳		
1] Learn Sett	ings [		
	ings 🛛 🕅 e <u>t</u> s Only		
Twisted N	e <u>t</u> s Only   <u>K</u> elvin		
Twisted   No	e <u>t</u> s Only   <u>K</u> elvin		

Begin by selecting **Program Cable** from the *Main Menu*, entering your password, and select **Learn New Cable – Custom** to display the *Learn Settings* dialog.

From here you can program or set up a number of test conditions.

Cancel returns you to the Main Menu.

- **Nets Only** Confines the programmed testing process to complete, multi-point nets. Single point nets, any test points not connected, and free ends/flying leads are ignored.
- **Free Ends** Enables the Horizon to test products with non-continuous conductors. Using the standard probe or the Digital Hand Held Probe, the operator can test products for continuity that do not terminate to a connector.
- **Twisted** Enables the Horizon to detect and test products with twisted pairs.
- **Kelvin** Enables the four wire testing mode of the Horizon. Programming a Kelvin test from this menu requires your fixture to be wired in Kelvin. The Horizon will prompt to learn the fixture prior to learning the PUT.
- (i) If you are using a Kelvin Adapter that has been learned and saved in the Adapter Library, do not enable Kelvin here.

#### Conductor

**Max Res.** As in normal cable testing, you can override 'Quick Scan' and specify values for Maximum Conductor Resistance. This is required when looking for low ohm resistors or learning a Kelvin fixture.

**Con. Dwell:** A programmable dwell to lengthen the time the source is held on each net during the learning cycle. This option may improve learning accuracy on very long products.

#### Use Kelvin

**Probe:** Option to create a probe using two test points for accurate resistance measurements of Free End products.

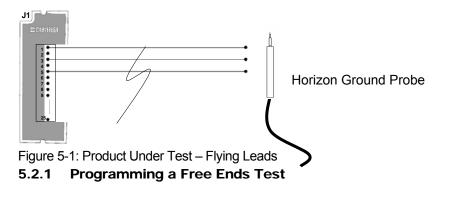
Select **Ok** after setting any of these desired parameters to start the *Component Settings* dialog.



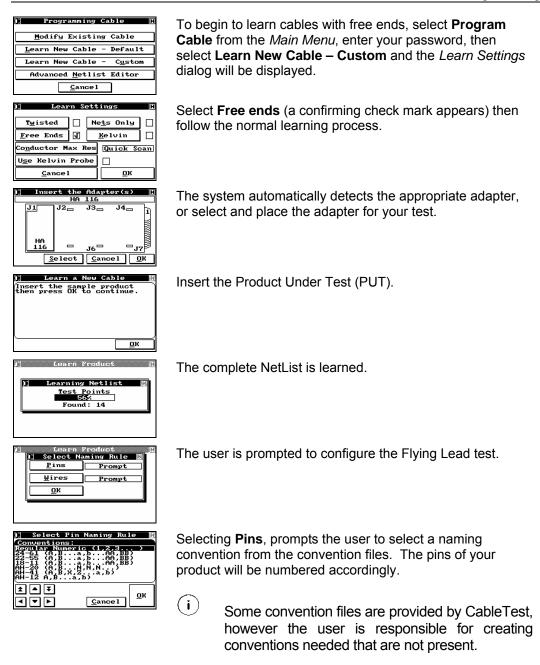
The Horizon will help you detect and program any one or all of the listed embedded components, but it must have a starting point, and it must know what it is looking for. While you can have any one, or all, of these component types in your cable, they will be discussed separately for ease of understanding. Simply follow the procedure(s) for the component(s) you have.

# 5.2 Free Ends or "Flying Leads"

Many cables and harnesses have wires that are terminated Into a connector on one end only. These can also be fully tested by using the supplied probe. All you need to do is to tell the Horizon where these leads are and how you want them tested.



⁵⁻⁴ Horizon Series Tester: Programmer's Manual



Learn Product     N       D Select Naming Rule     N       Pins     Auto:       Uires     Prompt       QK	Connected to Connected to U E R T Y U I O P A S D F G H J K L 4 Z X C U B N N Est 0.9 Space Bar Clear	The use conduct enter a l probed.
Learn Product     N       1     Select Naming Rule     N       2     Pins     Auto:       2     Uires     None       0K     0K	#     Learn Product     IS       #     Frobe flying lead 1     Press OK when done       (< Prev	The use conduct numberd based o selected The con labelled
Learn Product     N       1     Select Naming Rule     N <u>Pins</u> Prompt <u>Uires</u> Prompt <u>OK</u>	I     Enter Pin's Name       Connected to       Q       Q       B       F       Y       Q       F       Y       Q       F       Y       Q       F       Y       Q       F       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Q       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y       Y	The use conduct conduct name fo

er probes the tors and is prompted to label for each wire

er probes the tors – they are red automatically on the convention d. nductors are not

er probes the tors specifying the tor label and the pin or each wire.

<u>P</u> ins	Prompt
∐ires	Prompt
<u>о</u> к	

	15.55
Probe flying lead 1 Press OK when done	16.9

Using the flying lead configuration:

Pins: Auto Wires: Prompt

After the Horizon has learned the low voltage parameters for the completed nets (if any) in your cable, the Probe Flying Lead 1 Press Ok When Done dialog appears.

The Product Under Test has three (3) conductors 'flying' from a DB25 connector. The Next and Prev options are to allow the user to probe the connectors and have them correspond to the connector numbering convention.

Using the supplied ground probe, touch the exposed end of one of the leads. A tone will sound, and the Enter The Lead's Label Connected To menu appears.

1] Enter wire's label 🗱 Connected to
GREEN
$ \begin{array}{c} \hline \\ \hline $

Input an appropriate label for the lead just touched. Since this will also be the prompt when the cable is tested, it is suggested that you make the label as instructive and clear as possible. You can use any character, and the label can be up to 30 characters in length. Select Enter and you will return to the Probe Flying Leads Press Ok When Done

	dialog.
Learn Freduct     S     Frobe flying lead 2      Press OK when done        Y Press OK when done       Y Prev     Done	The dialog increments to the next lead, however, our product has the 3 rd pin as the second lead, so we can select <b>Next</b> to have them correspond.
Elearn Product     [3]       [1] Probe flying lead 3     [3]       Press OK when done       (< Prev Done     [Next >>>	Probe the second lead.
Denter wire's label Connected to BLACK UWERTVUIOP ASDFGHJKL4 ZKCUBNMESS 0.9 Space Bar Clear	Enter the label for the second flying lead.
Image: Constraint of the second se	The Horizon increments to the next Pin, however, our product has the 5 th pin as the third lead. Select <b>Next</b> to advance.
Learn Product       N         )       Probe flying lead 5       N         Press OK when done       (       Press OK when done         (< Prev       Done       Next >>	Probe the third lead.
Image: State	Enter the label for the third lead.
/i       Learn Product       [1]         /i       Probe flying lead 6       [2]         Press 0K when done       [3]         (       Prev       [2]         Done       [Next >>]	With no more leads to probe, select <b>Done</b> .

Advanced Programming

)] Enter Part Number (	H
FLYING LEADS	)
QWERTYUIOP ASDFGHJKL4	ב ר
ZXCUBNMESC 0.9 Space Bar Clear	
09 Space Bar Clear	

]] Set Test Parameters []			
Name / <u>P</u> rompt	<u>A</u> dapters		
<u>L</u> ow Voltage	Components		
<u>H</u> igh Voltage	<u>N</u> et List		
More Op <u>t</u> ions	P <u>r</u> int		
T <u>e</u> st Now	v <u>C</u> ancel <u>O</u> K		

C	Edit Net 🔳
0@FLYI	NG LEADS
~Net( ~Net(	J1.C1.2) BLACK, J1.C1.3)
~Net(	J1.C1.4) HITE; J1.C1.5)
(SNet)	H1:61:93
<b>±</b> •	Edit     Label       OK
◄▼	▶ Open Twisted

C	Lal	oel Pin		64
OGFL	ING LEA	DS END 1		
<del>7 JI.</del>	92 8993999 C1.1 (Sy	28182		
È.	Ŧ	Lal	bel	
				<u>o</u> ĸ
	<u> </u>		L	

Enter a part number for the flying lead product.

From here, you can modify any of your test parameters or define additional tests, such as DC or AC HiPot tests. Consult the appropriate sections of this manual for details.

When you are through, Select **Net List** to verify the learned product.

The *Edit Net* dialog reveals the correctly learned product. Select **Open** for more details for each net.

Pin list for net 1.

Select **Ok** to return to the *Edit Net*. **Ok** again to return to *Set Test Parameters*, and **Ok** a third time to save the learned product.

## Test Program as CBL File

(some state of the second seco	For greater detail see section <b>9</b> .
*CABLE*,FLYING LEADS,1	*NET*,,
*QUICKCONTINUITY*	J1.C1.13,,
*OUICKISOLATION*	*NET*,,
*STAR*	J1.C1.14,,
*THRESHOLD*,61	*NET*,,
*ADAPTER*, HA 116,	J1.C1.15,,
*POSITION*,J1	*NET*,,
*NET*,,	J1.C1.16,,
FREE_END 1, GREEN,	*NET*,,
J1.C1.1,,	J1.C1.17,,
*NET*,,	*NET*,,
J1.C1.2,,	J1.C1.18,,
*NET*,,	*NET*,,
FREE_END 3, BLACK,	J1.C1.19,,
J1.C1.3,,	*NET*,,
*NET*,,	J1.C1.20,,
J1.C1.4,,	*NET*,,
*NET*,,	J1.C1.21,,
FREE_END 5,WHITE,	*NET*,,
J1.C1.5,,	J1.C1.22,,
*NET*,,	*NET*,,
J1.C1.6,,	J1.C1.23,,
*NET*,,	*NET*,,
J1.C1.7,,	J1.C1.24,,
*NET*,,	*NET*,,
J1.C1.8,,	J1.C1.25,,
*NET*,,	*END*
J1.C1.9,,	
*NET*,,	
J1.C1.10,,	
*NET*,,	
J1.C1.11,,	
*NET*,,	
J1.C1.12,,	

 $(\mathbf{i})$ 

#### 5.2.2 Testing A Cable With Free Ends

As with all testing on the Horizon, testing a cable with free ends is easy and straightforward.

Make sure that the standard probe, or the optional Hand Held Digital Probe, is attached before starting the testing process.



Select **Test** from the *Main Menu*. **Select** the cable to be tested (if not already shown in the *Test Configuration* display), and push **Test Now**. The Horizon will instruct you to insert the adapters needed for the test, and you will start the test procedure.

The Horizon will instruct you to touch the first flying lead (free end) to be tested. (Notice that the prompt incorporates the label used during the learning process.) Using the probe, touch the correct lead; the Horizon will sound a positive tone, and automatically sequence to the next lead. If you touch the wrong lead, or if the lead is open, a negative tone sounds, and the system does not automatically sequence. If you are sure you are touching the correct lead, push **Skip** to sequence to the next lead.

		INK LE D Pro		21
	( <u> </u> Fly Wi:	ing Le ce GRE <u>S</u> kip	ad 1 👔 EN	
Erre		d: J1		3582
S-			<u>C</u> an	oel
	Test i [] Fly:	n fras ing Le	ad3 🖹	
	Win	re BLA <u>S</u> kip	СК	
Erre 52	art fes		Cass	e X

Touching and holding the probe to the lead will display its address; as well, if you quickly touch any of the leads the address will appear on the display.

Probe the Next Lead.

 $(\mathbf{i})$ 



Probe the Next Lead.



The standard or 'customized' low voltage tests are performed on the PUT.

# 5.3 Programming and Testing Twisted Pairs

#### 5.3.1 Automatically Learning Twisted Pairs

[] Learn Settings 🗳			
T <u>w</u> isted		Ne <u>t</u> s Only	
<u>F</u> ree Ends		<u>K</u> elvin	
Co <u>n</u> ductor Max Res <u>Quick Scan</u>			
U <u>s</u> e Kelvin Probe			
<u>C</u> ance l		<u>о</u> к	

Enable **Twisted** and **Nets Only**.

**Twist** enables the twisted pair-testing mode of the Horizon. Selecting **Twist** will automatically prompt the user to enter the threshold value. The default value is 20 pf.

1: Twisted Pair Threshold Capacitance Setting
Actual Value2pF
<u>Cancel N</u> ew <u>O</u> K

Cancel - to return to the Learn Setting menu.

New - to change the Actual Value.

Ok - to accept the Actual value and return to the *Learn Setting* menu.

)] Set A	Value I Capac:	for Th itance	reshold 🗱		
	20				
1	2	3	<u>C</u> lear		
4	5	6	BS		
7	8	9			
	0		Enter		

Enter the threshold value.

Select **Enter** to continue. This will return you the *Threshold Capacitance Setting* menu. Select **Ok** to return to the *Learn Setting* menu.

On the Learn Settings menu select Ok.

Com	Setti	ngs	Η	
Resistor	•s 🗌	C <u>a</u> pac	itors	
Diodes		<u>S</u> wit	ches	
Back	<u>C</u> an	cel	<u>о</u> к	

On the *Component Settings* menu, select **Ok** to start learning the product.

Placed the appropriate adapter for the terminated end of your product. Select **Ok** to continue.

Insert the product into the adapters and select **Ok** to begin the learning process.

As the product is learned, a status screen keeps the user informed about the progress.

Enter	Part	Number	н	Enter a

twisted pair
1234567890
** ( ) / , : 4
# \$ < > % " / Esc Enter
A.Z Space Bar Clear

1) Learning Twisted Pairs Twisted Pairs 20% Found: 3

)] Set Test Parameters []		
Name / <u>P</u> rompt	<u>A</u> dapters	
Low Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>Cancel</u> DK	

) Edit Net	0
~Net(J1.C1.2, J1.C2.2) ~Net(J1.C1.3, J1.C2.3) ~Net(J1.C1.4, J1.C2.4) ~Net(J1.C1.4, J1.C2.4) ~Net(J1.C1.5, J1.C2.5) ~Net(J1.C1.6, J1.C2.6) ~Net(J1.C1.6, J1.C2.7)	
★ ▲ ¥ <u>E</u> dit <u>L</u> abel	ок
◀ ▼ ▶ Open Twisted	<u> </u>

Enter an appropriate part number for the product learned and select **Enter**.

On this menu, the user can set different test parameters, test the product, add or view components or view the NetList.

On the Set Test Parameters menu, select NetList.

Select Twisted.

🚺 Select Twist 🔳
to Twisted Pairl Twisted Pair2 Twisted Pair3 Twisted Pair3
± ▲ ¥ <u>A</u> dd <u>D</u> elete ◀ ▼ ▶ <u>E</u> dit <u>L</u> abel
1) Edit Tuist ⊕4 ∞Net(J1.C1.1, J1.C2.1) ~Net(J1.C1.2, J1.C2.2)
1     Image: Add Delete       Image: Delete     OK
11 Edit Commonent List

C<u>a</u>pacitors

<u>D</u>iodes <u>B</u>lack Boxes

<u>T</u>wisted Pairs

<u>K</u>eys

Resistors

The *Select Twist* window displays the twisted pairs that were found during the learning process.

In this window the user can add, edit, delete or label the twisted pair.

When **Edit** is selected from *Select Twist*, the user can delete the nets, label the nets or change the threshold value.

Select Ok to continue.

The Select Twist menu can also be displayed by selecting **Components** on the Set test Parameters menu. This will open the Edit Component List menu.

Select Twisted Pairs to enable the Select Twist menu.

## Test Program as CBL File

(s) \datab\cables\main\twisted.cbl For greater detail see section 9.

*CABLE*,TWISTED,1	*NET*,,
*THRESHOLD*,61,250	J1.C1.5,,
*QUICKCONTINUITY*	J3.C1.5,,
*STAR*	*NET*,,
*QUICKISOLATION*	J1.C1.6,,
*ADAPTER*,HA 116,	J3.C1.6,,
*POSITION*,J1	*NET*,,
*ADAPTER*,HA 115,	J1.C1.7,,
*POSITION*,J3	J3.C1.7,,
*TWIST*,,	*NET*,,
*THRESHOLD*, 2e-11	J1.C1.8,,
*NET*,,	J3.C1.8,,
J1.C1.9,,	*NET*,,
J3.C1.9,,	J1.C1.10,,
*NET*,,	J3.C1.10,,
J1.C1.21,	*NET*,,
J3.C1.21,	J1.C1.11,,
*TWIST*,,	J3.C1.11,,
*THRESHOLD*,2e-11	*NET*,,
*NET*,,	J1.C1.12,,
J1.C1.16,,	J3.C1.12,,
J3.C1.16,	*NET*,,
*NET*,,	J1.C1.13,,
J1.C1.22,,	J3.C1.13,,
J3.C1.22,	*NET*,,
*TWIST*,,	J1.C1.14,,
*THRESHOLD*,2e-11	J3.C1.14,,
*NET*,,	*NET*,,
J1.C1.24,,	J1.C1.15,,
J3.C1.24,,	J3.C1.15,,
*NET*,,	*NET*,,
J1.C1.25,,	J1.C1.17,,
J3.C1.25,	J3.C1.17,,
*NOTWIST*	*NET*,,
*NET*,,	J1.C1.18,,
J1.C1.1,	J3.C1.18,,
J3.C1.1,,	*NET*,,
*NET*,,	J1.C1.19,,
J1.C1.2,,	J3.C1.19,,
J3.C1.2,,	*NET*,,
*NET*,,	J1.C1.20,,
J1.C1.3,,	J3.C1.20,,
J3.C1.3,,	*NET*,,
*NET*,,	J1.C1.23,,
J1.C1.4,,	J3.C1.23,,
J3.C1.4,,	*END*
03.01.4,,	

#### 5.3.2 Testing a Cable with Twisted Pairs



When **Test Now** is selected to the *Set Test Parameter* menu or *Test Configuration* menu, a progress bar will display the status of the test.

The *Test Report* menu will display all test results. This menu displays all tests that passed.

This *Test Report* menu displays a failed twisted pair cable during test.

## 5.4 Resistors

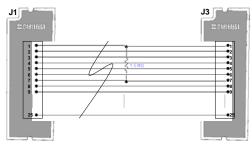


Figure 5-2: PUT with embedded Resistor

#### 5.4.1 Programming Resistors - autolearn

1. Learn Settings 🔳				
T <u>w</u> isted	Ne <u>t</u> s Only 🗌			
<u>F</u> ree Ends	<u>K</u> elvin			
Co <u>n</u> ductor Max Res <u>5Ω</u>				
U <u>s</u> e Kelvin Probe				
<u>C</u> ance l	<u>о</u> к			

For proper resistor measurement and detection, **Conductor Max Res** must be set to a specific value. (This is especially true for resistor values  $\sim 300\Omega$  or less. The Horizon will need to be able to differentiate between conductors and low-value resistors).

Select Ok to continue.

1. Component Settings
<u>R</u> esistors C <u>a</u> pacitors
<u>D</u> iodes <u>S</u> witches
Back Cancel OK
1. Choose the range Expected Resistance

Co <u>m</u> mon G	iround 🗌
M <u>i</u> nimum	<u>1KΩ</u>
M <u>a</u> ximum	100KΩ

C F		the M		
Expected Resistance				
[KΩ]	1	2	3	<u>C</u> lear
MΩJ	4	5	6	BS
	7	8	9	Enter
		0	Esc	Enter

)C E		the Ma ed Res		e	
1.600					
[KΩ]	1	2	3	<u>C</u> lear	
MUI	4	5	6	BS	
	7	8	9		
◄▲		<u> </u>	Esc	Enter	

Select **Resistors** to begin the *Expected Range* dialog.

Select **Common Ground** if components connected to a common bus.

Input the minimum expected resistance for all of the embedded resistors in your cable. In the example shown, the lowest expected value is  $1.4M\Omega$ .

Select Enter when done.

The Horizon will then ask you for the maximum expected value for all of the resistors in your cable. In the example shown, no resistor is expected with a value greater than  $1.6M\Omega$ .

Select **Enter** when done to return to the *Component Settings* menu.

The **Resistors** box is now checked to show that the Horizon will look for resistors in the range shown. If you are satisfied, select **Ok** and the *Insert The Adapter(s)* dialog appears.

0] Inse	rt the HA		er(s) 🗄
J1	J2_	13	^{J4} - 1
HA 116	_	HA 116	-,17
5	elect	Cance	∍1 <u>Ω</u> κ

Insert the adapters that you will need to test your product; select **Ok** when done to go to the *Learn A New Cable* window.



Mount your sample cable on the adapters as instructed, then select **Ok** and the Horizon will learn your cable.

If you selected **Common Ground**, the NetList will be learned and the user will be prompted to select from the learned list the common bus prior to learning the resistors.

Learning Resistors Test Points 100% Found: 1	
-------------------------------------------------------	--

While the Horizon is learning your cable, a number of status screens will appear, including one that indicates how many resistors it is finding that meet the search criteria you set up.

When it has completed learning your cable, the *Set Test Parameters* menu is displayed.

)) Set Test Parameters 🛄				
Name / <u>P</u> rompt	<u>A</u> dapte	ers		
<u>L</u> ow Voltage	Compone	ents		
<u>H</u> igh Voltage	<u>N</u> et List			
More Op <u>t</u> ions	Print			
T <u>e</u> st Now	<u>Cancel</u> <u>O</u> K			

From this menu, you can set up additional tests, modify tests you have already specified, verify that the tests you want to perform have the correct parameters, and provide natural language labels for all nets and nodes.

Labelling will help your rework station more easily identify and correct any faults found.

Select **Components** to apply these features to the resistors just learned. The *Edit Component List* dialog appears.

9.	Edit Component List	H
	<u>R</u> esistors <u>R</u> eys	]
	C <u>a</u> pacitors	]
	<u>D</u> iodes	]
	<u>B</u> lack Boxes	
	<u>T</u> wisted Pairs	
	Select Resistor	H
0.01	RESISTOR	
- R	<b>6</b> .	

▲ ¥ <u>A</u>dd <u>D</u>elete

▼ ▶ <u>E</u>dit <u>L</u>abel

<u>о</u>к

From this menu, you can verify, edit and label all of the components that have just been learned.

Select **Resistors** to begin this process.

In the example shown, the Horizon has learned one resistor **R1**. If more resistors are learned, highlight the one of interest.

Select **Edit** to show more details and bring up the *Edit Resistor* menu.

	E	lit Re	sisto	c	55
Term	inal _	1 (+)	B1.,	J1.C1	1.1
Term	inal į	2 (-)	B1	J1.C1	L.7
<u>U</u> a lu	e 1.3	34MΩ m	in 1.	64MΩ	max
<u>T</u> e	st				
More	e Opti	ons	Labe	1	ок

In the example shown, Terminal 1 of the first resistor (**R1**) is connected to pin 1 of the first connector on the adapter located at J1. Terminal 2 is connected to pin 7 of the same connector.

Select **Terminal 1** or **Terminal 2** change the location of these terminals.

(i) The default tolerance for the component is set to 10%

Select **Value** to alter the tolerance of the measured component.

Select **Change Thresholds** to set and alternate tolerance.

Enter the minimum and maximum threshold.

	] Select Detect Mode 🔳	
2*e	Change T <u>a</u> re Value	
<b>1</b> 0	C <u>h</u> ange Thresholds	
<u>Ua</u>	Autodetect <u>T</u> hresholds	K
	<u>C</u> ance l	
No	ve obciouze"] Trypei ] Th	

≱] Edit Besistor

[] Edit Resistor
Terminal <u>1</u> (+) <u>B1.J1.C1.1</u>
Terminal <u>2</u> (-) <u>B1.J1.C1.7</u>
$\underline{V}$ alue 1.3M $\Omega$ min 1.59M $\Omega$ max
<u>I</u> est 1.5MΩ J
More Options Label OK

You can adjust the tolerance of your component based on the combined tolerance of the component and the Horizon.

Select **Test** to constantly scan the component.

The dynamic measured value of the component will be displayed next to **Test**.

Select Label to label the resistor.

Enter the label and select Enter to accept it.

] Label Resistor 🗱
RESISTOR1
1234567890
1234567890
# \$ < > % " / Ess
A.Z Space Bar Clear

10	Select I	Resistor	H
00RES	ISTOR STOR1		
	oroni		
È.	¥ <u>A</u> dd	<u>D</u> elete	$\square$
নিল	▶ Edit	Label	<u>o</u> x

All of the needed changes have been entered, so select **Ok** to return to *Set Test Parameters*.

Add is used to add resistors to a cable without learning them and to take care of certain special cases.

Name / <u>P</u> rompt	<u>A</u> dapte	ers
<u>L</u> ow Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> in	t
T <u>e</u> st Now	<u>C</u> ance 1	<u>о</u> к
	Paramuturi	
Nam []Save Cabl	e Record?	
Lo		.95
Hig Yes	No	
Start All 617		
0.1100 H V V V V V V V		
	<u>Cancel</u>	OX
řest Nov	Cancel	·····
Test Nov	Cancel	OX
řest Nov	Cancel	OX
Test Now Derectory Name Main	Cancel	OX
Test Now Derectory Name Main	Cancel	OX

If you are through specifying the test for your product, select Ok to save the test procedure in the internal database. Cancel will take you back to Program Cable and discard all of the learned parameters.

Select Yes to save your cable record. The Save To Directory dialog appears. No returns you to the Main Menu.

Move the cursor until the directory in which you want to save the cable is highlighted, then select **OK**. The cable record is saved, and you are returned to the Programming Cable menu. (If you want to store your cable in a new directory, select New, and you will be prompted to enter the new name.

Select Enter when done. You can use any combination of up to 30 characters.

## Test Program as CBL File

(s) \datab\cables\main\resistor.cbl For greater detail see section 9.

*CABLE*,RESISTOR,1	*NET*,,
*CONTINUITY*,0,5	J1.C1.13,,
*STAR*	J3.C1.13,,
*THRESHOLD*,61	*NET*,,
*ADAPTER*,HA 116,	J1.C1.14,,
*POSITION*,J1	J3.C1.14,,
*ADAPTER*,HA 116,	*NET*,,
*POSITION*,J3	J1.C1.15,,
*NET*,,	J3.C1.15,,
J1.C1.1,,	*NET*,,
J3.C1.1,,	J1.C1.16,,
*NET*,,	J3.C1.16,,
J1.C1.2,,	*NET*,,
J3.C1.2,,	J1.C1.17,,
*NET*,,	J3.C1.17,,
J1.C1.3,,	*NET*,,
J3.C1.3,,	J1.C1.18,,
*NET*,,	J3.C1.18,,
J1.C1.4,,	*NET*,,
J3.C1.4,,	J1.C1.19,,
*NET*,,	J3.C1.19,,
J1.C1.5,,	*NET*,,
J3.C1.5,,	J1.C1.20,,
*NET*,,	J3.C1.20,,
J1.C1.6,,	*NET*,,
J3.C1.6,,	J1.C1.21,,
*NET*,,	J3.C1.21,,
J1.C1.7,,	*NET*,,
J3.C1.7,,	J1.C1.22,,
*NET*,,	J3.C1.22,,
J1.C1.8,,	*NET*,,
J3.C1.8,,	J1.C1.23,,
*NET*,,	J3.C1.23,,
J1.C1.9,,	*NET*,,
J3.C1.9,,	J1.C1.24,,
*NET*,,	J3.C1.24,,
J1.C1.10,,	*NET*,,
J3.C1.10,,	J1.C1.25,,
*NET*,,	J3.C1.25,,
J1.C1.11,,	*RESISTOR*,,RESISTOR1
J3.C1.11,,	J3.C1.1,,
*NET*,,	J3.C1.7,,
J1.C1.12,,	*VALUE*,1.46586e+06,1.7916e+06
J3.C1.12,,	*END*

#### 5.4.2 Programming Resistors – Manual

Even when you program embedded resistors manually, the NetList must have already been automatically learned (refer to Section 2.2 for details).

Set Test Parameters     H       Name / Prompt     Adapters       Low Uoltage     Components       High Voltage     Net List       More Options     Print       Test Now     Cancel	From Set Test Parameters, select <b>Components</b> and the <i>Edit Component List</i> dialog appears.
Edit Component List       Resistors       Capacitors       Diodes       Black Boxes       Invisted Pairs	Select <b>Resistors</b> .
Select Resistor     H       CoRESISTOR       1       1       1       1       1	The Select Resistor dialog box is empty if no resistors were detected during the learn process, or if you did not select the <b>Resistor</b> option within a custom learn.
)] Select Resistor ⊨ ⊕eRESISTOR > R1 ★ ▲ ¥ Add Delete ↓ ▶ Edit Label OK	Select <b>Add</b> to manually enter this component. Add as many resistors as you have in your product. Adding resistors increments existing resistors by 1. Each new resistor will be R1 and the current R1 becomes R2 the current R2 becomes R3

1. Each new resistor will be R1 and the current R1 becomes R2, the current R2 becomes R3 etc...

Highlight the first and select Edit.

The Edit Resistor dialog opens with no information present.

[] Edit Resistor	Н
Terminal <u>1</u> (+) N/C	
Terminal <u>2</u> (-) N/C	
Ualue OmΩ min OmΩ max	
<u>T</u> est	
More Options Label OK	

Select **Terminal 1 (+)** to assign it the proper net.

### Advanced Programming

JOpen Net and Pick Terminal H OpResistor Mick(Ji Cl. 1, J3:Cl. 1) Met(J1:Cl. 2, J3:Cl. 3) Met(J1:Cl. 4, J3:Cl. 3) Met(J1:Cl. 4, J3:Cl. 3) Met(J1:Cl. 4, J3:Cl. 6) Met(J1:Cl. 7, J3:Cl. 6) Met(J1:Cl. 7, J3:Cl. 7)	The <i>Select Net</i> dialog appears. Using the arrow keys, scroll the cursor to highlight the correct net/pin location for Terminal 1.
	Select <b>Open</b> to select a pin.
1] Pick Terminal [] 00Resistor 2012011 (SYS18) 203.01.1 (SYS82)	Highlight a pin and select <b>Ok</b> to accept the location of Terminal 1.
±▲¥ <u>Cancel</u> ⊴VÞ	
D     Edit Resistor     H       Terminal 1 (+)     J1.C1.1       Terminal 2 (-)     N/C       Ualue     Omf min     Omf max       Iest	The first terminal is displayed.
IOpen Net and Pick Terminal H       ODResistor       ONEX[J1:C1:1, J3:C1:1]       ONEX[J1:C1:2, J3:C1:2]       ONEX[J1:C1:2, J3:C1:3]       ONEX[J1:C1:2, J3:C1:6]       ONEX[J1:C1:7, J3:C1:7]       ONEX[J1:C1:7, J3:C1:7]       OK	Repeat the above operation for Terminal 2.
] Edit Resistor H Terminal <u>1</u> (+) J1.Cl.1 Terminal <u>2</u> (-) J1.Cl.7	With the terminals properly identified, you now need to program the value of the component.
Ualue Omû min Omû max Test More Options] Label OK	If your product is attached with the proper resistance in place, select <b>Test</b> to view the measured value.
) Edit Resistor H Terminal <u>1</u> (+) J1.C1.1 Terminal <u>2</u> (-) J1.C1.7	The Horizon engages the measurement circuitry to display the value of resistance between the selected terminals.
Ualue         OmΩ min         OmΩ max           Test         OK: 1.44MΩ           More Options         Label         OK	Select Value to set the tolerance.

