CableTest Systems Inc.

HORIZON SERIES TESTER

H1500 PROGRAMMER'S MANUAL

v 4.5.xx

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CABLETEST

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Warranty. CABLETEST warrants that the shipped Product will be free from defects in material and workmanship in conformance with our specifications for a period of one year (1) from date of shipment by CABLETEST. This is the only warranty, which CABLETEST makes relating to the Product. CABLETEST make no other warranty, express or implied, and specifically no warranty of merchantability or fitness for a particular purpose. This warranty is limited to replacement or rebuilding of any Product and shall constitute the exclusive remedy for breach of warranty and CABLETEST shall not be responsible for any incidental or consequential damages. Products covered by this warranty must be returned prepaid and received within the warranty period. No allowances will be made for labour, material, time, damage or transportation claims, nor will Product be replaced or rebuilt if it was damaged from improper use. This warranty does not apply to loss or damage caused by accidents; riot; labour disputes; acts of God; inadequate power sources; power interruptions; use with hazardous or explosive chemicals and/or materials; unfit or inadequate environmental control, including site conditions and chemicals used individually or in combination; improper operation, maintenance, supervision, training, or use of safety precautions relating to the operation of the Product; or other causes beyond the control of CABLETEST. No allowances will be made for the cost of work done or repairs done by others.

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CABLETEST

1 INTRODUCTION

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

1.2 Abbreviations and Symbols

Important: Additional User Information

Caution: Indicates how to avoid potential damage to parts/components or loss of data.

Warning: Indicates how to avoid potential bodily harm.

Keyboard Shortcut – Horizon Lite user navigation information

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

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.

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.

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.

2 GETTING STARTED

How to create and test your first product

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 ” Test ” select **<Alt-T>**

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>**.

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.
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.

The factory installed Password is "1234".

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

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.

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.

For the following exercise, it is assumed that you are using a simple end-to-end 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.

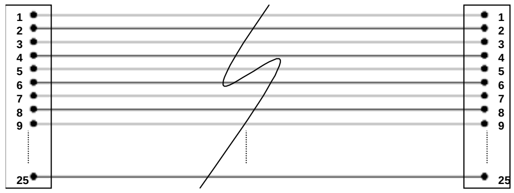
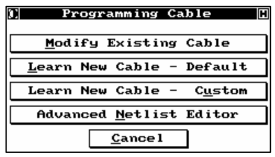


Figure 2-1: Example Cable (One to One, 25 Conductors)

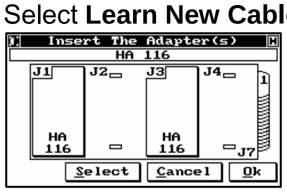


Several methods of programming cables are provided in your new Horizon. These are discussed in detail in the following sections. For this exercise, we are going to learn a new cable using the standard method.

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.

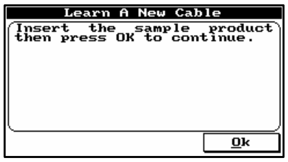


The top of the Horizon is divided into two sections, each of which has four grey connectors. The left most set of connectors (top and bottom) constitutes J1, as can be seen from the label at the top. The two to the right make up J2, and so forth. Adapters that use a single set of connectors are referred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

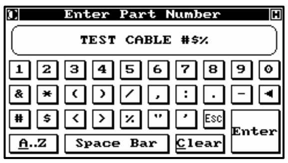
Insert your adapters in the position(s) of choice and select **Ok <Alt-O or Enter ↵>**.



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.

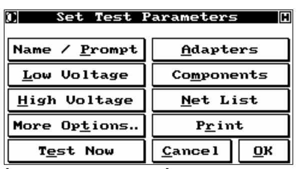
Any mistakes at this stage will be treated by the system as a good cable and may affect the accuracy of later testing.

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.



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.

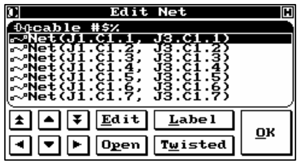
After you have entered the correct part number, select **Enter <Enter ↵>**. The *Set Test Parameters* dialog appears.



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 harness may have.

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.



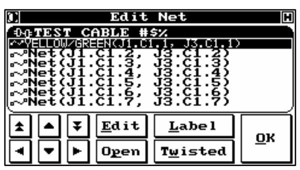
One obvious use of the NetList is to help verify that the cable you are learning is a good one (also known as a sanity check). Reading the NetList is simple and straightforward.

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.

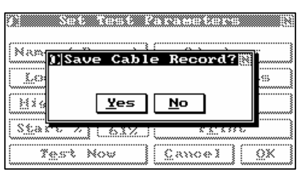
Selecting the **Open <Alt-P>** button would show these additional elements. The **Edit <Alt-E>** button allows you to specify exactly on which nets to perform certain additional tests, such as a HiPot test, if you do not want to perform these tests on the whole cable. This will be explained in detail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

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



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 ↵>** twice and the *Save Cable Record* dialog appears.



Select **Yes <Enter ↵>** 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.

As before, you can use any combination of up to 30 characters. If you want to store your cable in a new directory, select **New <Alt-N>**, and you will be prompted to enter the new name. Select **Enter <Enter ↵>** when through. Then move the cursor until the directory in which you want to save the cable is highlighted, and select **Ok <Enter ↵>**. The cable record is saved, and you are returned to the *Programming Cable* menu.

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.

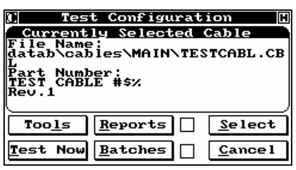
Select **Cancel <Alt-C or Esc>** and you will return to the *Main Menu*.

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.

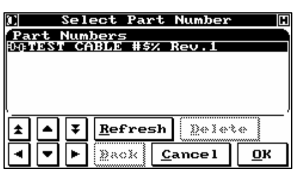
To test your cable

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



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

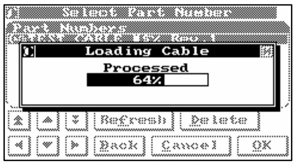
If you do not see the correct information you will have to press **Select <Alt-S>** to select your cable. The *Select Part Number* dialog appears.



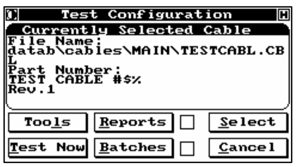
Select the part number for your cable, using the arrow keys if necessary, and select **Ok <Enter ↵>**. The *Test Configuration* dialog reappears with your cable as the Currently Selected Cable.

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

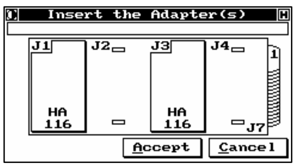
This selection process is only necessary if you want to test a cable other than that shown as the Currently Selected Cable, and will only need to be performed in the future whenever you need to change the type of cable being tested.



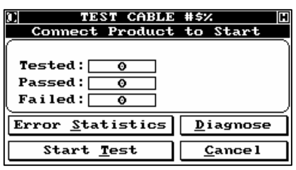
The Horizon loads the selected product.



To start testing your cable, select **Test Now <Alt-T or Enter ↵>**. The *Insert the Adapter(s)* dialog appears.

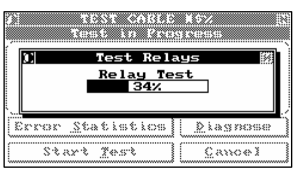


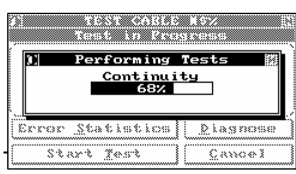
Insert the adapters required to test your cable. Make sure that you insert them in the same order and position as they were mounted when you learned the cable. Note that the system will prompt you for any missing, mis-positioned, or incorrect adapters by flashing an outline in the appropriate position and by flashing the part number. As soon as all of the proper adapters are mounted, the *Connect Product to Start* dialog appears.



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.

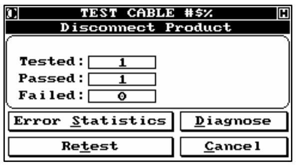




The system will indicate testing progress by displaying a horizontal bar graph that visually tracks the continuity and isolation tests as they are performed.

ⓘ 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.)

ⓘ 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 ↵>**; then, when instructed, turn off the power. To cancel shut down select **No <Alt-N or Esc>**.

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

3 SYSTEM SETUP

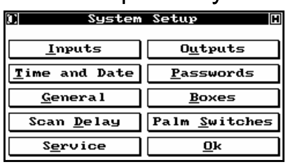
3.1 Introduction

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.

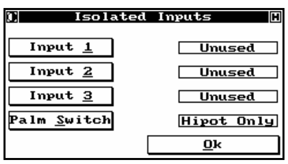
From *Main Menu*, select **System Setup** to access the *System Setup* menu.

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).



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



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.

Unused Input disabled.

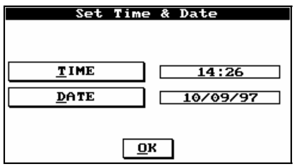
Palm Switch Toggles the Palm Switch function between Start Test and Start HiPot.

Ok returns you to *System Setup*.

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.



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.

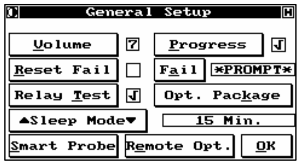
Select **Enter** to return to the *Time and Date* menu.

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.

3.4 General Setup Functions

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



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 self-test 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.

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.

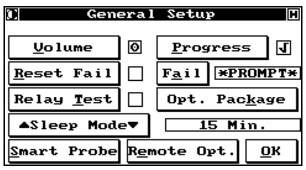
Opt. Package Setup option for additional packages and language control.

Smart Probe Setup options for the Digital Hand Held Probe.

Remote Opt. Setup options for Horizon Control using RS232.

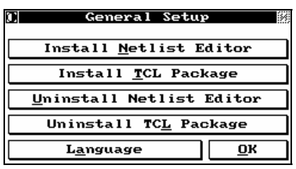
Select **Ok** to return to *System Setup*.

3.4.1 Installing software Options

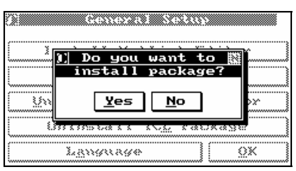


Opt. Package - Installation of optional software packages (TCL, Advanced NetList Editor) or changing the default language for the Horizon.

3.4.1.1 Install Advanced NetList Editor



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

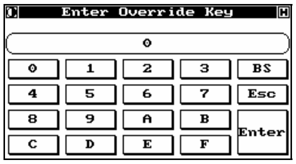


Select **Yes** to continue to install the Advance NetList Editor. The *Package Installation Warning* menu will appear.

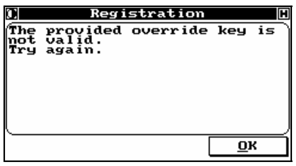
No will return you to the previous menu

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.

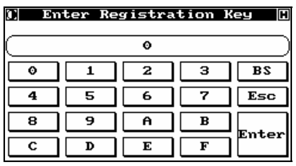
You must provide the unit's serial number as well as Uninstall Verification Key.



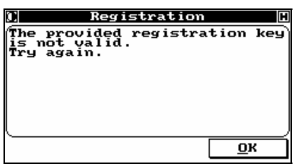
Enter the Override Key, which is provided by the factory.



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.



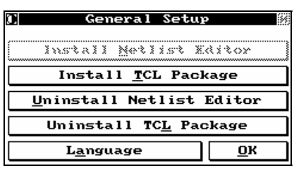
Enter the Registration Key.



If there is an error when entering the Registration Key, this message will appear. Select **Ok** and try again.

If it persists, call the Horizon Technical Support.

3.4.1.2 Install TCL Scripting Package



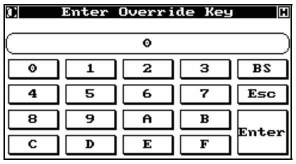
To install the TCL Package, select **Install TCL Package**.

Select **Yes** to continue to install the TCL Package. The *Package Installation Warning* menu will appear.

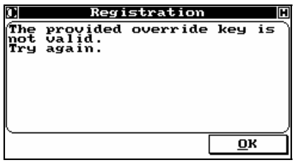
No will return you to the previous menu.

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.

You must provide the unit's serial number as well as Uninstall Verification Key.

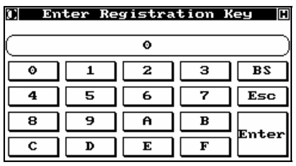


Enter the Override Key, which is provided by the factory.

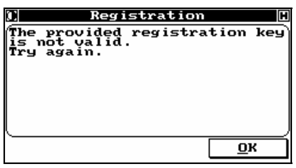


If there is an error when entering the Override Key, this message will appear. Select **Ok** and try again.

If it persists, call the Horizon Technical Support.



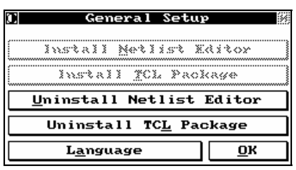
Enter the Registration Key.



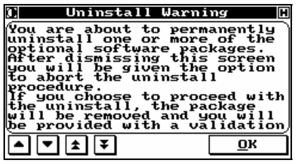
If there is an error when entering the Registration Key, this message will appear. Select **Ok** and try again.

If it persists, call the Horizon Technical Support.

3.4.1.3 Uninstall Advanced NetList Editor or TCL Package

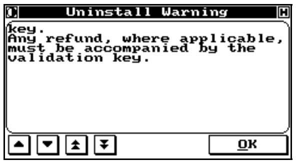


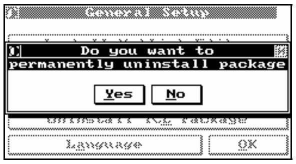
To uninstall the Advanced Netlist Editor or the TCL Scripting Package, select **Uninstall** for the specific option.



Read this warning carefully. Use the up and down arrows to scroll through the warning message.

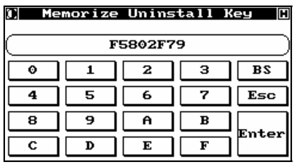
Select **Ok** to continue.





Select **Yes** to permanently uninstall the Editor or the TCL Package.

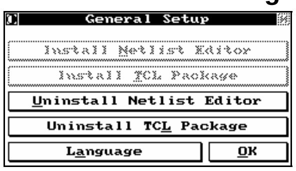
No will abort the uninstall process and return to the *General Setup* menu.



Write down the displayed the validation key. CableTest will require this key if the Editor or the TCL Package is re-installed.

Select **Enter** to return to the *General Setup* menu.

3.4.1.4 Default Language



Language – Select the default language of the Horizon.

The *Select Language* menu will allow the user to select the language of choice.