	Edit Resistor [] Select Detect Mode []	
2*e>	<u>Change Ta</u> re Value	
<b>T</b> @	C <u>h</u> ange Thresholds	)
<u>Ua</u>	Autodetect <u>T</u> hresholds	×
	<u>C</u> ance l	
No	re untions: Lanes I: Us	

Edit Resistor

Terminal <u>1</u> (+) J3.C1.1 Terminal <u>2</u> (-) J3.C1.7

 Ualue
 1.33MΩ min
 1.63MΩ max

 Test
 OK: 1.51MΩ

 More Options..
 Label
 OK

Three value options are available:

- Autodetect Thresholds: Automatically selects ±10% the average value measured by the Horizon.
- **Change Thresholds**: Allows the user to manually set the thresholds for the component.
- Change Tare Value: This allows the user to add a resistor tare value. This may be useful in scenarios that include test fixtures with long interface cables.

The threshold is displayed.

Select **Ok** to return to the resistor list.

5.4.3	Programming	<b>Resistors - Advanced</b>	Options
-------	-------------	-----------------------------	---------

]	Edit F	Resist	or	H
Termina	1 <u>1</u> (+)	) <u> </u>	3.C1.	1
Cermina	1 2 (-)	) _ J	з.сі.	7
la lue	1.33MΩ	min 1	.63MΩ	max
<u>T</u> est		OK: 1	51MΩ	
	ntions	Lat		ок
<u>M</u> ore O	ptions.		,ei	ōv
<u>M</u> ore O	Edit F	Resist		Ēv
<u>M</u> ore O <u>K</u> elvin	Edit F RESI		or ,	_
<u>K</u> elvir	Edit F RESI	Resist ISTOR1	or ,	H
<u>K</u> elvir	Edit F RES □ □ 〔	Resist ISTOR1 Mode	Re	H
Sense Sense	Edit F RES □ □ 〔	Resist ISTOR1 Mode	n Re: N/C	H

From the *Edit Resistor* dialog ... Select **More Options...** to set advanced measurement features.

The More Options are as follows:

**More Opt.** from this screen allows the user to set a measurement dwell for the selected component.

Programmable Dwell: .01s to 1000s

Edit Resistor       RSSISTORI       MSSISTORI       Sense 1 (+)       N/C       Sense 2 (-)       N/C       Stimulus       Puto       Visual	Any component with 2 test points at each terminal can be measured using the 4 wire method (Kelvin). Select <b>Kelvin</b> to enable the <b>Sense</b> buttons. Select <b>Sense 1 (+)</b> to select the first sense test point.
Deen Net and Pick Terminal H           Opresistor           What GL CL 1, JS CL 1)           What GL CL 2, JS CL 2)           What GL CL 3, JS CL 2)           What GL CL 4, JS CL 2)           What GL 2, JS CL 2	For the example product the resistor is positioned between nets each of which contain two test points. Highlight the first net the component is connected to. Select <b>Open</b> to continue.
Pick Terminal       00Resistor       > 11. cl. (SVSB2)       > JS.cl. 1 (SVSB2)       ▲ ▼       Cancel       ④K	When the component was defined one of the test points associated with the net was selected (in this example J3.C1.1). The alternate test point must be selected for the sense test point (J1.C1.1). Highlight the test point and select <b>Ok</b> .
Edit Resistor       H         RESISTORI       Mode         Sense 1       Hode         Sense 2       ->         Stimulus       Auto         Visual       QK	The <b>More Options</b> menu contains the first sense point.
Edit Resistor       H         RESISTORI       Hode         Kelvin J       Hode         Sense 1 (+)       J1.C1.1         Sense 2 (-)       J1.C1.7         Stimulus       Auto	Repeat the above steps for the second sense point. Once complete select <b>Ok</b> to return to the <i>Edit Resistor</i> dialog.
	(i) Kelvin measurements are only viable for resistances less than $400\Omega$ .

<u>K</u> elvin	Mode Resist
Sense <u>i</u> (>>	N/C
Sense 2 (->	NZC N
<u>Stimulus</u>	Auto
<u>V</u> isual	<u>0</u> x

Horizons equipped with the optional High Current Source can Increase the measurement stimulus for their component by selecting **MODE** from the **More Options** dialog.

() Select Measurement Mode [] Auto Resistance

HC Resistance Uoltage Drop HC Load <u>C</u>urrent Fixed HC Volt Fixed HC Res The measurement modes are displayed:

Auto Resistance: Utilizes the default Horizon source (5mA)

#### HC

**Resistance:** Allows the user to program a stimulus up to the limit of their programmable source (e.g. 1A). The measurement will be expressed in ohms.

#### Voltage

**Drop:** Allows the user to program a stimulus up to the limit of their programmable source (e.g. 1A). The measurement will be expressed in volts.

#### HC Load

**Current:** Apply a voltage (limit 28V) and measure the current drawn by the load.

### Fixed HC

Volt: Use the Fixed HC source to measure the component (voltage reference).

#### Fixed HC

**Res:** Use the Fixed HC source to measure the component (resistance reference).

# 5.4.3.3 Programming Resistors – Advanced Options – Testing Lamps

C Edit	Resisto	or H
<u>K</u> elvin	<u>M</u> ode	Resist
Sense 1 (>>	]	N/C
Sense 2 (>	]	N/C
2.118 1199 t \$ <u>2</u>	]	Auto)
<u>V</u> isual		<u>0</u> K

Horizon's equipped with the optional High Current Source can be utilized to test resistive load components (e.g. lamps (bulbs)).

From the More Options dialog, select Mode.

)C]	) Select Measurement Mode [		
	A <u>u</u> to Resistance		
	HC Resistance		
	<u>U</u> oltage Drop		
	HC Load <u>C</u> urrent		
Fiz	Fixed HC Volt Fixed HC Res		

$[\mathbf{C}]$	I	Enter S		s 🕺	
	in [V]				
$\square$	20.0				
	1	2	3	<u>C</u> lear	
	4	5	6	BS	
	7	8	9	Fred and	
	Image: Constraint of the sector of the secto				

	Resistor [] AMP		
<u>K</u> elvin	Mode Curr.		
Sense 1 (>>	NZC		
Sense 2 (>	N/C		
<u>S</u> timulus 200			
<u>V</u> isual <u>O</u> X			

0	Select Stin	mulus	Type	Η
	<u>5</u> mA Cu	rrent		
	1 <u>2</u> V Se	ource		
	HCS Uo	ltage		
	HCS Cu	<u>r</u> rent		
Fi	ked HC Vol <u>t</u>	Fixed	HC R	25

Select **HC Load Current** and enter the voltage you wish applied to the component.

Select Enter to continue.

For lamps you can also add a visual test to the program. From the **More Options** dialog, select **Visual** to program the components.

The stimulus options are as follows:

5mA Current: Utilizes the default Horizon source (5mA) with a 5V limit.

- **12V Source:** Utilizes the Horizon's 12V source with a maximum load of  $100\Omega$ .
- **HCS Voltage:** Allows the user to program applied voltage to the load up to the limit of 28V and 1A.

# HC Load

**Current:** Allows the user to specify the current applied to the load up to the limit of 1A and 28V.

Fixed HC Volt: Utilizes the Horizon's Fixed HC source (1A) with a 4.2V limit.

Fixed HC Res: Utilizes the Horizon's Fixed HC source (1A) with a 4.2V limit.

⁵⁻²⁶ Horizon Series Tester: Programmer's Manual

<u>K</u> elvin 🗌	<u>M</u> ode Curr.
Sense 1 (>>	
Sense 2 (>	N/C
<u>S</u> timulus	200

Fully programmed resistive load with visual test.

# 5.4.4 Testing A Cable With Resistors

Testing a product with embedded components is the same as testing any other cable or harness. For details, consult Testing Cables in Section 4.



The display shows the Directory location and the Part Number for the last cable tested. If this is the product you want to test, select **Test Now**; otherwise, press **Select**. The *Select Part Number* dialog appears.

The first step in the testing process is to insert the proper adapter(s). After the proper adapters are installed, the system automatically sequences to *Connect Product To Start*. Accept, forces the Horizon to *Connect Product To Start*, while Cancel returns to *Test Configuration*.

Insert your product in the appropriate connectors. The Horizon will detect when the product is inserted and automatically start the test. If your product passes, the green Pass light will be lit and a positive tone will sound; if it fails, the red Fail light will be lit and a negative tone will sound. If, for some reason, the test does not automatically start, or you have disabled the automatic start feature, selecting **Start Test** will force the test process to start.

7] BESISTU Tent in Pros	
1) Performing Resistor 100%	
Error Statistics Start Jest	<u>Èlagnose</u> <u>Cancel</u>
[] RESISTO Connect Product	
Tested: <u>1</u> Passed: <u>1</u> Failed: <u>0</u>	
Error <u>S</u> tatistics	Diagnose
Start <u>T</u> est	<u>C</u> ance l

The system performs the standard low voltage tests (Continuity and Isolation), then scans for the Resistors.

On the test is complete, the display will change, instructing you to disconnect the product. Disconnecting the product updates the statistics database and automatically resets the system to test the next product. Inserting the next cable starts the process again.

1. Test Report II Reported Results: ALL
273.6mOhm Net(J1.C1.23, J3.C1.23) res: 259.2mOhm Net(J1.C1.24, J3.C1.24) res: 267.3mOhm 257.3mOhm 277.0hm
$ \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \text{Resistor1} : 1.497 \text{MOhm} \\ \hline \end{array} \\ \begin{array}{c} \begin{array}{c} \\ \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \hline \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \\ \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \\ \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \hline \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \\ \end{array} \\ \begin{array}{c} \\ \\ \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \\ \end{array} \\ $

While the screen still prompts the user to disconnect the product you may select **Diagnose** to view the results of the last test.

If no results are shown you may need to set the display to Pass or All (see Section 4.4.2); or, the diagnostics may have already reset.

#### 5.4.5 Testing a Cable with Resistors - Lamps

(i)



confirmation of illumination from the operator.

When testing a product with an embedded illuminating

component such as a bulb, the test program halts for



The diagnostic (test report) for a passed product, list the component with the measured load in resistance (or selected output – resistance, voltage, or current).

#### 5.4.6 Error Reporting for Resistors

All of the same errors are available in this mode as for general cable testing. The following additional error screens cover the special circumstances associated with embedded resistors.

1. Test Report
Reported Results: ALL
268,7mOhm Net(J1.C1.23, J3.C1.23) res: 279,3mOhm Net(J1.C1.24, J3.C1.24) res: 248,9mOhm 248,9mOhm 248,4mOhn 264,4mOhn *RESISTOR1 too low: 1.003MOhm *RESISTOR1 too low: 1.003MOhm
▲▼±¥ <u>Print</u> OK
1) Test Report
I. Test Report L Reported Results: ALL

The resistance for resistor 1 is below the expected value, including the tolerance zone. The actual resistance is measured and reported to help a technician correct the problem.

The resistance for resistor 1 is above the expected value, including the tolerance zone. The actual resistance is measured and reported to help a technician correct the problem

<b>C</b>	Test Report
R	eported Results: ALL
Net( 274.8 Net( 279.9 Net( 279.7	nOhm JI.Cl.23, J3.Cl.23) res: nOhm JI.Cl.24, J3.Cl.24) res: nOhm 1.25, J3.Cl.25) res: nOhm STORI too high: infinite End of Report ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
<u>-</u>	<b>≵</b> <u>P</u> rint <u>O</u> K

The resistor path for resistor 1 is extremely high. The actual problem could be the resistor itself or one of the connecting terminals is open.

# 5.5 Capacitors

# 5.5.1 Programming Capacitors – Auto learn

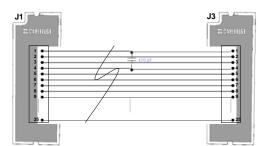


Figure 5-3: PUT with embedded Capacitor

Compo	nent	Setti	ngs	H
<u>R</u> esistors		C <u>a</u> pac	itors	
<u>D</u> iodes		<u>S</u> wit	ches	
	-			
<u>B</u> ack <u>C</u> ane		cel	<u>o</u> ĸ	

From *Component Settings*, select **Capacitors**. *Component Settings* is accessed by selecting **Program Cable** on the *Main Menu*, select **Learn New Cable - Customized** from the *Program Cable* menu, and finally **Ok** from *Learn Settings*. The *Choose the Range* dialog appears.

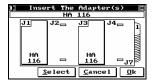
)) Choose t	he Range 🗱
Minimum	100pF
 M <u>a</u> ximum	100nF
Co <u>m</u> mon Ground	
<u>C</u> ance l	<u>о</u> к

Select **Common Ground** for capacitors tied to a common point.

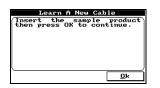
Enter the minimum and maximum expected values.

Do not enter 0 for the minimum!

The **Capacitors** box is now checked to show that the Horizon will look for capacitors in the range shown. Verify that the settings are what you want, and then select **Ok** so the *Insert The Adapters* dialog appears. You will be prompted to insert the required adapters. After finishing, select **Ok**.



Insert the adapters that you will need to test your product; select **Ok** when done to go to the *Learn A New Cable* window.



Next, insert your cable as instructed and select **Ok** to continue the learning process.

If you selected **Common Ground**, the NetList will be learned and the user will be prompted to select from the learned list the common bus prior to learning the capacitors.

Learn Product           Learning Capacitors         Image: Capacitor state         Image: Capacitor state <thimage: capacitor="" state<="" th="">         Image: Capaci</thimage:>	

While the Horizon is learning your cable, a number of status screens will appear, including one that indicates how many capacitors it is finding that meet the search criteria you set up. When it has completed learning your cable, the *Set Test Parameters* menu is displayed.

)] Set Test F	°arameter⊆	5
Name / <u>P</u> rompt	<u>A</u> dapte	ers
<u>L</u> ow Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et Li	ist
More Op <u>t</u> ions	. P <u>r</u> int	
T <u>e</u> st Now	<u>Cancel</u> DK	

You do not have to do anything else to test this cable with an embedded capacitor. However, from this menu you can set up additional tests, modify tests you have already specified, verify that the tests you want to perform have the correct parameters, and provide plain English labels for all nets and nodes. Labelling will help your rework station more easily identify and correct any faults found. In addition, you can review all of the parameters the Horizon has set to make sure they are what you want.

Select the **Components** button to apply these features to the capacitors just learned. The *Edit Component List* dialog appears.

Edit Component List

 Resistors
 Keys

 Capacitors

 Diodes

 Black Boxes

 Lwisted Pairs

Then select Capacitors.

	Select	Capacitor	н
0.0 CA	PACITOR		
⊪ C1			
± 4	• ∓ <u>A</u> dd	Delete	
			<u>o</u> ĸ
◄     ◄	/ ►	<u>C</u> ancel	_

The Horizon found one capacitor. Select **Edit** to show more details and bring up the *Edit Capacitor* menu.

1. Edit Capacitor
Terminal <u>1</u> (+) J3.C1.1
Terminal <u>2</u> (-) J3.C1.4
Ualue 538pF min 658pF max
Test OK: 615pF
More Options Label OK

)]Open Net and Pick Terminal [
D@Capacitor1
~Net(J1.C1.1, J3.C1.1) ~Net(J1.C1.2, J3.C1.2)
~Net(11.C1.3; 13.C1.3)
~Net(j1.č1.5; j3.č1.5)
SNEt(31:61:7; 33:61:7)
★ ▲ ¥ Xdit Cancel
◄ ▼ ► Open Twisted

In the example shown, Terminal 1 of the first capacitor (Cap1) is connected to pin 1 of the first connector on the adapter located at J1. Select Terminal 1 to view more details of this net. The Select Net menu appears.

This display indicates which net the capacitor is wired to. If this agrees with other documentation, it is another indication that the cable has been learned properly. Select Open to label this pin.

1. Edit Capacitor
CAPACITOR1
Terminal <u>1</u> (+) J3.C1.1
Terminal <u>2</u> (-) <u>J3.C1.4</u>
Value 538pF min 658pF max
<u>T</u> est OK: 615pF
More Options Label OK

1 Select Detect Mode T<u>a</u>re Value Ťe Change Thresholds Autodetect <u>T</u>hresholds Cance l

Change T<u>a</u>re Value

C<u>h</u>ange Thresholds Autodetect <u>T</u>hresholds

<u>C</u>ance l

թ] n]

By selecting **Value**, you can alter the capacitance thresholds (tolerance) as well as alter the value of capacitance tare.



The default tolerance set is 10%.

Select Change Tare Value if you wish to alter the tare value. The value is a measurement of capacitance at the test level of the system. For example if you are testing from a test fixture, the tare capacitance should be altered to include the capacitance of the fixture.

Select Change Thresholds if you wish to alter the tolerance for the component.

Enter Tare Value 🎆	Enter a new tare value and select <b>Enter</b> to accept.
1439	•
DF J         1         2         3         Clear           DF         4         5         6         BS	(i) Every time this screen is accessed the

Every time this screen is accessed the default tare value (calculated during the system Capacitance Tare) will be displayed. Selecting enter will restore the default value.

Select **Change Thresholds** to input a specific tolerance you 1. Select Detect Mode may enter the minimum and maximum expected values.

Enter the minimum and maximum threshold

1] Edit Ca CAPAC	pacitor	Η
Terminal $\underline{1}$ (+)		1
Terminal <u>2</u> (-)	J3.C1.	4
Ualue 538pF m	in 658pF	max
<u>T</u> est	DK: 615pF	
More Options	<u>L</u> abe l	<u>о</u> к
[] Label Ca	apacitor	<b>1</b> 2
САРАС	ITOR1	
12345	6 7 8	9 🔊
#\$<>>>		
A.Z Space Ba	r Clear	Enter
C Select C	apacitor	н
-9-pCAPACITOR    ≪CAPACITOR1		
± ▲ ∓ <u>A</u> dd	Delete	-
	<u>Cancel</u>	<u>о</u> к
)] Set Test F	arameters	н
0 Set Test F Name / <u>P</u> rompt	arameters <u>A</u> dapte	
		rs
Name / <u>P</u> rompt	<u>A</u> dapte	rs nts
Name / <u>P</u> rompt <u>L</u> ow Voltage	<u>A</u> dapte Co <u>m</u> pone	rs nts st
Name / <u>P</u> rompt <u>L</u> ow Voltage <u>H</u> igh Voltage	<u>A</u> dapte Compone <u>N</u> et Li	rs nts st
Name / Prompt Low Voltage High Voltage More Options Test Now	<u>A</u> dapte Compone <u>N</u> et Li <u>Print</u> <u>C</u> ancel	rs nts st t <u>O</u> K
Name / Prompt Low Voltage High Voltage More Options Test Now 7 Set Test t	<u>A</u> dapte Compone <u>N</u> et Li <u>Print</u> <u>C</u> ancel	rs nts st t <u>O</u> K
Name / Prompt Low Voltage High Voltage More Options Test Now 2 Set Test 1	<u>A</u> dapte Compone <u>N</u> et Li <u>Print</u> <u>C</u> ancel	rs nts st t <u>O</u> K
Name / Prompt Low Voltage High Voltage More Options Test Now 2 Set Test 1	<u>A</u> dapte Compone <u>Net Li</u> <u>Print</u> <u>Cancel</u>	rs nts st t <u>O</u> K
Name / Prompt Low Voltage High Voltage More Options Test Now C Set Test t Save Cabl	<u>A</u> dapte Compone <u>Net Li</u> <u>Print</u> <u>Cancel</u>	rs nts st DK
Name / Prompt Low Voltage High Voltage More Options Test Now N Set test t Low Save Cabl	Adapte Compone <u>N</u> et Li <u>Print</u> <u>Cancel</u>	rs nts st t QK
Name / Prompt Low Voltage High Voltage More Options Test Now N Set test t Low Save Cabl	Adapte Compone <u>N</u> et Li <u>Print</u> <u>Cancel</u>	rs nts st t QK
Name / Prompt       Low Voltage       High Voltage       More Options       Test Now	Adapte Compone Net Li Print Cancel Record No	rs           nts           st <u>OK</u>
Name / Prompt       Low Voltage       High Voltage       More Options       Test Now       (Note Cability)       Save Cability       Loss       High       Yes       Directory Name	Adapte Compone Net Li Cancel Cancel Record? No	rs nts st b OK
Name / Prompt       Low Voltage       High Voltage       More Options       Test Now       ?       Set Test R       Par       Save Gabl       Low       High       Yes       3	Adapte Compone Net Li Cancel Cancel Record? No	rs           nts           st <u>OK</u>
Name / Prompt       Low Voltage       High Voltage       More Options       Test Now       (Note Cability)       Save Cability       Loss       High       Yes       Directory Name	Adapte Compone Net Li Cancel Cancel Record? No	rs           nts           st <u>OK</u>
Name / Prompt       Low Voltage       High Voltage       More Options       Test Now       (Note Cability)       Save Cability       Loss       High       Yes       Directory Name	Adapte Compone Net Li Cancel Cancel Record? No	rs           nts           st <u>OK</u>
Name / Prompt       Low Voltage       High Voltage       More Options       Test Now       (Note Cability)       Save Cability       Loss       High       Yes       Directory Name	Adapte Compone Net Li Cancel Cancel Record? No	rs nts st : 0 K
Name / Prompt       Low Voltage       High Voltage       More Options       Test Now       N       Set Test I       Part Save Cabl       Low       Y       Save Cabl       Low       Y       Save Cabl       Low       Y       Save Cabl       Low       Y       Save Cabl       Low       Yes	Adapte Compone Net Li Print Cancel e Record? No Cancel	rs           nts           st <u>OK</u>

Select Label to assign a label to the component.

Enter a label and select Enter to accept.

All of the needed changes have been entered, so select **Cancel** to return to *Set Test Parameters*.

**Add** is used to add capacitors to a cable without learning them and to take care of certain special cases.

If you are through specifying the tests for your product, select **Ok** to save the test procedure in the internal database. **Cancel** will take you back to *Program Cable* and discard all of the learned parameters.

Select **Yes** to save your cable record. The *Save To Directory* dialog appears. **No** returns you to the *Main Menu.* 

Move the cursor until the directory in which you want to save the cable is highlighted, then select **Ok**. The cable record is saved, and you are returned to the *Programming Cable* menu. (If you want to store your cable in a new directory, select **New**, and you will be prompted to enter the new name. Select **Enter** when through. You can use any combination of up to 30 characters.

Test Program as C	CBL File					
(S) \datab\cables\main\ca	apacitor.cbl	For greater	detail	see	section	9.
*CABLE*,CAPACITOR,1	*NET*					
*STAR*		L.C1.13,,				
*THRESHOLD*,61		3.C1.13,,				
*ADAPTER*, HA 116,	*NET	Γ*,,				
*POSITION*,J1	JI	L.C1.14,,				
*ADAPTER*, HA 116,	J3	3.C1.14,,				
*POSITION*,J3	*NET	Γ*,,				
*NET*,,	JI	L.C1.15,,				
J1.C1.1,,	J3	3.C1.15,,				
J3.C1.1,,	*NET	Γ*,,				
*NET*,,	Jl	L.C1.16,,				
J1.C1.2,,	J3	3.C1.16,,				
J3.C1.2,,	*NET					
*NET*,,		L.C1.17,,				
J1.C1.3,,		3.C1.17,,				
J3.C1.3,,	*NET					
*NET*,,		L.C1.18,,				
J1.C1.4,,		3.C1.18,,				
J3.C1.4,,	*NE]					
*NET*,,		L.C1.19,,				
J1.C1.5,,		3.C1.19,,				
J3.C1.5,,	*NE]					
*NET*,, J1.C1.6,,		L.C1.20,, 3.C1.20,,				
J3.C1.6,,	*NET					
*NET*,,		L.C1.21,,				
J1.C1.7,,		3.C1.21,,				
J3.C1.7,,	*NET					
*NET*,,		L.C1.22,,				
J1.C1.8,,		3.C1.22,,				
J3.C1.8,,	*NET					
*NET*,,	Jl	L.C1.23,,				
J1.C1.9,,	J3	3.C1.23,,				
J3.C1.9,,	*NET	Γ*,,				
*NET*,,	JI	L.C1.24,,				
J1.C1.10,,	J3	3.Cl.24,,				
J3.C1.10,,	*NET	Γ*,,				
*NET*,,		L.C1.25,,				
J1.C1.11,,		3.C1.25,,				
J3.C1.11,,		PACITOR*,,CAP	ACITOR1			
*NET*,,		3.C1.1,,				
J1.C1.12,,		3.C1.4,,	0- 10 6	F02	FD- 10	
J3.C1.12,,		ALUE*,5.3865		.583	5∠e-10	
		TARE*,1.41919	e-09			
	*END*					

# 5.5.2 Programming Capacitors - Manual

Even when you program embedded capacitors manually, the NetList must have already been automatically learned (see Section 4 for details).

Set Test Parameters     H       Name / Prompt     Adapters       Low Voltage     Components       High Voltage     Met List       More Options     Print       Test Now     Cancel	From Set Test Parameters, select <b>Components</b> and the <i>Edit Component List</i> dialog appears.
Edit Component List       Resistors     Keys       Capacitors       Diodes       Black Boxes       Twisted Pairs	Select Capacitors.
Select Capacitor     I       the Character     I <td><ul> <li>Select Add to manually enter this component. Add as many capacitors as you have in your product.</li> <li>Adding capacitors increments existing capacitors by 1. Each new capacitor will be C1 and the current C1 becomes C2, the current C2 becomes C3 etc</li> </ul></td>	<ul> <li>Select Add to manually enter this component. Add as many capacitors as you have in your product.</li> <li>Adding capacitors increments existing capacitors by 1. Each new capacitor will be C1 and the current C1 becomes C2, the current C2 becomes C3 etc</li> </ul>
	Highlight the first and select <b>Edit</b> to set the components properties.
D     Edit Capacitor     H       Terminal $1 (+)$ N/C       Terminal $2 (-)$ N/C       Ualue     OpF min     OpF max	The <b>Edit Capacitor</b> dialog opens with no information present. Select <b>Terminal 1 (+)</b> to assign it the proper net.
<u>Iest</u> <u>More Options.</u> <u>Label <u>O</u>K ]Open Net and Pick Terminal H Opengagitori</u>	The Select Net dialog appears.

D@Capacitor1	n In
~Net(J1.Cl.2, J3.Cl.2) ~Net(J1.Cl.3, J3.Cl.3) ~Net(J1.Cl.3, J3.Cl.3) ~Net(J1.Cl.4, J3.Cl.4) ~Net(J1.Cl.5, J3.Cl.5) ~Net(J1.Cl.7, J3.Cl.6) ~Net(J1.Cl.7, J3.Cl.7)	Us co
± ▲ ∓ Kdit Cancel ◀ ▼ ▶ Open Twisted	Se

Using the arrow keys, scroll the cursor to highlight the correct net/pin location for Terminal 1. Select **Open** to select a pin.

#### Advanced Programming

1] Pick Terminal [] CarCapacitor I - Ji.Cl.1 (SVS18) - JS.Cl.1 (SVS52)	Highlight a pir Terminal 1.
Image: A triangle of the second se	The Cash Issue
Terminal 1 (+)         J1.Cl.1           Terminal 2 (-)         N/C           Ualue         OpF min         OpF max           Test	The first termi
Dpon Net and Pick Terninal #         Brcavasitori         Statusitori	Repeat the ab
D       Edit Capacitor       H         Terminal 1 (+)       J1.C1.1         Terminal 2 (-)       J1.C1.4         Ualue       OpF min       OpF max         Test	With the termi program the v If your produc place, select T
1) Edit Capacitor (1) Terminal <u>1</u> (+) J1.C1.1	The Horizon e

Terminal <u>1</u> (+) J1.C1.1
Terminal <u>2</u> (-) J1.C1.4
Value OpF min OpF max
<u>T</u> est OK: 606pF
More Options Label OK

Highlight a pin and select **Ok** to accept the location of Terminal 1.

The first terminal is displayed.

Repeat the above operation for Terminal 2.

With the terminals properly identified, you now need to program the value of the component. If your product is attached with the proper capacitance in place, select **Test** to view the measured value.

The Horizon engages the measurement circuitry to display the value of capacitance between the selected terminals. Select **Value** to set the tolerance.

	Select Detect Mode
	Change T <u>a</u> re Value
	C <u>h</u> ange Thresholds
Au	utodetect <u>T</u> hresholds
	<u>C</u> ance l

Three value options are available:

Autodetect Thresholds:	Automatically selects $\pm 10\%$ the average value measured by the Horizon.
Change Thresholds:	Allows the user to manually set the
mesneus.	thresholds for the component.
Change	
Tare Value:	This allows the user to manually alter the capacitance tare value. This may be useful in scenarios that include test fixtures with long interface cables.

 Edit Capacitor
 H

 Terminal 1 (+)
 J1.Cl.1

 Terminal 2 (-)
 J1.Cl.4

 Ualue
 549pF min

 671pF max

 Test

 0K: 609pF

 More Options.

The threshold is displayed.

Select Ok to return to the Capacitor List dialog.

# 5.5.3 Programming Capacitors – Advanced Options

1] Edit Capacitor [
Terminal <u>1</u> (+) <u>J1.C1.1</u>
Terminal <u>2</u> (-) J1.C1.4
Value 549pF min 671pF max
Test OK: 609pF
More Options Label OK
C Edit Capacitor
DC Hipot Settings Default

<u>A</u>C Hipot Settings <u>Default</u> <u>E</u>lectrolytic □

<u>o</u>k

From the Edit Capacitor dialog, select More Options...

The **More Options** are as follows:

### 5.5.3.1 Programming Capacitors – Advanced Options – HIPOT

 $(\mathbf{i})$ 

)] Edit Capac	itor 🛙
<u>D</u> C Hipot Settings	Custom
AC Hipot Settings	Default
<u>E</u> lectrolytic	
	<u>о</u> к

The same as changing HiPot values for individual nets (see Section 4), users have the option of adding, changing values, or eliminating HiPots performed on capacitors.

In order to change local HiPot variables, the global setting for the High Voltage test must be set to Linear.

#### 5.5.3.2 Programming Capacitors – Advanced Options – Electrolytic

I Edit Capacitor	c H
DC Hipot Settings 🗌 I	)efault
AC Hipot Settings 🗌 I	)efault
<u>E</u> lectrolytic J	
	ок

Electrolytic capacitors can be tested with the Horizon by selecting the Electrolytic option.

# 5.5.3.3 Programming Capacitors – Advanced Options – Test Stimulus

<u>DC Hipot Settings</u> <u>AC Hipot Settings</u> <u>Electrolytic</u> <u>DK</u>

Toggle **Stimulus** to select between the Horizon's  $50\mu$ A and 5mA sources.

# 5.5.4 Testing a Cable with Capacitors

Testing a product with embedded components is the same as testing any other cable or harness. For details, consult Section 4.



Select the product you wish to test.

Highlight and select **Ok** to continue.

The test program is loaded.



Select **Test Now** to begin testing the selected cable product.

Insert the required adapters.

Insert your product in the appropriate connectors. The Horizon will detect when the product is inserted and automatically start the test. If your product passes, the green Pass light will be lit and a positive tone will sound; if it fails, the red Fail light will be lit and a negative tone will sound. If, for some reason, the test does not automatically start, or you have disabled the automatic start feature, selecting **Start Test** will force the test process to start.

Test in Prog	K (2) Kess
Y         Performing 1           Capacitor         100%	
Error Statistics	<u></u> lagnose
Start Test	<u>Cance</u> l
1. CAPACITO Disconnect Pr	
Tested: 1	
Passed: 1	
Failed: 0	
Error <u>S</u> tatistics	<u>D</u> iagnose
Re <u>t</u> est	<u>C</u> ance l
1) Test Repo	rt I
Reported Resul	
Test Program: CAPA 07/29/1999 09:42:0 CAPACITOR1 : 592. ~~~~ End of Report	CITOR 7pF
Prin	ы ок

The system performs the standard low voltage tests (Continuity and Isolation), then scans for the Capacitors.