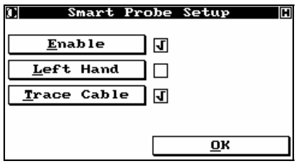
The selected language will only change the operator's menus. These menus are *Main Menu* and *Test.* All other screen will remain in English.

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

3.4.2 Digital Hand Held Probe (Smart Probe)

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.

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



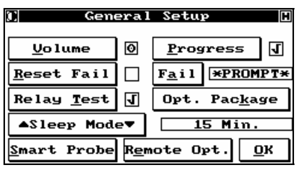
Smart Probe Setup menu:

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.

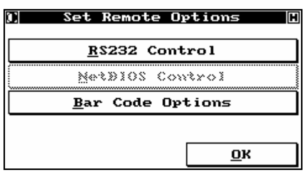
Trace Cable Activated the DHHP can be used to trace a failed product.

3.4.3 Remote (RS232) Options / Bar Code Reader Setup



Select **Remote Opt.** Button for the *Set Remote Option* menu.

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

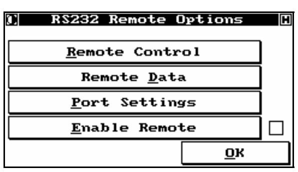


Select **RS232 Control** to externally control the Horizon.

Select **Bar Code Options** for the setting up a reader.

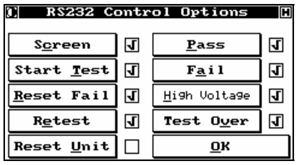
Press **OK** to return to the *General Setup* menu.

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.



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.

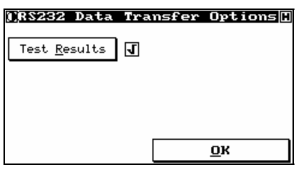
Reset Unit Controls the ResetUnitON and ResetUnitOff commands. The reset unit command family requires additional conditions to be enabled.

Pass Controls the PassOn and PassOff commands.

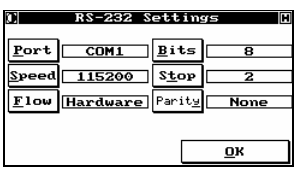
Fail Controls the FailOn and FailOff commands.

High Voltage Controls the HighVoltageOn and HighVoltageOff commands.

Test Over Controls the TestOverOn and TestOverOff commands.



Remote Data Enable or disable results returned to the Host PC at the end of a test.



Port Settings

Port Select between COM1 and COM2. The Horizon 1500 only uses COM1.

Speed Available speeds are: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.

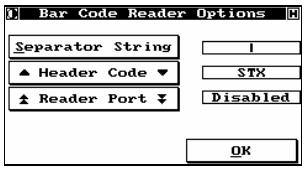
Flow The only available selection is Hardware.

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

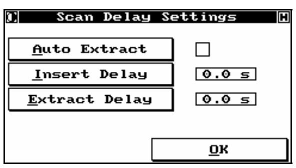
Separator String Select your part number separator

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".



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.

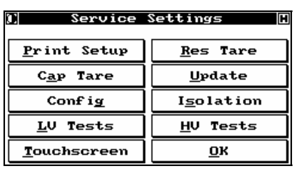
Another case in which the extract delay is useful is if you are testing a product composed mostly of components. In this case, the Horizon could mistakenly think that the product has been disconnected at the conclusion of the test and automatically re-arm for the next test immediately, before you have 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

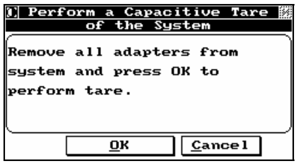
The **Service** button allows access to the *Service Settings* module.

Print Setup



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

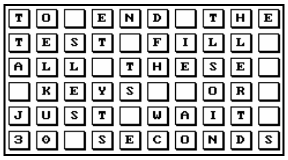
Cap Tare: This feature tares out the capacitance of the Installed switching modules on the Horizon. Should cards be changed or expansion boxes added, this service must be implemented.



Select **Ok** to perform the Tare

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

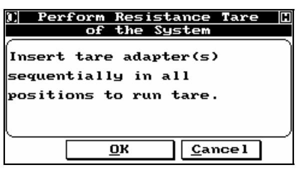
Touch Screen: Enables the user to test each of the possible touch screen positions to make sure they are working correctly. Select Keys to activate this function.



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*.

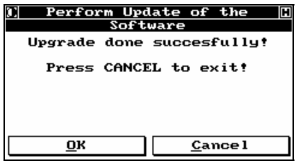
Res Tare: This feature tares out the resistance of the installed switching modules on the Horizon. Should cards be changed or expansion boxes added this service must be implemented.



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.

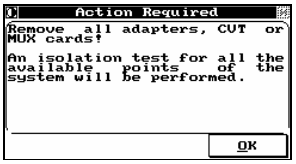
Update: Horizon client software updates can be inserted using the update feature. By selecting Update, the user is prompted whether to perform the update. Insert the first of the provided diskettes (this disk will be labelled 1 of n) and select OK.



Once complete, select **Cancel** to exit the *Update* module.

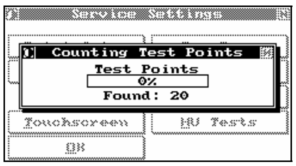
If your system is operating through a network, the update will only update the local Horizon. You will need to update the files located on the network server manually.

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

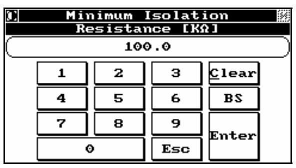


Remove all adapters and products from the Horizon.

Select **Ok** to continue.

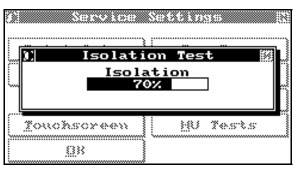


The Horizon learns the number of available test points.



The isolation resistance between points is verified at a default level of 100kΩ.

Select **Enter** to continue.



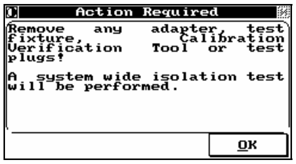
Switchcard isolation is being verified.

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

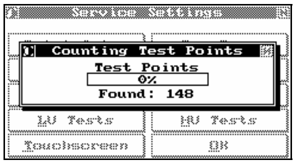
Select **Ok** to return to the *Service* menu.

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.



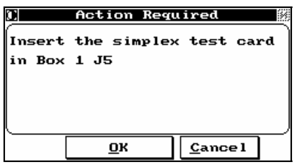
Remove all adapters/fixtures/product from the switching of the Horizon.



Horizon performs a standard isolation test on the switching network.

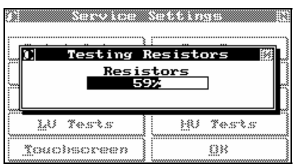
Follow the on screen prompts.

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.



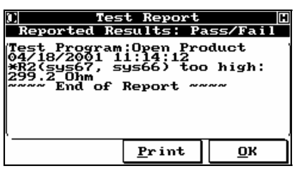
The Horizon will prompt you to insert the card into the first Quad position of the first Box (J5).

Select **Ok** to continue.

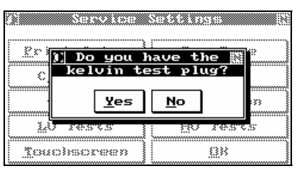


Simplex LV test in progress.

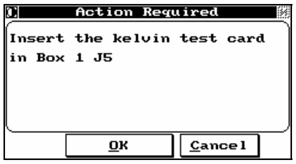
Once complete the Horizon will prompt you to move the card to the next position. Repeat until all Quad positions have been tested.



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.



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 *Service* menu dialog.

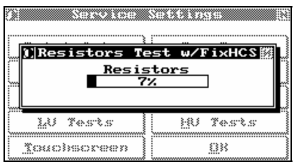


The Horizon will prompt you to insert the card into the first Quad position of the first Box (J5).

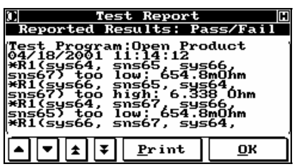
Select **Ok** to continue.

Test in progress using the standard LV source.

Test in progress using the optional High Current Source (if not installed will be skipped).



Test in progress using the Fixed High Current Source.

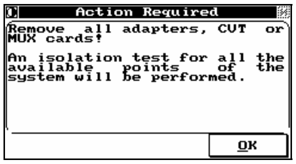


At the end of the Kelvin LV tests, the report is shown. Any faults will be listed.
If a fault is reported, contact CableTest's Customer Support Group.

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

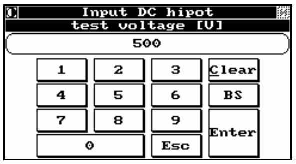
This option will only be enabled if a HiPot or HCS is installed in the Horizon.

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



Remove all adapters or product for the Horizon.

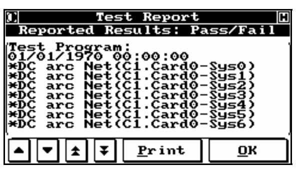
A safety isolation test is performed – follow the procedure shown above.



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.

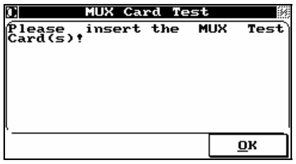
Select whether you wish to perform a linear or mass high voltage test. See Appendix C for more details regarding Mass HiPot.

You are prompted whether you wish to perform the HiPot prior to High Voltage being applied to the switching.



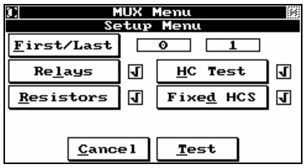
If the test fails, contact the Horizon Technical Support

To run a service test on the programmable and/or fixed High Current sources, select **HC HiPot Test**.



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**.

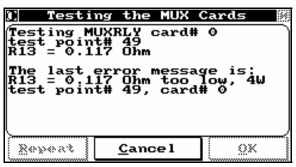


First/Last: This feature allows the user to select the first switchcard and the last switchcard to be tested.

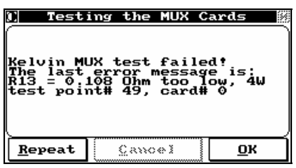
Relays: When enabled, the relays on the switchcards will be tested.

Resistors: When enabled, the resistors on the switchcards will be tested for the correct resistance value.

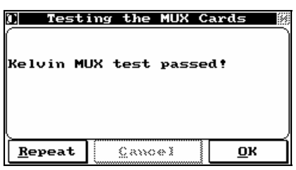
Test: Start test



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



HCS Service Test Failed.

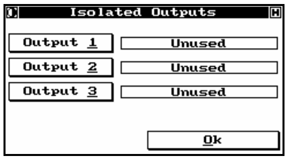


HCS Service Test Passed.

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.



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:

Unused	None of the outputs are active.
Pass	The product passed all required tests.
Fail	The product failed one or more required tests.
HV On	The high voltage power supply is active.
Test Over	The 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 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

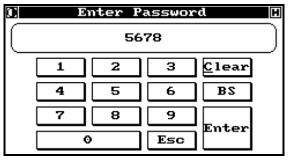
Select **Passwords** to display the *Password Settings* dialog.

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.



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.

Valid passwords: **1000 – 9999**

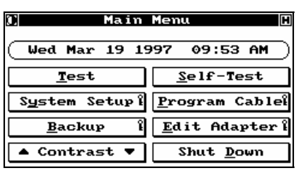
Horizon currently supports three levels of passwords: **Operator**, **Service**, and **Supervisor**. Select the type you want for this password and you will return to the *Password Settings* menu.

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.



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

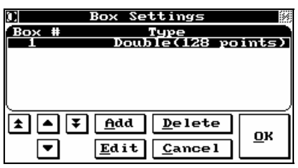
Enable can then be selected to enable or disable password protection. An associated box displays the status of password protection. A checkmark indicates that password protection is enabled.

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

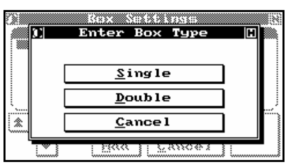
In addition, when passwords are disabled, the key symbol is no longer displayed on any of the buttons on the *Main Menu*.

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 points
Double: 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*.

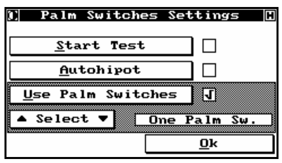
Select **Ok** when you are through to go back to *System Setup*.

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*.



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.

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.

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;

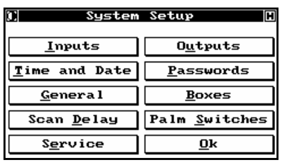
One Temporary A switch that only needs to be pushed momentarily;

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.



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

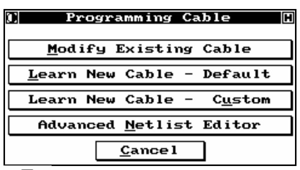
"Wire Only" Cables and Harnesses

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.

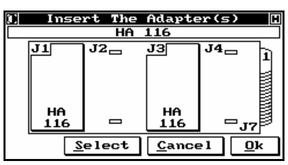
4.2 Learning the Cable

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.



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).



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

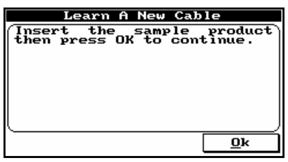
Select **Ok** after all adapters are properly mounted.

Cancel returns to *Programming Cable*.

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.

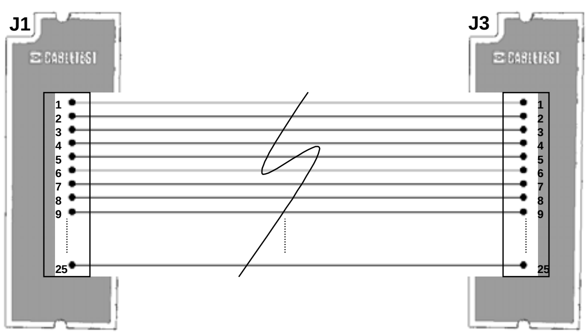
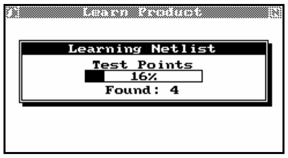
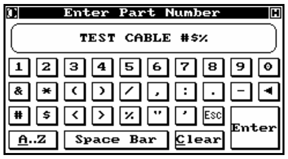


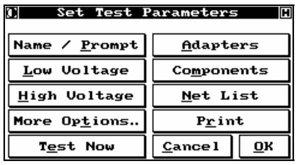
Figure 4-1: Product Under Test (PUT)



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



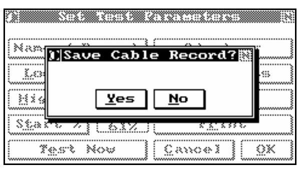
After the NetList has been learned, you are asked to *Enter the Part Number*, and a keyboard is displayed. You can use any combination of alpha and numeric characters as well as other valid ASCII symbols, such as parentheses, *, &, ^, etc., for your part number.



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.



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*.

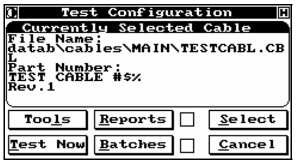
Test Program as CBL File

`\datab\cables\main\testcabl.cbl` For greater detail see section **9**.

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

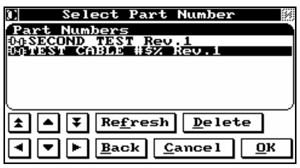
4.3 Testing Your Product

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.

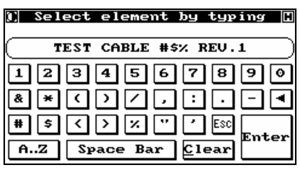


The display shows the Directory location and the Part Number for the cable you just learned or the last cable tested (depending which happened more recently). If this is the product you want to test, select **Test Now**; otherwise, press **Select**. The *Select Part Number* dialog appears.

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*.

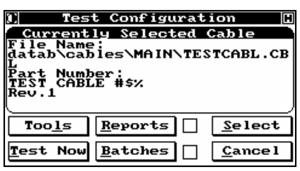


Use the arrow keys to move the cursor to the proper Part Number. Select **Ok** to select the desired product to be tested. **Refresh** re-loads the directory from file. **Delete**, removes part numbers. **Back** returns you to *Open Directory*, while **Cancel** returns you to *Test Configuration*.

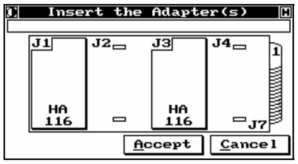


Fast Load: To alleviate searching through long lists of files for your test program, simply touch the center of the screen and type the name of the file to load it quickly. You can also type in partial names to get a list of matching files.

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

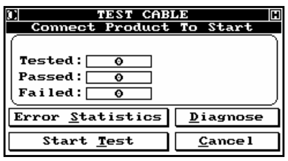


The new Part Number is now displayed as the *Currently Selected Cable*. Select **Test Now** to start the testing process. The function of **Reports** is described in section 7.1, while **Batches** is described in section 7.2. **Cancel** returns you to the *Main Menu*.



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*.

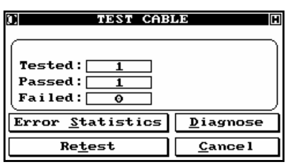


Insert your product in the appropriate connectors. The Horizon will detect when the product is inserted and automatically start the test. If your product passes, the green Pass light will be lit. If it fails, the red Fail light will be lit.

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.

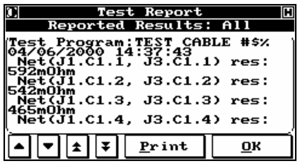
See Section 4.6 for automated start test details.

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).



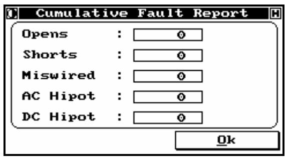
At the completion of the test, the display will change instructing you to disconnect the product. The act of disconnecting the product updates the statistics database and automatically re-arms the system to test the next product.

(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.



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.

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



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).

Consult section 7.2 for details regarding **Batches**.

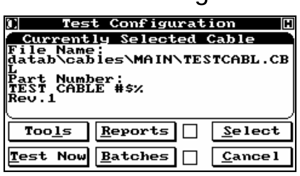
4.4 Controlling the Diagnostics

There are five options available for diagnostic display.

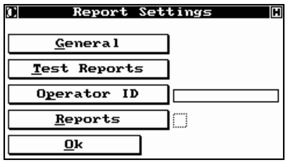
None:	No results are displayed.
Fail:	Only failed results are displayed.
Pass:	Only pass results are displayed.
Pass/Fail:	For on-screen diagnostics this behaves the same as Fail (see section 7.1 for greater details on Pass/Fail and reports).
All:	All results are displayed.

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

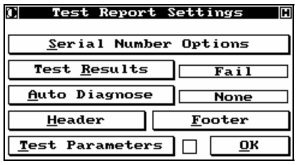
4.4.1 Altering the results displayed before testing.



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



Select **Test Reports**.



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’

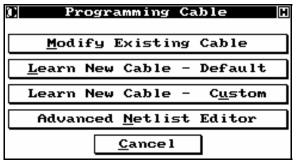
Altering the results displayed in the diagnostic dialogue during the test cycle can be done by touching the center of the display or using the Space Bar.

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

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.

4.5 Modifying Your Test Program

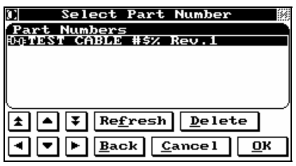


At any point you wish to alter the parameters of a test you may do so by selecting **Modify Existing Cable** from the *Programming Cable* menu.

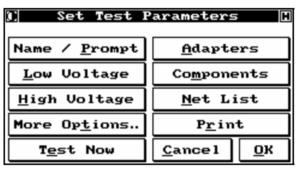
You can open this menu by selecting **Program Cable** from the *Main Menu*.

To utilize the optional **Advanced Netlist Editor** refer to Section 4.8.

Highlight the directory containing the test program you wish to modify and select **Ok**.

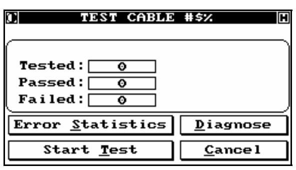


Highlight the test program you wish to modify and select **Ok**.



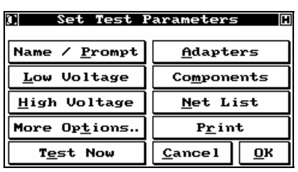
The *Set Test Parameters* menu appears. You can modify all the parameters of the test program from this menu.

Select **Test Now** to test any changes you make to the test program.

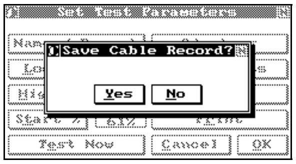


If the product does not automatically test, select **Start Test** to run the test.

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



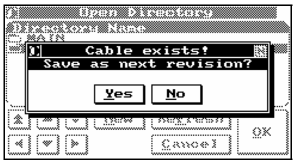
If you are satisfied with the modifications, select **Ok**.



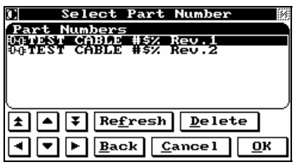
You are prompted to confirm that you wish to save.
Select **Yes** to continue.

Select a directory to save the file within or select **New** to create a new directory.

Select **Ok** to continue.

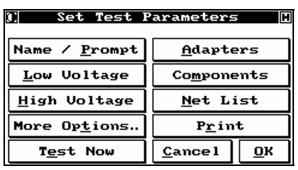


If you are saving the file into the directory that it originated you now have the option of saving the file as a next revision or overwriting the existing file.

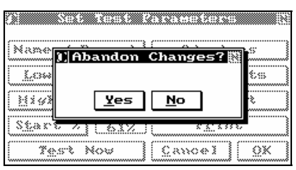


If you select **Yes** to next revision a new record is created with the same part number and an incremented revision number.

If you select **No**, you are prompted whether you wish to overwrite the existing file.
Select **Yes** to do so.



If you do not wish to save your modifications, then simply select **Cancel** from *Set Test Parameters*.



Then confirm you wish to abandon the changes.

4.6 Automated Start Test

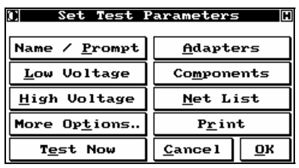
By default the Horizon is setup to begin testing once a product is inserted in the required adapters.

The default setting is 61% of product insertion.

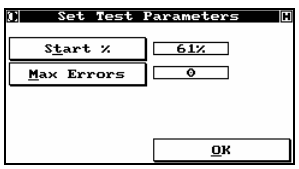
At the start of a test (when no external controls are in use) the system is scanning the test points for product insertion. Once 61% of the product is detected the test begins.

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.



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



Select **More Options → 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.

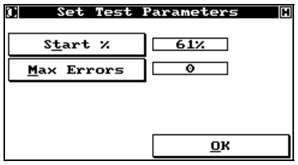
If you find that your product is hard to insert and, for example, requires the user to rock the connectors for proper insertion, you can utilize the Scan Delay feature of the Horizon to delay the start of test once it is triggered.

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.

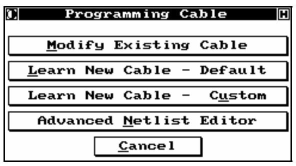


To enable this feature select **More Options → Max Errors** from the *Set Test Parameters* menu.

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

4.8 Advanced NetList Editor (Optional)

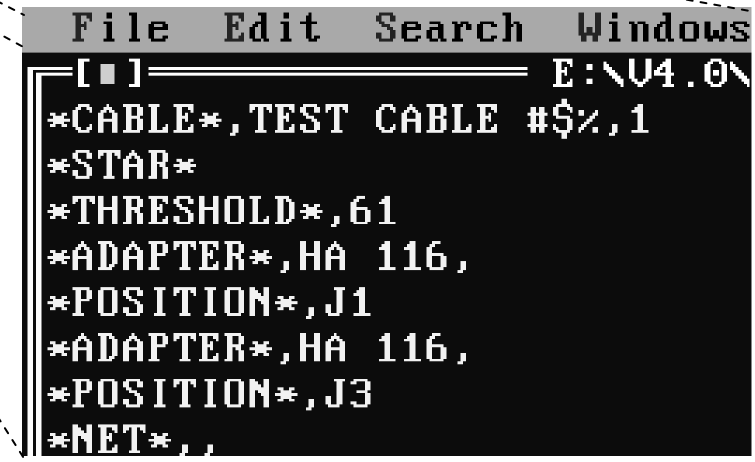
An available option for the Horizon is an onboard script editor. To edit script from the Horizon you will need to have a VGA monitor and an AT keyboard attached to the system.



Select **Advanced Netlist Editor** to open the text editor.

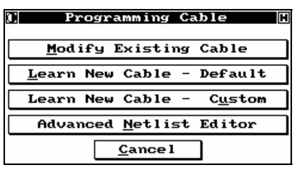
Open the desired directory and select the product you wish to edit.

The online text editor opens, displaying the test program's script.



Once you have edited the file as necessary, select **<Alt-F>** to pull down the File menu, then, **<S>** or **<F2>** to save and **<Alt-X>** to exit and return to the Horizon client software.

Please review section 9 for greater text editing details.



Exit returns you to the *Program Cable* menu.

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

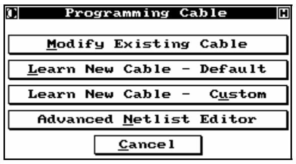
The Horizon Quick Scan method is the default learning and measurement method for both Continuity and Isolation tests.

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 ~300Ω
Isolation:	greater than ~80kΩ

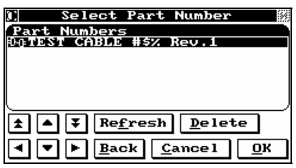
Should you wish different thresholds than listed above, you must change the Low Voltage settings to the Measured method.

4.9.2 Measured Scan

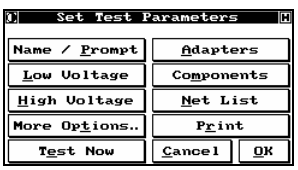


At any point you wish to alter the parameters of a test you may do so by selecting **Modify Existing Cable** from the *Programming Cable* menu.
You can open this menu by selecting **Program Cable** from the *Main Menu*.

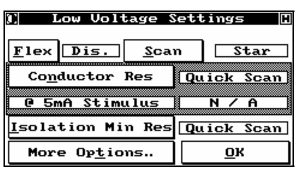
Highlight the directory containing the test program you wish to modify and select **Ok**.



Highlight the test program you wish to modify and select **Ok.**



From the *Set Test Parameters* menu, select **Low Voltage**.

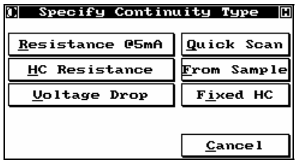


The default settings of Quick Scan are displayed.
To select a measured value for the Isolation test, select **Isolation Min Res**.

Enter the minimum resistance measurement for the Isolation test in kΩ.

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.



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 Uses the MSR to measure the maximum resistance for the attached nets. Set the Maximum Conductor Resistance accordingly.

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

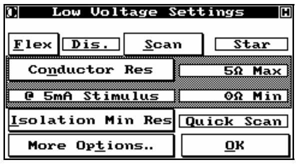
The Fixed HC option can only be used for 4-wire measurements.

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

Select **Enter** to continue.

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.

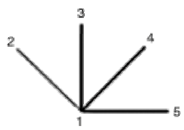


The settings are updated.

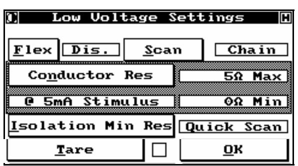
4.9.3 Star or Chain Scan

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.

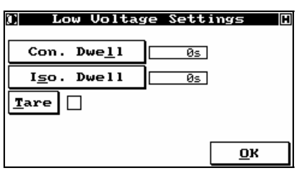


The second method is the **Chain** scan. The chain scanning method selects the first point in a net and measures continuity to the second point in a net. Next, the second point is select and continuity is measured to the third etc…



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

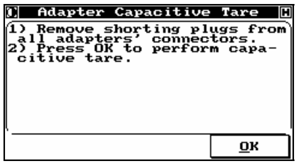
4.9.4 Tare



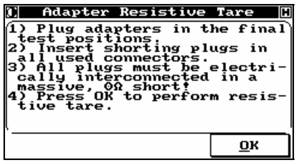
The Tare values can be added directly to a test program without performing a full System Tare or an Adapter Tare.

The tare is performed from the *Low Voltage Setting* menu.

Select **More Options → Tare**.

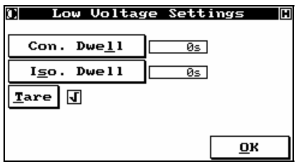


Remove the shorting connectors and select **OK** to start the capacitive tare.



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.

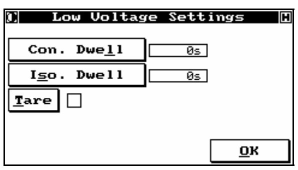


When the tare is complete, **Tare** will be checked.

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

4.9.5 Improving Accuracy with High Capcitive Loads (Long Cables)

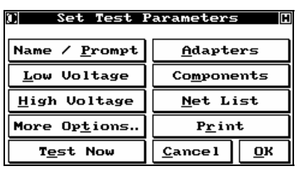
In order to improve measurement accuracy it may be beneficial to add a delay to continuity or isolation measurements. To add a delay to your test program, select **More Options** from the *Set Test Parameters* menu.