Once the test is complete, the display will change, instructing you to disconnect the product. Disconnecting the product updates the statistics database and automatically resets the system to test the next product. Inserting the next cable starts the process again.

Prior to disconnecting the tested product, the user can select **Diagnose** to view the results of the last test.

# 5.5.5 Error Reporting for Capacitors

All of the same errors are available in this mode as for general cable testing. Basically, the additional error screens are the same as for embedded resistors.

1: Test Report E Reported Results: ALL Test Program; CAPACITOR 07/29/1999 09:42:31 *CAPACITOR: too iow: 355.5pF *CAPACITOR: too iow: 355.5pF	The measured capacitance is too low.
<u>Print</u> <u>DK</u> <u>Reported Results: ALL</u> <u>Rest Program: CAPACITOR</u> 07/29/1959 09:54:58 *CAPACITOR: too high: 775.5pF	The measured capacitance is too high.
Print OK	

# 5.6 Diodes

# 5.6.1 Programming Diodes – Auto learn

The Horizon can be used to test products with the following types of embedded diodes: generic, signal, rectifier, Schottky, Germanium, LED's, and resistor LED's. The diodes are tested for both forward and reverse bias, and the LED's may also be visually tested. Diodes may be automatically learned by the Horizon, or you can choose to program them manually. It is highly recommended that you let the Horizon do the work unless you have a large number of diodes, or you are not satisfied with the results of the automatic learning process.

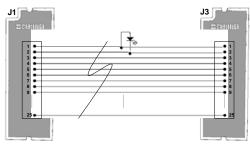


Figure 5-4: PUT with embedded Diode

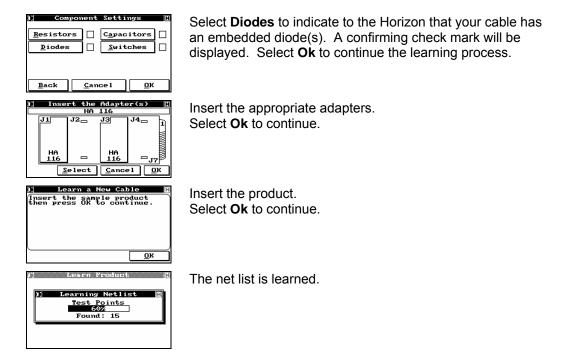
)] Learn Se	ettings 🔲
T <u>w</u> isted	Ne <u>t</u> s Only
<u>F</u> ree Ends	<u>K</u> elvin
Co <u>n</u> ductor Max R	es 5Ω
U <u>s</u> e Kelvin Pro	be 🗌
<u>C</u> ance l	<u>о</u> к

As with resistors and capacitors, diodes are learned automatically through the customized path. From the *Main Menu*, select **Program Cable**, followed by your password; then select **Learn New Cable – Customized**. The *Learn Settings* menu appears. You must change the **Conductor Max Res.** from 'Quick Scan' to a specific resistance. The 'Quick Scan' setting is intended for wire only cables.  $5\Omega$  is suggested (the Horizon sets this value for you), and works well in the vast majority of cases.



Failure to set **Conductor Max Res**. to a specific value may cause the Horizon to wrongly detect the diode(s) as nets, compromising the validity of the testing phase.

Select **Conductor Max Res.**, enter the desired value (or accept the default  $5\Omega$ ), select **Enter**, and then push **Ok** to go to the *Component Settings* screen.



1 Learn Product R Learning Diodes R Test Points 16% Found: 1	The Horizon scans for diodes in your product.
Enter Part Number     H       CABLE WITH DIODE       Q W E R T Y U I O P       A S D F G H J K L       Z X C U B N M Ess       09 Space Bar Clear	Label the product under test.
Set Test Parameters     H       Name / Prompt     Adapters       Low Voltage     Components       High Voltage     Net List       More Options     Print       Test Now     Cancel	If you want to review the parameters, select <b>Components</b> . This is always recommended as a "sanity check", especially if you have not programmed diodes, or diodes of this type, before.
1) Edit Component List H <u>Resistors Reys</u> <u>Capacitors</u> <u>D</u> iodes <u>B</u> lack Boxes <u>T</u> wisted Pairs	Then select <b>Diodes</b> . The <i>Edit Diodes</i> dialog is shown.
Select Diode     H       OpCABLE UITH DIODE       W D1 KGENERICK       Label	In the example cable, the Horizon found one diode, and detected that this diode is a Generic type. The following table lists the parameter by which diodes are identified by the Horizon. Select <b>Edit</b> to view the details of the learned component.

# Table 1 Diode Types

Туре	V _{fmin} [V] @50μA	V _{Fmax} [V] @50μA	I _{Rmax} [μΑ] @5V
GENERIC	0.060	2.300	20.0
SIGNAL	0.400	0.600	20.0
RECTIFIER	0.400	0.800	20.0
SCHOTTKY	0.060	0.400	20.0
GERMANIUM	0.060	0.400	20.0
LED	1.475	1.825	20.0
RESISTORLED	1.550	2.300	20.0

<u>A</u> node	J1.C1.1
<u>C</u> athode	J1.C1.2
<u>D</u> etect <u>Type</u>	*GENERIC*
Test OK: Vf=44	16mV, Ir=OnA
More Options.	Label OK

Name / <u>P</u> rompt	<u>A</u> dapters	
Low Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>Cancel</u>	

The diode's Anode, at pin 1 and its Cathode, at pin 2 are of connector 1 on adapter J1. (This agrees with the test spec. for the example cable).

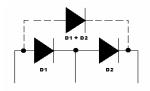
Select Label to label the component.

If you are through specifying the test for your product, select **Ok** to save the test procedure in the internal database. **Cancel** will take you back to *Program Cable* and discard all of the learned parameters.

# Test Program as CBL File

continueri , c, s	01.01.19,,
*STAR*	J3.C1.13,,
*THRESHOLD*,61	*NET*,,
*ADAPTER*,HA 116,	J1.C1.14,,
*POSITION*,J1	J3.C1.14,,
*ADAPTER*, HA 116,	*NET*,,
*POSITION*,J3	J1.C1.15,,
*NET*,,	J3.C1.15,,
J1.C1.1,,	*NET*,,
J3.C1.1,,	J1.C1.16,,
*NET*,,	J3.C1.16,,
J1.C1.2,,	*NET*,,
J3.C1.2,,	J1.C1.17,,
*NET*,,	J3.C1.17,,
J1.C1.3,,	*NET*,,
J3.C1.3,,	J1.C1.18,,
*NET*,,	J3.C1.18,,
J1.C1.4,,	*NET*,,
J3.C1.4,,	J1.C1.19,,
*NET*,,	J3.C1.19,,
J1.C1.5,,	*NET*,,
J3.C1.5,,	J1.C1.20,,
*NET*,,	J3.C1.20,,
J1.C1.6,,	*NET*,,
J3.C1.6,,	J1.C1.21,,
*NET*,,	J3.C1.21,,
J1.C1.7,,	*NET*,,
J3.C1.7,,	J1.C1.22,,
*NET*,,	J3.C1.22,,
J1.C1.8,,	*NET*,,
J3.C1.8,, *NET*,,	J1.C1.23,, J3.C1.23,,
J1.C1.9,,	*NET*,,
J3.C1.9,,	J1.C1.24,,
*NET*,,	J3.C1.24,,
J1.C1.10,,	*NET*,,
J3.C1.10,,	J1.C1.25,,
*NET*,,	J3.C1.25,,
J1.C1.11,,	*DIODE*,,
J3.C1.11,,	J1.C1.1,,
*NET*,,	J1.C1.2,,
J1.C1.12,,	*GENERIC*
J3.C1.12,,	*END*

#### 5.6.2 Programming Diodes – Auto learn, Special Case – Phantom Diodes



Depending on how the diodes are wired, the Horizon could find a "phantom diode" that is a combination of diodes 1 and 2 as illustrated by the dashed line. This could either show up as a third diode, or as a single diode. In either case, a careful examination of the components learned will reveal if this has happened, and if so, which occurred.

Figure 5-5: Phantom Diodes

	Test 1	g Diodes Points 2% d: 3	
C	Set Test I	arameter≤	5 🗄
Nai	me / <u>P</u> rompt	<u>A</u> dapte	ers
Ŀ	ow Voltage	Compone	ents
<u>H</u> i	gh Voltage	<u>N</u> et L:	ist
Mo	re Op <u>t</u> ions	P <u>r</u> in	t
	T <u>e</u> st Now	<u>C</u> ance 1	<u>о</u> к
01			
	Edit Compo	ment Lis	: H
5.8	<u>R</u> esistors	<u>K</u> eys	
5.12		<u>K</u> eys	
75	Resistors	<u>K</u> eys itors	
	<u>R</u> esistors C <u>a</u> pac	<u>K</u> eys itors des	
	<u>R</u> esistors C <u>a</u> pac <u>D</u> io <u>B</u> lack	<u>K</u> eys itors des	

★ ★ ¥ <u>A</u>dd <u>D</u>elete

◀ ▼ ▶ <u>E</u>dit <u>L</u>abel

Select Diode ADIODE WITH PHANTOM D1 *GENERIC* D2 *GENERIC* D3 *GENERIC*

▲ ¥ <u>A</u>dd <u>D</u>elete

▼ ▶ <u>E</u>dit <u>L</u>abel

<u>о</u>к

<u>o</u>ĸ

Η

Auto learning the above configuration resulted in 3 found components.

Select **Components** to enter the *Set Test Parameters* menu.

Select **Diodes** to view the found components.

The the three expected diodes are displayed. Select **Edit** to view the parameters of each component... review section 5.6.1 for editing details.

In this example the phantom component is discovered to be D2.

Highlight D2 and select **Delete**.

	Select Dide
8- D.1	The year really want []
¥- ⊅3	1]Do you really want[] to Delete Diode?
	Yes No
	Edit Label OX

1] Select Di	
00DIODE WITH PHAN	TOM
D2 *GENERIC*	
± ▲ ¥ <u>A</u> dd <u>D</u> e	elete
<b>■▼▶</b> <u>Edit</u>	abel OK
	iamer

Confirm deletion with a **Yes**.

Once the Diode list is correct, select **Ok** to return to the *Set Test Parameters* menu.

# 5.6.3 Programming Diodes – Manual

Even when you program embedded diodes manually, the NetList must have already been automatically learned (see Section 4 for details).

)] Set Test I	arameters [		
Name / <u>P</u> rompt	<u>A</u> dapters		
<u>L</u> ow Voltage	Components		
<u>H</u> igh Voltage	<u>N</u> et List		
More Op <u>t</u> ions	P <u>r</u> int		
T <u>e</u> st Now	<u>Cancel</u>		

Edit Compo	nent List	L
<u>R</u> esistors	<u>K</u> eys	
C <u>a</u> pac	itors	
Dio	les	
<u>B</u> lack	Boxes	
<u>T</u> wisted	Pairs	
_		



From Set Test Parameters, select **Components** and the *Edit Component List* dialog appears.

Select Diodes.

The *Select Diode* dialog box is empty if no diodes were detected during the learn process, or if you did not select the **Diode** option within a custom learn.

$[\mathbf{C}]$	Select Diode	H
0-0-D I 0	DDE *GENERIC*	
	<b>↓</b> Add Delete	$ \rightarrow$
<b>F</b> F		<u>о</u> к
╝┖	▶ <u>E</u> dit <u>L</u> abel	

Select **Add** to manually enter this component. Add as many Diodes as you have in your product – the new diodes are automatically selected as Generic.

(i) Adding diodes increments existing diodes by 1. Each new resistor will be D1 and the current D1 becomes D2, the current D2 becomes D3 etc... Highlight the first and select **Edit**.

<u>A</u> node	N/C	
<u>C</u> athode	N/C	
<u>D</u> etect Type	*GENERIC*	
Test	-	

et and Pick Terminal [

ок

The **Edit Diode** dialog opens with no information present. Select **Anode** to assign it the proper net.

The *Select Net* dialog appears. Using the arrow keys, scroll the cursor to highlight the correct net/pin location for the Anode. Select **Open** to select a pin.

	Pick	Termin	ia l	н
0 0 D IODE	1 751	16101		
J1.C1 J3.C1	1 (3)	(\$82)		
				J
± • Ŧ	1	<u>C</u> ar	ncel	=
নিচিচি	i			<u>o</u> ĸ
그냐냐				

▲ ¥ ﷺ dit <u>C</u>ance 1

▼ ► 0<u>p</u>en

C Edit 1	Diode H
<u>A</u> node	J1.C1.1
<u>C</u> athode	N/C
<u>D</u> etect Type	*GENERIC*
Test	
More Options	Label OK

Highlight a pin and select **Ok** to accept the location of Terminal 1.

The first anode terminal is displayed.

Repeat the above operation for the Cathode.

l]Open	Net	and	Pick	Termi	na l 🔳	
00DIO ∼Net(	D)3 (J1.C	1.1,	J3.C	1.1)		
~Net( Net( ~Net(		$1.2 \\ 1.6 \\ 1.4$	J3.C UCEO J3.C	1.2) 1.60 1.40	_	
~Net(		1.5;	J3.C J3.C	1.5)		
~~net ★	<b>T</b>	L.r.	Can		$\dashv$	
		ben			<u>о</u> к	
		<b>_</b>				

)) Edit	Diode H
<u>A</u> node	J1.C1.1
<u>C</u> athode	J1.C1.3
Detect Type	*GENERIC*
<u>T</u> est	]
More Options.	Label OK

With the anode and cathode properly identified, you now need to program the type of diode embedded.

If your product is attached with the proper diode in place, select **Detect** to automatically set the type and values.

	Edit Dinde Select Detect Mode	
	Autodetect <u>D</u> iode Type	
	Autodetect <u>T</u> hresholds	
Moxe	· Obelozze ] [ 750561 ] [ 75	

C Edit	Diode 🗄
<u>A</u> node	J1.C1.1
<u>C</u> athode	J1.C1.3
<u>D</u> etect Type	*LED*
Test OK: Vf=1	- 74U, Ir=40nA
More Options.	Label <u>O</u> K

You can either Autodetect Diode Type or Autodetect Thresholds. The diode types preset are listed in Table 1 Diode Types. If your component does not conform to one of these types, select Autodetect Thresholds to learn the component attached.

The threshold is displayed. To manually edit the thresholds of the component select **More Options**. Select **Ok** to return to the resistor list.

# 5.6.4 Programming Diodes – Advanced Options

From the *Edit Diode* dialog, select **More Options**.

<u>A</u> node	J1.C1.1
<u>C</u> athode	J1.C1.3
Detect Type	*GENERIC*
<u>T</u> est	)
More Options.	Label OK
) Edit 1	Diode in
Visual Ist	Parallel

 Fyd
 Stimulus
 Auto:
 Soud
 SU

 Uf
 1.480 min
 1.820 max

 Rgu
 Stimulus
 Auto:
 20/100KG

 Ir
 OmA min
 200A max

 Uisual
 Auto:
 5mA/50
 0K

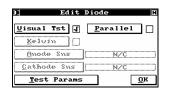
From the **More Options** dialog select **Test Params** to manually edit the Diode's Thresholds.

Should you wish to alter the forward and reverse values, select either **Vf** or **Ir** to enter the minimum and maximum values.

#### 5.6.4.1 **Programming Diodes – Advanced Options – LEDs**

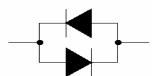
(C)	Edit	Diode	H
<u>A</u> 1	node	J1.C1	.1
<u>C</u> a1	thode	J1.C1	.3
Detec	t Type	*LED	×
<u>T</u> est	DK: Vf=1	.74U, Ir=4	10nA
<u>M</u> ore (	Dptions	<u>L</u> abe l	<u>0</u> K

The advanced option for the LED allows the user to set a visual test on the component. Select **More Options**.



Select **Visual Tst** to enable the visual confirmation during testing.

# 5.6.4.2 Programming Diodes – Advanced Options - Diodes in Parallel



The Horizon is capable of auto-detecting diodes in parallel. If you are manually entering diodes you will need to open the more options for the component and select Parallel to properly identify the component.

1] Edit Diode [
<u>A</u> node J1.C1.1
Cathode J1.C1.3
Detect Type *GENERIC*
Iest
More Options Label OK
C Edit Diode 🖸
Visual Ist Parallel J
<u>Kelvin</u>
Anode Sus
Cathode Sus N/C
<u>T</u> est Params <u>O</u> K
C Edit Diode 🗄
Anode J1.C1.1
<u>C</u> athode J1.C1.3
Detect Type *GENERIC**GENE
Test
More Options. Label OK

Select More Options from the Edit Diode dialog.

Select **Parallel** to properly define the component. Select **Ok** to return to the *Edit Diode* dialog.

The diode is now identified as being in parallel by the duplication of its type.

### 5.6.4.3 Programming Diodes – Advanced Options - BI-colour LED's

Jisua	l Tst	J 🛛 [	<u>P</u> ara	llel	J
Xe I	U X X				
<u>Buo</u>	લેલ કેસ્ટ	: ][		N/C	)
Cath	ode Si	<u>\s</u> ][		NZC	)
<u>T</u> es	st Par	ams		<u>(</u>	<u>э</u> к

The BI-color LED is both a visual component and a parallel component.

If you are manually entering diodes you will need to open the **More Options** for the component and select **Parallel** and **Visual Tst** to properly identify the component. Select both under **More Options** from the *Edit Diode* dialog.

) Edit	Diode 🗄
Anode	J1.C1.1
<u>C</u> athode	J1.C1.2
<u>D</u> etect Type	*LED**LED*
Test OK: Vf=1	.73U, Ur=1.4U
More Options.	Label OK

 Label Dicke
 H

 GREEN%RED
 1234567890

 1234567890

 1234567890

 1234567890

 123456780

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The component settings will be properly displayed. With Test selected the Vf, Vr will be displayed as well the component will light in both directions. A special labeling format is available for the BI-coloured LED. Select **Label** to continue.

# <forward>%<reverse>

In the example, the product has been labeled: **GREEN%RED** When the user is prompted to visually confirm the component functions the appropriate label will be displayed.

# 5.6.5 Testing Cables with Diodes

The testing procedure for a product with embedded components is the same as testing any other cable or harness. For details, consult Section 4.

Select Part Number     Part Numbers       Part Numbers     Part Numbers       Part Numbers<	<b>Select</b> the proper cable and push <b>Test Now.</b> You will be instructed to insert the proper adapters, then to insert the cable to be tested. Inserting the cable will automatically start the test.
Image: Test Configuration     Image: Test Configuration       Currently Selected Cable       File Name: datables MAIN\CABLEWIT.CB       Fart Number: CABLE WITH DIODE       Rev.1       Tools       Resorts       Select       Test Now       Batches       Cancel	Select <b>Test Now</b> to begin testing the displayed part.
COBLE WITH DIODE     I       Connect Product to Start       Tested:       0       Passed:       0       Failed:       0       Error Statistics       Diagnose       Start Test	Insert the product to begin the test.
CABLE WITH DIBDE     R       Diodes     0x       Ox     0x       Error Statistics     Diagnose       Start Test     Cancel	After the net list is verified for continuity and isolation, the system scans for the diodes.



At the end of the test, disconnect the product to reset the system for the next test.

Prior to disconnecting the product, if the user selects **Diagnose** the results of the last test will be displayed.

# 5.6.6 Testing LEDs and BI-LEDS

f LCD F Diodes 100%	Tests
Error Statistics	<u>⊉</u> iagnose
Start jest	<u>Çance</u> l
I     LED       I     Performing       I     Usual test       LED #1       Yes     N       Error year test       Start Test	t OK?
LED LED	H
Tested: 1 Passed: 1	
Failed:	Diagnose
	<u>D</u> iagnose <u>C</u> ance l
Failed: 0 Error <u>S</u> tatistics	Cancel

The same tests are performed for LEDs as with diodes and will include the same error results. However once the standard diode test is complete (and passed) a visual test (if selected) will be preformed.

The operator is prompted to confirm the component is lit. With BI-LEDs the operator will be prompted twice, once for each direction of the component. The special labelling option will apply at this point.

At the end of the test, disconnect the product to reset the system for the next test.

Prior to disconnecting the product, if the user selects **Diagnose** the results of the last test will be displayed.

# 5.6.7 Error Reporting for Diodes

All of the same errors are available in this mode as for general cable testing. In addition, a number of extra screens track diode specific faults.

Itest Report       It         Reported Results: ALL         Test Program: CABLE WITH         07/36/1999 13:07:57         #01 open: UF)         2.30         Urrent         Dispersive         UF         Print         DK	The diode was open. The Horizon measures and reports the forward voltage to be greater than 2300mV (this value is the maximum forward voltage at $50\mu$ A for a Generic Diode: see Table 1 Diode <b>Types</b> ) 'D1' is the designator assigned by the Horizon to the first diode detected. If there are more than one, you will probably want to use the Label function so that the diagnostics are more meaningful.
Test Report       Test Report         Test Program: CABLE WITH       0780         Dyrap       13:09:15         W1 shorted: UF= 16mU, Ur=         18mU         End of Report ****         Print       0K	Diode (D1) is shorted. The Horizon measures and reports the reverse voltage across the short.
Image: Construction of the state of the	The diode is present but it is installed backwards.

# 5.6.8 Error Reporting for LEDs and BI-LEDS

A 4	1	5	vebor		
	Report	ed	Result	s: f	LL
GI	t Progr 30/1999 EEN/RED REEN vi: D visu Find o	di di sua al	:07:03 m l test test:	: 08	
			Print		<u>o</u> ĸ

The same error messages apply to LEDs and BI-LEDs prior to the visual test. Should the component pass the initial test... and fail the visual test the Diagnostics will report a failure.

# 5.7 Four Wire or "Kelvin" Testing

# 5.7.1 Introduction

There are two methods for creating Kelvin measurement test programs for the Horizon.

(i)

The first method is to utilize the Kelvin adapter features discussed in section 6. If you choose to learn your test fixture as a Kelvin adapter, you need not read this procedure.

The second method would be to utilize standard Horizon adapters and **learn** your Kelvin fixture for a specific test program.

C Learn Se	ettings 🛛 🗎			
T <u>w</u> isted	Ne <u>t</u> s Only			
<u>F</u> ree Ends	<u>K</u> elvin			
Co <u>n</u> ductor Max Res <u>5Ω</u>				
U <u>s</u> e Kelvin Probe				
<u>C</u> ance l	<u>0</u> x			

Component Settings

Back Cancel

insert without nd the 11 be ture ha

<u>D</u>iodes

HA 116

Resistors Capacitors

rt The Adapter(s)

**J**3

HA 116

t the fixture t the sample press OK. prompted after as been learned. be the fixture prompted to.

₫к

<u>S</u>elect <u>C</u>ancel <u>O</u>k Learning the Fixtur or Kelvin Measureme

prompt 5 been 9 the promp

HA 116 .12

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#### To learn a cable using a Kelvin fixture, select Program Cable from the Main Menu, then, from the Programming Cable menu, select Learn New Cable - Custom.

From the Learn Settings menu, select Kelvin. A check mark will appear, indicating that this cable will be learned as Kelvin. After any other desired settings, select **Ok**.

Add any components at this time.

Select Ok when through.

Insert the adapters needed for the cable being tested and select Ok.

The Horizon must first learn the Kelvin fixture. During this process, the system will automatically determine which test points are being used for two wire measurements and which for four-wire.

Insert the fixture (adapter cabling) only and select Ok to start learning.

🥼 🛛 Learn a New Cable 🛛 🗱
Using Kelvin Measurement
Insert the sample product then press OK to continue.
<u>о</u> к
1) Set Test Parameters
Name / <u>P</u> rompt <u>A</u> dapters

Name / <u>P</u> rompt	<u>A</u> dapters	
<u>L</u> ow Voltage	Components	
<u>H</u> igh Voltage	<u>N</u> et List	
More Op <u>t</u> ions	P <u>r</u> int	
T <u>e</u> st Now	<u>Cancel</u> <u>O</u> K	

After learning the fixture, the Horizon will learn the sample cable. Insert the cable, making sure that all connections are completely seated, then select **Ok** to start the process.

To verify the product has been properly learned, select Net List.



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Highlight the Kelvin net you wish to verify. Select Open to view all of its connections.

All four test points are included within this net. In this example the J1.C1.1 and J3.C1.1 are a Kelvin node as are J1.C1.4 and J3.C1.4. The connection between these two nodes is the product under test.

To verify this connection, the net must be Kelvin.

Select **Ok** to return to the *Edit Net* dialog.

Select Edit to view the nets parameters.

Edit Net
Derkeluin
~Net(J1.C1.2, J3.C1.2)
~Net(J1:C1:5; J3:C1:5)
~~Net(J1.C1.6, J3.C1.6) ~~Net(J1.C1.7, J3.C1.7) ~Net(J1.C1.8, J3.C1.8)
★ ▲ ¥ Edit Label ou
I I I Open OK
1] Edit Net's Settings
)] Edit Net's Settings 🔲

ettings 🗄
Default
Default
Default
Default
<u>1</u> <u>о</u> к

The Kelvin option is checked – the net is Kelvin.

# 5.7.2 Testing a Cable using Kelvin

The procedure for testing a cable using "Kelvin testing" is the same as testing any other cable or harness. (For more details, consult Section 4.)



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The display shows the Directory location and the Part Number for the last cable tested. If this is the product you want to test, select Test Now; otherwise, press Select and choose the proper cable.

Insert the proper adapter(s). After the proper adapters are installed, the system automatically sequences to Connect Product To Start.

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Accept Cancel



Insert your product. The Horizon will detect when the product is inserted and automatically start. If your product passes, the green Pass light will be lit and a positive tone will sound; if it fails, the red Fail light will be lit and a negative tone will sound. If, for some reason, the test does not automatically start, or you have disabled the automatic start feature, selecting **Start Test** will force the test process to start. Select **Cancel** when finished testing.

# 5.8 Switches

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## 5.8.1 Introduction

The Horizon can test cables and harnesses with embedded switches. The basic philosophy is that each time a switch changes position, the cable has changed its configuration. As a result, the learning process steps you through each of the switch positions as the Horizon learns the configuration for each position. Then, during the testing phase, the operator duplicates the process. Switches can be combined with other embedded components, or used in conjunction with any other testing requirement, such as HiPot testing or Kelvin testing.

Any product that consists of multiple states (net lists that differ due to mechanical manipulation) is suitable for a Switch Test.

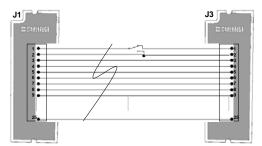
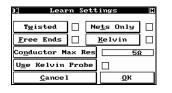


Figure 5-6: PUT with embedded Switch - in OPEN position



As with resistors and capacitors, switches are learned through the customized path. From the *Main Menu*, select **Program Cable**, followed by your password, then **Learn New Cable – Customized**. The *Learn Settings* menu appears. You may change the **Conductor Max Res**. From 'Quick Scan' to a specific resistance.

Select Ok to go to the Component Settings screen.



5.1	Component Settings	
	P <u>e</u> rmanent Switches	
	Temporary Switches	
	Max 1KΩ	
	Cancel OK	

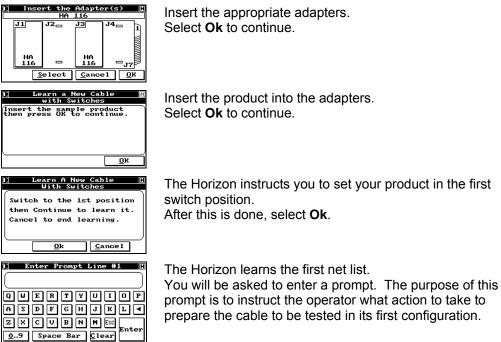
Select **Switches** to indicate to the Horizon that your cable has an embedded switch(es). The *Component Settings* menu will open.

In the *Component Setting* screen, you have two available options.

Permanent Switches: Used for mechanical switches.

**Temporary Switches:** Used for momentary switches, such as membrane switches.

# 5.8.2 Programming Switches - Permanent



)] Enter First Prompt Line [
OPEN
QWERTYUIOP ASDFGHJKL ZKCUBNHESS 0.9 Space Bar Clear
)] Enter Next Prompt Line [
<u></u>



The prompt entered will appear to the operator during the test cycle prior to testing the switch position. Select Enter to confirm the prompt.

If no more prompt lines are required, select **Esc** to advance to the next switch position.

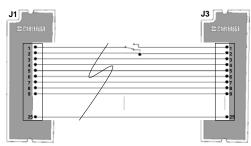


Figure 5-7: PUT with embedded Switch - in CLOSED position

C Learn A New Cable 🔳 With Switches
Switch to the 2nd position then Continue to learn it. Cancel to end learning.
1] Enter First Prompt Line 🔲
CLOSED
0 U E R T Y U I O F A S D F G H J K L 4 Z X C U B N H E 0.9 Space Bar <u>C</u> lear
1 Learn a New Cable W
with Switches Switch to the 3rd pos.
then press OK to learn it.
Cancel to end learning.
<u><u>O</u>K <u>Cance1</u></u>

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Place your product in the second switch position. Select  $\mathbf{Ok}$  to continue.

The second net list is learned. You are prompted to enter the prompt that will appear prior to the second switch position. Select Enter to confirm the prompt.

If no more switch positions are required, select **Cancel** to exit the learn cycle.

Advanced Programming

)] Enter Part Number 🛛				
SWIT	CHES	7		
QWERT	<b>A</b> DIDI	ñ		
	нэкг	ถ		
ZXCVB	M M Esc Ente	r		
09 Space Ba	r <u>C</u> lear			
)] Set Test P	arameters	H		
Name / <u>P</u> rompt	<u>A</u> dapters			
Low Voltage Components				
High Voltage <u>N</u> et List				
<u>H</u> igh Voltage	<u>N</u> et List			
<u>H</u> igh Voltage More Op <u>t</u> ions	<u>N</u> et List P <u>r</u> int			

) Select	Switch	Positio	m 🖸
00 SWITCHES	S		
A Switchi Switch2			
± ▲ ∓			
নিহাচ		ancel	<u>о</u> к
لكالنالا	2		

You are prompted to enter the part number. Select **Enter** to confirm the part number.

From this point on, the process is identical to that for any other cable. You do not have to do anything else to finish programming and to test this cable with embedded switches. Select **Ok** to save the test procedure in the internal database.

If you select **Net List** you will be prompted to select the Switch Position you wish to review.