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

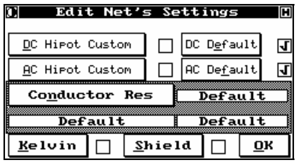
Select **Iso. Dwell** to add a delay to the isolation measurement.

4.9.6 Customize Conductor Tests by Nets

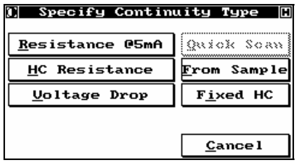


From the *Set Test Parameters* menu, select **Net List**.

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



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



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

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.

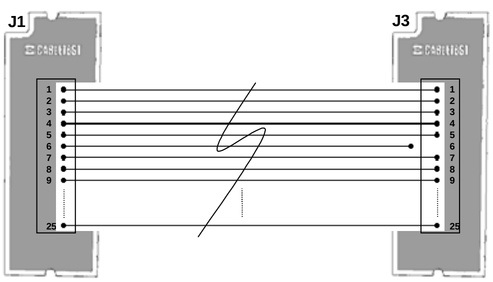
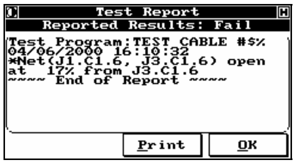


Figure 4-2: PUT with Open J3.C1.6



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.

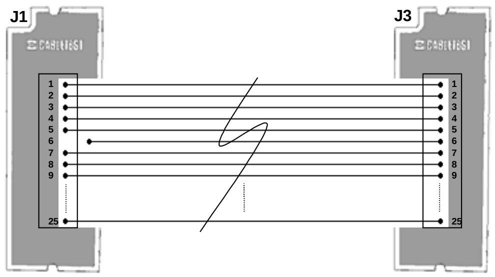
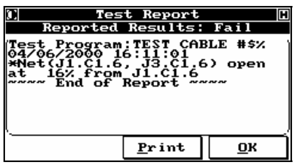


Figure 4-3: PUT with Open J1.C1.6



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.

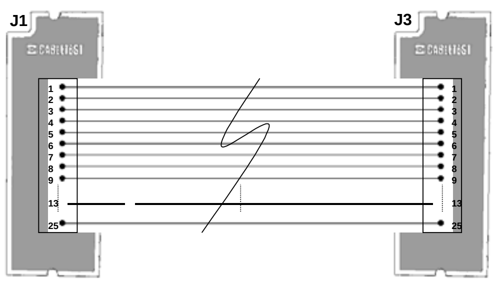
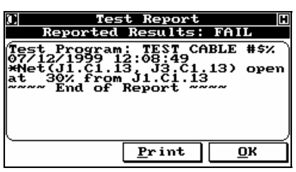


Figure 4-4: Open at 30%.



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

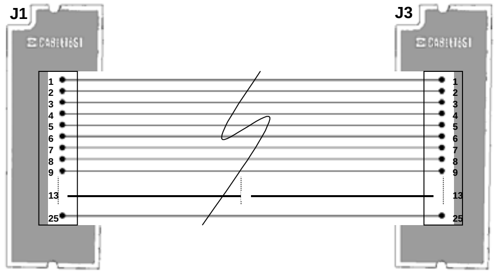
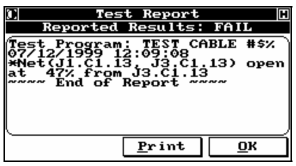


Figure 4-5: Open at 47%.



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.

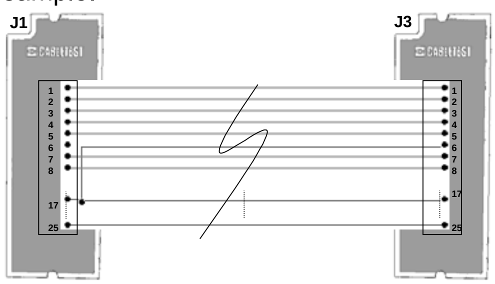
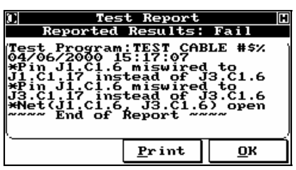


Figure 4-6: PUT Miswired



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

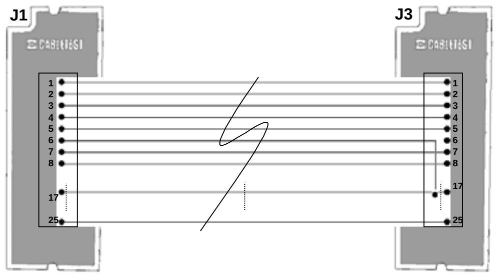
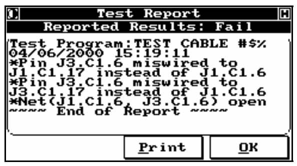


Figure 4-7: PUT Miswired – reversed

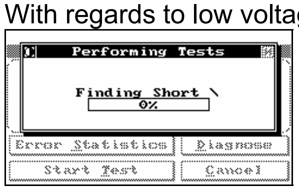


Reversing the cable and re-testing, the Horizon reports the same net to be faulty but points to the correct adapter at which the fault can be located.

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.



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.

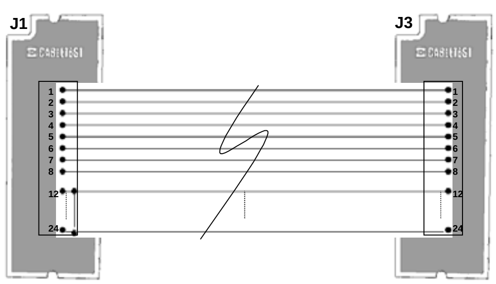
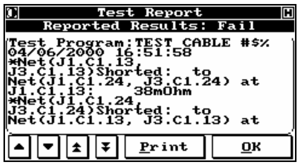


Figure 4-8: Short at J1



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.

Asterisks always precede faults.

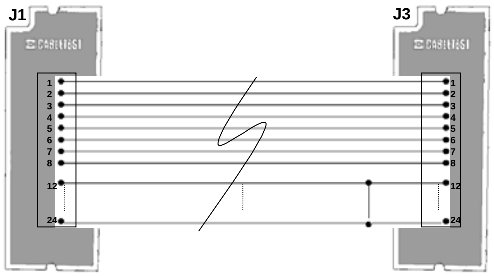
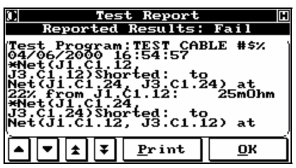
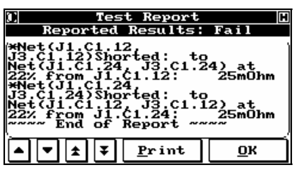


Figure 4-9: Short at 81%



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.

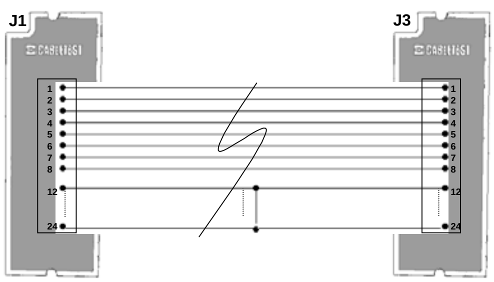
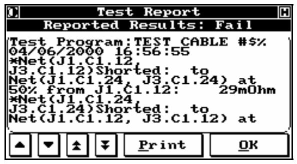
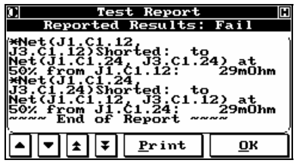


Figure 4-10: Short at 55%



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.

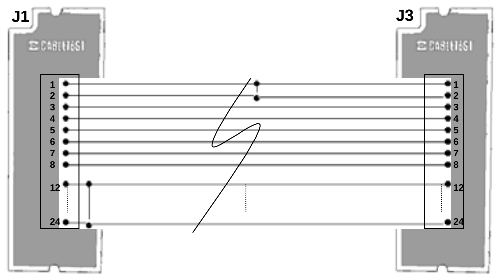
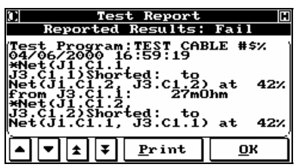
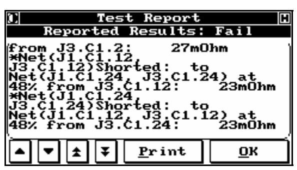


Figure 4-11: Multiple Shorts



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

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:

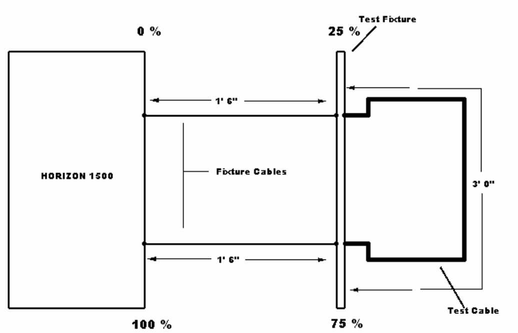


Figure 4-12: Example of a Test Fixture Setup

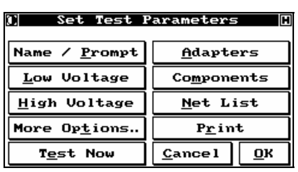
The above setup demonstrates the notion of faulty end recognition when a test fixture is being used with the Horizon. In the case above, should a short occur on the test cable during a low voltage test, then, the short would be reported between 25% and 75%. The front of the cable is located at 25% of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

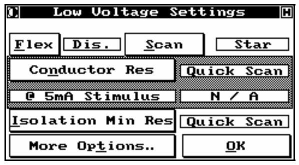
4.11 Flex Test

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.



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**.



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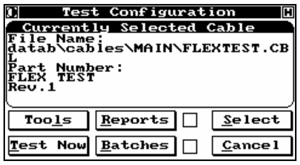
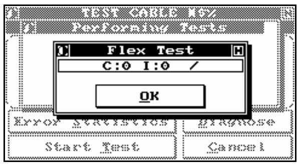
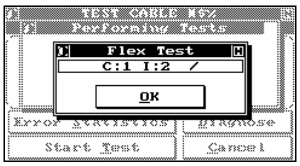

4.11.2 Testing the Cable – Flex Test



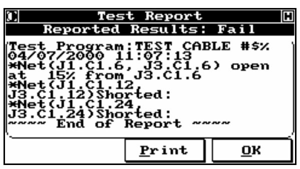
To actually perform the Flex test on a product is easy and straightforward. Select **Test** on the *Main Menu* to bring up the *Test Configuration* menu, press **Select** to select the product for testing (unless it is already displayed), then select **Test Now**. You will be instructed to insert the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





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.

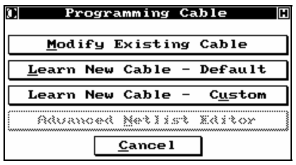
For details on the Horizon's **Build Aid** capabilities, please see Section 9.1.5.

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.

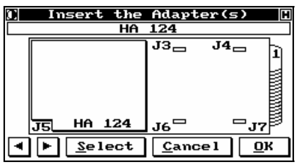
The following example makes use of the standard Horizon ground probe as well as a cup of ordinary unsalted water.

STEP 1: Learn the open product.

From the *Main Menu* of your Horizon, select **Program Cable**.

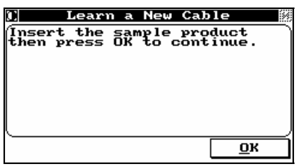


From the *Programming Cable* menu, select **Learn New Cable - Default**.



Place the appropriate adapter for the terminated end of your product.

Once detected, select **OK** to continue.

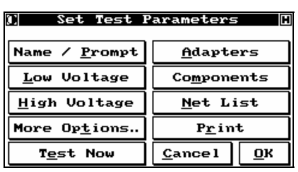


You need not place the product onto the adapter at this point. The learn process is required to create the pin list for terminated end of the product.

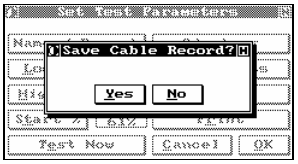
Select **OK** to continue

Enter an appropriate part number for the product you are about to assemble.

Select **Enter** to continue.



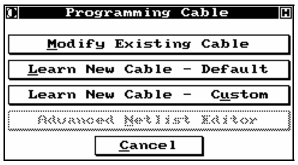
You need not enter any further parameters. Select **OK** to save the learned product.



Confirm with **Yes**.

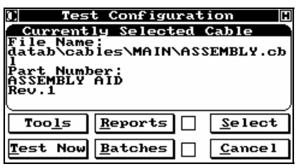
Select the directory you wish to save the file within, or create a new one by selecting **New**.

Select **OK** to save.



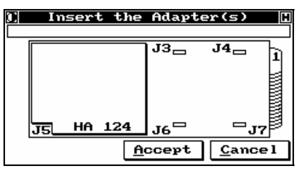
Select **Cancel** to return to the *Main Menu*.

From the *Main Menu*, select **Test** to enter the *Test Configuration* menu.

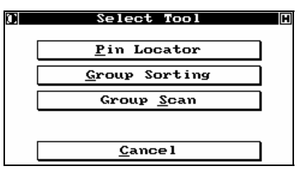


The last loaded product (in this case the product we just learned) is displayed. If it is not the correct product, choose **Select** to load the correct one.

Select **Tools** to begin the Assembly Aid process.



The system prompts for the adapter needed. Place the adapter to continue.



The *Select Tool* menu appears.

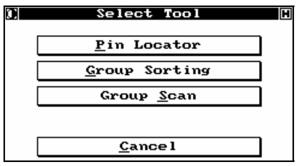
Step 2: Group Scan

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.

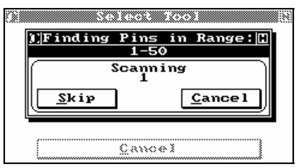
Place the non-terminated end into the glass of water.



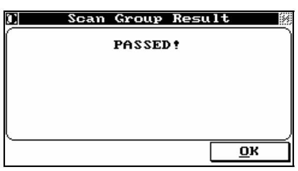
From the *Selector Tool* menu, select **Group Scan**.

Enter a range that includes all the conductors.
For this example we enter 1-50.

Select **Enter** to continue.

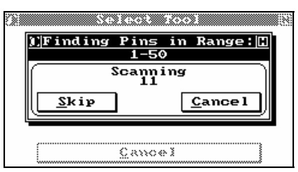


The scan will begin as soon as the conductors are submerged in the grounded water.



If all the conductors are continuous the group scan will pass.

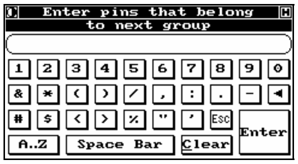
Select **OK** to continue.