#### Test Program as CBL File S \datab\cables\main\switch.cbl For greater detail see section 9. *NET*,, *CABLE*,SWITCHES,1 *NET*,, *STAR* J1.C1.13,, J1.C1.8,, *THRESHOLD*,61 J3.C1.13,, J3.C1.8,, *NET*,, *NET*,, *ADAPTER*, HA 116, *POSITION*,J1 J1.C1.14,, J1.C1.9,, *ADAPTER*,HA 116, J3.C1.14,, J3.C1.9,, *POSITION*,J3 *NET*,, *NET*,, J1.C1.15,, *SWITCH*,, J1.C1.10,, *CHAIN* J3.C1.15,, J3.C1.10,, *NET*,, *PROMPT* *NET*,, J1.C1.16,, J1.C1.11,, OPEN *NET*,, J3.C1.16,, J3.C1.11,, *NET*,, *NET*,, J1.C1.1,, J3.C1.1,, J1.C1.17,, J1.C1.12,, *NET*,, J3.C1.17,, J3.C1.12,, *NET*,, J1.C1.2,, *NET*,, J3.C1.2,, J1.C1.18,, J1.C1.13,, *NET*,, J3.C1.18,, J3.C1.13,, J1.C1.3,, *NET*,, *NET*,, J3.C1.3,, J1.C1.19,, J1.C1.14,, *NET*,, J3.C1.19,, J3.C1.14,, J1.C1.4,, *NET*,, *NET*,, J3.C1.4,, J1.C1.20,, J1.C1.15,, *NET*,, J3.C1.20,, J3.C1.15,, *NET*,, J1.C1.5,, *SWITCH*,, J3.C1.5,, *CHAIN* J1.C1.16,, *NET*,, J3.C1.16,, *PROMPT* J1.C1.6,, CLOSED *NET*,, J3.C1.6,, *NET*,, J1.C1.17,, J1.C1.1,, *NET*,, J3.C1.17,, J1.C1.2,, J1.C1.7,, *NET*,, J3.C1.1,, J1.C1.18,, J3.C1.7,, J3.C1.2,, *NET*,, J3.C1.18,, *NET*,, *NET*,, J1.C1.8,, J3.C1.8,, J1.C1.3,, J1.C1.19,, *NET*,, J3.C1.3,, J3.C1.19,, J1.C1.9,, *NET*,, *NET*,, J3.C1.9,, J1.C1.4,, J1.C1.20,, J3.C1.4,, *NET*,, J3.C1.20,, J1.C1.10,, *NET*,, *END* J3.C1.10,, J1.C1.5,, *NET*,, J3.C1.5,, *NET*,, J1.C1.11,, J3.C1.11,, J1.C1.6,,

J3.C1.6,,

J1.C1.7,, J3.C1.7,,

*NET*,,

*NET*,,

J1.C1.12,,

J3.C1.12,,

### 5.8.3 Programming Switches – Temporary (Membrane Switches)

Temporary switches are also known as Keys. They are seen by the Horizon as a component.

1) Component Settings H Permanent Switches <u>T</u> emporary Switches	In the <i>Component Settin</i> options.	ng screen, you have two available	
Max <u>IKΩ</u>	Permanent Switches: switches.	Used for mechanical	
	Temporary Switches:	Lised for momentary switches su	ich

Temporary Switches: Used for momentary switches, such as membrane switches.

Select Temporary Switches.

1. Input the Maximum  Expected Resistance				
0.050				
KU 1	1	2	3	<u>C</u> lear
MΩ	4	5	6	BS
	7	8	9	Enter
• •			Esc	Encer

Component Settings

P<u>e</u>rmanent Switches

<u>Temporary</u> Switches  $\sqrt{}$ 50<u>Ω</u>

<u>R</u>esistors C<u>a</u>pacitors

Insert Adapter(s) HSA 112

<u>J3</u>

<u>16</u>__

<u>Select</u> <u>Cancel</u> <u>O</u>K

Diodes 🗌 Switches J

<u>C</u>ancel <u>O</u>K

J4_

**J**7

ок

Max

<u>B</u>ack

J1

<u>C</u>ancel

J2[

HSA 112

1. Component Settings

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Η

ì

Input the maximum expected resistance for the embedded switch. In the example shown, the highest expected value is 50Ω.

Select Enter when through to return to Component Settings menu.

Notice that the Temporary Switches box is now checked and the maximum resistance value has changed.

Select Ok to continue.

Notice that the Switches box is checked, indicating to the Horizon that your cable has an embedded switch (es).

Select **Ok** to continue the learning process.

Insert the appropriate adapters.

Select **Ok** to continue.

): Learn a New Cable IM Insert the sample product then press OK to continue.	Insert the product into the adapters.
	Select <b>Ok</b> to continue.
Learn Product     Learn Product     Learning Netlist     Test Points     47%     Found: 20	The net list is learned.
il Learn Product R Fler D. Touch key R Die 45.74Ω Done	Press and hold the momentary switch. Once the measured resistance is displayed, release the switch.
Enter Key's Label         Reset         1 2 3 4 5 6 7 8 9 0         & * ( ) \ : 0 - /         # \$ ( ) \ : 0 - /         # \$ ( ) \ : 0 - /         # \$ ( ) \ : 0 - /         A.Z Essed area         Essed area	Enter a label name and select <b>Enter</b> to accept.
f Learn Fraduct R Fler <mark>I Touch key R</mark> ine Done	Press and hold to measure the next momentary switch. With no more switches to press, select <b>Done</b> .
1 Learn Product R 1 Learn Product R 1 Learn Product R Add it to the key list? Yes No	If the same switch (key) has been pressed twice, then the <i>Key was pressed before!</i> screen will appear. Selecting <b>Yes</b> will accept the switch and selecting <b>No</b> will continue without accepting the switch.
) Set Test Parameters () Name / Prompt Adapters Low Voltage Components High Voltage Net List More Options Print Test Now Cancel OK	From this point on, the process is identical to that for any other cable. You do not have to do anything else to finish programming and to test this cable with embedded switches. Select <b>Ok</b> to save the test procedure in the internal database.

## 5.8.4 Manual Entering Temporary Switches (Keys)

Name / <u>P</u> rompt	<u>A</u> dapte	rs
<u>L</u> ow Voltage	Compone	nts
<u>H</u> igh Voltage	<u>N</u> et Li	st
More Op <u>t</u> ions	P <u>r</u> in	t
T <u>e</u> st Now	<u>Cancel</u>	<u>o</u> x

<u>R</u> esistors	<u>K</u> eys	
C <u>a</u> pacitors		
Diodes		
<u>B</u> lack Boxes		
<u>T</u> wisted	l Pairs	

C 6TEST		Selec	t Key	E
± •	Ŧ	<u>A</u> dd	<u>D</u> elete	<u>о</u> к
┛╺	►	<u>E</u> dit	<u>L</u> abe l	

Edit Key

OΩ min

More Options.. Label OK

N/0

N/C

0Ω max

Terminal <u>1</u> (+)

Terminal <u>2</u> (-)

Ualue 🗌

<u>T</u>est

From the Set Test Parameters menu, select **Components** and the *Edit Component List* dialog appears.

Select Keys.

(i)

The *Select Key* dialog box is empty if no keys were detected during the learn process, or if you did not select the **Switches** option within a custom learn.

Select Add to manually enter this component.

Add as many keys as you have in your product.

Adding resistors increments existing resistors by 1. Each new resistor will be R1 and the current R1 becomes R2, the current R2 becomes R3 etc...

Highlight the first and select **Edit**.

The Edit Key dialog opens with no information present.

Select Terminal 1 (+) to assign it the proper net.

10pen N	et and :	Pick Term	inal 🖪
0.0			
~Net(J)	.či.ić		
~Net(J]	. <u>ci.is</u>		
~Net(J)	C1.20		
	<b>1</b> (		$ \rightarrow $
É ≜ Ĕ	X <it< td=""><td><u>C</u>ancel</td><td>ок</td></it<>	<u>C</u> ancel	ок
┫┲┝	Ogen	Twisted	<u> </u>

The Open Net and Pick Terminal dialog appears.

Using the arrow keys, scroll the cursor to highlight the correct net/pin location for Terminal 1

Select **Open** to select a pin. If the net only has a single pin, select **Ok**.

C Pic	k Terminal 🔳
<b>D</b> @Resistor	
$^{-11.01.1}_{-3.01.1}$	SVS18)
~ J3.CI.I (	313027
	,
± • Ŧ	<u>C</u> ancel
	<u>o</u> uncer ox
	<u>_</u>
1C	Edit Key
Terminal 1	(+) J1.C1.17

0Ω min

More Options.. Label OK

<u>C</u>ance l

Twisted

J1.C1.17

J1.C1.21

<u>L</u>abe l

N/C

0Ω max

<u>о</u>к

0Ω max

<u>о</u>к

Terminal <u>2</u> (-)[

let(J1.C1.2)

┣

Terminal 1 (+)

Terminal <u>2</u> (-)[

More Options.

Ualue 🗌

<u>T</u>est

¥ %413

O<u>p</u>en T<u>w</u>i Edit Key

OΩ min

Jalue 🗌

Test

Highlight a pin and select **Ok** to accept the location of Terminal 1.

The first terminal is displayed.

Repeat the above operation for Terminal 2.

When the terminals properly identified, you now need to program the value of the component.

If your product is attached with the proper resistance in place, select **Test** view the measured value.

<b>C</b>	Touch key	H generali
-2°30,3	Open	1)
lus	<u>A</u> dvance	258 X

Press and hold the key on the product.

Teres	l) Touch key	H ;;
Terns	OK: 47.48Ω	
Value Tes	<u>A</u> dvance	<u>899 X</u>

C Edit	Key	H
Terminal <u>1</u> (+)[	J1.C1.	17
Terminal <u>2</u> (-)[	J1.C1.	21
Ualue OΩm	in O	Ω max
<u>T</u> est 0	K: 47.489	2
More Options	<u>L</u> abe l	<u>о</u> к

The Horizon will measure the resistance values of the key.

Select **Advance** or release the key on the product to display the value on the *Edit Key* menu screen.

The Horizon engages the measurement circuitry to display the value of resistance between the selected terminals.

Select Value to set the tolerance

	Select Detect Mode
	Change T <u>a</u> re Value
	C <u>h</u> ange Thresholds
ţ,	utodetect <u>I</u> hresholds
	<u>C</u> ance l

C Edit	Key	<b>[</b> ]
Terminal $1 (+)$	J1.C1.	17
Terminal <u>2</u> (-)	J1.C1.	21
Ualue OΩm	in 50:	Ω max
<u>I</u> est		
More Options	<u>L</u> abe l	<u>о</u> к

Select **Change Threshold** to manually set the threshold for the product

Set the minimum and maximum threshold.

The threshold is displayed.

Select Ok to return to the keys list.

### 5.8.5 Four-Wire Measurement and Switches

#### 5.8.5.1 Overview of the Four-Wires Measurement and Switches

For test setups using a Kelvin fixture as opposed to a Kelvin adapter this section applies. If you are using a Kelvin adapter you need not read this section.

The Four-wire (Kelvin) resistance measurement is possible even when the product that is tested has got embedded switches or, for some other reasons, is tested in multiple steps.

In general a four-wire resistance measurement setup consists of:

- 1) The Horizon system,
- 2) The Kelvin test fixture and
- 3) The product to be tested.

#### 5.8.5.2 Using the Four-Wires Measurement and Switches

When programming a cable using a Kelvin test fixture, the tester has to go through 2 steps:

1) Learning the Kelvin fixture and

2) Learning the cable's NetList.

Set fixture for the 1st pos. then press OK to learn it.

<u>C</u>ance1

Cancel to end learning.

<u>O</u>k

This applies to the products that have embedded switches or that are to be tested in multiple steps. Each different switch position or each different test step must learn both the Kelvin fixture and the cable's NetList.

Learn Settings	From the
Twisted     Nets Only       Free Ends     Kelvin       Conductor Max Res     50       Use Kelvin Probe	Select <b>Kelvin</b> and then select <b>Ok</b> .
Component Settings     I       Resistors     Capacitors       Diodes     Switches       Back     Cancel     DK	Select <b>Switches</b> and then select <b>Ok</b> .
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Have the adapter(s) and the Kelvin test fixture connected to the system in their proper positions. If standard Horizon adapters are used the system will auto-detect them in most cases
Learning The Fixture For Kelvin Measurement Please insert the fixture cable without the sample without press RK You will be prompted after the fixture has been	After the adapter(s) / Kelvin fixture(s) are properly inserted select <b>Ok</b> to get to this screen.
learned. Note the fixture bo not remove the fixture unless you are prompted so. <u>Ok</u>	By selecting <b>Ok</b> the system starts learning the configuration of the Kelvin fixture. The product that is supposed to be tested must not be connected at this time since it will affect inadvertently the learning of the Kelvin fixture's structure.
] Learn Kelvin Fixture 🛄 for Switches	Since the product will be tested in several steps, it is

Since the product will be tested in several steps, it is possible that the Kelvin fixture's structure (NetList) will be different for each one of the steps.

This screen asks you to make sure that the Kelvin fixture is configured for the first testing step.

Select **Ok** when the fixture is configured properly.

1] Learn a New Cable	Н				
with Switches					
Switch to the 1st position then press OK to learn it.					
Cancel to end learning.					
	J				
<u>O</u> k <u>C</u> ance 1					

)] Enter Prompt Line #1	H
PRODUCT LOADED	)
QWERTYUIOP	ן
	]
09 Space Bar Clear	

After the Kelvin fixture is learned you are prompted to connect the product in its first switching position (first test step) configuration.

Please make sure the product is appropriately connected and then select **Ok**.

After the first switching position (first test step) is learned you are asked to enter up to three prompt lines.

Of course you will enter your own message, something that reflects the step being performed.

The prompt lines are displayed at the test time for the operator to know how to configure the product under test.

When Horizon is operated in an automated mode, the display message is rather informative, telling which step is being performed.

1] Enter Prompt Line #2 PLUNGER DEPRESSED QWERTYUIOP ASDFGHJKL ◀ Z X C V B N M ESC nte 0..9 Space Bar Clear Enter Prompt Line #3 QWERTYUIOP A S D F G H J K L 🚽 Z X C U B N M ESC nter 0..9 Space Bar Clear 1] Learn Kelvin Fixture for Switches Set fixture for the 2nd pos. then press OK to learn it. Cancel to end learning.

<u>O</u>k

<u>C</u>ance1

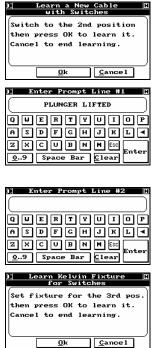
This is an example of a second prompt line.

If you don't need the third prompt line, just select **Esc**. You can actually skip by selecting **Esc** in any of the three prompt line screens. All subsequent (if any) prompt line screens will be skipped.

Now, once the first switching position (first test step) is completely defined, the system prompts you for the second switching position.

At this step you have to configure the Kelvin fixture for the second test step.

Do not forget to disconnect the product to allow for proper test fixture learning.



After the Kelvin fixture is learned in its second configuration, you are prompted to connect the product under test in its second configuration.

Again, after the product's second test step configuration is learned, you can enter up to three prompt lines.

Selecting **Esc** will skip past the current and any subsequent prompt line screens.

This is an example of a blank prompt line.

You are now prompted for the third switching position. If the cable is to be tested in two distinct switching positions only, select **Cancel** here to go to the next step.

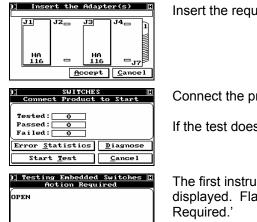
#### 5.8.6 Testing Cables with Switches

The testing procedure for a product with embedded components is the same as testing any other cable or harness. For details, consult section 2.

1] Select Part Number
Part Numbers
00CAPACITOR Rev.1 00FLEX TEST Rev.1
DOFLYING LEADS Rev.1
OGRESISTOR Rev.1
BESWITCHES Rev.1 BETEST CABLE #5% Rev.3
<b>★ ▲ ¥</b> Re <u>f</u> resh <u>D</u> elete
▼ ► Back Cancel OK
1] Test Configuration
Currently Selected Cable
Currently Selected Cable File Name: datab\cables\MAIN\SWITCHES.CB L Part. Number:
Currently Selected Cable File Name; Gatab\cables\MAIN\SWITCHES.CB Fart Number; SWITCHES
Currently Selected Cable File Name: datab\cables\MAIN\SWITCHES.CB L Part. Number:
COURTENTIU SElected Cable File Name: databloables\MAIN\SWITCHES.CB Part Number: SWITCHES: Rev.1
Currently Selected Cable File Name; datab\cables\MAIN\SWITCHES.CB Part Number; SWITCHES

Highlight the product you wish to test. Select **Ok** to continue.

Select Test Now to begin testing the listed product.



<u>C</u>ance 1

<u>o</u>κ

(i)

Insert the required adapters.

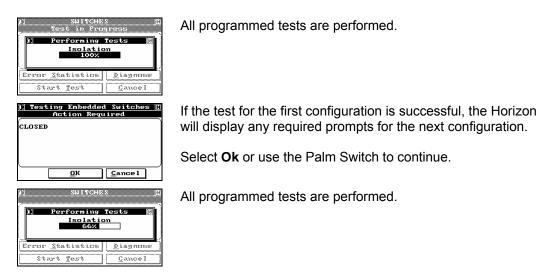
Connect the product you are testing to begin the test cycle.

If the test doesn't automatically begin, select Start Test.

The first instructional prompt you programmed will be displayed. Flashing at the top is the message 'Action

After the instructions are carried out, push **Ok** and the Horizon will completely test the first configuration.

Regardless of the **Palm Switch** settings (set within the System Setup), you may use a Palm Switch to advance the Horizon through a test with switch positions.



C SWITCHE:	S E
Disconnect P	roduct
Tested :         1           Passed :         1           Failed :         0	
Error <u>S</u> tatistics	<u>D</u> iagnose
Re <u>t</u> est	<u>C</u> ance l

If the system passes the second switch position the operator is prompted to disconnect the product to reset the system for the next test.

You may select **Retest**, to test the current product again. If your test included specific values for Continuity or Isolation; or, if you ran a Linear Hipot test, you can select **Diagnose** to view the results.

#### 5.8.7 Prompt / Abort / Ignore / Retry

2	Tes	t ph	ase :	faile	ed f	н
R	etry	] 🖻	bort	٦I	gnore	ור
R	_					
<u>R</u>	_		bort		gnore 218338	

Under General in the System Setup, user's of the Horizon have the option to enable and disable a feature specific to Switch Tests.

The option is labelled FAIL. Please review section 3 for greater detail on setting the option.

- Abort Should a product with multiple states (switches) have a failure the test will abort and the product fails.
- **Retry** Should a product with multiple states (switches) have a failure the user will be prompted to try the same position again until the position passes or Cancel is selected.
- **Ignore** Should a product with multiple states (switches) have a failure the failure will be logged and the user will be able to continue testing the product advancing to the next switch position.
- **Prompt** During a test with multiple states (switches) a failure will cause the Horizon to prompt the user to select either Abort, Retry or Ignore.



The Horizon keeps track of each switch configuration separately.

### 5.8.8 Error Reporting for Switches

All common cable faults are reported in this mode as they are for general cable testing. The switch mode differentiates by keeping track of each switch configuration separately.

Reported Results: ALL Test Program: SWITCHES 07/30/1999 14:06:31 -Switch Position 1: +Net(11.0.13:03/2(1.13) open -Switch Collage -Switch Collage -Switc	0	Τe	est Rep	ort	н
07/30/1999 14:06:31		Reporte	ed Resu	lts: f	1.1.1
l.	07/3	30/1999	14:06:	31	) open
<u>P</u> rint <u>O</u> K			<u>P</u> ri	nt	<u>o</u> ĸ

In this example, the cable passed all tests in configuration 2, but the net containing J1.C1.13 and J3.C1.13 was open in configuration 1.

# **6 ADAPTERS**

How to Define New Adapters and Add Them to the Library



## 6.1 Introduction

This section is an in depth discussion of the process of "Learning" an adapter or fixture and adding it to the Horizon's internal database. This process only needs to be done one time for a given adapter or adapter type, unless that adapter is physically modified or its specifications are changed. For example, if an adapter for a DB25 connector with an ungrounded shield is learned, then that adapter is used to the point that it must be discarded and replaced with an identical adapter, the new one does not have to be relearned. If, however, you decide to ground the shield, this would represent a new adapter specification and it would have to be relearned.

(i) If you purchased any of the more than 300 adapters that are in the CableTest catalogue or price list, they are already part of the library and do not have to be relearned unless you are using them as part of a fixture of your own design.

#### Why should I learn a fixture?

Fixtures are mechanical platforms that are normally separated from the top of the Horizon and are connected to the Horizon by some sort of interface cable. They are usually designed to accommodate a number of connectors or connector types, and to optimize the production flow of a given shop. (It is beyond the scope of this manual to engage in a detailed discussion of fixtures. If you would like to build one, and are unsure about how to proceed, contact your authorized CableTest Representative for more details.)

As part of the learning process, the Horizon effectively can recalibrate itself to the surface of the fixture. The net effect is greater testing accuracy of your products, with much less chance of erroneous results.

You should learn a fixture after it is built, even if it is based on CableTest supplied adapters.

#### Can I build my own adapters?

(i)

If you would like to build some or all of your own adapters, contact your CableTest Representative for details. After they are built, each will need to be learned using the following procedures.

## 6.2 Learning an Adapter

). Main Menu 🚺						
Thu Sep 11 1997 01:40 PM						
<u>I</u> est <u>S</u> elf-Test						
S <u>y</u> stem Setupî <u>P</u> rogram Cableî						
<u>Backup</u> Î <u>E</u> dit Adapter Î						
▲ Contrast ▼ Shut <u>D</u> own						
)] Programming Adapter 🔲						
<u>M</u> odify Existing Adapter						
Learn New Adapter						
<u>T</u> est Adapter						
Advanced <u>N</u> et	Advanced <u>N</u> etlist Editor					
<u>C</u> an	 Cance l					

Enter Part Number
SPECIAL
QWERTYUIOP
QWERTYUIOP ASDFGHJKL4
$Z \times C \cup B \in M$ $\mathbb{E}$ <u>0</u> 9 Space Bar <u>C</u> lear
09 Space Bar Clear

	Adapter Library
89	Single (max 32 points)
CF CF	Double (max 64 points)
1.8	Quad (max 128 points)
*	Huge (max 1024 points)

 $(\mathbf{i})$ 

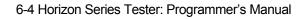
To learn an adapter, select **Edit Adapter** from the *Main Menu*. The *Adapter Library* dialog appears.

Selecting **Learn New Adapter** starts the process for incorporating a new adapter into the library and brings up the *Enter Part Number* screen.

Input the desired name or part number for the adapter. The name can be up to 30 characters long, and can include any valid, visible ASCII character, including #()?/, etc. When you have finished typing the name, select **Enter** to accept the input and display the *Enter Adapter's Size* screen.

The top of the Horizon (or an expansion box) is divided into two sections, each of which has four gray connectors. An adapter that uses a single set of these gray connectors is referred to as a **Single**, while one that uses all four connectors in a section is referred to as a **Double**. An Adapter that uses all eight connectors in a box is called a **Quad**. A **Huge** adapter can actually be of any size, but is normally applied to fixtures and adapters that span or use multiple boxes. It is also commonly used with back wired boards of up to 1024 points. The main identifying characteristic of a Huge adapter, other than the number of pins, is that it has no automatic self-identification capability and must therefore be specifically identified when products are tested. Select the size appropriate for your adapter.

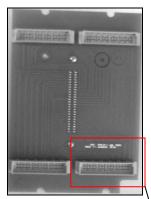
Single, Double, Quad or Huge, have nothing to do with the number of connectors on an adapter, nor with the number of points used, but only with the maximum number of test points available. For example, a Single might have three DB9's mounted on it for a total of 27 pins with 5 unused. It also has nothing to do with the type or configuration of the cables being tested. For example, you could fully test a cable with a DB9 connector, or a harness



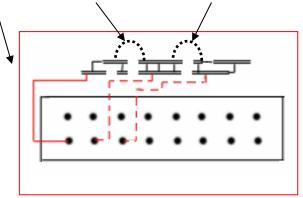
with three DB9 connectors on the adapter just mentioned.

(i) If you select **Huge** as the adapter type, since Huge does not self-ID, the Horizon will skip the next few steps and go directly to the *Enter Number Of Connectors* dialog.





For the other three types, you will enter the Enter First ID Type menu. There are two ID positions on a standard adapter. These can be populated with any desired combination of resistors and/or capacitors. Select the button indicating the type of the first ID component on your adapter. If the choice is **Resistor** or **Capacitor**, the *Enter The Value* Of First ID Component dialog appears. Selecting None indicates that there is no first ID component. Hardwired is a Cirrus compatible ID scheme that uses short circuits between several test points not used by the product to be tested. The major disadvantage of this method is that it uses valuable test points that you might need for cables. The main reason for its inclusion here is that, if you already have Cirrus adapters, you can use them directly on a Horizon by means of a special adapter (E.g. HA 245). If you select None or Hardwired, the next step is skipped. **ID COMPONENT #2 ID COMPONENT #1** 



(i)

I	Enter The Value Of First ID Component					
$\square$	1000.000					
<u> </u>	1	з	<u>C</u> lear			
<u>κυ</u>	4	5	6	BS		
	7	8	9			
◄►		э	Esc	Enter		

The Horizon will automatically measure the value of the component, if any are present, mounted in the first ID location. If this value is what you expected, select **Enter** to accept it and go to the *Enter Second ID Type* menu. In the example shown, it is a  $1000\Omega$  resistor. If it is not what you expected, check the value of the component before going on.

(i) If you have not mounted any components as yet, or you plan to install new values, you can override the measured value at this time, but don't forget to install the proper values later. Otherwise, the Horizon will not correctly self-ID the adapter.

The recommended range for ID resistors is between  $100\Omega$  and  $100k\Omega$ . You must use metal film resistors with a 1% tolerance. Capacitors can range between 100pF and 100nF. Capacitors must be able to withstand the HiPot test voltages of up to 1500kV, and have a tolerance of at least 2%.

	Enter	Second	ID	Type	$\square$
생		<u>R</u> esist	or		8
CF CF HF		C <u>a</u> pacit	or		00
14		<u>N</u> one			
*		<u>H</u> ardwir	red		

Enter The Value Of Second ID Component					
	1	500.00	0		
[ U]]	1	2	з	<u>C</u> lear	
KU	4	5	6	BS	
	7	8	9		
	Image: Constraint of the sector of the secto				

Enter The Number Of Connectors				
2				
1	2	3	<u>C</u> lear	
4	5	6	BS	
7	8	9	<b>.</b> . ]	
0		Esc	Enter	

The second ID component does not have to be of the same type as the first, so you are asked to enter the component of choice. Again, if the choice is Resistor or Capacitor, the *Enter The Value Of Second ID Component* dialog appears. As before, if you select **None** or **Hardwired**, the next step is skipped.

The Horizon automatically measures the value of the component, if any are present, mounted in the first ID location. If this value is what you expected, select **Enter** to accept it. In the example shown, it is a  $1500\Omega$  resistor.

Input the number of connectors mounted on your adapter. Remember, there is no restriction as to the number and type of connectors that can be used on one adapter, so long as the total number of test pins does not exceed the maximum for the adapter type selected (32 for a Single, 64 for a Double, and so on). In the example shown, there are a total of 2 connectors mounted on the adapter. Select **Enter** to access the *Enter Connector 1'S Name* menu.

Enter Connector 1'S Name
DB9 #1
1234567890
* • • • • • • • • • •
#   \$   <   >   %   "   '   Esc
<u>A</u> Z Space Bar <u>C</u> lear

Input a name for the first connector. This name can be up to 30 characters in length and can consist of any character. It is good practice to base this name on some easily identifiable feature of the connector, such as its type, color, manufacturer's part number, etc. After you have finished, select **Enter** to access *Enter Connector 1'S Nr. Of Pins*.

C En	ter #	of Pi	ns 🕅
	9	Ð	
1	2	3	<u>C</u> lear
4	5	6	BS
7	8	9	
0		Esc	Enter
[] Edit Co	nnect DB9	<u>or's N</u> #1	etlist 🗱
Conn.Pin Sys.Pin & Sense			
ุ่งเวลาม			===
45			===
치비핀	<u>1</u> 2/AB	<u>K</u> elv	in √
ৰি হিচা	Edit	Prin	t OK

Input the number of test pins associated with the first connector. Select **Enter** to go to the *Enter Connector 1'S Netlist* dialog.

You now need to map the Horizon's internal pin/switch designators to the connector pin number

(i) The **Kelvin** toggle is provided for the two special cases; Kelvin adapters, and adapters with shorted pins. For standard adapters the toggle has no effect. It is recommended for non-Kelvin Huge adapters to disable the feature - this will increase the probing speed as you learn your adapter.

Using the provided ground probe, touch the tip to each connector pin in its standard numbering sequence. The Horizon maps the connector pin to its corresponding system pin (column one) and displays a pin map similar to the one at the left. The second column (Sense) is reserved for the special case, Kelvin adapters.

The Horizon is equipped to let the user define the numbering convention needed for their adapter.

If your connector uses a unique numbering convention, select **12/AB** to open the *Conventions* list. If the convention you wish to use is not present, you can add it to the conventions listed.

You may also edit each individual connector pin name by highlighting the **Conn. Pin** and selecting **Edit**. See below for more details.

When finished, select **Print** if you wish to print out the completed pin map. Otherwise, selecting **Back** will cycle you to the menu for the next connector on the adapter.

)] Enter S [enter	ystem er 102	Test 1 4 for	Point # N/Cl	54
	3	z		2
1	2	3	<u>C</u> lear	
4	5	6	BS	
7	8	9		
0		Esc	Enter	

You can manually enter system pins or define a point as NC (not connected) by highlighting the Conn. Pin and selecting **Edit**. Enter the associated system pin number, select **Enter**, and you will return to *Enter Connector 1's Netlist*. Continue in this manner until all pin numbers have been mapped. When finished, select **Print** and/or **BACK** as above.

Enter 1024 for N/C (not connected) pins.

(i) If the Kelvin toggle is enabled, selecting **Edit** will prompt the user to enter values for both the Sys. Pin and Sense pins - if your adapter is not a Kelvin adapter, the default 1024 (NC) should be present in the Sense column. With Kelvin disabled you are prompted only for the Sys. Pin value.

)] Edit Pin's Name 🔳
1
QWERTYUIOP
QWERTYUIOP ASDFGHJKL ZXCVBNMEss Enter
09 Space Bar Clear

In the Edit mode, the operator is also given the opportunity to give the connector pin a unique name. The entered value will be used instead of the default numerals.

i

The option to name pins at this level is limited since no lower case letters are available. To properly set a numbering convention it is recommended to use the Conventions feature as described in section 0.

)] Edit Connector's Netlist 🗱
DB9 #1
Conn.Pin Sys.Pin & Sense
1 23
2 30 3 1 4 9
4 9
Ľ
<b>★</b> ▲ ¥ <u>1</u> 2/AB <u>K</u> elvin □
◀ ♥ ▶ <u>E</u> dit <u>P</u> rint <u>O</u> K
C Edit Adapter C

1. Edit Adapter SPECIAL			
Part Number	C <u>a</u> p Tare		
<u>I</u> D Components	<u>R</u> es Tare		
Co <u>n</u> nectors			
Cancel	ОК		

Repeat the above steps for any and all remaining connectors. After you have programmed all *n* connectors, where *n* is the total number of connectors declared, selecting **OK** will open the *Edit Adapter* menu.

From the *Edit Adapter* menu, you have the option to edit any of the adapter's properties.

Part Number: Edit or change the name of the adapter

ID Components: Re-enter or re-detect values of id components.

Connector List: Edit connector names and pin mapping of an adapter.

## 6.3 Taring the Adapter/Fixture

If you are adding a fixture to the Adapter Library, you may desire to Tare the fixture so the resistance and capacitance is not reflected in the Horizon's results.

You can Tare your fixture right from the Edit Adapter menu.

<u> </u>

**Cap Tare:** For increased capacitance measurement accuracy, the capacitance of the adapter may be learned and utilized as a tare value.

1] Adapter Resistive Tare 🛄
1) Plug adapter in proper po- sition: leftmost for single,
double and quad adapters and final test position for huge
(test fixture) ones.
<ol> <li>Remove product under test from adapter.</li> </ol>
3) Connect shorting plugs to all connectors that need to
be tared. 4) Press OK to perform resis-

Res Tare: For increased resistance measurement accuracy, the resistance of an adapter can by learned and utilized as a tare value. In order to perform this function, you must short all points together that are contained on each connector.