If a conductor is open the scan will pause. Select **Skip** to continue scanning or **Cancel** to exit the scan.

The end of the scan will display the conductor/pin not probed. This conductor is most likely open.

Select **OK** to continue.



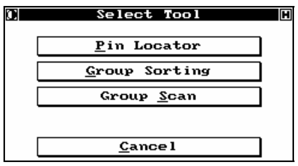
Select **ESC** to return to the *Select Tool* menu.

Step 3: Group Sorting

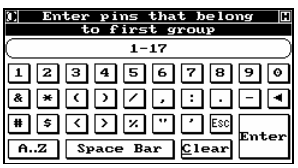
The next step involves separating the loose ends of the product into groups for easy connector assembly.

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.



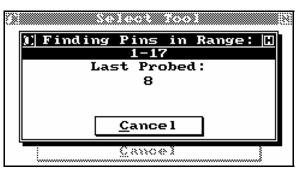
From the *Select Tool* menu, select **Group Sorting**.



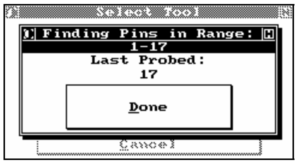
Enter the pins that belong to Group 1 (1 - 17)

Select **Enter** to continue.

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



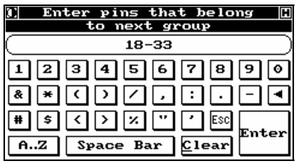
As you probe the conductors, the pin you last probed is displayed. Conductors that do not belong to the group will not respond to the probe's touch.



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

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

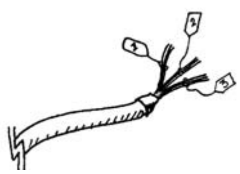
Select **Done** to continue.



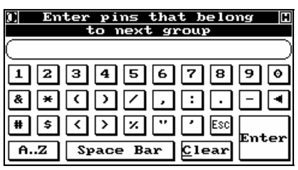
Enter the pins for the second group and begin probing the remaining conductors.

Probe until done.

Select **Done** to continue.

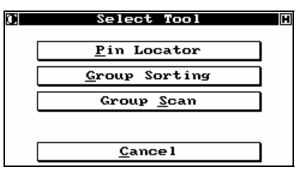


Upon completion of the second group, you will now have three sets of conductors.



Select **ESC** to continue.

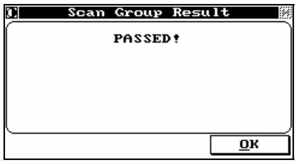
Step 4: Group Verification (group continuity)
It is highly recommended, once the groups are separated, to perform a group scan on each of the groups.



From the Select Tool menu, select **Group Scan**.

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).

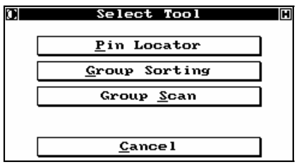


Repeat the scan for Group Two and Group Three.

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.

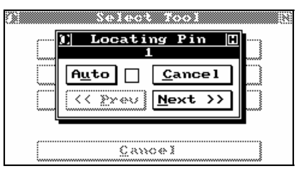


From the *Select Tool* menu, select **Pin Locator**.

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.



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.

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.

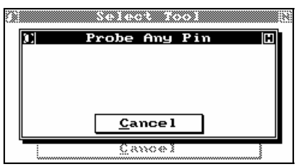
Enter the range for the next group of pins you wish to locate and select **Enter** to continue.

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.

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.



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.

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.

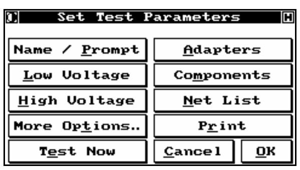
4.13.2 Safety

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.

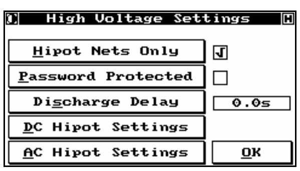
To use Palm Switches with your High Voltage Test, see Section 3, System Setup.

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*.



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:
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.

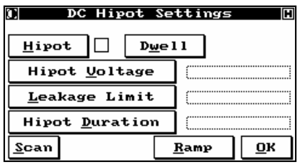
Selecting **Password Protected** (a check mark is shown) means that an operator level password must be entered before high voltage testing can proceed. **Cancel** returns to *Set Test Parameters* with no action taken, while **Ok** implements the desired setup.

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.

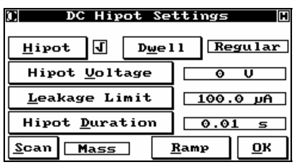
Programmable Discharge Delay values: .1s to 1200s.

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

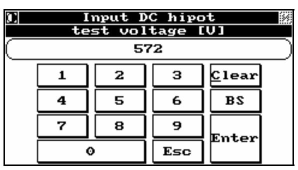
Selecting **DC Hipot Settings** brings up the *DC HiPot Settings* menu.
AC HiPot testing is discussed section 4.14.



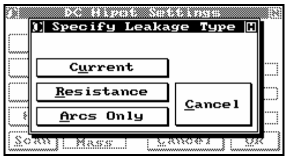
For safety reasons, DC high voltage testing cannot even be setup until the **HiPot** button is selected. As soon as it is selected, and the check mark appears, the rest of the menu becomes active and is no longer greyed out. Selecting **Ok** incorporates the DC HiPot test that was specified into the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



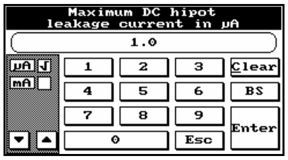
Now that the Horizon has been instructed to perform HiPot testing, the test parameters can be defined. Select **HiPot Voltage** and the *Input the DC HiPot test voltage in Volts* dialog is displayed.



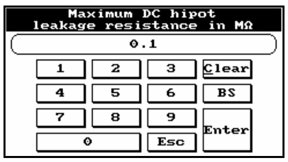
Enter the desired DC HiPot voltage. You can specify any value you want from 50V up to either 1000 or 1500 Volts, depending on the high voltage source installed. The voltage can be specified in single (1) volt increments. When the proper voltage has been entered, select **Enter** and you will be returned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



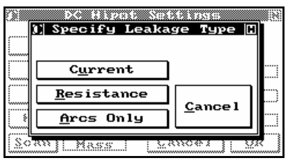
You can specify the desired leakage limit directly as a **Current**, as a function of **Resistance**, or simply enable the Horizon to detect **Arcs Only**. Select **Current** to enable the *Maximum DC HiPot leakage current* dialog.



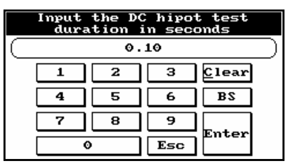
Enter the desired leakage current, paying attention to the insulation specifications for the wire being used. The allowable range is from 1µA to 5mA. Use the arrow keys to change between ‘µA’ and ‘mA’ if needed.
Select **Enter** to confirm your input and return to the *DC Hipot Settings* menu.



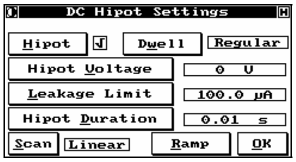
If you would prefer to specify leakage in terms of resistance, select **Resistance** after selecting **Leakage Limit** the *Maximum DC HiPot leakage resistance in MΩ* dialog will appear. Input a leakage resistance between 0.1MΩ and 1000MΩ and then select **Enter** to confirm your input and return to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



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.

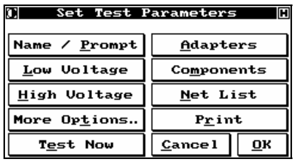


Selecting **Hipot Duration** displays the *Input the DC HiPot test duration in seconds* dialog. Enter the length of time that you would like the DC high voltage be applied, from 0.01 to 600 seconds. Select **Enter** to return to *DC Hipot Settings.*



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.



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

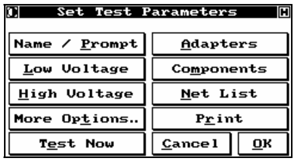
Test Program as CBL File

\datab\cables\main\testca~1.cbl For greater detail refer to section **9**.

```
*CABLE*,TEST CABLE #$%,2
  *QUICKCONTINUITY*
  *QUICKISOLATION*
  *STAR*
  *THRESHOLD*,61
  *DCHIPOT*,572
    *LEAKAGE*,0.0001
    *DWELL*,0.1
    *REGULAR*
    *MASS*
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,
    J1.C1.4,,
    J3.C1.4,,
  *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,,
  *NET*,,
    J1.C1.9,,
    J3.C1.9,,
  *NET*,,
    J1.C1.10,,
    J3.C1.10,,
*NET*,,
    J1.C1.11,,
    J3.C1.11,,
  *NET*,,
    J1.C1.12,,
    J3.C1.12,,
  *NET*,,
    J1.C1.13,,
    J3.C1.13,,
  *NET*,,
    J1.C1.14,,
    J3.C1.14,,
  *NET*,,
    J1.C1.15,,
    J3.C1.15,,
  *NET*,,
    J1.C1.16,,
    J3.C1.16,,
  *NET*,,
    J1.C1.17,,
    J3.C1.17,,
  *NET*,,
    J1.C1.18,,
    J3.C1.18,,
  *NET*,,
    J1.C1.19,,
    J3.C1.19,,
  *NET*,,
    J1.C1.20,,
    J3.C1.20,,
  *NET*,,
    J1.C1.21,,
    J3.C1.21,,
  *NET*,,
    J1.C1.22,,
    J3.C1.22,,
  *NET*,,
    J1.C1.23,,
    J3.C1.23,,
  *NET*,,
    J1.C1.24,,
    J3.C1.24,,
  *NET*,,
    J1.C1.25,,
    J3.C1.25,,
*END*
```

4.13.4 Customize DC Hipot by Nets

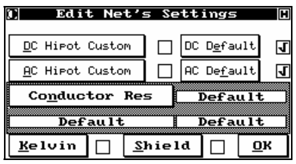
You can choose to perform HiPot testing on only a portion of your cable by performing a HiPot test on the entire cable except for certain nets. In which case, you select those nets you do not wish to perform a HiPot test on.



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.

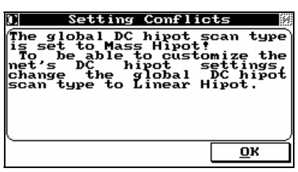
Using the arrow keys, move the cursor to highlight the net you want to exclude (or include) from HiPot testing.

Select **Edit** for the *Edit Net's Settings* menu.



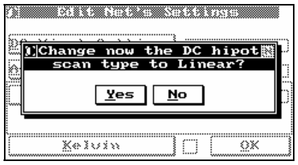
Note that the display shows that this net is currently set to assume the default settings for both DC and AC HiPot tests. In the example cable being used, DC HiPot has been learned per the settings above, but no AC HiPot testing has been defined. Therefore, if no changes were made, this net would be 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*.

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.



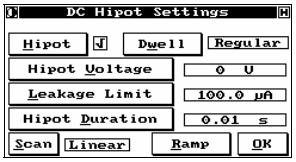
If from the *Set Test Parameters* you set up High Voltage settings with **Scan** set to MASS, you will be prompted with this message.

Select **Ok** to acknowledge the conflict.



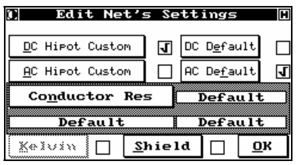
You are now given the option to alter the global settings to Linear, should you wish to continue editing the local High Voltage variable.

Select **Yes** to accept the change.



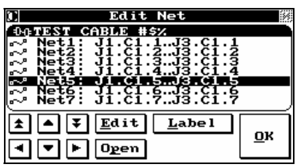
Selecting **Hipot** will remove the check mark and this net will not be HiPot tested. Notice, however, that you can actually specify different HiPot test settings for different parts of the cable! In the example cable, that's exactly what we chose to do, setting a different voltage and duration to be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



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~2.cbl For greater detail see section **9**.

```
*CABLE*,TEST CABLE #$%,3
  *QUICKCONTINUITY*
  *QUICKISOLATION*
  *STAR*
  *THRESHOLD*,61
  *DCHIPOT*,572
    *LEAKAGE*,0.0001
    *DWELL*,0.1
    *REGULAR*
    *LINEAR*
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    *DCHIPOT*,0
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,
    J1.C1.4,,
    J3.C1.4,,
  *NET*,,
   *DCHIPOT*,0
    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,,
  *NET*,,
    J1.C1.9,,
    J3.C1.9,,
  *NET*,,
    J1.C1.10,,
    J3.C1.10,,
  *NET*,,
    J1.C1.11,,
    J3.C1.11,,
  *NET*,,
    J1.C1.12,,
    J3.C1.12,,
  *NET*,,
    J1.C1.13,,
    J3.C1.13,,
  *NET*,,
    J1.C1.14,,
    J3.C1.14,,
  *NET*,,
    J1.C1.15,,
    J3.C1.15,,
  *NET*,,
    J1.C1.16,,
    J3.C1.16,,
  *NET*,,
    J1.C1.17,,
    J3.C1.17,,
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    J1.C1.18,,
    J3.C1.18,,
  *NET*,,
    J1.C1.19,,
    J3.C1.19,,
  *NET*,,
    J1.C1.20,,
    J3.C1.20,,
  *NET*,,
    J1.C1.21,,
    J3.C1.21,,
  *NET*,,
    J1.C1.22,,
    J3.C1.22,,
  *NET*,,
    J1.C1.23,,
    J3.C1.23,,
  *NET*,,
    J1.C1.24,,
    J3.C1.24,,
  *NET*,,
    J1.C1.25,,
    J3.C1.25,,
*END*
```
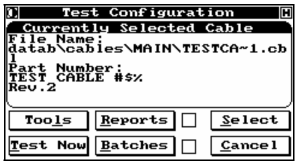
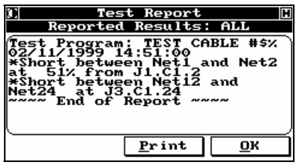

4.13.5 Cable Testing Using the DC Hipot

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.

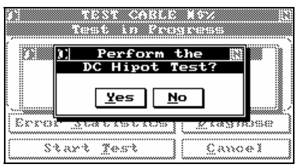


Select **Test** on the *Main Menu*. Select the cable to be tested, if it is not the cable displayed, and select **Test Now**. You will then be instructed to insert the adapters and to connect the product for testing.



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.

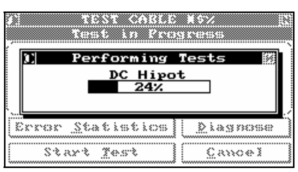
ⓘ If a product fails any of the low voltage tests, HiPot testing will not be performed.