(i)

To tare a connector you must have a minimum of three (3) test points.

Ô	Save Adapter Re	cord?
	<u>Y</u> es <u>N</u> o	
DÌ	Do you want Abandon Chan	to 🛄
f		ges?
	<u>Y</u> es <u>N</u> o	

Select **Ok** to save the learned adapter.

**Cancel** prompts the operator to confirm abandoning the new adapter.

#### Adapters

#### Adapter as ADP File

```
S
     \datab\adapters\special.adp
                                   For greater detail see section 9.1.3.
*ADAPTER*, SPECIAL
                           (\mathbf{i})
*SIGNATURE*,1,1000,1,150
                                   This file can be edited using any text editor or
0
                                   word processor, however if you use a word
*SIZE*,1
                                   processor it is imperative to save the file as Text
*CONNECTOR*, DB9 #1,
12,1,,,,
                                   Only, otherwise you will not be able to utilize it.
11,2,,,,
10,3,,,,
9,4,,,,
8,5,,,,
13,6,,,,
14,7,,,,
15,8,,,,
0,9,,,,
*CONNECTOR*, DB9 #2,
7,1,,,,
5,2,,,,
1,3,,,,
2,4,,,,
3,5,,,,
6,6,,,,
4,7,,,,
28,8,,,,
24,9,,,,
```

## 6.4 Testing a New Adapter

If you create an adapter for the Horizon, it is a good idea to test it before entering it into the database.

(i)

This feature is also useful for troubleshooting existing adapters and fixtures.

1) Main	Menu 🖸		
Tue Aug 25 1	998 03:13 PM		
<u>T</u> est <u>S</u> elf-Test			
S <u>y</u> stem Setup <u>P</u> rogram Cable			
<u>B</u> ackup	Edit Adapter		
🔺 Contrast 🔻	Shut <u>D</u> own		
1] Programming Adapter [			
<u>M</u> odify Existing Adapter			
<u>L</u> earn New Adapter			
<u>T</u> est Adapter			
Advanced <u>N</u> etlist Editor			
<u>C</u> ance 1			

From the Main Menu select Edit Adapter.

From the Programming Adapter menu, select Test Adapter.

)] Probe any a	dapter p	in. 🗱
Conn.Pin Su	s.Pin &	Sense
2		
204560	===	===
56	===	===
<u> </u>		
🛓 🔺 ¥ 12/93	<u>K</u> elvin	- <b>J</b>
<ul> <li>****</li> </ul>	<u>P</u> rint	<u>0</u> ĸ

Using the standard ground probe for the Horizon, touch all the pins on the adapter to verify they have continuity to system pins and to verify whether any shorts exist or if Kelvin connections are all existent and correct. Once complete, select **OK** to return to the *Programming Adapter* menu.

## 6.5 Connector Pin Conventions

Connector pin conventions can take many forms. The Horizon allows the user to create their own conventions and add them to the convention database.

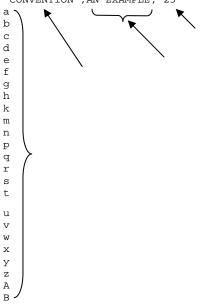
To add conventions you need to first create the file. On a computer use an available text editor (MS DOS[™]: Edit, Windows[™]: Notepad or Wordpad).

There are only 3 absolute requirements for the file:

1) The string ***CONVENTION*** must start the file along with a name for the convention and the number of pins it supports.

2) The file must have the extension '.CNV'

3) The file must be stored in the CONVENT subdirectory of the Horizon database. EXAMPLE: *CONVENTION*, AN EXAMPLE, 25



Save the new file as 'Text Only' using up to 8 characters and the CNV extension.

#### E.g. example.CNV

(i)

If you create the file using a word processor (like Word or Word Perfect) it is imperative you save as "Text Only")

#### Adding the file to the Horizon:

To add the file to the Horizon database you can use one of two methods. The first is to manually copy the new file to appropriate subdirectory on the Horizon's hard drive.

#### C:\v4.0\datab\convent

Or, you can use the client software to assist you.

On a blank diskette, create a subdirectory (or Folder) called Convent. Copy the new convention file(s) into this directory on the diskette.

Hain Menu     He       Tue Aug 25 1998 03:13 PM       Test       Self-Test       System Setup       Program Cable       Backup       Edit Adapter       A Contrast V	From the <i>Main Menu</i> of the Horizon, select <b>Backup</b> .
1] Backup - Restore Shell [7] <u>B</u> ackup <u>R</u> estore <u>S</u> ave Log Files <u>M</u> ore Options <u>C</u> ancel	Select <b>Restore</b> .
CAll       [P]artial       [N]one         Cable Files       A P N I         Adapter Files       A P N I         Convention Files       A P N I         Piotures Files       A P N I         Qancel       QK	Toggle <b>Test Programs</b> and <b>Adapter Files</b> to the <b>N</b> position (the check mark will appear next to the N). Select <b>Next</b> to continue.
Select Restore Options Edili (Nione  Convent	The file(s) will be copied.



You will be prompted whether you wish to restore from another disk.

If you have no other files to restore or copy to the database, select No.

#### 6.5.1 Special Case: The Kelvin Adapter

91 4

Should you wish to define your adapter as Kelvin (please see Appendix F: Case Studies for an explanation of Kelvin), the Kelvin feature must be enabled before probing adapter points.



12

★ ▲ ¥ <u>1</u>2/AB <u>K</u>elvin √ ▼ ▶ Edit Print OK

Select Kelvin on the Edit Connector's Netlist dialog in order to ensure a Kelvin connection is learned. A check mark will appear next to the option.

By defining an adapter as Kelvin, you are essentially assigning two system pins to each connector/adapter pin. In this scenario both column one and column two will have system numbers assigned.

 $(\mathbf{i})$ 

241567

It is important to remember that the number of system points it will utilize defines the size of an adapter. In the case of an 18-pin connector defined in Kelvin, 36 system pins are used. That makes the adapter a double as opposed to a single.

Adapter as ADP File S

\datab\adapters\kelvin.adp

#### Adapters

```
*ADAPTER*,KELVIN,

*SIGNATURE*,3,00000000,3,00000000

*SIZE*,1

*VERSION*,4.0.0

*CONNECTOR*,,

38,1,,46,,,

0,2,,8,,,

39,3,,47,,,

16,4,,24,,,

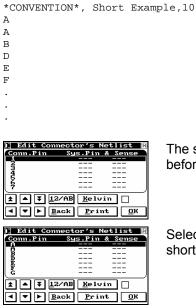
.
```

#### 6.5.2 Special Case: Shorted Pins

In some rare cases an adapter may have two pins that are shorted together. In order to assist the Horizon to compensate for this scenario, two important steps must be followed:

The first important step is to create a convention (as described in 0) that represents the adapter as it exists.

For example, if pins 1 and 3 were shorted together, you must give them identical labels:



The second important step is to disable the **Kelvin** toggle before probing the adapter pins.

Selecting **12/AB**, you can select the new Convention for the shorted pin adapter.



(i)

Probe the adapter. The system will find the two system points for the shorted adapter points, and will place them in sequence.

It is essential to disable the Kelvin toggle before probing this special case adapter. If not the system will learn the shorted points as Kelvin points.

#### Adapters

Adapter as ADP File				
(S) \datab\adapters\shorted.adp				
*ADAPTER*,SHORTED, *SIGNATURE*,3,0000000,3,0000000 *SIZE*,1 *VERSION*,V4.2.24 *CONNECTOR*,, 18,A, 19,A, 20,B, 21,D, 22,E, 23,F, 28,G, 6,H, 7,J,				
15,K				



## Editing an existing Adapter

Never edit or alter an adapter file if it has been used to learn a product. If you alter an adapter after creating a test program you will need to relearn the product.



Select Modify Existing Adapter to edit an adapter.

If you want to edit some or all of the adapter's settings, move the arrow keys to highlight the desired adapter, then select **Ok**. The *Adapter Settings* menu will be displayed.

I <u>Edit Ad</u> SPECI			ŀ
<u>P</u> art Number	С <u>а</u> р	Tare	
<u>I</u> D Components	<u>R</u> es	Tare	
Co <u>n</u> nectors			
<u>C</u> ance l		<u>o</u> k	

From this menu, you can edit any or all of the programmed parameters associated with a given adapter. Selecting **Part Number** allows you to rename the adapter as described at the beginning of this section; selecting **ID Components** takes you through the ID components process previously discussed; pushing **Connector List** lets you re-map the adapter as described above.

1)Save	Adapter Record?
	Yes No

1] Do you want t Abandon Change

Yes No

Select **Ok** when finished to save and return to *Adapter Library*.

Selecting **Cancel** also returns you to *Adapter Library*, but with no action taken.

# 7 GENERATING REPORTS AND BATCH TESTING



## 7.1 Generating Reports

As part of your test procedure, you can include reports for each cable tested. These reports can either be printed or saved to file.

Report settings can be either **Global** or **Test Program Specific**. The following section details setting up Global Test Report Settings. The settings will effect all tested products.

If you wish to have different report settings for individual test programs, see section 9.1.5. Setting up reports

Reports are setup up from the Test Configuration menu.

From the *Main Menu*, select **Test** to access the *Test Configuration* menu.

I IESC CONFIGURACION			
	ly Selecte : bles\MAIN\ ber: LE #\$%		
Too <u>l</u> s	<u>R</u> eports		<u>S</u> elect
<u>T</u> est Now	<u>B</u> atches		<u>C</u> ance 1
C Re	eport Sett	ings	5
<u>G</u> ene	eral		
<u>T</u> est R	eports		
Operat	tor ID		
<u>R</u> epo	orts	]	
Ok			

Select General for General Report Settings.

#### 7.1.1 Print, Save to File, or Both

Select **Print To** to select the target for reports.

Printer:Writes reports to the parallel port of the HorizonFile:Writes reports to a log file.

Select both options sets the setting to **Multiple**. Reports will be printed and written to the log file.

#### 7.1.1.1 Printer Settings

)] General Report	Settings [
<u>P</u> rint To	Printer
<u>L</u> eft Margin	5
<u>W</u> idth	80
<u>F</u> orm Feed	
Bbbend	<u>о</u> к

In the example to the left, the report will be printed via the parallel port, with a 5 space left margin and each line consisting of 80 characters.

To set the width of the left margin, select **Left Margin**: The *Enter Left Margin* dialog appears. Enter a width from 0 - 32.

C	En	ter Lei [0	ft Marg .321	rin 🏼
		Ę	5	
	1	2	3	<u>C</u> lear
	4	5	6	BS
	7	8	9	Friday
		0	Esc	Enter

To set the width of the page, select **Width**: The *Enter Report Width* dialog appears. Enter a width from 20 - 1000.

(i) The default settings should suit most printers.

 1]
 Enter Report Uidth
 #

 [2001]
 [2001]
 [2001]

 80
 [2001]
 [2001]

 1
 2
 3
 [21ear]

 4
 5
 6
 BS

 7
 8
 9
 [Enter]

 0
 Esc
 [Enter]

Select **Form Feed** if you would like each test to be on a separate printed sheet – this must be selected if you plan to have a header or footer on your printed report.

## 7.1.1.2 File Settings

I General Rep	ort Settings 🔛
<u>P</u> rint To	File(s)
<u>L</u> eft Margin	5
∐idth	80
<u>F</u> orm Feed	
<u>A</u> ppend	<u>о</u> к

When the Print To 'File(s)' option is selected, the system saves the test results and the errors to two files. The .ALL file contains any report option that has been enabled, including the errors. The .ERR file contains only the errors. The file names are created from the product name by using the first few characters.

(i) Some character conversions may occur in order to render the file names valid.

**Append** enables the user to have each test appended to existing log files.

V Disabled (no check mark) each test overwrites the existing log.

Selecting **Ok** returns you to the *Report Settings* menu.

Report Se	ttings
<u>G</u> enera l	
<u>T</u> est Reports	]
O <u>p</u> erator ID	
<u>R</u> eports	
<u>0</u> k	

#### 7.1.2 Report Settings

Select **Test Reports** to configure the reports for your test.

)] Test Report Settings	H
Serial Number Options	٦
Test <u>R</u> esults None	
<u>A</u> uto Diagnose None	
<u>H</u> eader <u>F</u> ooter	٦
<u>T</u> est Parameters 🗌 <u>O</u> K	٦

#### 7.1.2.1 Serial Numbers

To serialize a product you are testing, select Serial Number Options.

Serial Number Options	
<u>N</u> one	
<u>M</u> anua l	
Auto	
SN ON FRII	
<u>0</u> ĸ	

The Serial Number Options dialog appears.

Manual Mode: The operator will be prompted for a serial number at the end of each test.

**SN on Fail**: Auto serial numbers will be incremented even if a product fails as well in manual mode the operator will be prompted for a serial number on fail products.

Auto: Serial numbers are incremented automatically after each tested product.

)] Enter First Serial Number [
BNC-1234-567
1234567890 8*()/4 #\$()/4
& * < ) / , : <b>4</b>
# \$ < > × · · Esc
AZ Space Bar Clear

1: Serial	Number	Setup	H
Initial	Servial	Numbon	
Interat		C-1234-55	
	ВГ	C-1234-61-	۲.
		ок	
			-

To setup an automatic serial number, enter the first serial number (up to 30 characters) and select **Enter**. The serial number can be comprised of both numbers and letters. The serial number will be advanced either alphabetically or numerically (depending on which is required) after each subsequent test and be logged.

Using the arrow keys, select which character(s) of the serial number you wish incremented after each tested product. Use the up arrow to increase the width of the cursor to include more characters or numbers of the serial number. Select **Ok** to accept the serial number and return to the *Test* 

Report Settings menu.

C	Serial Nu	umber	Options 🏼 🎉
<u> </u>	None		
	<u>M</u> anua l		
	<u>A</u> uto		J BNC-1234-
	<u>S</u> N on Fai	1	J
	<u>o</u> k		

The reports are configured to automatically increment a serial number for both passed and failed products starting with the number that is partially displayed.

#### 7.1.2.2 Report Contents

The **Test Results** button can be toggled between 5 choices:

None	Does not include any results in the report should the cable pass
or fail.	
Pass	Results are included only when a product passes.
Fail	Results are included only when a product fails.
Pass/Fail	Reports are generated for both Pass and Fail products; however,
results are excluded fro	m passed products and included on failed products.
All	Results are included for both passed and failed products.

The **Test Parameters** button toggles the check mark to be, present or absent in the neighbouring square. Present, the reports will include a list of the test parameters you have set; absent, they will be excluded.

#### 7.1.3 Autodiagnose

Selecting **Auto Diagnose** toggles between 5 options. The result of setting Auto Diagnose automatically opens the Test Results display at the end of each test with the display option selected here.

<b>None</b> or fail.	Does not include any results in the report should the cable pass
Pass	Results are included only when a product passes.
Fail	Results are included only when a product fails.
Pass/Fail	Reports are generated for both Pass and Fail products; however,
results are excluded fro	om passed products and included on failed products.
All	Results are included for both passed and failed products.

#### 7.1.4 Header and Footer

Header and Footer information can be added to the Printed and Logged reports

The Header and/or Footer can exist in two manners:

1) The first is on a per test cycle basis.

2) The second is on individual test cable basis (See Section 7 for details).

#### Specific Test Cycle Headers and Footers

The header and footer when entered will be added to all tested product regardless of individual test programs loaded.

1) Test Report Settings H Serial Number Options Test Results All Auto Diagnose All Header Footer Iest Parameters J OK	From the Test Report Settings menu, select Header.
COMPANY X QUERTYUIOP ASDFGHJKL4 ZXCUBNMESS	The number of lines for the Header is unlimited. The width of each line is limited by the maximum character width of the sheet to be printed on.
09 Space Bar Clear	Enter the first line and select <b>Enter</b> to move to the next line.
Image: Second system       Image: Second system <td< td=""><td>Enter the next line and select <b>Enter</b>.</td></td<>	Enter the next line and select <b>Enter</b> .
1 2 3 4 5 6 7 8 9 0	If all the lines are entered, select <b>ESC</b> to exit.
1     Test Report Settings     H       Serial Number Options       Test Results     All       Auto Diagnose     All       Header     Footer       Test Parameters     I	Select <b>Footer</b> to enter Footer information.
1)       Enter First Footer Line       H         OUR COMPANY       OUR COMPANY         Q       W       E       T       Y       U       I       O         A       S       D       F       G       H       J       K       I       A         Z       X       C       U       B       N       H       Esc       Enter         09       Space Bar       Clear       Enter       Enter       Enter       Enter	Enter the first line of your footer and select <b>Enter</b> to continue.

#### **Reports and Batches**

1     2     3     4     5     6     7     8     9     0       & #     (     )     ,     :     .     -     4       #     \$     (     )     ,     :     .     -     4       #     \$     (     )     ,     :     .     -     4       #     \$     (     )     ?     :     .     -     4       #     \$     (     )     ?     '     fiss     Enter       AZ     Space Bar     Clear     Enter	When a	all lines are enter, select <b>ESC</b> to exit.
)] General Report Settings     H       Print To     Printer       Left Margin     5       Uidth     80       Form Feed     J       Append     OK	í	For Headers and Footers to opera MUST set the reports to have a each tested product.

r Headers and Footers to operate correctly you JST set the reports to have a form feed after ch tested product.

#### 7.1.5 **Operator ID**

C Report Settings	H
<u>G</u> enera l	
<u>I</u> est Reports	
Operator ID	
Reports	
<u>0</u> k	
al Enton Chonstonic ID	



)] Report Set	tings 🛛 🖪
<u>G</u> enera l	]
<u>T</u> est Reports	)
Operator ID	JONATHAN
<u>R</u> eports	
<u>0</u> k	

Select Operator ID to include the name of the operator for this test session.

The ID can be up to 30 characters in length.

Select Enter and you will be returned to the Report Settings menu. Note the operator's name is present.

#### 7.1.6 **Enable Reports**

C	Report Settings	н
	<u>G</u> eneral	
	<u>T</u> est Reports	
	Operator ID JONATHA	N
	<u>R</u> eports J	
	<u>0</u> k	

The final setting is to select the reports to be activated. By selecting Reports, a check mark appears in the neighbouring square.

1] Test Configuration		
File Name	)les\MAIN\TES )er:	
	Reports J	<u>S</u> elect
<u>T</u> est Now	Batches	<u>Cancel</u>

Select **Ok** and the *Test Configuration* menu returns. Note the check mark present in the square next to the **Reports** button. If you do not select **Reports** on the *Report Settings* menu, then, this check mark will not be present and no reports will be logged for your test session.

# 7.1.7 Viewing Reports Saved to File

To view the reports generated by a test session that have been saved to file(s) follow these steps:

). Main Menu 🚺				
Thu Sep 11 19	997 01:40 PM			
<u>T</u> est	<u>S</u> elf-Test			
S <u>y</u> stem Setupî	<u>P</u> rogram Cablel			
<u>B</u> ackup î	<u>E</u> dit Adapterî			
🔺 Contrast 🔻	Shut <u>D</u> own			
]] Backup - Re	store Shell 🖪			

<u>B</u>ackup

Restore

<u>Save Log Files</u> More Options From the Main Menu, select Backup.

By selecting **Save Log Files**, the Horizon will save the log files, *<testname>*.ALL and *<testname>*.ERR, to a diskette inserted into the floppy drive.

For more details refer to section 8.1.

Select Cancel to return to the Main Menu.

	(			anne S	
1 Do	уоу Іос	want	to	erase	these
	165	<u>Y</u> es		<u>N</u> o	IFICE !
		<u>C</u>	83504	ΡĴ	

The user has the option to delete log files after transferring them to a diskette.

Select **Yes** to delete and **No** to continue without deletion.

You can read the log files saved to your diskette by using any text editor on your personal computer. The files are located in a subdirectory labelled 'logs' and another subdirectory labelled after the serial number of the Horizon the files originated; and, all the files have extensions .ALL and .ERR.

# 7.2 Batches

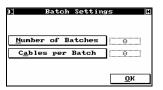
In many shops, it is often the case where the products (cables or harnesses) must be sorted or packaged in lots. It goes without saying that each product in the lot must be a good product. While this sounds trivial, in the press of running a production floor, keeping this straight can prove to be difficult. The Horizon has a special feature designed to help you if this is your situation.

# 7.2.1 Setting Up Testing By Batches

)] Main	Menu 🗉
Thu Sep 11 19	997 01:40 PM
<u>T</u> est	<u>S</u> elf-Test
S <u>y</u> stem Setupî	<u>P</u> rogram Cablel
<u>B</u> ackup i	<u>E</u> dit Adapterî
🔺 Contrast 🔻	Shut <u>D</u> own
1] Test Conf	:
Currently Sel	

File Name; GatabCoshes\MAIN\TESTCABL.CB Part Number; TEST CABLE #\$% Rev.1 Test Now <u>Reports Select</u> <u>Batches Cancel</u> The **Batches** feature is set up from the *Test Configuration* menu accessed by selecting **Test** on the *Main Menu*.

From this menu, select **Batches** to set up the batch parameters needed for a given product. Note that the operator must set this up for each testing session where batches are needed. In that way, using the batch feature is straightforward and will not require any special attention by supervisory personnel. Selecting **Batches** brings up the *Batch Settings* dialog.



batches; select **Cables Per Batch** to enter the number of cables per batch needed.

Select Number Of Batches to input the desired number of

I Enter # of batches

	!	5	
1	2	3	<u>C</u> lear
4	5	6	BS
7	8	9	
0		Esc	Enter

Batch Settings

 Number of Batches
 5

 Cables per Batch
 0

The example requirement calls for five batches of ten cables each. Selecting **Enter** enters the number of batches.

Select Cables per Batch.

			<u>о</u> к
<b>3</b> C]	Enter #	of cab	les 🚺
Ē		10	
	1 2	3	Clear
	4 5	6	BS

Number of Batches 5

C<u>a</u>bles per Batch 10

0 Esc

Selecting **Enter** inputs the number of cables per batch.

The *Batch Settings* menu shows that the data has been entered correctly. Select **Ok** to return to the *Test Configuration* dialog.

Once the values become active (not shaded) the batches feature has been enabled.

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<u>o</u>x

Test Configuration         H           Currently Selected Cable         File Name:           datablcables\MAIN\TESTCABL.CB         Fart Number:           Fart Number:         TEST CABLE		
Test Now Rev. 1	ports	<u>S</u> elect Cancel
• •	CABLE #\$	
	L of: 5 to ge	5 : 44
Error Statis	stics	iagnose

<u>Cancel</u>

Re<u>t</u>est

Re<u>t</u>est

Note that the box by **Batches** now has a check mark indicating that the Horizon will keep track of each lot as the cables are tested. Select **Test Now** to continue testing.

The *Test Cable* display has changed to reflect the data entered above. In the example shown, a total of six cables have been tested, of which all have passed. The batch portion of the display reflects this fact and indicates that an additional 44 good cables will need to be tested in order to fulfill the requirement. The failed cables have not been counted towards meeting the requirement. Selecting **Cancel** will force a return to *Test Configuration*.

The Horizon will indicate when each batch is filled with

1] Starting New Batch 🎇
This product belongs to a new batch. Press OK to continue.
<u></u> <u></u> D
1. TEST CABLE #\$%
Batch :       2       of :       5         Tested :       11       to go :       39         Passed :       11       Failed :       0
Error <u>S</u> tatistics <u>D</u> iagnose

The Horizon will indicate when each batch is filled with good cables. The user is prompted to acknowledge the completion of a batch.

The start of a new batch.

# 7.2.2 Batch Completion

<u>C</u>ance 1

<u>o</u>ĸ

The Horizon automatically recognizes when a batch or set of batches has been completed.



After you have successfully completed a batch or set of batches, the screen looks like this just before you disconnect the final passed cable.

As soon as you disconnect the last successfully tested cable, the Horizon prompts the user to acknowledge the last batch completed. Select **Ok** to return to the *Test Configuration* menu.

	t Configurat ly Selected	
File Name datab\cal	ies\MAIN\TE	TCABL . CB
L Part Number: TEST CABLE #\$%		
Rev.1		ļ
	<u>Reports</u>	Select
<u>T</u> est Now	<u>B</u> atches J	<u>C</u> ance 1

From here, you can set up another batch or set of batches, turn off batch mode and continue testing, select another cable and continue testing, or return to the *Main Menu*.

# **8 BACKUPS AND RESTORES**



# 8.1 Backups and Restores

# 8.1.1 Performing Backups

The Horizon allows you to safeguard your test programs and adapter library by backing them up to diskette. Simply follow these steps:

C Main	Menu H
Wed Mar 19 19	97 09:53 AM
<u>T</u> est	<u>S</u> elf-Test
S <u>y</u> stem Setupî	<u>P</u> rogram Cablei
<u>B</u> ackup î	<u>E</u> dit Adapterî
▲ Contrast ▼	Shut <u>D</u> own
1] Select remova perform backur Removable Drive D:	/restore with
	Cancel OK

From the *Main Menu* select **Backup**, and then enter a valid password and the *Backup* – *Restore Shell* is displayed.

The Horizon supports multiple removable media drives. Should for example have an external drive attached the unit the system will detect it and request the user to select the drive you wish to backup to or restore from.

Highlight the drive letter and select **Ok** to continue.

C	Backup - Restore Shell	ŀ
	<u>B</u> ackup	
	<u>R</u> estore	
	<u>Save Log Files</u>	
	More Options	
	<u>C</u> ance l	

The *Backup* – *Restore Shell* offers the user to easily perform backups and restores of the test program files and adapter library.

A backup transfers the files from the internal hard disk to a floppy diskette, while a restore transfers the files from a floppy diskette to the hard disk.

 $\bigtriangledown$ 

You are strongly advised to perform backups regularly. This is especially important after learning a new product, after performing a change in a test program, or after defining a new adapter. Make sure you store the backup diskette in a safe place.

Another good use of the backup/restore function is to transfer test programs or adapter library files between systems. When multiple systems are used to test the same product, you can learn the product on one system, then use the diskette to transfer the test program to other systems.

Select Backup to begin.

1] Select Files to Restore 🗱 [A]11 [P]artial [N]one			
C <u>a</u> ble Files	A 🗌 P 🗸 N 🗌		
A <u>d</u> apter Files	A J P 🗌 N 🗌		
Con <u>v</u> ention File	-s AJP		
<u>P</u> ictures Files	. A J P □ N □		
<u>C</u> ance l	<u>о</u> к		

Select the Items to wish to backup by toggling the button to either **A**, **P**, or **N**.

A	=	ALL
Ρ	=	Partial
Ν	=	None

1] Select Files to Restore 🧱 [A]11 [P]artial [N]one А∏₽√ЛΝ∏ Cable Files Adapter Files A 🛛 P 🗌 N 🗌 А ЈР 🗌 Н 🗌 Convention Files А **Ј**Р 🗌 N 🗌 <u>P</u>ictures Files <u>C</u>ance l ок Open Direct ory ory Name ▲ ¥ <u>R</u>efresh <u>S</u>elect + ◄ ► <u>Nack</u> <u>Cance1</u> <u>DK</u> Open Directory or File H Directory Name BUILD AID Rev.1 PI R TEST 32 COAX CABLES Rev.2 ▲ ¥ <u>R</u>efresh <u>S</u>elect -± ▶ Baok Cancel OK

In this example, only partial cable files will be backed-up and all of the other files will be backed up after the selection is done.

Select Ok to continue.

To select a test program to be backed up, select the '+' button to expand the directories to review saved test programs (note, you can collapse directories by selecting '-'.

Using the arrow keys, highlight the test program to be backed-up and press **Select**. A check mark will appear in the left hand column indicating that the test program is selected.

More than one test program can be selected for backup. When you satisfied, select **Ok** to continue.

#] Open Directory []
) Insert Empty Disk 🗱
in Drive A:
Abort
≪   ♥   ▶   <u>K</u> ack   <u>C</u> arscet   <u>U</u> S
and and and an
1) Backup Message 翻
The target disk belongs to another backup set.
Backups cannot be performed
on non-empty disks belonging
to other backup sets.
1. Replace this target disk with an empty one now then
press OK to continue.
2. Just press the OK button and let the system erase all

▲▼±₹

If you are prompted with this screen, ensure the diskette is properly inserted and it is not write protected.

If the diskette is not empty or the Horizon detects an older backup on the diskette, the *Backup Message* screen appears.

Select Ok to continue.

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Bpen birectory     R       P     Backing up Cables       Checking cap Libits     Capped       Image: District State     Sample	Selec will e Selec
Bren Directory     N       Backing up Adapters     M       A: NADAPTERS'HAI03.ADP       Target Disk Space       97%       Backup Progress       10%       Abort	As file rema backi
Image: Construction of the second	Once a sug
BACKUP ROPORt         M           The backup has been         backup has been           Completed o continue.         press DR to backed.           Press DR to backed.         up;           Prime ADAPTERS'CARDES-2.         ADP           DATABNADAPTERS'CARDES-2.         ADP           DATABNADAPTERS'CARDES-2.         ADP	Once displa throu Selec
) Backup - Restore Shell H Backup <u>R</u> estore <u>S</u> ave Log Files <u>M</u> ore Options <u>C</u> ancel	Selec Horiz
7] Backup - Restore Shell [2] []Do yoy want to erase these[3] Files from Horizon drive? [Yes No Cancel	The u them Selec
Backup - Restore Shell         J Copy File(s)         Log         342         2000 2009 File(s)         Quote 2009 File(s)         Quote 2009 File(s)         Quote 2009 File(s)         Quote 2009 File(s)	(i) _L disk t

Selecting **Yes** in the *Erase All Files on Target Disk* screen will erase the contents on the diskette. Select **No** to append the information on the disk.

As files are being backed-up, the progress bar indicates the remaining space on the disk and the progress of the total backup.

Once complete the user is prompted to remove the disk and a sugested label is displayed.

Once the diskette is removed, the *Backup Report* screen will display all files backed up. Use the arrow keys to scroll through the list.

Select Ok to return to the Backup - Restore Shell screen.

Select **Save Log Files** to backup the log files on the Horizon.

The user has the option to delete log files after transferring them to a diskette.

Select **Yes** to delete and **No** to continue without deletion.

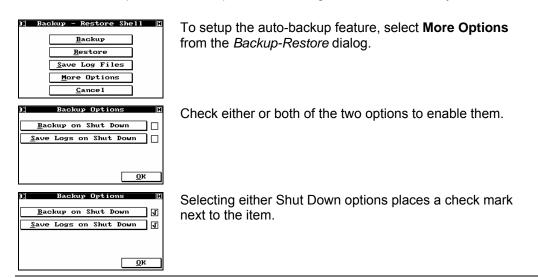
Log files can only be copied from the Horizon's hard sk to a floppy diskette.

# 8.1.2 Performing Restores

1] Backup - Restore Shell H <u>B</u> ackup <u>R</u> estore <u>S</u> ave Log Files <u>More Options</u> <u>C</u> ancel	Select <b>Restore</b> to begin restoring backed-up files from a floppy to the Horizon.
Rackup - Restore Shell         Restoring Cables         DATABXYST32*1.CBL         Target Disk Space         0%         Restore Progress         3%         Abort	During restore, the screen will display which directory and files are being restored. The top progress bar display the available space in the diskette, and the bottom progress bar display the percentage completed
#       Backup - Restore Shell II         3:       Eject Disk Labeled II         976724390-1       II	Once the restore is complete, this screen will appear. Remove the diskette from the floppy drive.
It         Restore Report         It           The restore has been         Be	Once the diskette is removed, the <i>Restore Report</i> screen will display all files restored. Use the arrow keys to scroll through the list.
	Select <b>OK</b> to return to the <i>Backup - Restore Shell</i> screen.