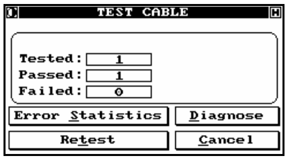
After the product has passed all of its low voltage tests, it can now be tested with high voltage. If you set up Autohipot during the system setup, HiPot testing will proceed automatically. If not, the *Perform DC Hipot Test?* dialog will appear.

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.)

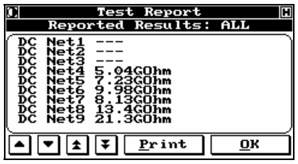
ⓘ In all of these cases, if you have installed and programmed any type of Palm Switch protection, it will also have to be activated as programmed before HiPot testing will start.



The display shows the progress of DC HiPot testing.



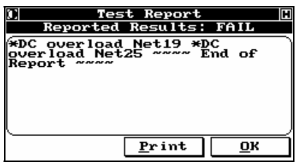
Should the product fail or if the HiPot was a linear scan, select **Diagnose** on the *Statistics* window to view the diagnostics.



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.

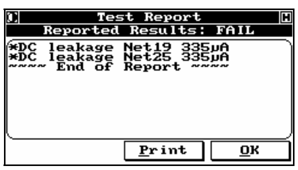
4.13.6 Error Reporting

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

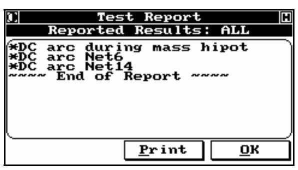


The sample *Test Report* indicates that, during the DC HiPot test, a fault occurred at nets 19 and 25.

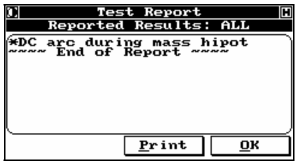
'DC Overload' is reported when an arc or excessive current leakage occurs during the charging cycle of the DC HiPot test. The message is used to differentiate between arcs during the HiPot test duration and during the time the cable is being charged to the HiPot voltage level.



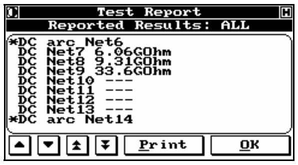
This sample report indicates that, during the DC HiPot test, there was current leakage at nets 19 and 25. The Horizon measures and reports the level of leakage.



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



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.

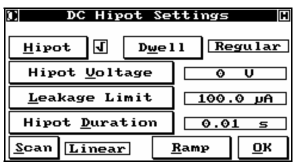


In this example the arc occurred during a LINEAR HiPot test.

All failures are identified with an asterisk (*).

4.13.7 Setting Various DC Hipot Cycle Times

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:



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
  *QUICKCONTINUITY*
  *QUICKISOLATION*
  *STAR*
  *THRESHOLD*,61
  *DCHIPOT*,500
    *LEAKAGE*,0.0001
    *DWELL*,0.1
    *SOAK*,5
    *MASS*
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,
    J1.C1.4,,
    J3.C1.4,,
  *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,,
  *NET*,,
    J1.C1.9,,
    J3.C1.9,,
  *NET*,,
    J1.C1.10,,
    J3.C1.10,,
  *NET*,,
    J1.C1.11,,
    J3.C1.11,,
*NET*,,
    J1.C1.12,,
    J3.C1.12,,
  *NET*,,
    J1.C1.13,,
    J3.C1.13,,
  *NET*,,
    J1.C1.14,,
    J3.C1.14,,
  *NET*,,
    J1.C1.15,,
    J3.C1.15,,
  *NET*,,
    J1.C1.16,,
    J3.C1.16,,
  *NET*,,
    J1.C1.17,,
    J3.C1.17,,
  *NET*,,
    J1.C1.18,,
    J3.C1.18,,
  *NET*,,
    J1.C1.19,,
    J3.C1.19,,
  *NET*,,
    J1.C1.20,,
    J3.C1.20,,
  *NET*,,
    J1.C1.21,,
    J3.C1.21,,
  *NET*,,
    J1.C1.22,,
    J3.C1.22,,
  *NET*,,
    J1.C1.23,,
    J3.C1.23,,
  *NET*,,
    J1.C1.24,,
    J3.C1.24,,
  *NET*,,
    J1.C1.25,,
    J3.C1.25,,
*END*
```

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.

ⓘ 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.

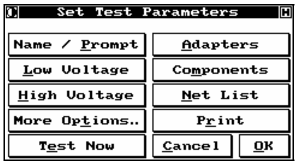
4.14.2 Safety

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.

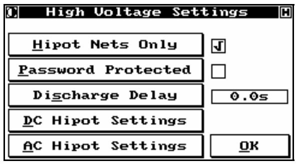
ⓘ To use Palm Switches with your High Voltage Test, see Section 3, System Setup.

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*.



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:
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.

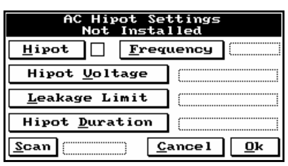
Selecting **Password Protected** (a check mark is shown) means that an Operator level password must be entered before high voltage testing can proceed. **Cancel** returns to *Set Test Parameters* with no action taken, while **Ok** implements the desired setup.

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.

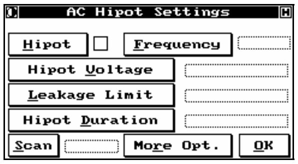
Programmable Discharge Delay values: .1s to 1200s.

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

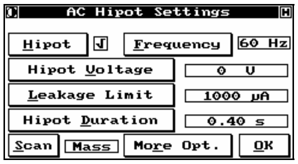
Selecting **AC Hipot Settings** brings up the *AC Hipot Settings* menu.
DC HiPot testing is discussed in section 4-36.



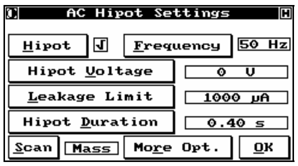
If you do not have a high voltage AC source installed, or if it is installed incorrectly, the *AC Hipot Settings* menu will indicate "Not Installed". Contact your authorized CableTest representative if you are supposed to have the AC HiPot testing capability and you get this message.



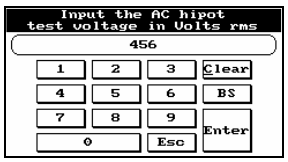
For safety reasons, AC high voltage testing cannot even be setup until the **Hipot** button is selected. As soon as it is selected, and the check mark appears, the rest of the menu becomes active. Selecting **Ok** incorporates the AC HiPot test that has been specified into the cable's test setup.



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.



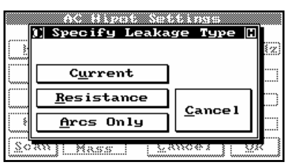
Next select **Hipot Voltage** and the *Input the AC HiPot test voltage in Volts rms* dialog is displayed.



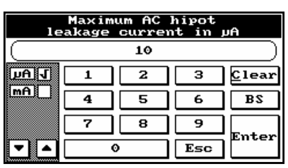
Enter the desired AC HiPot test voltage. You can specify any value you want up to 1000Vrms (optional systems configurations are programmable to 1061Vrms and 1067Vrms). The voltage can be specified in single (1) volt increments.

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

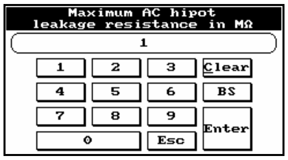
When the proper voltage has been entered, select **Enter** and you will be returned to the *AC Hipot Settings* menu. Select **Leakage Limit** and you will enter the *Specify Leakage Type* dialog.



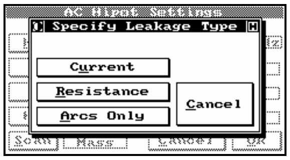
You can specify the desired leakage limit directly as a current, as a function of resistance, or simply ask the Horizon to look for arcs only. Selecting **Current** brings up the *Maximum AC HiPot leakage current in µA* dialog.



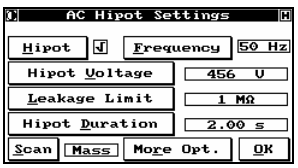
Enter the desired leakage current, paying attention to the insulation specifications for the wire being used. The allowable range is from 1µA to 5mA. Use the arrow keys to change between µA and mA as needed. Selecting **Enter** when done will return you to the *AC Hipot Settings* menu.



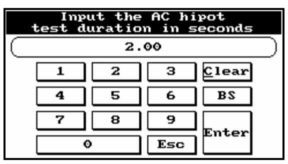
If you would prefer to specify leakage in terms of resistance, selecting **Resistance** after selecting **Leakage Limit** will display the *Maximum AC HiPot leakage resistance in MΩ* dialog. Input a leakage resistance between 0.1MΩ and 1000MΩ and then select **Enter** to return to the *AC Hipot Settings*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



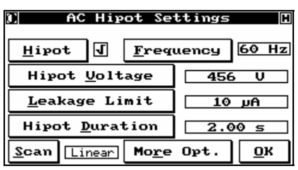
The last choice is **Arcs Only**. (The Horizon will still automatically test for arcs if leakage is specified. If an arc is detected, testing is immediately suspended, the arc is reported, and no further high voltage testing is performed on that cable.) This test will rapidly check for any insulation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



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

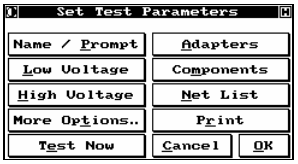


Enter the length of time that you would like the AC high voltage to be applied, from 0.01 to 600 seconds. Select **Enter** to return to *AC Hipot Settings*.



Scan switches between the Mass scan and the Linear scan 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. As detailed in Appendix C, a Mass HiPot test is much faster with no loss in accuracy.

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



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

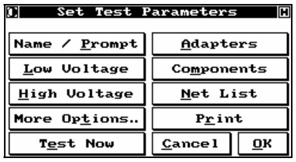
Test Program as CBL File

\datab\cables\main\testca~4.cbl   For greater detail see section **9**.

```
*CABLE*,TEST CABLE #$%,5
  *STAR*
  *THRESHOLD*,61
  *ACHIPOT*,456
    *LEAKAGE*,0.001
    *DWELL*,0.4
    *LINEAR*
    *60HZ*
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,
    J1.C1.4,,
    J3.C1.4,,
  *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,,
  *NET*,,
    J1.C1.9,,
    J3.C1.9,,
  *NET*,,
    J1.C1.10,,
    J3.C1.10,,
  *NET*,,
    J1.C1.11,,
    J3.C1.11,,
  *NET*,,
    J1.C1.12,,
    J3.C1.12,,
  *NET*,,
    J1.C1.13,,
    J3.C1.13,,
  *NET*,,
    J1.C1.14,,
    J3.C1.14,,
  *NET*,,
    J1.C1.15,,
    J3.C1.15,,
  *NET*,,
    J1.C1.16,,
    J3.C1.16,,
  *NET*,,
    J1.C1.17,,
    J3.C1.17,,
  *NET*,,
    J1.C1.18,,
    J3.C1.18,,
  *NET*,,
    J1.C1.19,,
    J3.C1.19,,
  *NET*,,
    J1.C1.20,,
    J3.C1.20,,
  *NET*,,
    J1.C1.21,,
    J3.C1.21,,
  *NET*,,
    J1.C1.22,,
    J3.C1.22,,
  *NET*,,
    J1.C1.23,,
    J3.C1.23,,
  *NET*,,
    J1.C1.24,,
    J3.C1.24,,
  *NET*,,
    J1.C1.25,,
    J3.C1.25,,
*END*
```

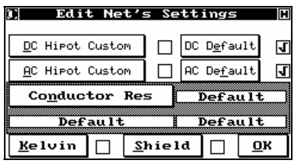
4.14.4 Customize the AC HIPOT by Nets

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.



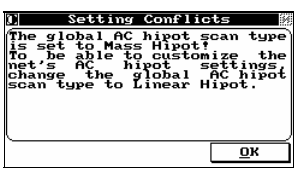
To program nets to be excluded from the HiPot test, select **Net List** from the *Set Test Parameters* menu. The *Edit Nets* dialog will be displayed.

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.

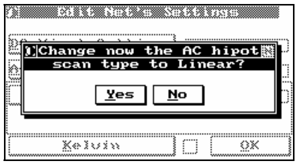


Note that the display shows that this net is currently set to assume the default settings for both DC and AC HiPot tests. In the example cable being used, AC HiPot has been learned per the settings above, but no DC HiPot testing has been defined. Therefore, if no changes were made, this net would be 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*.

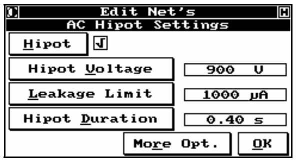
If the net you are selecting is a Ground or Chassis point in your product, you may designate it as a 'Shield' by selecting **Shield** from the *Edit Net's Settings* menu. This net will no longer be charged during the High Voltage test, though it will still remain as a common point.



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.

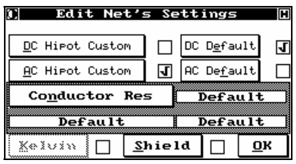


You are now given the option to alter the global settings to Linear, should you wish to continue editing the local High Voltage variable.
Select **Yes** to accept the change.



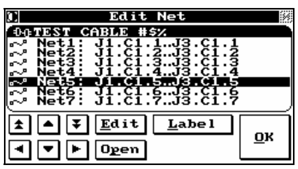
Selecting **Hipot** will remove the check mark and this net will not be HiPot tested. Notice, however, that you can actually specify different HiPot test settings for different parts of the cable! In the example cable, that's exactly what we chose to do, setting a different voltage and duration to be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



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
  *STAR*
  *THRESHOLD*,61
    *ACHIPOT*,500
    *LEAKAGE*,0.001
    *DWELL*,0.4
    *LINEAR*
    *60HZ*
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    *ACHIPOT*,0
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,
    J1.C1.4,,
    J3.C1.4,,
  *NET*,,
   *ACHIPOT*,0
    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,,
  *NET*,,
    J1.C1.9,,
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  *NET*,,
    J1.C1.10,,
    J3.C1.10,,
  *NET*,,
    J1.C1.11,,
    J3.C1.11,,
  *NET*,,
    J1.C1.12,,
    J3.C1.12,,
  *NET*,,
    J1.C1.13,,
    J3.C1.13,,
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    J1.C1.14,,
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    J1.C1.16,,
    J3.C1.16,,
  *NET*,,
    J1.C1.17,,
    J3.C1.17,,
  *NET*,,
    J1.C1.18,,
    J3.C1.18,,
  *NET*,,
    J1.C1.19,,
    J3.C1.19,,
  *NET*,,
    J1.C1.20,,
    J3.C1.20,,
  *NET*,,
    J1.C1.21,,
    J3.C1.21,,
  *NET*,,
    J1.C1.22,,
    J3.C1.22,,
  *NET*,,
    J1.C1.23,,
    J3.C1.23,,
  *NET*,,
    J1.C1.24,,
    J3.C1.24,,
  *NET*,,
    J1.C1.25,,
    J3.C1.25,,
*END*
```
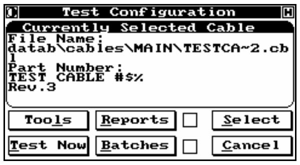
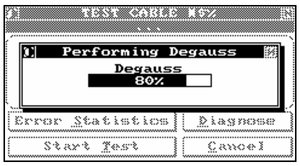

4.14.5 Cable Testing Using AC HiPot

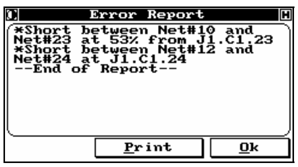
To perform an AC HiPot test on a cable as part of the test specification, simply follow the same procedures as for low voltage testing.