# 8.1.3 Auto-Backups

Allows the user to perform a backup and/or save log files each time the system is exited.





Shut Down

▲ Contrast ♥

If the Backup on Shut Down is enabled the operator is prompted at shutdown if they wish to perform a backup. Select Yes or No to continue.

If the Save Logs on Shut Down is enabled the operator is prompted at shutdown if they wish to save log files prior to shutting down. Select **Yes** or **No** to continue.

# 9 CREATING AND EDITING NETS FROM A TEXT EDITOR

Advanced Horizon Scripting Features and Manual Test Program Writing



# 9.1 Horizon 1500 Test File Format

# 9.1.1 Introduction

A Horizon test program is a Comma Delimited ASCII (CDA) file. This makes it easy to generate test programs off-line using a spreadsheet or a text editor.

Another advantage of using a text format is that plug-in modules for popular desktop applications can be written to port legacy test programs into Horizon ones. CableTest has successfully implemented such conversion plug-ins for Microsoft Excel and Word. Conversions from CAD programs are also possible. This opens a new avenue for the "Test by Design" concept.

Starting with version 4.2.17 the Horizon software will automatically indent the saved test programs for better readability, though indentation is not mandatory. The space character or the TAB character can be used for indentation. It is recommended to use spaces whenever possible since this would guarantee that the test program file is viewed in the same way no matter what text editor is used. While the Horizon software can read the TAB character properly, it is treated differently in different text editors thus rendering the source difficult to read in some cases.

Horizon software versions older than 4.2.17 will partially support the indentation. They will only save left-flushed files (all lines start in the first column) and the use of the *PROMPT* and *SCRIPT* keywords require that the text that follows is terminated when a '*' character is encountered in the first column (i.e. the next keyword cannot be indented!).

A basic test program is generally sectioned into:

- Identification Header;
- Adapter Interface;
- Test Parameters and Prompts;
- List of Nets (NetList);
- Lists of Components;
- Test Scripts (TCL).

Except for the Identification Header and the Adapter Interface Section that must be present in all test programs the other sections are optional (though a test program without a NetList will prevent any testing to occur). Some elements of a Horizon test program are not only optional, but they cannot be used unless optional software packages are purchased (e.g. the Test Scripts section can only be used in conjunction with the optional TCL Interpreter package). Some other elements of the test program can only be used if the Horizon hardware supports them (e.g. DC HiPot commands can only be executed if the machine is equipped with a DC HiPot Unit).

Below is a sample test	program with its individual	sections identified.
		Secuons luchtineu.

*CABLE*,AWP-1001GT,1	ID Header
*ADAPTER*, AATEST,	Adapter Interface
*POSITION*,J5	
*STAR*	Test Parameters and Prompts
*THRESHOLD*,61	
*DCHIPOT*,50	
*IR*,5e+07	
*DWELL*,2	
*REGULAR*	
*LINEAR*	
*NET*,,	NetList
J5.C1.1,,	
J5.C2.3,,	
*NET*,,	
J5.C1.2,,	
J5.C2.6,,	
*NET*,,	
J5.C1.3,,	
J5.C2.10,,	
*NET*,,	
J5.C1.4,,	
J5.C2.5,,	
*NET*,,	
J5.C1.5,,	
J5.C2.9,,	
*NET*,,	
J5.C1.6,,	
J5.C2.8,,	
*NET*,,	
J5.C1.7,,	
J5.C2.1,,	
*NET*,,	
J5.C1.8,,	
J5.C2.7,,	
*NET*,,	
J5.C1.9,,	
J5.C2.2,,	
*NET*,,	
J5.C1.10,,	
J5.C2.4,,	
*END*	

# 9.1.2 Test Program ID Header

The test program **ID Header** is mandatory. It consists of the tested product's name and test program's revision. Since most tested products are cables, the terms cable and tested product will be interchangeably used in this document.

The **ID Header** consists of one line that must have the following structure:

*CABLE*,<s_cableName>,<s_programRevision>

where, ***CABLE*** is a keyword or tag, **<s_cableName>** indicates a string field representing the cable's name and **<s_programRevision>** indicates a string field representing the test program's revision. The user must supply proper information in these fields.

The example below indicates revision 1 of a test program for the cable AWP-1001GT.

```
*CABLE*,AWP-1001GT,1
```

As it can be seen in the example above, commas separate the fields. String fields can be of an arbitrary length (unless otherwise noted) and can contain any printable character (including spaces). Due to the nature of the CDA rules, if a field contains one comma character or more, the entire string must be enclosed in double quotation marks. While the Horizon system and all CDA aware applications take care of this aspect automatically, when manually generating test programs using a text editor, the user is responsible for this. An example of field embedded comma is given below:

*CABLE*, "RW113, RW114, RW115",1

The program revision does not have to be a number. The Horizon software can automatically increment to the next revision even if it is a letter:

*CABLE*,RJ45 PATCH CORD,A

When the above test program is modified, Horizon can save it as the next revision:

*CABLE*,RJ45 PATCH CORD,**B** 

By default, Horizon will make the revision 1 for any newly learned test program.

(i) It is important to remember that all test programs that reside in the same directory must have unique combinations of cable name and program revision. The file name (what is seen when the DIR command is issued at the

DOS prompt) is not important for this purpose. Although it is a good practice to name the file in such a way that it reflects what the test program contains, this is not always possible because of the DOS file naming limitations. The Horizon generates the file name (maximum 8 characters in length) by truncating the internal cable name and making sure that the file name is unique (this last requirement is for the sake of DOS only). The Horizon will not save a test program if the cable's name and program's revision collide with an existent one. When manually creating a test program the user must ensure that such a collision doesn't occur.

# 9.1.3 Adapter Interface Section

Any tested product is connected to a test system one way or another. This connection is usually called an adapter interface, adapter cable, test fixture, or test panel. The Horizon calls it simply an adapter. In this light an adapter defines the connections between The Horizon's test points and the device under test (typically a cable).

The Horizon comes with a comprehensive library of standard adapter definitions. Besides being able to take advantage of the standard adapters, the user can easily add new adapters to the library.

Whether or not it employs standard adapters, custom adapters or any combination thereof, each test program must specify them. This is done in the Adapter Interface Section as described below:

```
*CABLE*,AWP-1001GT,1
*ADAPTER*,AATEST,
*POSITION*,J5
```

 $(\mathbf{i})$ 

The first line tells the system that the adapter called AATEST is to be used. The second line specifies where on the test bed the adapter is placed. As a reminder, the adapters used by the Horizon are classified by size in four categories:

Single - for up to 32 test points per adapter (placed at J1, J2, J3, or J4); Double - for up to 64 test points per adapter (placed at J5 or J6); Quad - for up to 128 test points per adapter (placed at J7); Huge - for up to 1024 test points per adapter (NA).

If your system contains expansion **boxes**, adapter positions will also be defined by a box number. E.g. B1.J3 (refers to a single adapter placed at position J3 on the first 128 point box), or B3.J7 (refers to a quad adapter placed at the third 128 point box).

```
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```

Except for the *Huge* adapters the others can be physically placed in more than one position on Horizon's test bed (some limitations apply). Therefore it makes sense that the position of the adapter is specified. The *Huge* adapters are more like a snapshot of the total number of test points and their position is always implicit (specifying it explicitly in a test program is considered syntax error). A test program snippet using a huge adapter is shown below:

```
*CABLE*, A FICTITIOUS CABLE, 1
*ADAPTER*, A FICTITIOUS HUGE ADAPTER
```

Please note that the *ADAPTER* line is not followed by a *POSITION* line.

If more than one non-huge adapter is specified, then they are described in sequence. The sequence of the listed adapters has no rules.

```
*CABLE*,AWP-1001GT,1
*ADAPTER*,AATEST,
*POSITION*,J5
*ADAPTER*,HA 116,
*POSITION*,J3
```

There is one more thing worth mentioning in this section. By default, the connectors on an adapter are named C1 through Cn where n is the number of connectors per adapter (i.e. an adapter with 3 connector would have them named C1, C2 and C3 by default). Although this annotation is straightforward and intuitive, sometimes users want to use other names for the connectors. More often than not this comes as a consequence of the fact that pre-existent test fixtures are already labeled. For such cases, the Horizon lets the user create labels for the adapters' connectors. This allows for more meaningful net list annotation.

The user can choose to label the connectors when a new adapter is defined. However, it is sometimes wiser to 'attach' the label to the connector within the test program as opposed to the adapter file. The latter case is covered here.

Let's assume that in the test program listed above, the adapter has two connectors that the user wants to label 'P' and 'K'. The new test program looks like the one following. The *CONNECTOR* keyword followed by the connector number and the connector label has an impact on the way the net list is generated.

The bolded areas show where the changes occurred. Besides creating user meaningful point names, the connector labels can be used to reduce the size of the test program file

or to simplify the default Horizon pin naming scheme (in some cases it can reduce the typing load).

```
*CABLE*,AWP-1001GT,1
 *ADAPTER*,AATEST,
    *POSITION*,J5
    *CONNECTOR*,1,P
    *CONNECTOR*,2,K
  *STAR*
  *THRESHOLD*,61
  *DCHIPOT*,50
    *IR*,5e+07
    *DWELL*,2
    *REGULAR*
    *LINEAR*
 *NET*,,
   .P.1,,
   .к.з,,
 *NET*,,
   .P.2,,
   .К.б,,
 *NET*,,
   .P.3,,
   .к.10,,
 *NET*,,
   .P.4,,
   .к.5,,
 *NET*,,
   .P.5,,
   .K.9,,
 *NET*,,
   .P.6,,
   .K.8,,
 *NET*,,
   .P.7,,
   .K.1,,
 *NET*,,
   .P.8,,
   .K.7,,
 *NET*,,
   .P.9,,
   .к.2,,
 *NET*,,
   .P.10,,
   .к.4,,
*END*
```

ID Header Adapter Interface

#### **Test Parameters and Prompts**

Netlist

It is worth noting that labelling an adapter's connector in a test program doesn't affect other test programs (i.e. other test programs can label the same adapter's connectors in a different way or not label them altogether).

# 9.1.4 Test Parameters

The test parameter fields are optional. If they are not encountered in the text file the default test parameters are automatically used. There are two main groups of testing parameters: the low voltage test parameters group and the high voltage test parameters group. The syntax and the default values are given for each testing parameter below.

# 9.1.4.1 Low Voltage Test Parameters

The low voltage test parameters are used during the low voltage tests and affect the continuity, isolation and flex tests. Some of the parameters can be set globally, to affect all the nets within the cable, or individually, on a per net basis. Others can only be set globally.

# **Continuity Test Parameters**

The continuity test can be performed by *Quick Scan* or by resistance measurement using the built-in continuity test algorithm. When the optional embedded *TCL* interpreter package is installed, a continuity test procedure can be defined using the *TCL* language and run instead of the internal algorithm.

If the *CONTINUITY* keyword is not found in the text file, then the default *Quick Scan* method is used. The *Quick Scan* method works globally. When the resistance thresholds are used, they can be specified globally – at the cable or section of cable (switch position) level – and/or individually – at the net level. The *CONTINUITY* line may require additional test parameters in some cases. Whenever additional continuity related test parameters are specified, they must appear immediately after the *CONTINUITY* line.

The syntax and options related to the continuity test are described below:

```
[[*CONTINUITY*, {<d_min>, <d_max> | <s_contScriptCmdAndArgs>}]
[*KELVIN*]
[{*HCRES* | *HCDROP*}, <d_stimulus>]]
```

The simplest case is when the *CONTINUITY* line is omitted from the test program altogether. In such cases the system will default the continuity test to *Quick Scan*. This method is by far the fastest since it uses a comparator to verify if there is continuity or not. It doesn't measure the actual resistance though, therefore some test engineers use it only in non-critical applications (like testing printer cables).

```
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```

When a continuity resistance measurement is needed then the *CONTINUITY* line must be specified. When including the *CONTINUITY* line in the test program, the minimum and maximum limits **must** be specified. When the measured continuity resistance is within the range defined by the two limits the test passes. When the measured continuity resistance is outside the range the test fails.

(i) Most of the time the minimum limit would be set to 0. It only makes sense to specify a higher minimum limit when a 4-wire measurement is used (best to be used in conjunction with the High Current Source option). When a continuity resistance lower than the minimum limit is measured it is probably because of a wrong wire gauge or length. Most of the time, test engineers are only interested to have the measured resistance values below the maximum limit.

In the example below a continuity test with the  $0\Omega$  and  $5\Omega$  limits is specified.

```
*CONTINUITY*,0.0,5.0
```

i

The continuity minimum and maximum thresholds must always be given in  $[\Omega]$ . For example a 1K $\Omega$  resistance would be entered as 1e3 or 1000.

In the example below the bolded line specifies that a Kelvin (4-wire) measurement is to be performed. Please note that, as the name suggest, a 4-wire measurement requires a special interconnection to the tested product where each point in the tested product is wired to two test points on the Horizon test bed. This is usually done via the adapter interface.

```
*CONTINUITY*,0,0.1
*KELVIN*
```

The example below specifies a Kelvin (4-wire) using the high current source. The bolded line instructs the tester to run a High Current source RESistance measurement using a stimulus of 0.5A.

```
*CONTINUITY*,0,0.3
*KELVIN*
*HCRES*,0.5
```

The high current source can also be used in a voltage drop mode as it can be seen in the example below. The minimum and maximum limits specified on the *CONTINUITY* line are 0V and 0.08V respectively. As the voltage drop test requires the two limits are given

in [V] this time. The bolded line specifies a High Current voltage DROP test using a stimulus current of 1A.

```
*CONTINUITY*,0,0.08
*KELVIN*
*HCDROP*,1
```

A special case is when an empty field is specified after the *CONTINUITY* keyword. In such a case, no continuity test will be performed at all. This may make sense in conjunction with the flex test which is described below or in some cases where something else other than a cable is tested (i.e. printed circuit board loaded with active components) and the final goal is achieved by running other tests. The example below specifies that the continuity test is not to be performed:

*CONTINUITY*,

#### **Continuity Scan Method**

Horizon describes the nets by means of a test point list (pin list or node list). Most common nets have just two test points each, the continuity test being performed on the conductor that connects the two points. With nets having more than two pins in their pin list, there would be more than one conductor to be checked. In such cases Horizon can perform the test in two different ways: *Star* and *Chain*.

Let's assume that we have a net with three nodes called A, B and C. Horizon can check the continuity among the three points in the *Star* mode by verifying from A to B and then from A to C or it can check the continuity in *Chain* mode by verifying from A to B and then from B to C.

To set the system for *Star* continuity specify the keyword *STAR* as in the example below:

*STAR*

To set the system for *Chain* continuity specify the keyword *CHAIN* as in the example below:

*CHAIN*

#### **Isolation Test Parameters**

The isolation test can be performed by Quick Scan or by resistance measurement using the built-in isolation test algorithm. When the optional embedded TCL interpreter package is installed, an isolation test procedure can be defined using the TCL language and run instead of the internal algorithm.

If the *ISOLATION* keyword is not found in the text file, then the default Quick Scan method is used. The isolation Quick Scan and resistance measurements work globally. They can be specified globally (at the cable or section of cable (switch position) level) only.

The syntax and options related to the isolation test are described below:

[*ISOLATION*,<d_min>]

In the example below, the isolation threshold was set for all the nets to  $1M\Omega$ . Any isolation resistance measurement that is below the minimum limit fails. Any measurement that is above the minimum limit passes. The isolation minimum limit must be always given in [ $\Omega$ ].

*ISOLATION*,1e6

A special case is when an empty field is specified after the ***ISOLATION*** keyword. In such a case, no isolation test will be performed at all. This may make sense in conjunction with the flex test which is described below or in some cases where something else other than a cable is tested (i.e. printed circuit board loaded with active components) and the final goal is achieved by running other tests. The example below specifies that the isolation test is not to be performed:

*ISOLATION*,

#### **Flex Test Parameters**

Sometimes it is desirable that intermittent contacts or shorts are found in a product at test time. The Horizon Flex test is designed just for that. The flex test will not be performed if the *FLEX* line is not found in the text file. The flex test can take one parameter that specifies the timeout. Optional continuity and isolation flex test specs can follow right after the *FLEX* line. The syntax is given below.

```
[[*FLEX*,<d_timeout>]
[[*CONTINUITY*,{<d_min>,<d_max>|<s_contScriptCmdAndArgs>}]
[*KELVIN*]
[{*HCRES*|*HCDROP*},<d_stimulus>]]
[*ISOLATION*,<d_min>]]
```

The first parameter is the timeout. When not specified or entered as 0, the time-out defaults to infinite. In this case the flex test is performed until the operator selects the Advance button on the touch screen. Otherwise, the timeout value should be entered in seconds. In the example below a flex test that times out after 5.5 seconds is specified.

*FLEX*,5.5

If the optional *CONTINUITY* and *ISOLATION* lines are not specified, the flex test uses the Quick Scan mode for both the continuity and isolation tests. The Quick Scan method offers the highest test speed for a greater chance to detect intermittent problems. For applications where changes in the continuity or isolation resistance are to be monitored resistance values can still be specified by employing the *CONTINUITY* and *ISOLATION* lines.

It may be particularly useful for the flex test to be able to perform just one of the two tests (i.e. run just the continuity test where the geometry of the cable eliminates the chance of an intermittent short) in order to speed up the test. Such an example is given below where the isolation test is skipped during the flex test:

```
*FLEX*,10
*ISOLATION*,
```

# **Auto-Insertion Threshold**

By default, when the product to be tested is plugged in the test fixture (adapter) the test starts automatically. The test is started upon one of the following conditions, whichever occurs first:

100% of the product tests OK for continuity; The **Start Test** button on the screen is selected; Less than 100% but more than the specified threshold of the product tests OK for continuity and a specified insertion delay lapses.

The third option allows for defective products to automatically start the test too. The default value for the insertion threshold is 61%. Depending on the product to be tested other values may be specified. The user is advised to experiment with various values if the default 61% doesn't satisfy their needs.

The syntax for this option is given in the example below. When a 100% threshold is specified, the test doesn't start automatically unless all connections test good.

*THRESHOLD*,100

# 9.1.4.2 High Voltage Testing Parameters

The high voltage testing parameters are used during the high voltage tests and affect the DC and AC HiPot tests. Some of the parameters can be set globally, to affect all the nets within the cable, or individually, on a per net basis. Others can only be set globally.

```
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```

#### **Password Protection**

The password protection is a safety feature used in conjunction with a product to be tested at high voltage. It prevents unauthorized personnel to perform such a test. The option is off by default. If the password protection is turned on, a valid password must be entered before the first test can start. The syntax is given below.

*PROTECTED*

In this example the test program is password protected.

#### **HiPot Not Connected Points**

By default, Horizon doesn't apply high voltage to the not connected points (single point nets) within the tested product. This is intended as a safety feature that stems from the idea that the not connected pins may be part of the unused connectors on the adapter (test fixture) and therefore might be exposed to operator touch during the HiPot tests. To HIPOT the Not Connected points use the keyword given below.

*HIPOTNC*

#### **DC HiPot Test Parameters**

The DC HiPot test can be specified for units that are equipped with a DC HiPot module. By default the DC HiPot is disabled. The DC HiPot parameters are usually specified for the entire product or section of product (switch position), but it is possible (only in the linear mode) to specify the DC HiPot parameters on a per net basis. When the DC HiPot is to be run in the mass mode, the only parameter that can be changed on a per net basis is disabling the HiPot test on that net by setting the HiPot voltage to 0. When the HiPot is to be run in the linear mode, any HiPot parameter (except for the HiPot type) can be modified for any net. The leakage can be measured either as a current, an insulation resistance or ignored altogether. The *DCHIPOT* line must appear the first. All other lines can appear in any order afterwards.

```
[*DCHIPOT*,<d_voltage>
[{*LEAKAGE*|*IR*},<d_limit>]
[*DWELL*,<d_dwell>]
[{*REGULAR*|*BYPASS*|*ADAPTIVE*|*SOAK*,<d_soak>}]
[{*MASS*|*LINEAR*}]]
```

In the example below, a 1000V dc HiPot will be performed using a 0.2s dwell time and the mass algorithm. The leakage current won't be measured – only the arcs will be monitored.

```
*DCHIPOT*,1000
*DWELL*,.2
```

*MASS*

In the example below a 500V dc HiPot will be performed. The dwell time is 1s the insulation resistance (IR) threshold is set to  $100M\Omega$  and the linear algorithm is used. The IR is measured using the regular mode.

```
*DCHIPOT*,500
*IR*,100e6
*DWELL*,1
*REGULAR*
*LINEAR*
```

In the example below a 500V dc HiPot will be performed. The dwell time is 1s the leakage current threshold is set to  $100\mu$ A and the linear algorithm is used. The leakage current is measured using a soak time of up to 5s.

```
*DCHIPOT*,500
*LEAKAGE*,100e-6
*DWELL*,1
*SOAK*,5
*LINEAR*
```

# AC HiPot Test Parameters

The AC HiPot test can be specified for units that are equipped with an AC HiPot module. By default the AC HiPot is disabled. The AC HiPot parameters are usually specified for the entire product or section of product (switch position), but it is possible (only in the linear mode) to specify the AC HiPot parameters on a per net basis. When the AC HiPot is to be run in the mass mode, the only parameter that can be changed on a per net basis is disabling the HiPot test on that net by setting the HiPot voltage to 0. When the HiPot is to be run in the linear mode, any HiPot parameter (except for the HiPot type) can be modified for any net. The leakage can be measured either as a current, an insulation resistance or ignored altogether. The *ACHIPOT* line must appear the first. All other lines can appear in any order afterwards.

```
[*ACHIPOT*,<d_voltage>
[{*LEAKAGE*|*IR*},<d_limit>]
[*DWELL*,<d_dwell>]
[{*60HZ*|*50HZ}]
[{*MASS*|*LINEAR*}]]
```

In the example below, a 60Hz 1000V ac HiPot will be performed using a 2s dwell time and the mass algorithm. The leakage current won't be measured – only the arcs will be monitored.

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```
*ACHIPOT*,1000
*60HZ*
*DWELL*,2
*MASS*
```

In this example a 50Hz 500V ac HiPot will be performed. The dwell time is 1s, the insulation resistance (IR) threshold is set to  $100M\Omega$  and the linear algorithm is used.

```
*ACHIPOT*,500
*IR*,100e6
*DWELL*,1
*LINEAR*
*50HZ*
```

#### 9.1.5 Build Aid

```
Activating the Build Aid Feature
To activate the build aid feature add the following syntax to the test list.
```

*BUILDAID*

Default Settings: With no further parameters, build aid will behave as follows... Build nets sequentially All beeps will be disabled No out of sequence test will be performed Probe is disabled

#### Audible Feedback

Enable audible feedback for a passed test::

```
*BUILDAID*
*PASS*
*BEEP*
```

Enable audible feedback for a failed test:

```
*BUILDAID*
*FAIL*
*BEEP*
```

**Building a Cable Sequentially** 

By default the Horizon expects the cable to be built sequentially (in the order defined in the test program). But, may be explicitly set for clarity:

```
*BUILDAID*

*SEQUENTIAL*

[ *PIN* ]

[ *OUTOFSEQUENCE* [ ,<timeout> ] ]
```

The optional *PIN* subcommand specifies that the build aid is to be done on a pin per pin basis. Otherwise the build aid is conducted on a net per net basis.

To build a cable on a net per net basis:

```
*BUILDAID*
*SEQUENTIAL*
```

To build a cable on a pin per pin basis:

```
*BUILDAID*
*SEQUENTIAL*
*PIN*
```

The optional *OUTOFSEQUENCE* subcommand specifies the system to consider an error when a net or pin was build out of sequence. If the optional timeout parameter is missing or is 0, then an out of sequence error is signalled as soon as it is detected. If a positive timeout value is specified, then the system waits that period and then if the out of sequence condition still exists it will signal an error. This latter feature is used when coaxial wires are built and both contacts close almost simultaneously but there is no guarantee which one closes first. It is then acceptable for the second conductor to make contact before the first, provided the first makes contact within the specified timeout period.

To build a cable with the out of sequence option with no timeout:

```
*BUILDAID*
*OUTOFSEQUENCE*
```

To build a cable with the out of sequence option with a programmed timeout (in seconds):

```
*BUILDAID*
*OUTOFSEQUENCE*, 0.5
```

# **Building a Cable Randomly**

By default the Horizon expects the cable to be build sequentially. When a random building order is acceptable and desired (at the operators discretion), then the random mode must be explicitly selected.

In order build a cable randomly:

```
*BUILDAID*
*RANDOM*
[ *PIN* ]
```

The optional *PIN* subcommand specifies that the build aid is to be done on a pin per pin basis. Otherwise the build aid is conducted on a net per net basis.

To build a cable on a net per net basis:

```
*BUILDAID*
*RANDOM*
```

To build a cable on a pin per pin basis:

```
*BUILDAID*
*RANDOM*
*PIN*
```

#### **Probing during Build Aid**

By default the system doesn't use the Horizon Ground Probe during the build aid process. In order to active the use of the Probe:

```
*BUILDAID*
*PROBE*
[ *ALL* ]
```

The optional *ALL* subcommand specifies that all wires may be probed and not only the one that is currently being built. When this option is used the Horizon's response when probing is deteriorated since it must scan all available points.

To activate the probe just for the wire that is being built:

*BUILDAID* *PROBE*

To activate the probe just for all wires:

```
*BUILDAID*
*PROBE*
*ALL*
```

#### 9.1.6 Print Options

Each tested product can have its own print options set within the test program. To set global print options see section 7.1.



Global report options will take precedence over embedded report options.

#### Logging Test Results to File

To enable the report logging use the syntax described below:

```
*REPORTS*

*FILE*

[*APPEND*]

[*FORMFEED*]

{*PASS* | *FAIL* | *PASSFAIL* | *ALL*}
```

The optional *APPEND* specifies that the results are to be appended at the end of the existent log file if any. If *APPEND* is missing or the log file doesn't exist then a new log file is generated.

The optional *FORMFEED* specifies that a form feed character is to be output to the file after each tested product. This is especially useful if the file is to be printed later.

The *PASS* specifies that test results are to be logged for passed cables only.

The *FAIL* specifies that test results are to be logged for failed cables only.

The *PASSFAIL* specifies that detailed test results are to be logged for failed cables only. The passed cables will only log a brief *Pass* message.

The *ALL* specifies that detailed test results are to be logged for both passed and failed cables.

If none of the *PASS*, *FAIL*, *PASSFAIL* and *ALL* options is listed then no test results would be logged.

```
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```

The *FILE* and *PRINTER* keywords are mutually exclusive. Either one can be used but not both in the same test program. If both are missing, then the report printing defaults to the printer.

#### Printing Test Results to a Printer

To enable the report printing use the syntax described below:

```
*REPORTS*

*PRINTER*

[*FORMFEED*]

[*LEFTMARGIN*,<number of characters>]

[*WIDTH*,<number of characters>]

{*PASS* | *FAIL* | *PASSFAIL* | *ALL*}
```

The optional *APPEND* specifies that the results are to be appended at the end of the existent log file if any. If *APPEND* is missing or the log file doesn't exist then a new log file is generated.

The optional *FORMFEED* specifies that a form feed character is to be output to the file after each tested product.

The optional *LEFTMARGIN* specifies the number of characters to be skipped at the left margin of the printout. If not specified it defaults to 5.

The optional *WIDTH* specifies the width of the page in number of characters. If not specified it defaults to 80.

The *PASS* specifies that test results are to be printed for passed cables only.

The *FAIL* specifies that test results are to be printed for failed cables only.

The *PASSFAIL* specifies that detailed test results are to be printed for failed cables only. The passed cables will only print a brief "Pass" message.

The *ALL* specifies that detailed test results are to be printed for both passed and failed cables.

If none of the *PASS*, *FAIL*, *PASSFAIL* and *ALL* options is listed then no test results would be printed.

The *FILE* and *PRINTER* keywords are mutually exclusive. Either one can be used but not both in the same test program. If both are missing, then the report printing defaults to the printer.

# Auto-diagnose Option

To enable the auto diagnose options use the syntax described below:

```
*REPORTS*
*AUTODIAGNOSE*
{*PASS* | *FAIL* | *PASSFAIL* | *ALL*}
```

The *PASS* specifies that test results are to be displayed automatically for passed cables only.

The *FAIL* specifies that test results are to be displayed automatically for failed cables only.

The *PASSFAIL* specifies that detailed test results are to be displayed automatically for failed cables only. The passed cables will only display a brief *Pass* message.

The *ALL* specifies that detailed test results are to be displayed automatically for both passed and failed cables.

If none of the *PASS*, *FAIL*, *PASSFAIL* and *ALL* options is listed then no test results would be displayed automatically.

The *AUTODIAGNOSE* can coexist with either one of the *PRINTER* and *FILE* options.

#### **Test Parameters**

Reporting the test parameters (test limits) can be enabled by using the syntax described below:

```
*REPORTS*
*TESTPARAMS*
```

When included in the test program the *TESTPARAMS* keyword enables the printing of test parameters. When omitted, the test parameters will not be printed.

#### Serial Numbers

The serial numbers can be enabled using the syntax described below:

```
*REPORTS*
*SERIALNUMBER*
[*FAIL*]
[*AUTO*]
```

When included in the test program the *SERIALNUMBER* keyword enables the serial number printing.

The optional *FAIL* specifies that a serial number is to be generated for failed products too. If omitted from the test program, the serial numbers would only be generated for the passed products.

The optional *AUTO* specifies that the serial number is to be automatically generated started from an initial value entered by the operator. The operator will also specify the part of the serial number that gets incremented. When *AUTO* is not specified the operator will have to enter the serial number for each product.

#### Header

To insert a header into a test program use the following syntax:

```
[*HEADER*
<s_first header line>
. . .
<s_last header line>]
*<keyword>*
```

All text following the *HEADER* tag up to the next tag (*<keyword>*) will be printed as a header. The option exists to have Header information added during the test cycle. To prompt the user for Header information use the *PROMPT* tag following the header line that requires entry.

# EXAMPLE:

*HEADER* CABLETEST SYSTEMS INC. 400 ALDEN RD MARKHAM, ON L3R 4C1 CUSTOMER: *PROMPT* CONTRACT/PO NO: *PROMPT* PART NUMBER: *PROMPT*

#### Footer

To insert a footer into a test program use the following syntax: [ *FOOTER* <s_first footer line> . . . <s_last footer line>] *<keyword>*

All text following the *FOOTER* tag up to the next tag (*<keyword>*) will be printed as a footer. The option exists to have Footer information added during the test cycle. To prompt the user for Footer information use the *PROMPT* tag following the footer line that requires entry.

# EXAMPLE:

*FOOTER* Authorization Signature/Stamp: _____

# 9.1.7 Prompts

In order to display instructions for the operator prior to starting the test on the product or prior to any of the switch tests use one of the prompt features. Horizon supports prompts on the fly (defined inline in the test program), prompt files and graphical bitmaps.

#### Prompts On the Fly

To insert a prompt on-the-fly use following syntax:

```
[*PROMPT*
<s_first_prompt_line>
...
<s_last_prompt_line>]
*<keyword>*
```

The first line that contains a keyword (starts with a '*' character) will end the prompt sequence. The text enclosed between the *PROMPT* line and the next keyword will be displayed on the screen prior to the test.

In the example below the bolded text represents the prompt that will be displayed on the screen:

```
*PROMPT*
Use following hook-up cables:
AKS 104-0005
AKJ 100-0021
AKH 101-0001
*CONTINUITY*,0,1
```

#### **Prompts Using Text Prompt Files**

Sometimes it may be desirable that multiple test programs share the same prompts. To use text defined in a prompt file use the following syntax:

```
9-24 Horizon Series Tester: Programmer's Manual
```

[*PROMPTFILE*,<s_file_name>]

When the field <s_file_name> contains just the name of the file without the path, then the file is searched in the DATAB\PROMPTS directory. When the complete file path is given then the file is searched on that path.

The example below searches the file on an absolute path.

*PROMPTFILE*,c:\v4.0\datab\cables\main\prmpt1.txt

The text contained in PRMPT1.TXT is loaded and displayed on the screen.

#### **Using Graphical Bitmap Prompts**

Horizon supports graphical files in PCX format. The PCX must be 1 bit black and white and must be exactly 240 pixels wide and 128 pixels high or they won't display properly. To use such a graphical prompt:

```
*BITMAP*,< s_file_name >
```

When the field <s_file_name> contains just the name of the file without the path, then the file is searched in the DATAB\PROMPTS directory. When the complete file path is given then the file is searched on that path.

The example below searches the file on an absolute path.

*BITMAP*,c:\v4.0\datab\cables\main\switch1.pcx

The text contained in SWITCH1.PCX is loaded and displayed on the screen.

#### Abort/Retry/Ignore/Prompt User on Failure

By default the system uses a system setting to decide whether to abort, retry, ignore or prompt the user on a switch test failure. The system setting can be overridden in the test program by using an appropriate keyword.