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.

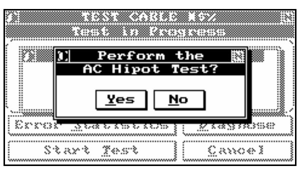


Since the test specification calls for an AC HiPot test, the Horizon automatically performs a degauss cycle before testing starts.



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.

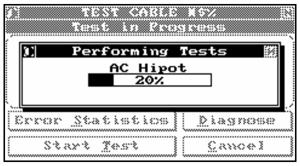
ⓘ If a product fails any of the low voltage tests, HiPot testing will not be performed.



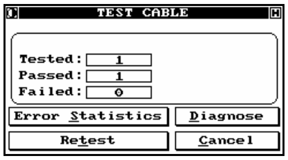
After the product has passed all of its low voltage tests, it can now be tested with high voltage. If you set up Autohipot during the system setup, HiPot testing will proceed automatically. If not, the *Perform AC Hipot Test?* dialog will appear.

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.)

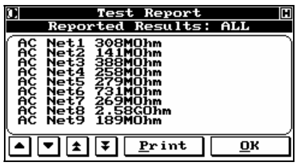
ⓘ In all of these cases, if you have installed and programmed any type of palm switch protection, it will also have to be activated as programmed before HiPot testing will start.



The display shows the progress of AC HiPot testing.



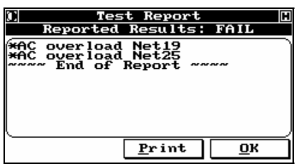
Should the product fail or if the Hipot was a linear scan, select **Diagnose** on the *Statistics* window to view the diagnostics.



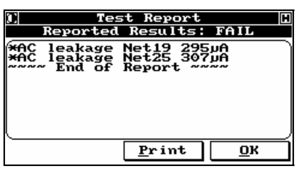
A linear HiPot was performed and passed. The diagnostics reports the measurements made during the test.

4.14.6 Error Reporting

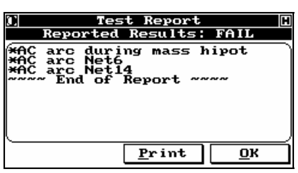
In addition to the standard Error Reports, additional ones are associated with AC HiPot testing.



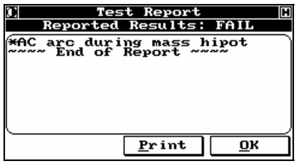
The sample *Test Report* indicates that, during the AC HiPot test, a fault occurred at nets 19 and 25.
'AC Overload' is reported when an arc or excessive current leakage occurs during the charging cycle of the AC HiPot test. The message is used to differentiate between arcs during the HiPot test duration and during the time the cable is being charged to the HiPot voltage level.



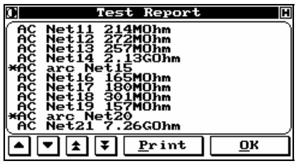
This sample report indicates that there was excess leakage at pin 19 and 25 at connector 1 on J1.
The Horizon measures and reports the leakage current.



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



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 (*).

4.14.7 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.

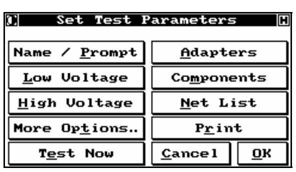
Programmable range: .01V to 10kV per second for both Ramp Up and Ramp Down.

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.

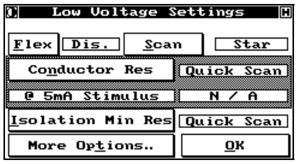
4.15 Fixed High Current Source

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.

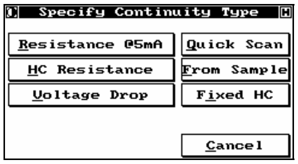
The Fixed High Current Source is only used in the "4-wire measurement" mode.



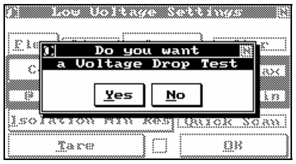
From the *Set Test Parameters* menu, select **Low Voltage**



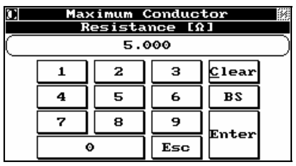
Select **Conductor Res** from the *Low Voltage Settings* menu.



In the *Specify Continuity Type* menu select **Fixed HC**.

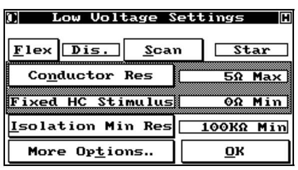


If you would like to measure the conductor's voltage drop, select **Yes**. Selecting **No** will to measure the conductor's resistance.

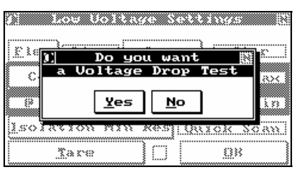


If **No** is selected, then set the *Maximum Conductor Resistance [Ω]* and select **Enter**.

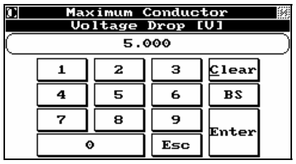
Enter the *Minimum Conductor Resistance [Ω]* and select **Enter**.



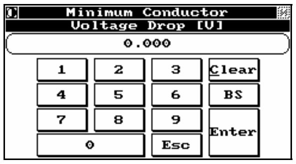
The settings are updated.



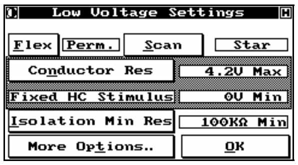
If **Yes** is selected, then set the *Maximum Conductor Voltage Drop [V]*.



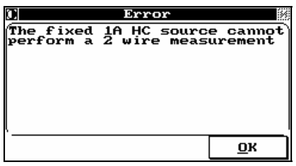
Select **Enter**.



Enter the *Minimum Conductor Voltage Drop [V]*.



The settings are updated



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.)

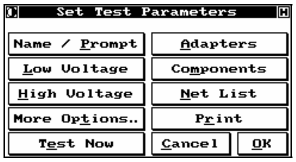
4.16.1 Overview of the Programmable High Current Source

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.

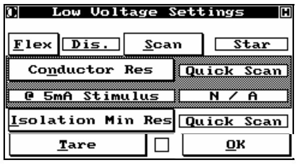
The continuity test current can be programmed up to 1A and either the conductor's resistance or the voltage drop can be used as qualifying parameters.

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.



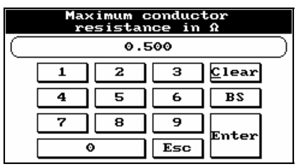
After learning a cable and entering a name for that cable, the *Set Test Parameters* menu is displayed. Select the **Low Voltage** button to change the continuity type.



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:

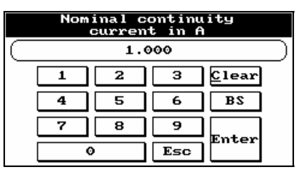
Quick Scan	**MSR**
Resistance @5mA	**MSR**
HC Resistance	Programmable HCS
Voltage Drop	**Programmable HCS**
Fixed HC	**Fixed HCS**
From Sample	**MSR**



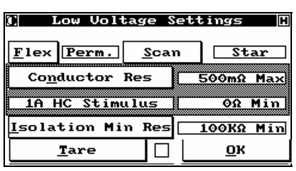
To utilize the Programmable HCS, select **HC Resistance.**

Enter the *Maximum Conductor Resistance (Ω)* …

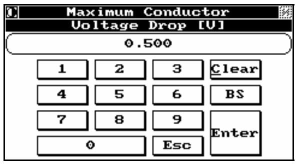
… enter the *Minimum Conductor Resistance (Ω)* …



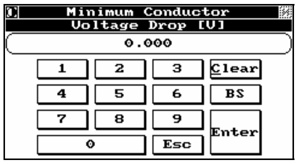
… and the nominal continuity current must be entered. The continuity test will be performed using the high current programmable source. The maximum resistance entered at the step above will be used to qualify the continuity test.



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

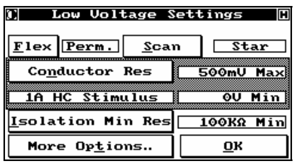


If **Voltage Drop** is selected, the dialog at the left is displayed. The *Maximum Conductor Voltage Drop (V)*…



… 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

\datab\cables\main\testca~6.cbl   For greater detail see section **9**.