```
[*ONFAIL*, {ABORT | RETRY | IGNORE | PROMPT }]
```

In the example below the system will abort testing any further the product. The product is failed as a result of the current switching position test failure.

*ONFAIL*,ABORT

In the example below, the current switching position will be re-tested following a failure this allows for some repairing the product on the fly and re-testing it without removing it

from the test station. If this option is used, the operator must make sure that the product can be repaired to pass or the system will loop infinitely on a failed test. Sometimes prompting the operator to choose whether to retry the test would be a better option. See below the PROMPT option.

*ONFAIL*,RETRY

In the example below the system will continue testing with the next switching position in case the current position has failed. This allows for a complete diagnostic of a defective product.

```
*ONFAIL*, IGNORE
```

In the example below the system will prompt the operator to choose whether to abort a failed test, ignore it (go to the next test) or retry it.

*ONFAIL*, PROMPT

# 9.1.8 Netlist

Most test programs must contain the NetList section. The NetList describes the tested product's connectivity. Each net consists of a list of at least one test point and may have a name and a label. Each net may also have customized test parameters. Even though the customized test parameters include DC and AC HiPot ones, the type of HiPot scan (mass or linear) cannot be specified at the net level.

```
*NET*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
      . . .
  <s_pinAddress_n>[,<s_pinLabel_n>]
  [*CONTINUITY*, <d_min>, <d_max>
    [*KELVIN*]
    [{*HCRES*|*HCDROP*}, <d_stimulus>]]
  [*DCHIPOT*, <d voltage>
    [{*LEAKAGE*|*IR*},<d_limit>]
    [*DWELL*,<d_dwell>]
    [{*REGULAR*|*BYPASS*|*ADAPTIVE*|*SOAK*,<d_soak>}]]
  [*ACHIPOT*, <d_voltage>
    [{*LEAKAGE*|*IR*},<d_limit>]
    [*DWELL*,<d_dwell>]
    [{*50HZ* | *60HZ*}]]
```

In the example below, the first net is labelled Ground and the second one Term. Pwr. Both nets consist of two test points. Neither one of the nets has customized test parameters.

```
*NET*,,Ground
B1.J1.C1.1,
B2.J1.C1.1,
*NET*,,Term. Pwr.
B1.J1.C1.2,
B2.J1.C1.2,
```

In the example below an anonymous net containing 6 test points will be tested for continuity using the customized test parameters of min  $0.0\Omega$  and max  $0.1\Omega$  measured Kelvin. The DC HiPot is disabled on this net.

```
*NET*,,
B1.J5.C1.5,
B1.J5.C1.6,
B3.J6.C3.7,
B3.J6.C3.8,
B5.J5.C1.5,
B5.J5.C1.6,
*CONTINUITY*,0,.1
*KELVIN*
*DCHIPOT*,0
```

#### NetList – Special Type – Shields

A net that is functionally a shield within your product may not need the same stringent testing that other nets need. A tag exists for these nets:

*NET*,,		
B1.J5.C1.5,		
B1.J5.C1.6,		
	*SHIELD*	

The Shield tag ties all nets designated shield together for both Isolation tests and Hipot tests. The result is to prevent failures do to shield nets being shorted together and or exhibiting high leakage levels during a high voltage test.

#### NetList – Advanced Option - Embedded Switches

A cable can be tested in a multi-phase fashion. This kind of testing is usually associated with embedded switches. Basically each switch position can have its own customized test

parameters and NetList. With minor exceptions a switch position may have the same features as a simple product test program (i.e. a switch position cannot have adapters or other switch positions). For the purpose of testing, the switch position holds the same capabilities as the whole product (without switches) does.

```
*SWITCH*[,<s_switch_name>[,<s_switch_label>]]]
```

In the example below the anonymous switch position has a net list of three single-point nets and will perform a HiPot on them. The low voltage and HiPot parameters are the global ones specified at the cable level but a local override will force the HiPot on the single-point nets.

```
*SWITCH*,,
 *HIPOTNC*
 *NET*,,
 B1.J1.C1.1,,
 *NET*,,
 B1.J1.C1.2,,
 *NET*,,
 B1.J1.C1.3,,
```

In the example below a test program with switches is depicted.

```
*CABLE*,TEST1,1
  *STAR*
  *ONFAIL*, IGNORE
  *THRESHOLD*,61
  *ADAPTER*, HA 138,
    *POSITION*,B1.J5
  *ADAPTER*, HA 138,
    *POSITION*,B1.J6
  *SWITCH*
    *PROMPT*
Connect probe to
first position
    *NET*,,
      B1.J5.C1.9,
      B1.J6.C1.3,
    *NET*,,
      B1.J5.C1.10,
      B1.J6.C1.1,
  *SWITCH*
    *PROMPT*
```

```
Connect probe to
second position
    *NET*,,
      B1.J5.C1.7,
      B1.J6.C1.3,
    *NET*,,
      B1.J5.C1.8,
      B1.J6.C1.1,
  *SWITCH*
    *DCHIPOT*,1000
      *DWELL*,.5
      *MASS*
      *IR*,10e6
      *HIPOTNC*
    *PROMPT*
Disconnect probe
from product!
Hipot Will be Performed!
    *NET*,,
      B1.J5.C1.1,
    *NET*,,
      B1.J5.C1.2,
    *NET*,,
      B1.J5.C1.3,
*END*
```

#### 9.1.9 Components

#### **Programming Resistors**

The text file format for resistors is as follows:
*RESISTOR*[,<s_netName_1>[,<s_netLabel_1>]]

```
<s_pinAddress_1>[,<s_pinLabel_1>]
<s_pinAddress_2>[,<s_pinLabel_2>]
*VALUE*,<minimum in ohms>,<maximum in ohms>
```

#### **Programming Resistors – Kelvin**

The text file format for resistors wired in kelvin is as follows:

```
*RESISTOR*[,<s_netName_1>[,<s_netLabel_1>]]
```

```
<s_pinAddress_1>[,<s_pinLabel_1>],<s_pinAddress_1>[,<s_pinLabel_1>]
```

```
<s_pinAddress_2>[,<s_pinLabel_2>],<s_pinAddress_2>[,<s_pinLabel_2
>]
*VALUE*,<minimum in ohms>,<maximum in ohms>
*KELVIN*
```

Resistor address includes sense and source at each terminal.

#### **Programming Resistors – High Current Source**

The text file format for resistors measured using the High Current Source is as follows:

#### **HC Resistance:**

```
*RESISTOR*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
  *VALUE*,<minimum in ohms>,<maximum in ohms>
  *HCRES*,<value>
where <value> is in amperes
```

#### HC VoltageDrop:

```
*RESISTOR*[,<s_netName_1>[,<s_netLabel_1>]]
    <s_pinAddress_1>[,<s_pinLabel_1>]
    <s_pinAddress_2>[,<s_pinLabel_2>]
    *VALUE*,<minimum in ohms>,<maximum in ohms>
    *HCDROP*,<value>
where <value> is in amperes
```

#### HC Load:

```
*RESISTOR*[,<s_netName_1>[,<s_netLabel_1>]]
    <s_pinAddress_1>[,<s_pinLabel_1>]
    <s_pinAddress_2>[,<s_pinLabel_2>]
    *VALUE*,<minimum in ohms>,<maximum in ohms>
    *HCLOAD*,<value>
where <value> is in volts
```

## **Programming Resistors – Lamps**

The text file format for resitive loads such as Lamps is as follows:

```
*RESISTOR*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
  *VALUE*,<minimum in ohms>,<maximum in ohms>
  *VISUAL*
  *HCVOLT*,<value>
Where <value> is in volts
```

#### **Programming Capacitors**

The text file format for capacitors is as follows:

```
*CAPACITOR*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
  *VALUE*,<minimum in Farads>,<maximum in Farads>
  *TARE*,<value>
```

Where <value> is the learned/Modified tare in Farads.

#### **Programming Capacitors – HiPot**

The text file format for HiPot testing capacitors is as follows:

```
*CAPACITOR*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
  *VALUE*,<minimum in Farads>,<maximum in Farads>
  *TARE*,<value>
  *DCHIPOT*,<voltage in volts>
    *DWELL*,<time in seconds>
    *LEAKAGE*,<current in amps>
  *ACHIPOT*,<voltage in volts>
    *DWELL*,<time in seconds>
    *LEAKAGE*,<current in amps>
  *LEAKAGE*,<current in amps>
```

Where <value> is the learned/Modified tare in Farads.

#### **Programming Capacitors – Electrolytic**

The text file format for electroytic capacitors is as follows:

```
*CAPACITOR*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
  *VALUE*,<minimum in Farads>,<maximum in Farads>
  *TARE*,<value>
  *ELECTROLYTIC*
```

#### **Programming Diodes**

The text file format for diodes is as follows:

```
*DIODE*[,<s_netName_1>[,<s_netLabel_1>]]
<s_pinAddress_1>[,<s_pinLabel_1>]
<s_pinAddress_2>[,<s_pinLabel_2>]
*<type>*
```

Where <type> is defined as per Table 1 Diode Types.

The text file format for diodes with custom or Auto detected thresholds is as follows:

```
*DIODE*[,<s_netName_1>[,<s_netLabel_1>]]
<s_pinAddress_1>[,<s_pinLabel_1>]
<s_pinAddress_2>[,<s_pinLabel_2>]
```

```
*<type>*
*FORWARD*,<minimum in volts>,<maximum in volts>
*REVERSED*,(minimum in amps>,<maximum in amps>)
```

#### **Programming Diodes – Visual test with LEDs** The text file format for a visual test using LEDs is as follows:

```
*DIODE*[,<s_netName_1>[,<s_netLabel_1>]]
<s_pinAddress_1>[,<s_pinLabel_1>]
<s_pinAddress_2>[,<s_pinLabel_2>]
*LED*
*VISUAL*
```

#### **Programming Diodes – Parallel**

The text file format for diodes in parallel is as follows:

```
*DIODE*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
  *<type>*
  *FORWARD*,<minimum in volts>,<maximum in volts>
  *REVERSE*<minimum in volts>,<maximum in volts>
  *PARALLEL*
```

Where <type> is defined as per Table 1 Diode Types.

Programming Diodes – LEDS/BI-LEDs The text file format for a visual test of BI-LEDs is as follows:

```
*DIODE*[,<s_netName_1>[,<s_netLabel_1>]]
  <s_pinAddress_1>[,<s_pinLabel_1>]
  <s_pinAddress_2>[,<s_pinLabel_2>]
  *LED*
  *FORWARD*,<minimum in volts>,<maximum in volts>
  *REVERSE*<minimum in volts>,<maximum in volts>
  *VISUAL*
  *PARALLEL*
```

Where <type> is defined as per Table 1 Diode Types.

# 9.2 Adapter File Format

The tested products are usually connected to the Horizon system through conventional adapters or adapter cables. The adapters or adapter cables are described in the adapter files. These files contain the connectivity tables that make correspondence between the connector's pin name and the system's test point number. In this way the Horizon 1500 system is able to test the product (by means of using test point numbers) while providing the user with meaningful diagnostics (by means of using connector pin names).

# Format

The syntax of an adapter file is as follows:

*ADAPTER*, <adapter's name>,
*SIGNATURE*, type #1, value #1, type #2, value #2,
*SIZE*, adapter size
*CONNECTOR*, <name of connector #1>
Sys. Pin, Pin Name, Pin Label , Sense, CTare, LVRL Tare, LVRH Tare,
HCRL Tare, HCRH Tare,

# ADAPTER: Required.

The name of the adapter is required and limited by 30 characters. No two adapters within the library can have the same name. The adapter's name is capitalized automatically.

# SIGNATURE: Optional.

Any adapter may have up to two ID components (to be used for automatic detection). Either one of the two ID components can be a Resistor, a Capacitor or be unused (None). The signature line takes 4 parameters separated by commas: the type of the first ID component, the value of the first ID component, the type of the second ID component and the value of the last ID component.

The ID component types are coded as follows:

- 1 For resistor ID components
- 2 For capacitor ID components
- 3 For no ID components

(i) For most users that connect their product by means of custom made adapter cables (as opposed to standard CableTest adapters) it is impractical to assign ID components to their adapter cables (since it would require that each adapter cable has ID components). In such cases it is recommended that the

adapter cables have no ID components (both ID types are set to 3 and the ID values to 0).

# SIZE:

The adapter's size is coded as follows:

- 1 For single-size adapters (up to 32 test points)
- 2 For double-size adapters (up to 64 test points)
- 4 For quadruple-size adapters (up to 128 test points)
- 5 For huge-size adapters (up to 1024 test points)
- (i) For adapter cables that are connected to the system through conventional Horizon adapters, please devise the adapter cable's size in accordance with the conventional adapter's size (i.e. if the conventional adapter was HA 180-1 the adapter cable's size would be double, if the adapter was HSA 272 then the adapter cable's size would be quad).

#### CONNECTOR: Required.

The name of the connector is optional. An adapter can have more than one connector. In such cases the subsequent connectors are listed in sequence – one after another.

**Sys. Pin:** The actual system pin on the Horizon Switching Cards **Pin Name:** The pin designation as selected by user - default numerical **Pin Label:** An optional designation value for each pin - has a higher priority than the Pin Name.

Sense: Sense Test Point for Kelvin connections

**CTare:** Capacitance Tare Value

LVRL Tare: Low Voltage Resistance Low Test Point Tare Value

LVRH Tare: Low Voltage Resistance High Test Point Tare Value

HCRL Tare: High Current Resistance Low Test Point Tare Value

HCRH Tare: High Current Resistance High Test Point Tare Value

The pin list is terminated either when another *CONNECTOR* keyword is encountered or when the file ends.

The last line in the adapter file must be a blank line (terminate the last pin list line with a carriage return such as the end of file character doesn't follow immediately after the last connector pin name).

Example1: *ADAPTER*,HA 116,

 $(\mathbf{i})$ 

```
*SIGNATURE*,1,1000,1,1500
*SIZE*,1
*VERSION*, V4.2.50
*CONNECTOR*, DB 25 FEMALE,
18,1,,,6.49643e-12,0.0549,0.0347,0.0371066,0.0372955,,
19,2,,,4.225e-12,0.0424,0.0224,,0.0383864,,
20,3,,,3.5e-12,0.0521,0.0434,0.0163888,0.0415342,,
21,4,,,4.85e-12,0.0472,0.0433,0.0297879,0.0443802,,
22,5,,,5.975e-12,0.0548,0.0572,0.0458907,0.0489997,,
23,6,,,4.1e-12,0.0664,0.0477,0.0287416,0.0520463,,
28,7,,,5.175e-12,0.0745,0.0683,0.0449316,0.0758962,,
6,8,,,5.09286e-12,0.074,0.0639,0.0616145,0.0653432,,
7,9,,,4.875e-12,0.0503,0.0543,0.0352298,0.0545201,,
15,10,,,4.25e-12,0.0443,0.0388,,0.0449438,,
14,11,,,3.025e-12,0.0323,0.0345,0.0299088,0.0388788,,
13,12,,,4.7e-12,0.0214,0.0321,0.0337148,0.0360858,,
12,13,,,3.205e-12,0.0346,0.04,0.0307894,0.0340614,,
17,14,,,3.15e-12,0.05,0.0437,0.0299103,0.0417339,,
16,15,,,4.75e-12,0.0545,0.0425,0.015863,0.0442314,,
24,16,,,5.15e-12,0.0483,0.0627,0.0536157,0.0579428,,
25,17,,,6.525e-12,0.0651,0.0657,0.0505918,0.0734726,,
26,18,,,5.325e-12,0.102,0.0734,0.0838286,0.0856556,,
2,19,,,6.925e-12,0.0847,0.087,0.0837441,0.0877148,,
1,20,,,6.825e-12,0.0815,0.0826,0.051058,0.0748405,,
0,21,,,7.3e-12,0.0621,0.0745,0.056447,0.0598312,,
8,22,,,6.175e-12,0.0438,0.0424,0.0382992,0.0500458,,
9,23,,,4.35e-12,0.0389,0.0542,0.0314001,0.0445852,,
10,24,,,5.3e-12,0.0467,0.0379,0.0763667,0.0399493,,
11,25,,,4.575e-12,0.0404,0.044,0.056884,0.0380404,,
```

In the example above, the adapter called HA 116 uses a DB 25 female connector. The adapter's size is Single and it uses two resistor ID's. The first ID component has  $1K\Omega$  and the second has  $1.5K\Omega$ . This adapter has been fully tared for capacitance, LV Resistance, and HC Resistance.

#### Example 2:

```
*ADAPTER*,HSA 214

*SIGNATURE*,1,12100,1,1210

*SIZE*,2

*CONNECTOR*,MIL ROUND M. 11

0,A

1,B

2,C
```

3,D 8,E 4,F 5,G 9,Н 28,J 27,K 24,L 26,M *CONNECTOR*, MIL ROUND F. 11 47,A 39,B 38,C 37,D 36,E 35,F 41,G 54,H 53,J 52,K 50,L 51,M

In the example above, it can be seen that the connector pin names are no longer numbers. The user has total freedom to name the connector pins according to their documentation.

#### **Creating Custom Adapter Files Off-line**

To create a custom adapter cable file, one would normally start from the adapter file that the adapter cable will be interfacing to. The examples below make the assumption that the HSA 272 adapter is used to interface two different types of adapter cables: ADPTCBL 1 and ADPTCBL 2. Using a text editor open the file called HSA272.ADP and save it as ADPTCBL1.ADP and then as ADPTCBL2.ADP. This way you have created the templates for the two new adapter files. The a portion of the original HSA272.ADP is listed below:

```
*ADAPTER*,HSA 272
*SIGNATURE*,3,0,3,0
*SIZE*,4
*VERSION*,4.0.0
*CONNECTOR*,ZIF 104 SOCKETS
8,1
9,2
10,3
11,4
```

12,5
13,6
14,7
15,8
40,9
41,10
42,11
43,12
44,13
0,14
2,15
3,16
4,17
5,18
6,19
7,20
1,20
•
•

.

# Example 1:

Now, let's assume that the first adapter cable that you want to create a file for is described in the table below:

#### ADPTCBL 1:

Product Connector Name	Pins	ZIF connector pins (mating to HSA 272)
С	А	1
С	В	3
С	С	5
С	D	7
С	E	9
С	F	11
С	G	13
С	Н	15
С	J	17
С	K	19

Use the text editor to open the file ADPTCBL1.ADP (created above) and change the adapter and connector names. Also, based on the observation that only the odd numbered ZF pins from 1 to 19 are used, eliminate all other pin lines from the file. The adapter file would now look like:

```
*ADAPTER*,ADPTCBL 1
*SIGNATURE*,3,0,3,0
*SIZE*,4
*VERSION*,4.0.0
*CONNECTOR*,MIL ROUND CONN 10 PINS,C
8,1
10,3
12,5
14,7
40,9
42,11
44,13
2,15
4,17
6,19
```

Now substitute the numbers in the right column (which represent the ZIF pin numbers) with the product connector's pin numbers. The file ADPTCBL1.ADP would now look like:

```
*ADAPTER*,ADPTCBL 1
*SIGNATURE*,3,0,3,0
*SIZE*,4
*VERSION*,4.0.0
*CONNECTOR*,MIL ROUND CONN 10 PINS,C
8,A
10,B
12,C
14,D
40,E
42,F
44,G
2,H
4,J
6,K
```

Save the file.

Appendix A: Horizon Specifications



# PHYSICAL SPECIFICATIONS

- Dimensions: 17" (432mm) W x 9" (229mm) D x 5" (127mm) H
- Weight: Less than 15lbs (6.8kg)
- Power Supply: Input Voltage 100 - 250 VAC 50 - 60 Hz 1.0 - 0.5 A

#### Output Voltage +12VDC, 3.5 A

# **ENVIRONMENTAL SPECIFICATIONS**

<b>Ambient Temperature:</b>	Operating	0°C - 55°C
-	Non-Operating	0°C - 45°C

Temperature Gradient: Operating/Non-Operating						
30°C/hr max, without condensation						

<b>Relative Humidity:</b>	Operating/Non-Operating
	8% - 80% non-condensing

- Vibration:Operating<br/>Non-Operating $2.45 \text{ m/s}^2 (0.25 \text{ G})$ <br/> $11.76 \text{ m/s}^2 (1.2 \text{ G})$ Shock:Operating $29.4 \text{ m/s}^2 (3 \text{ G})$ 
  - Shock:Operating29.4m/s² (3G)Non-Operating490 m/s² (50G)
- Corrosion Gas: No Corrosion Gas

# HORIZON INPUTS AND OUTPUTS Outputs

•	Rated Load:	0.5A 125VAC, 1A 24VDC
	Contact Material:	Ag (Au clad)
	Carry Current:	2A
	Max. Operating Voltage:	125VAC, 60VDC
	Max Operating Current:	1A
	Max. Switching Capacity:	62.5VA, 30W
	Min. Permissible Load:	1mA, 5VDC
Inputs		
	Trigger Voltage:	12 – 24V

QUICK SCAN SPECIFICATIONS Continuity:	
Stimulus: 5mA Threshold: ~300Ω ¹ Voltage Limit: 5V	
Isolation:Stimulus: $50\mu A$ Threshold: $\sim 80k\Omega^1$ Voltage Limit: $5V$	
$\begin{array}{c} \textbf{MEASUREMENT SPECIFICATIONS} \\ \textbf{Resistance:} \\ 2-Wire Measurement^2 \\ 0.1\Omega \text{ to } 2M\Omega & \pm 2.5\%, \pm 20m\Omega \\ 2M\Omega \text{ to } 10M\Omega & \pm 7.0\%, \pm 1K\Omega \\ 10M\Omega \text{ to } 25M\Omega & \pm 15\%, \pm 10K\Omega \\ 25M\Omega \text{ to } 50M\Omega & \pm 30\%, \pm 10K\Omega \\ \end{array} \begin{array}{c} \text{Resolution: } 3 \text{ digits} \\ \text{Resolution: } 3 \text{ digits} \\ \text{Resolution: } 3 \text{ digits} \\ \end{array}$	-
4-Wire (Kelvin) Measurement ³ 10m $\Omega$ to 400 $\Omega$ ±2.5%, ±10m $\Omega$ Resolution: 1m $\Omega$ or	3 digits
<b>4-Wire(Kelvin) HCS Resistance Measurement:</b> 1mΩ to 400Ω ±2.5%, ±1mΩ Resolution: 1mΩ or	3 digits
Capacitance:50pF to 10, 000μF±10%Resolution: 3 digits	
High Voltage AC 50/60Hz (Optional):Programmable: $50 - 1000VAC \pm 12\%, \pm 1V$ Voltage $50 - 1067VAC \pm 12\%, \pm 1V$ Current:min: 5mA, typical: 8mA, maFrequency $50Hz - 60Hz \pm 15\%$	Resolution: 1V
Measurement6Leakage Current $5\mu$ A - 5 mA $\pm 12\%$ , $\pm 5\mu$ /IR4 $10M\Omega$ - $200M\Omega$ $\pm 12\%$	A Resolution: 1μA Resolution: 3 digits
¹ Actual value may vary between different systems. ² The low range 2-wire resistance measurement specifications r ³ For resistances of more than 400Ω these measurements defau ⁴ @1000VAC	ely on tared fixtures. ult to 2-wires.

	Arc Detection HiPot Type	Automatic Mass or Linear		
High V	Voltage DC (Optional): Programmable:	F0 4000\/D0	. 4.00/ 4)/	Desclution: 41/
	Voltage Current:	50 - 1000VDC 50 - 1500VDC min: 2mA, typic		Resolution: 1V Resolution: 1V 5mA
	Measurement ⁶			
	Leakage Current IR ⁵ Arc Detection HiPot Type	1μA - 5 mA 10MΩ - 1.5GΩ Automatic Mass or Linear	•	Res: 1µA or 3 digits Resolution: 3 digits
High C	Current <i>(Optional):</i> Programmable:			
	Current	1mA to 500mA 1mA to 1A	±2.5%, ±1mA ±2.5%, ±1mA	Resolution: 1mA Resolution: 1mA
	Voltage	1 to 28VDC	±2.5%, ±0.1V	Resolution: 0.1V
	Measurement ⁶ :			
	Voltage	0V – 2.5V 2.5V - 28V	±2.5%, ±2mV ±2.5%, ±25mV	Res: 1mV or 3 digits Res: 10mV or 3 digits
	Current	1mA – 0.1A 0.1mA to 1A	±2.5%, ±1mA ±2.5%, ±5mA	
	Kelvin Resistance MilliVolt Drop	1mΩ to 400Ω 1mV - 3V	±2.5%, ±1mΩ ±5.0%, ±1mV	-

⁵ @1500VDC

⁶ From High Current Source – The Horizon cannot measure external stimuli

Appendix B: Troubleshooting Your Horizon



Problem	Possible Cause	Possible Solution
High Voltage or High Current module error during start-up.	Noted module not detected during initialization.	Replace unit.
Adapters aren't auto- detected	Capacitance Signature Adapter Switch Card Failure MSR Card Failure	Perform System Capacitance Tare Replace Switch Cards Replace MSR Card
System Will not Boot Up	BIOS settings incorrect Interface Card Not Seated Properly General Hard Drive Failure	Perform HDD Auto-detect Re-seat Interface Card Replace Hard Drive
LCD Too Dark	Contrast Set Low Back Light Failure	Increase Contrast Replace Back Light
Can't Select Buttons on LCD	Touch Screen Failure	Replace Touch Screen
Error Message: "Error initializing switching cards"	Power Supply #3 not present General Switching Card Failure	Ensure all required power supplies are present Service Switching Cards
Lost Password		Contact Horizon Service
Product always fails HiPot – Arcs	DC or AC HiPot Failure	Service High Voltage Module(s)

Appendix C: Mass HiPot Examples



# CableTest Systems Inc.

# **Mass HiPot Routine**

The following binary tables show the nets connected to high potential (+) and to ground potential (-) for a 16-net product during the Mass HiPot routine. Similar patterns are generated for other product sizes. The 16-net product is used for illustrative purposes only.

The routine presented in Table 1 (below) guarantees that each net is raised to high voltage at least once. This is important to ensure that leakage (i.e. Insulation Resistance or 'IR') is measured on all points and to ensure that Dielectric Withstand Voltage (DWV) testing is performed on all nets against all external ground points.

# Scenario 1: Good Product (No need to sub-divide into smaller groups)

When the Product Under Test (PUT) is 'good' (i.e. passes IR and DWV tests), and the current limit of the MPT's high voltage supply is not exceeded, the iterations will be carried out as shown in Table 1.

Test	Net	Net Number														
Phase	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
2	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-
3	+	+	+	+	-	-	-	-	+	+	+	÷	-	-	-	-
4	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-
5	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-

Table 1: Mass HiPot Routine - Product Under Test is 'Good', no faults exist.

The MPT will automatically divide the nets into smaller groups so that the current requirements are reduced when either of the following situations occurs:

a. More current is required to charge the PUT than the source can deliver; or

b. The leakage limit is exceeded due to the size of the group during IR tests.

These situations are illustrated in Scenarios 2 through 5 for 'good' and 'bad' PUT's.

#### Scenario 2: Good Product – PUT's High Capacitance Overloads HV Source

Overload of the high voltage (HV) source can be caused by high capacitance when the PUT's grouped nets are connected in parallel. This scenario is most likely to occur in AC Mass HiPot testing when the AC drive current is too high for a large number of nets. To avoid overloading the HV source during Mass HiPot testing, group splitting will occur recursively until the combined capacitance of the nets connected to the high potential is small enough so that the system's overload condition is not triggered when high voltage is applied. An overload condition will not result in a FAIL condition unless it is caused by

one net only (i.e. a true fault is detected). An example of group splitting caused by an overload condition is shown in *Table 2*.

Test	Net Number	•															
Cycle	Condition	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Pass!	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
2	Overload?	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-
2a	Pass!	+	+	+	+												
2b	Pass!	-				+	+	+	+								
3	Pass!	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
4	Pass!	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-
5	Pass!	+	+	-	-	+	+	-	-	-	-	-	-	-	-	-	-
6	Pass!	-	-	-	-	-	-	-	-	+	÷	-	-	+	+	-	-
7	Pass!	+	-	+	-	+	-	+	-	-	-	-	-	-	-	-	-
8	Pass!	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	-

Table 2: Splitting caused by current overload due to mass grouping

# Scenario 3: Good Product – Mass IR Tests Fail – Net Groups Are Too Large

The MPT's IR leakage limit is typically chosen as though one net in the PUT was being tested against all other nets. For this reason, it is possible to reach a 'good' product's current leakage limit during Mass IR testing due to the net grouping that occurs.

Test	Net Number																
Cycle	Condition	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Pass!	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
2	Leakage?	+	+	+	÷	+	+	+	+	-	-	-	-	-	-	-	-
2a	Pass!	+	+	+	+												-
2b	Pass!	-				+	+	+	+								-
3	Leakage?	+	+	+	+	-	-	-	-	+	+	+	+	-	-	-	-
3a	Pass!	+	+	+	+												-
3b	Pass!	-								+	+	+	÷			-	-
4	Leakage?	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-
4a	Pass!	+	+			+	+										-
4b	Pass!	-								+	+			+	+		-
5	Leakage?	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
5a	Pass!	+		+		+		+									-
5b	Pass!	-	-	-	-	-	-	-	-	+	-	+	-	+	-	÷	-

Table 3: Splitting caused by excessive current leakage due to mass grouping

During the Mass IR test's binary scan, multiple nets are measured simultaneously. As the combined leakage of all these nets adds up, the PUT's IR leakage limit may be exceeded. If this occurs, a FAIL condition is detected by the MPT. The MPT will then determine whether this condition was caused by cumulative net grouping or by the excessive leakage of a faulty net. This is done by performing recursive group splitting in a

*'divide and re-test'* fashion until all faulty nets are identified or the condition disappears (e.g. Test Cycles 2a, 2b, 3a, 3b, etc.).

If the FAIL condition disappears on group splitting, a FAIL will not be recorded.

#### Scenario 4: Bad Product – Arc Detected During Mass HiPot Test

When an arc is detected during a mass HiPot test, the system can either split the group recursively (binary iterations) or it can default directly to linear (sequential or CableTest Systems Inc. 'single phase') fault detection. The use of binary or linear iterations upon fault detection is a programmable option. Linear fault detection may be required when it is not desirable to expose the PUT to repeated arc faults that can occur during the faster binary fault detection routine. The binary and linear fault detection methods are illustrated in Tables 4a and 4b respectively.

Test **Net Number** Cycle 
 Condition
 1
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 Pass! 1 2 ARC! 4 4 4 4 4 2a ARC! 2b Pass! Pass! 2c 2d ARC! 2e Pass! 3 Pass! +÷ ++ Pass! 4 ÷ + ÷ H ÷ ÷ ł 5 ARC! 4 + + + 4 + + 5a Pass! 5b ARC! 5c Pass! 5d Pass! 5e Pass! 5f ARC! 6 Pass!

Table 4a: 'Bad' PUT – Arc between 2 nets during Mass HiPot (Binary search for fault)

Test	Net Number																
Cycle	Condition	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Pass!	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
2	ARC?	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-
2a	Pass!	+															
2b	Pass!		+														
2c	ARC!			÷													
2d	Pass!				+												
2e	Pass!					+											
2f	Pass!						+										
2g	Pass!							+									
2h	Pass!								+								
3	Pass!	+	+	F	+	-	-	-	-	+	+	+	+	-	-	-	-
4	ARC?	÷	+	F	-	+	+	-	-	+	+	-	-	+	+	-	-
4a	Pass!	+															
4b	Pass!		+														
4c	Pass!					+											
4d	Pass!						+										
4e	Pass!									+							
4f	Pass!										+						
4g	Pass!													+			
4h	ARC!														+		
5	Pass!	+	-	F	-	+	-	+	-	+	-	+	-	+	F	+	-

Table 4b: 'Bad' PUT – Arc between 2 nets during Mass HiPot (Linear search for fault)

# Scenario 5: Bad Product – Leakage Failure During IR Test

The following table shows an example of splitting as a result of a leakage condition. Test cycles 3a through 3f correspond to the recursive group splitting that is used to detect the fault.

Test	Net Numbe												ivid oc				
Cycle	Condition	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Pass!	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
2	Pass!	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-
3	Leakage?	+	+	+	+	-	-	-	-	+	+	+	+	-	-	-	-
3a	Pass!	÷	+	+	+												
3b	Leakage?									+	+	+	+				
3c	Pass!									+	+						
3d	Leakage?											+	+				
3e	Pass!											+					
3f	Leakage!												+				
4	Pass!	+	+	+	÷	+	+	+	+	-	-	-	-	-	-	-	-
5	Pass!	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+

 Table 5: 'Bad' PUT – Splitting due to excessive current leakage during Mass IR Test

# Linear (Sequential or 'Single Phase') Testing

The linear fault detection method relies on holding one net at a time at the high potential and all other nets at ground potential. That net under test is qualified in a single pass or test cycle and is tested against all other nets. For groups of 4 nets or less, linear (sequential or 'single phase') testing will be performed until all faults are found.

Test	Net or Net Group Number															
Cycle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	-
16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+

Table 6: Sequential or 'Linear' Testing

# Summary

If an error condition occurs during one of the mass high voltage test phases where multiple nets are at high potential, the mass algorithm will use a recursive fault detection routine.

The binary mode uses a "*divide and re-test*" strategy. The group of nets connected to the high potential is divided in two new groups and testing is repeated. If the new subgroups experience a new FAIL condition that requires splitting again, the subgroups will be split recursively in a similar fashion until the fault is found or the FAIL condition is eliminated. In this example, the PUT has 16 nets and the smallest sub-group that will be tested with the "*divide and re-test*" strategy has 5 nets. For groups of 4 nets or less, linear (sequential or 'single phase') testing will be performed until all faults are found.

# **APPENDIX D: CALIBRATION VERIFICATION**



# Introduction

An option available to Horizon customers is a system calibration verification tool. The tool is an adapter card with accompanying software.

The verification tool is designed to check the measurement parameters of the Horizon 1500. CableTest Systems takes great care to ensure their customers that their system conforms to the technical specifications laid out by our engineers. However, in order to maintain these quality standards, the customers may need periodically to verify the systems calibration.

Currently calibration cannot be done in the field. Should a problem appear, contact Horizon Technical Support at 1-800-495-1998 X240.

#### **General Overview**

The calibration equipment consists of a calibration board and an accompanying disk containing the software that works with the calibration board.

The calibration board contains resistors and capacitors that are carefully selected to be precise and stable over time. The exact value of each resistor was measured using a FLUKE 8840A and four-wire mode. The exact value of each capacitor was measured using an LCR meter, type SR715, manufacturer Stanford Research Systems. These values are stored in a file on the disk and used to compare the measured values against the tolerance limits accepted for the tester. The accompanying disk must be used with its designated board; and, they can be confirmed by comparing the serial number displayed on the calibration board cover with the tester's display at the start up time.

Along with the resistors and capacitors, a voltage surge protector and a diode are included on the calibration board to check the capability of the system to accurately detect active components and high voltage arcs (provided the unit has the high voltage testing capability).

A pair of external jacks provides the user with the capability to check their own external components. Also, if the unit has the high voltage testing capability, the user can check these parameters using a voltmeter. The result of measuring the built-in components can be printed on a customized report, by means of a standard parallel printer.

# **Using the Calibration Equipment**

#### Installation

Insert the disk in drive A: and power up the unit. In a short time you will see the Horizon's logo, followed by a diagnose screen were you will see the information concerning the number and the status of each detected MUX card. Each MUX card deals with 64 test points, therefore for a maximum of 1024 test points, maximum 16 cards can be detected.

For example, if your system has 128 test points, you must detect two cards, usually assigned as number 0 and 1. Therefore on the screen, the squares number 0 and 1 should be highlighted. If a MUX card is detected but does not pass a self test, its corresponding position on the screen will be displayed on a gray background, which means that card is defective and the situation must be reported to the supervisor. Besides the MUX boards status, you will see the serial number of the software that should match the serial number of the calibration board. After another few seconds you will reach the main menu.

#### The Main Menu Screen

1] Horizon 15 Calibration	
Thu Oct 09 1997	01:57 PM )
<u>C</u> AL IBRATIO	IN
S <u>Y</u> STEM SET	JP
<u>S</u> ELF TEST	
▲ CONTRAST ▼ S	HUT <u>D</u> OWN

From the *Main Menu* screen you have the following options: **CALIBRATION**. By selecting this option you can choose the source of the reference components used in method, from the ones built in the calibration board (INTERNAL) or the ones that you can connect to the external jacks (EXTERNAL). **SYSTEM SETUP** will let you adjust the system's clock and calendar (**TIME & DATE**) and also to setup a set of parameters for the printed report list (**PRINTER**) **SELF-TEST** will run again the self-test code. **CONTRAST**: adjusts the brightness of the LCD screen **SHUTDOWN**: Exits the calibration software

Calibration System Setup
<u>T</u> IME & DATE
PRINTER SETUP
<u>REFERENCE</u> VALUES
CALIBRATION <u>H</u> ISTORY
EXIT

Set Time & Date

14:26

10/09/97

TIME

DATE

Selecting **SYSTEM SETUP** produces the *Calibration System Setup* menu.

Selecting **TIME & DATE** allows you to properly set the values to accurately log the calibration verification.

Setup the p report fo	
<u>L</u> eft margin	5 sp
<u>H</u> eader	] 🖸
Co <u>m</u> pany	] J
Operator <u>I</u> .D	<u>о</u> к

<u>0</u>K

Selecting **PRINTER SETUP** allows the user to specify the extent of the print job (i.e. including a header or the operator's id.) and the left margin.

Enter the header string
YOUR CHOICE OF HEADER
QWERTYUIOP ASDFGHJKL ZXCUBNMEss <u>Q.9</u> Space Bar <u>Clear</u>
ASDFGHJKL ◀
09 Space Bar Clear

Enter the company name YOUR COMPANY NAME QWERTYUIOP ASDFGHJKL4 ZKCUBNMEsso 0..9 Space Bar Clear

Enter the operator ID
YOUR NAME
QWERTYUIOP
$ \begin{array}{c} \mathbb{Z} \times \mathbb{C} \cup \mathbb{B} \\ \mathbb{Q}9 \end{array} \\ \hline \\ \mathbb{S}_{pace Bar} \\ \mathbb{C}_{lear} \\ \end{array} \\ \hline \\ \begin{array}{c} \mathbb{E}_{nter} \\ \mathbb{C}_{nter} \\ \mathbb{C}_{nter$
09 Space Bar Clear

By selecting **Header**... you can enter this information where relevant or disable their function entirely.

By selecting **Company**... you can enter this information or disable it.

By selecting **Operator I.D**... you can enter this information or disable it.

When selected (a check mark present next to it) then information entered will be included in the printed report, otherwise it will be omitted.

Reference values setup
Refer to the manual for information on how to measure the reference components. To gain acces to the reference values editor you will need to enter the password indicated in the back of your manual.
<u></u> k

1	Ent	er the	passu	ord	H
$\square$					
					_
	1	2	3	<u>C</u> lear	
	4	5	6	BS	
	7	8	9	Enter	
		0	Esc	Enter	

Selecting **REFERENCE VALUES** from the *Calibration System Setup* menu, and the message to the left appears.



Do not alter the **Reference Values** unless they match the values measured on the Calibration Board. Pressing **Ok** the Horizon prompts you to enter the appropriate password. Your password is supplied when you purchase your calibration verification kit.

Modify the Reference Values Select

REF RESISTORS
REF <u>C</u> APACITORS
<u>P</u> ASSWORD
<u>о</u> к

Select **REF RESISTORS** to alter their reference values.

Edit Refere	ence Values
RESI	STORS
R1 1.000 Ω	R4 99.9 K
R2 10.08 Ω	R5 1.000 M
R3 1.001 K	R6 10.00 M
C	ancel <u>O</u> k

Select the resistor value you would like to alter. Refer to the schematic of the calibration board to select the correct resistor.

 Edit Reference Values

 CAPACITORS

 C1
 101 pF
 C3
 9.900 nF

 C2
 1.023 nF
 C4
 77.08 nF

 Cancel
 <u>0k</u>

Select **REF CAPACITORS** from the *Modify the Reference Values* menu to alter their reference values. Select the Capacitor you would like to alter. Refer to the schematic of the calibration board to select the correct capacitor.

1 Enter	the n	ew pas	sword 🔳						
[	1234								
1	2	З	Clear						
4	5	6	BS						
7	8	9							
	»	Esc	Enter						

Select **PASSWORD** from the *Modify the Reference Values* menu to select a new password to protect your reference values.

#### Verify calibration using the internal reference components

				zon atio		ոս	
C	Thu	Oct	09	1997	01	:57	PM
		<u>(</u>	CAL I	BRAT	ION		
		S	<u>y</u> st	EM SI	ETUP		
			<u>S</u> EI	⊿F TE	ST		
4	COI	TRAS	ST 🔻		SHU	т <u>р</u> о	WN

To select calibration verification press **CALIBRATION** on the *Calibration Menu*.

9C]	SELECT THE SOURCE OF THE REFERENCE VALUES	Ē
	INTERNAL	
	<u>E</u> XTERNAL	
	<u>C</u> ANCEL	

 Select the tests

 Resistors

 Capacitors

 Uiodes

 High voltage

 Start

Select **INTERNAL** to use the components of the calibration board to perform the verification test.

Select the tests you would like to perform. A test will be included if a check mark is present next to the option.

Press Start to begin calibration verification.

At the beginning of the test, the system will check automatically for the position where your calibration board is

found.

If your calibration board was not identified a message "Insert the calibration board" will pop up on the screen and will disappear when you insert the calibration board.

This feature is especially useful when you want to compare a specific measurement on all the MUX cards available on your system.

The 6 resistance values are measured by the Horizon and compared to the list of reference values. The 6 resistance values are measured by the Horizon and compared to the list of reference values. The 6 resistance values are measured by the Horizon and compared to the list of reference values. The 6 resistance values are measured by the Horizon and compared to the list of reference values. The 6 resistance values are measured by the Horizon and compared to the list of reference values. The 6 resistance values are measured by the Horizon and compared to the list of reference values. The 6 resistance values are measured by the Horizon and compared to the list of reference values.

The 6th value of  $10M\Omega$  is at the end of the tolerance spectrum for the Horizon and will have a tolerance of up to 10% from the reference value.

Prior to performing the Capacitance Verification, the user is prompted to remove the Calibration Verification Tool from the

Press **Ok** for the next test.

Capacitive Calibration The system will perform a capacitive calibration. Remove Cal/Ver Tool, then press OK.
<u></u> k

Print result Cancel Ok

Capacitive Calibration The capacitive calibration Calver Tool in the position, then press OK. <u>Ok</u> Remove the tool and select **Ok**.

unit to perform a capacitance tare.

When prompted, replace the tool and select **Ok** to continue.

Measuring Internal Capacitors C Nom. Min. Max. Meas. OK					
1	103	98	107	101pF	4
2	1.001	0.978	1.023	1.019nF	1
з	10.05			10.18nF	1
4	77.46	75.90	79.01	78.02nF	4
Print result Cancel Ok					

The second test, capacitance, measures the 4 capacitor values and compares them to the listed reference value.

Press **Ok** for the next test.

Checking the diode
Diode detected: -∎4- Vf: 73 mV
<u>P</u> rint result <u>O</u> K
High Voltage Tests
AC current measurement:OK AC arcs detected:OK
DC current measurement:OK DC arcs detected:OK

Print result

The third test is a diode test. The test notes the diode orientation (a successful test) and measures the forward voltage.

The fourth test is a high voltage test, measuring the AC and DC currents and the detection of AC and DC arcs.

The system continuously scans until **Ok** is selected.

During each of the tests you have option to Print result,

Verify calibration using external reference components

<u>o</u>k

)C	SELECT THE SOURCE OF THE REFERENCE VALUES	
	<u>I</u> NTERNAL	
	<u>E</u> XTERNAL	
	<u>C</u> ANCEL	

Check calibration using xternal reference components <u>R</u>esistors 5mA DC Capacitors 50uA DC <u>D</u>iodes AC Hipot HC <u>S</u>ource DC <u>H</u>ipot Cance l

ENTER THE VALUE OF THE EXTERNAL REF. RESISTOR

1498.100

Ω 1

ко 1

◙▲

7

2 3 <u>C</u>lear

Esc

4 5 6 BS 89 Ente Choosing the EXTERNAL option in the SELECT THE SOURCE OF THE REFERENCE VALUES menu allow the user to test there own measured components.

To verify resistance measurement, select Resistors.

Measure your resistor and enter the value.

Connect the test resistor to the jacks			
Reference:	1498.100 KR		
Measured :	R=1.4MΩ		
Tolerance:	0.9%		
	<u>о</u> к		

Connect the resistor to the external jacks on the calibration board. The Horizon measures the value and compares it to the value you entered as a reference value. The tolerance between the two is given.

Press **Ok** to return to the *Check calibration using external* reference components menu.

Check calibration using external reference components			
<u>5</u> mA DC			
5 <u>0</u> uA DC			
<u>A</u> C Hipot			
DC <u>H</u> ipot			
<u>C</u> ance l			

Hossaye Make sure there are no capacitors connected to the Jacks. The system will packs and capacitance calibration. <u>O</u>k

ENTER THE VALUE OF THE EXTERNAL REF. CAPACITOR 0.441 2 1 1 з Clear րե 🗌 6 BS 4 5 8 7 9 Enter • Esc

The first step is to allow the Horizon to measure the capacitance of the jacks, so their value is not computed as part of the component to be measured.

To verify capacitance measurement, select Capacitors.

Measure the capacitance of your component using an extremely reliable tool, such as a bridge. Enter the measured value.

Connect the test capacitor to the jacks			
Reference:	0.441 nF		
Measured :	C=442pF		
Tolerance:	0.2%		
	<u></u> к		

Connect the component to the external jacks on the calibration board and the Horizon measures the value comparing it to the reference value entered. The tolerance between the two values is reported.

 
 Check calibration using external reference components
 Se

 Resistors
 5mA DC
 fol

 Capacitors
 50uA DC
 fol

 Diodes
 AC Hipot
 HC Source

 HC Source
 DC Hipot
 Cancel

Press **Ok** to return to the *Check calibration using external* reference components menu.

Select **Diodes** to verify the Horizon detects polarity and forward voltages through the diode junction.

Connect the diode to the jacks			
Diode: Vf:	Open		
	<u>о</u> к		

The Horizon correctly reports the absence of a diode.

Connect the diode to the jacks			
Diode: Uf:	Short		
	<u>о</u> к		

The Horizon correctly reports a short between the diode terminals.

Connect the diode to the jacks			
Diode: Uf:	-→I- 63 mU		
	<u>o</u> x		

Check calibration using external reference components		
<u>R</u> esistors	<u>5</u> mA DC	
Capacitors	5 <u>0</u> uA DC	
<u>D</u> iodes	<u>A</u> C Hipot	
HC <u>S</u> ource	DC <u>H</u> ipot	
	<u>C</u> ance l	

The Horizon correctly reports the polarity and the forward voltage of the diode.

Press **Ok** to return to the *Check calibration using external reference components* menu.

The Horizon uses two fixed currents to perform it measurements. Select **5mA DC** to verify the value and **50\muA DC** to verify the value.

Checking the 5mA cu	ırrent
(Connect a miliampme the jacks, check t current and press you are done.	ter at he 5mA OK when
	<u>0</u> k

Use an ammeter to measure the current through the two jacks.

An example measurement from a Horizon was 4.946mA

Press **Ok** to return to the *Check calibration using external reference components* menu.

Checking the 50 µA current
Connect a miliampmeter at the jacks, check the 50µA current and press OK when you are done.
<u>0</u> k

Check calibration using xternal reference components

Ca<u>p</u>acitors <u>D</u>iodes

HC <u>S</u>ource

<u>5</u>mA D

5<u>0</u>uA DC

AC Hipot

DC <u>H</u>ipot <u>C</u>ancel Select **50µA**. Use an ammeter to measure the current through the two jacks.

An example measurement from a Horizon was  $49.97 \mu$ A.

Press **Ok** to return to the *Check calibration using external reference components* menu.

Select **AC Hipot** to verify the AC hipot card in your machine (should you have this feature installed).

CHECKING THE AC HIGH VOLTAGE		
<u>U</u> oltage	100 U	
<u>F</u> requency	60 Hz	
Isolation R:	11 MΩ	
Touch here t	o activate HV	
<u>H</u> ipot On	<u>о</u> к	

As a safety precaution, the high voltage will only be present and be maintained as long as the touch screen is pressed.

Check calibration using external reference components		
<u>R</u> esistors <u>5</u> mA DC		
Ca <u>p</u> acitors	5 <u>0</u> uA DC	
<u>D</u> iodes	<u>A</u> C Hipot	
HC <u>S</u> ource	DC <u>H</u> ipot	
	<u>C</u> ance l	

CHECKING THE DC HIGH UOLTAGE		
<u>U</u> oltage 100 U		
Isolation R: 10 M $\Omega$		
Touch here to activate HV		
<u>H</u> ipot On <u>O</u> K		

As a safety precaution, the high voltage will only be present and be maintained as long as the touch screen is pressed.

CHECKING HIGH U	
<u>U</u> oltage	100 U
Frequency	60 Hz
Isolation R:	5 MΩ
Touch here to	o activate HV
<u>H</u> ipot On	<u>o</u> ĸ

Check calibration using external reference components		
<u>R</u> esistors <u>5</u> mA DC		
Capacitors	5 <u>0</u> uA DC	
<u>D</u> iodes	<u>A</u> C Hipot	
HC <u>S</u> ource	DC <u>H</u> ipot	
	<u>C</u> ance l	

measured and compared to the applied voltage. Once the voltmeter is across the jacks, the internal resistance of the meter will be displayed as the Isolation R[esistance]. You can also use this feature to measure known values of high resistance across the jacks to test how well the Horizon measures these values with the high voltage.

Using a voltmeter, the potential across the jacks can be

Press Ok to return to the Check calibration using external reference components menu.

Select **DC Hipot** to verify the DC hipot card in your machine (should you have this feature installed).

Using a voltmeter, measure the potential across the jacks to be compared to the applied voltage. Once the voltmeter is across the jacks, the internal resistance of the meter will be displayed as the Isolation R[esistance]. You can also use this feature to measure known values of high resistance across the jacks to test how well the Horizon measures these values with the high voltage.

Example of using the high voltage to measure a resistor value. The measured resistance of  $4.964M\Omega$  was placed across the external jacks and the AC voltage was applied.

Select HC Source to verify the High Current Source of your Horizon.

Checking the High Current Source		
<u>M</u> ode	Auto	
<u>C</u> urrent	100mA	
Max Volt	5.00	
<u>S</u> ource On		

1000

4 _____ 7 8 9 Enter

Esc

6 BS

2

4 5

A

1

Select Current.

Enter the Iout value [mA] Enter the maximum current of the HC Source in your machine... either 500mA or 1A. 3 <u>C</u>lear

Select Enter.

Checking the High Current Source		
Mode	Auto	
<u>C</u> urrent	1000mA	
Max Volt	4.20	
<u>S</u> ource On		<u>0</u> k

Using the Calibration Tool, place an ammeter between the jacks.

Select Source On.

Checking the High Current Source		
Mode	Auto	
<u>C</u> urrent	1000mA	999mA
Max Volt	4.20	104mU
	Resist.:	<u>104mΩ</u>
<u>S</u> ource On	] J	<u>0</u> k

Checking the High Current Source

Max <u>U</u>olt 5.00

<u>S</u>ource On

Manual Current 1000mA

<u>0</u>k

<u>M</u>ode

Check the ammeter reads the correct current. The shaded portion of the screen shows the Horizon measurements. Compare those with your meter's measurements.

Select **Source On** to turn off the High Current Source, and then select Mode.

Mode set to 'Manual' makes the Max Volt option available.

Select Max Volt.

Enter the Vout value [V] 28.0 1 2 3 <u>C</u>lear 4 5 6 BS 7 8 9 Enter 0 Esc

Enter the maximum voltage the High Current Source can sustain: 28V.

Select Enter.

Checking the High Current Source		
Mode	Manual	1
<u>C</u> urrent	1000mA	
Max <u>U</u> olt	28.00	
-	•	
<u>S</u> ource On	] 🗆	<u>0</u> k

Checking the High Current Source		
Mode	Manua 1	
<u>C</u> urrent	1000mA	0.0mA
Max <u>U</u> olt	28.00	28.10
	Resist.:	Open
<u>S</u> ource On	] 🛛	<u>0</u> k

Using the Calibration Verification Tool, place a voltmeter across the jacks.

Select Source On.

Select Source On.

Select Mode to return to 'Auto'.

Check the voltmeter reads the correct voltage and compare it to value read by the Horizon in the shaded area on the screen.

Select **Source On** to turn off the High Current Source.

Select a low value resistor, example  $0.1\Omega$ , and place it between the jacks of the Calibration Verification Tool.

Checking the High Current Source		
<u>M</u> ode	Auto	
<u>C</u> urrent	1000mA	
Max Volt	] 4.20	
<u>S</u> ource On		<u>0</u> k

Checking the High Current Source		
<u>M</u> ode	Auto	
<u>C</u> urrent	1000mA	999mA
Max Volt	4.20	108mV
	Resist.:	108mΩ
	Resist	
<u>S</u> ource On	<u> </u>	Ūĸ

Calibration History

1) Horizon 1500 Calibration Menu	H
Thu Oct 09 1997 01:57 P	ĕ
<u>C</u> AL IBRATION	
S <u>Y</u> STEM SETUP	
<u>s</u> elf test	
▲ CONTRAST ▼ SHUT <u>D</u> OW	١

Check the measured value of the resistor, shown in the shaded area, to the known value of the component.

Once you have performed calibration verification for the first time on your Horizon, a log is taken of the date and type of verification (Internal or External).

To view calibration history. Select **SYSTEM SETUP** from the *Calibration Menu*.

Select **CALIBRATION HISTORY** from the *Calibration System Setup* menu.

File Open Error
Could not open the calibration history file for this unit.
<u> </u>
Calibration History of unit SN 10/10/97: INTERNAL

Before calibration verification is done for the first time on you're the Horizon the message to the left will be reported.

Calibration history logs the date and type (Internal or External) of calibration verification done on your system.

The following is an example of the printed report:

CHOICE OF HEADER Company name: Cabletest Systems Inc. Operator ID: Jonathan Dorfman Date: Fri Oct 03 1997 01:29pm

OK

CALIBRATION AND VERIFICATION REPORT

Calibration Box SN#: 123456-78 Horizon 1500 SN#: 123456-22 Reference components: PREDEFINED VALUES

Measuring Internal Resistors

Calibration card on position 1					
R	Nom.	Min.	Max.	Meas. Ok	
1	1.008	0.982	1.033	1.029 Ohm	OK
2	10.01	9.84	10.18	10.02 Ohm	OK
3	0.998	0.983	1.012	1.001 KOhm	OK
4	99.8	94.8	104.8	100.0 Kohm	OK
5	998	948	1048	997 KOHM	OK
6	10.00	9.00	11.00	9.96 MOhm	OK

Measuring Internal Capacitors

Calibration card on position 1					
С	Nom.	Min.	Max.	Meas.	Ok
1	103	98	107	101pF	OK

2	1.001	0.978	1.023	1.013nF	OK
3	10.05	9.84	10.25	10.11nF	OK
4	77.46	75.90	79.01	77.81nF	OK

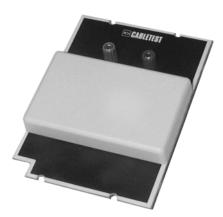
CHECKING THE DIODE

Calibration card on position 1 DIODE : Detected Vf=87 mV

CHECKING THE HIPOT

Calibration card on position 1 AC Arcs Detected:OK AC Current measurement:OK DC Arcs Detected:OK DC current measurement:OK

# Calibration Verification Tool – Reference Value Measurement Guide – Calibration Procedure



Introduction:

The Horizon 1500 Calibration Verification Tool is composed of several components that are utilized by the Calibration Verification Software to verify that the Horizon 1500 is within specifications

Necessary Equipment: Philips Screwdriver Kelvin Clips

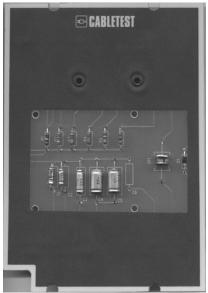
Instruments DMM (Ω 2W / Ω 4W) LCR Bridge

Calibration Conditions: Warm up time: N/A Temperature: 23°C +/-2°C Critical Specifications 4 Digit DC Accuracy 4 Digit Accuracy Recommended Model HP34401A SRS SR715/SR720

1. Remove the Protective Shell from the tool.

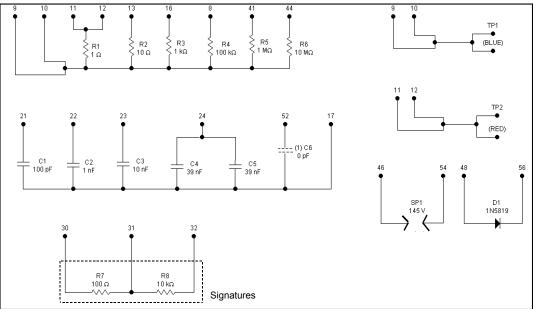


Remove the 4 screws holding the shell in place.



Components are exposed.

### 2. Measuring the Values



Schematic of Calibration Verification Tool NOTE: The PCB decal, used to get the residual capacitance C0.

The Components are clearly labeled on the tool:

2.1 Resistors R1 and R2 are measured at their terminals using a 4 wire (Kelvin) measurement.

The tolerance of the resistor components is 1% the nominal value.

R1 = 1000mΩ R2 = 10000mΩ

2.2 Resistors R3, R4, R5, R6 are measured at their terminals using a simplex resistance measurement.

The tolerance of the resistor components is 1% the nominal value.

R3 = 1000Ω R4 = 10000Ω

R5 = 100000Ω R6 = 1000000Ω

2.3 The capacitors are measured at their terminals using an LCR Bridge at 100Hz.

The tolerance of the capacitor components is 2% the nominal value.

C1 = 100pF C2 = 1000pF C3 = 10000pF C4||C5 = 78000pF

C6 need not be verified.

NOTE: C4 and C5 are in parallel with a combined capacitance of 78nF. Recording the Measured Values:

The measured values must be entered within the CAL.REF file found on the accompanying diskette with the tool.

The file can be edited using any DOS or WINDOWS text editor. E.g. Edit or Notepad.

The file has the following format:

123456-12	$\rightarrow$ Serial Number of Card
1000	$\rightarrow m\Omega$
10000	$\rightarrow m\Omega$
1000	$\rightarrow \Omega$
100000	$\rightarrow \Omega$
1000000	$\rightarrow \Omega$
1000000	$\rightarrow \Omega$
100	$\rightarrow$ pF
1000	$\rightarrow$ pF
10000	$\rightarrow$ pF
78000	$\rightarrow pF$

Edit the file to reflect the actual measured values of each component. The units are not required within the file.

Once complete, save the file as text only onto the calibration verification tool diskette.

Example File: 123456-12 1000 9994 1001 99987 1002400 10040200 101 1003 10107 78115 Company Name:____ _____ Horizon 1500 Model:_____ Serial Number:_____ Date & Time:_____ HORIZON 1500 CALIBRATION TOOL VERIFICATION REPORT Please refer to the manual for the recommended method for measuring each component RESISTORS R1:_____( $m\Omega$ ) R2:_____(mΩ) R3:____(Ω) R4:_____(Ω) R5:____(Ω) R6:____(Ω) CAPACITORS: Cl:____(pF) C2:____(pF) C3:_____(pF) C4:_____(pF) Calibration verified by:_____

**Glossary of Terms** 



Build Aid	A special test parameter that allows the Horizon to aid in the building of a product. Assists in avoiding miswiring during product assembly.
Calibration Verification	Verifying your Horizon is maintaining measurement within CableTest engineering specifications.
CapTare	Measurement of capacitance up to a specific
Conventions	location for increased measurement accuracy. The numbering / lettering of connector pins using a specific sequence.
EPO	Emergency Power Off
FER™	Faulty End Recognition – a unique feature of the Horizon that enables the operator to quickly and easily locate low voltage shorts anywhere along the length of a product.
Flex Test	A special test parameter that allows the operator to manipulate the cable while the Horizon searches for opens, mis-wiring, and shorts. In many cases, faults only occur intermittently depending on the cable position.
Flying Leads	Any product that is terminated at one end with accessible contacts at another location.
Hipot testing	The application of high voltage (either DC or AC) to a product.
Kelvin "four-wire" testing	Accurate low resistance measurement of a conductor or resistor. The method uses four wires instead of two (simplex).
Netlist	Groups of test points, sorted by their connections.
Palm Switch	An optional safety feature available for the Horizon.
Quick scan	The default setting for low voltage tests of a product. The scan performs a standard isolation and continuity test on your product.
ResTare	Measurement of resistance up to a specific location for increased measurement accuracy.
Smart Probe	An optional product available for the Horizon. The Smart Probe currently works in conjunction with the Build Aid feature and with the Net List Editor.
Standard Probe	Included tool with the Horizon to use with the Build Aid feature of the Horizon.

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