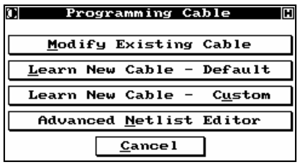
```
*CABLE*,TEST CABLE #$%,7
  *CONTINUITY*,0,0.5
  *HCRES*,1
  *QUICKISOLATION*
  *STAR*
  *THRESHOLD*,61
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,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

5 ADVANCED PROGRAMMING AND TESTING

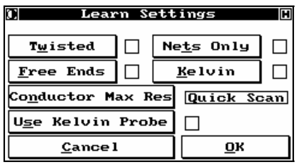
Components, Switches and Kelvin Measurement

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.



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.

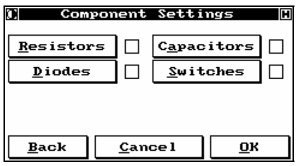
If you are using a Kelvin Adapter that has been learned and saved in the Adapter Library, do not enable Kelvin here.

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.

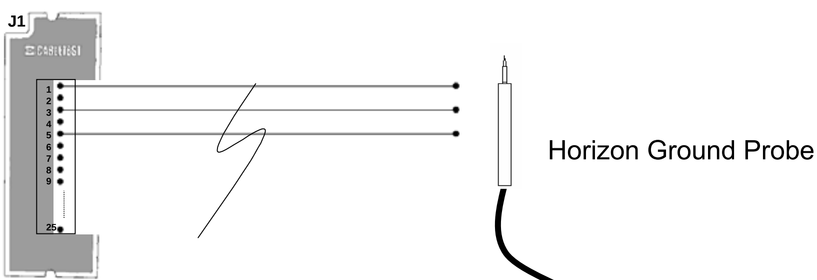
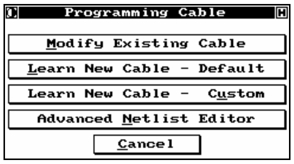
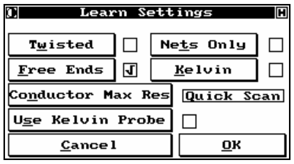


Figure 5-1: Product Under Test – Flying Leads

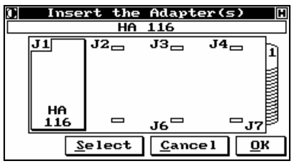
5.2.1 Programming a Free Ends Test



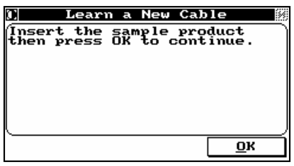
To begin to learn cables with free ends, select **Program Cable** from the *Main Menu*, enter your password, then select **Learn New Cable – Custom** and the *Learn Settings* dialog will be displayed.



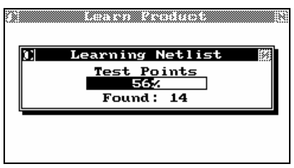
Select **Free ends** (a confirming check mark appears) then follow the normal learning process.



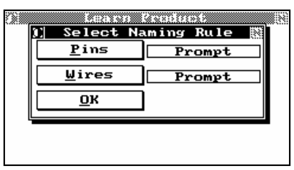
The system automatically detects the appropriate adapter, or select and place the adapter for your test.



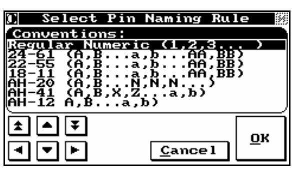
Insert the Product Under Test (PUT).



The complete NetList is learned.

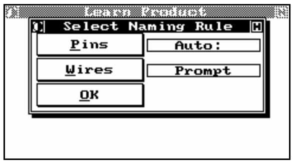


The user is prompted to configure the Flying Lead test.

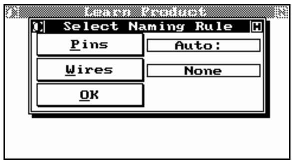


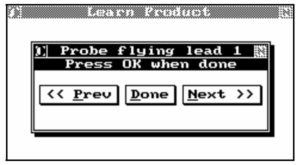
Selecting **Pins**, prompts the user to select a naming convention from the convention files. The pins of your product will be numbered accordingly.

Some convention files are provided by CableTest, however the user is responsible for creating conventions needed that are not present.

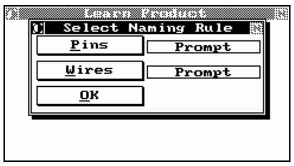


The user probes the conductors and is prompted to enter a label for each wire probed.

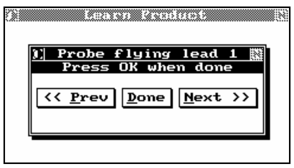




The user probes the conductors – they are numbered automatically based on the convention selected.
The conductors are not labelled.



The user probes the conductors specifying the conductor label and the pin name for each wire.



Using the flying lead configuration:

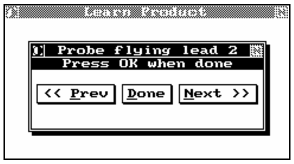
Pins: Auto
Wires: Prompt

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.

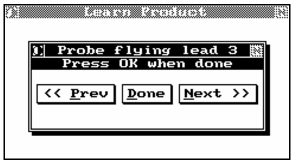
The Product Under Test has three (3) conductors 'flying' from a DB25 connector. The **Next** and **Prev** options are to allow the user to probe the connectors and have them correspond to the connector numbering convention.

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.

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.

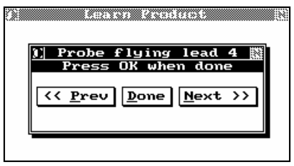


The dialog increments to the next lead, however, our product has the 3rd pin as the second lead, so we can select **Next** to have them correspond.

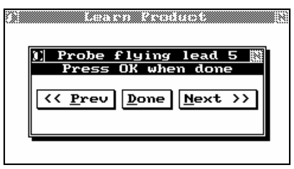


Probe the second lead.

Enter the label for the second flying lead.

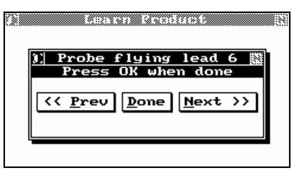


The Horizon increments to the next Pin, however, our product has the 5th pin as the third lead. Select **Next** to advance.

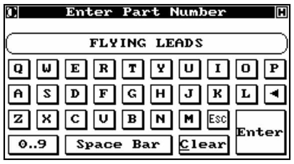


Probe the third lead.

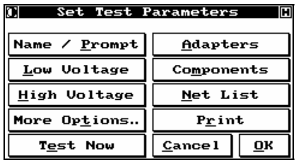
Enter the label for the third lead.



With no more leads to probe, select **Done**.



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

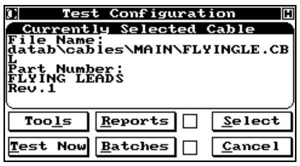
\datab\cables\main\flyingle.cbl For greater detail see section **9**.

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

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.



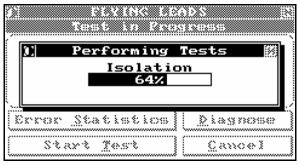
Select **Test** from the *Main Menu*. **Select** the cable to be tested (if not already shown in the *Test Configuration* display), and push **Test Now.** The Horizon will instruct you to insert the adapters needed for the test, and you will start the test procedure.

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.

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.

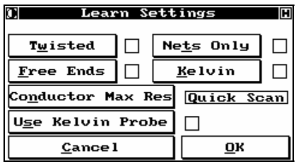
Probe the Next Lead.



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



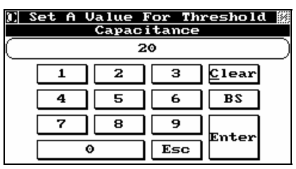
Enable **Twisted** and **Nets Only**.

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.

Cancel - to return to the *Learn Setting* menu.

New - to change the Actual Value.

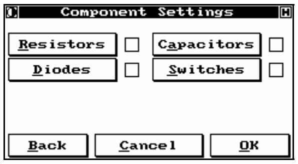
Ok - to accept the Actual value and return to the *Learn Setting* menu.



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**.

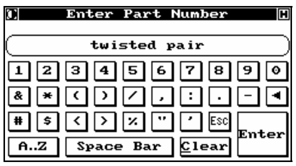


On the *Component Settings* menu, select **Ok** to start learning the product.

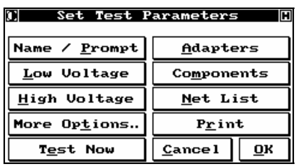
Placed the appropriate adapter for the terminated end of your product. Select **Ok** to continue.

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

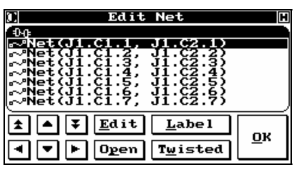
As the product is learned, a status screen keeps the user informed about the progress.



Enter 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.

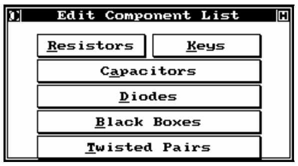
Select **Twisted**.

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.

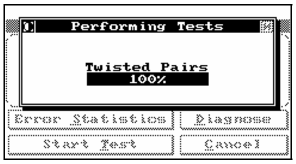
Select **Twisted Pairs** to enable the *Select Twist* menu.

Test Program as CBL File

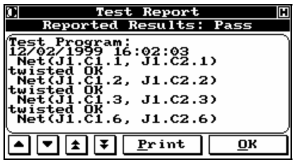
`\datab\cables\main\twisted.cbl`   For greater detail see section **9**.

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

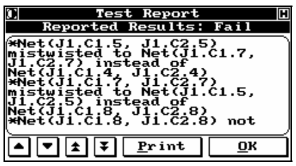
5.3.2 Testing a Cable with Twisted Pairs



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

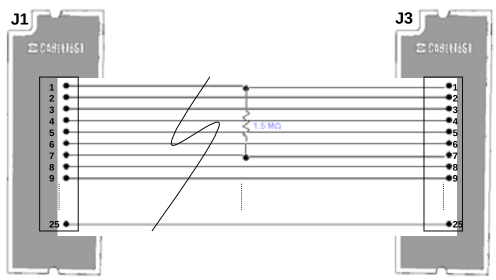
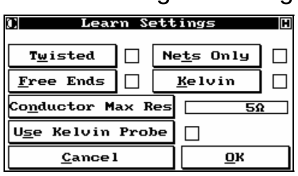


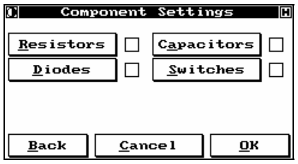
Figure 5-2: PUT with embedded Resistor

5.4.1 Programming Resistors - autolearn

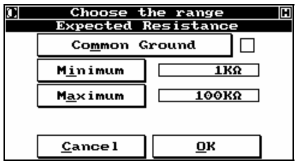


For proper resistor measurement and detection, **Conductor Max Res** must be set to a specific value. (This is especially true for resistor values ~300Ω or less. The Horizon will need to be able to differentiate between conductors and low-value resistors).

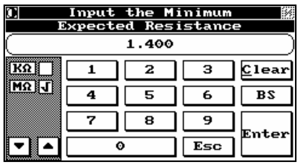
Select **Ok** to continue.



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

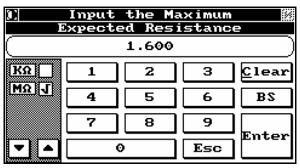


Select **Common Ground** if components connected to a common bus.



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

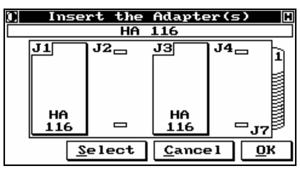
Select **Enter** when done.



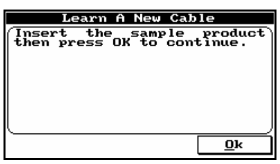
The Horizon will then ask you for the maximum expected value for all of the resistors in your cable. In the example shown, no resistor is expected with a value greater than 1.6MΩ.

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.

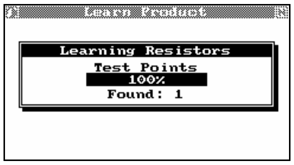


Insert the adapters that you will need to test your product; select **Ok** when done to go to the *Learn A New Cable* window.



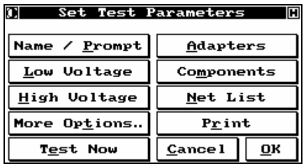
Mount your sample cable on the adapters as instructed, then select **Ok** and the Horizon will learn your cable.

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.



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.

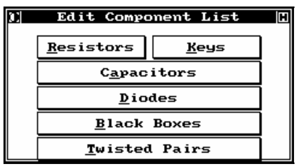
When it has completed learning your cable, the *Set Test Parameters* menu is displayed.



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.

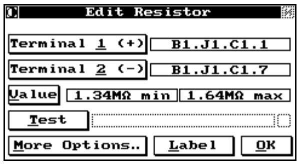


From this menu, you can verify, edit and label all of the components that have just been learned.

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.

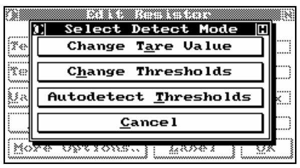


In the example shown, Terminal 1 of the first resistor (**R1**) is connected to pin 1 of the first connector on the adapter located at J1. Terminal 2 is connected to pin 7 of the same connector.

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

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.

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.

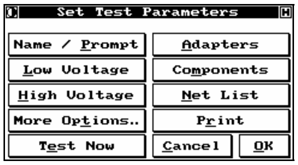
The dynamic measured value of the component will be displayed next to **Test**.

Select **Label** to label the resistor.

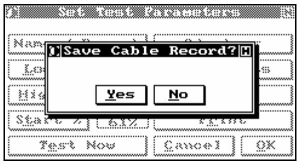
Enter the label and select **Enter** to accept it.

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.



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

`\datab\cables\main\resistor.cbl` For greater detail see section **9**.

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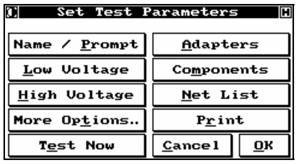
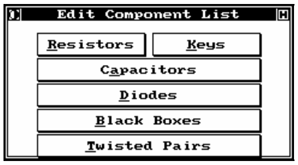

5.4.2 Programming Resistors – Manual

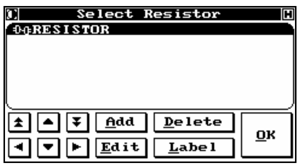
Even when you program embedded resistors manually, the NetList must have already been automatically learned (refer to Section 2.2 for details).



From *Set Test Parameters*, select **Components** and the *Edit Component List* dialog appears.



Select **Resistors**.



The *Select Resistor* dialog box is empty if no resistors were detected during the learn process, or if you did not select the **Resistor** option within a custom learn.

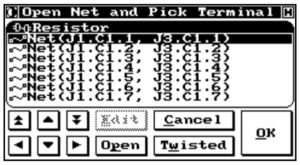
Select **Add** to manually enter this component.
Add as many resistors as you have in your product.

Adding resistors increments existing resistors by 1. Each new resistor will be R1 and the current R1 becomes R2, the current R2 becomes R3 etc…

Highlight the first and select **Edit**.

The **Edit Resistor** dialog opens with no information present.

Select **Terminal 1 (+)** 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 Terminal 1.

Select **Open** to select a pin.

Highlight a pin and select **Ok** to accept the location of Terminal 1.

The first terminal is displayed.

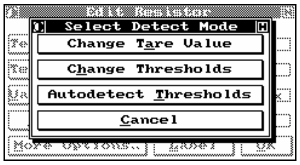
Repeat the above operation for Terminal 2.

With the terminals properly identified, you now need to program the value of the component.

If your product is attached with the proper resistance in place, select **Test** to view the measured value.

The Horizon engages the measurement circuitry to display the value of resistance between the selected terminals.

Select **Value** to set the tolerance.



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.

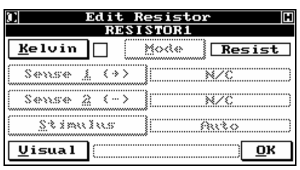
Change Tare Value: This allows the user to add a resistor tare value. This may be useful in scenarios that include test fixtures with long interface cables.

The threshold is displayed.

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

5.4.3 Programming Resistors – Advanced Options

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



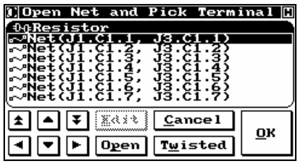
The **More Options** are as follows:

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

Programmable Dwell: .01s to 1000s

5.4.3.1 Programming Resistors – Advanced Options – Kelvin

Any component with 2 test points at each terminal can be measured using the 4 wire method (Kelvin).
Select **Kelvin** to enable the **Sense** buttons.
Select **Sense 1 (+)** to select the first sense test point.



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 **Open** to continue.

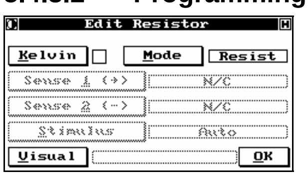
When the component was defined one of the test points associated with the net was selected (in this example J3.C1.1). The alternate test point must be selected for the sense test point (J1.C1.1).
Highlight the test point and select **Ok**.

The **More Options** menu contains the first sense point.

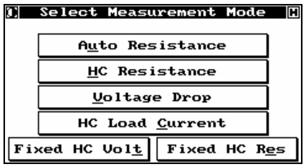
Repeat the above steps for the second sense point.
Once complete select **Ok** to return to the *Edit Resistor* dialog.

Kelvin measurements are only viable for resistances less than 400Ω.

5.4.3.2 Programming Resistors – Advanced Options – High Current Source



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



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.

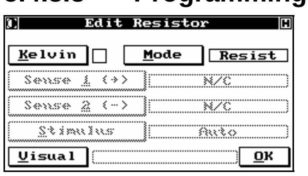
Voltage Drop: Allows the user to program a stimulus up to the limit of their programmable source (e.g. 1A). The measurement will be expressed in volts.

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).

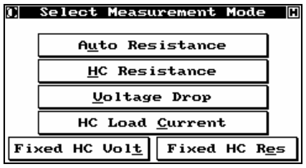
Fixed HC Res: Use the Fixed HC source to measure the component (resistance reference).

5.4.3.3 Programming Resistors – Advanced Options – Testing Lamps

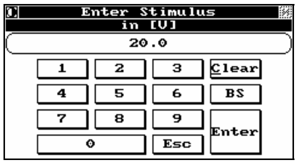


Horizon's equipped with the optional High Current Source can be utilized to test resistive load components (e.g. lamps (bulbs)).

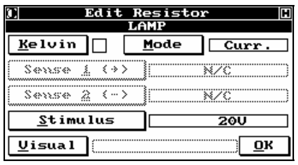
From the **More Options** dialog, select **Mode**.



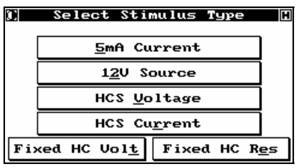
Select **HC Load Current** and enter the voltage you wish applied to the component.



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.

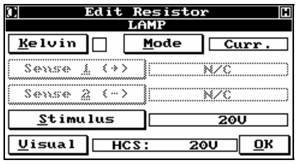
12V Source: Utilizes the Horizon's 12V source with a maximum load of 100Ω.

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.

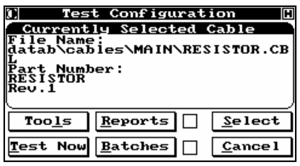
Fixed HC Res: Utilizes the Horizon's Fixed HC source (1A) with a 4.2V limit.



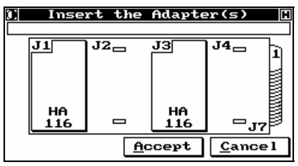
Fully programmed resistive load with visual test.

5.4.4 Testing A Cable With Resistors

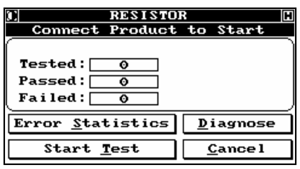
Testing a product with embedded components is the same as testing any other cable or harness. For details, consult Testing Cables in Section 4.



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.

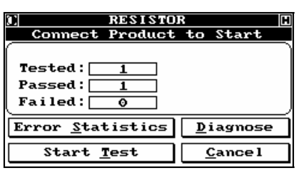


The first step in the testing process is to insert the proper adapter(s). After the proper adapters are installed, the system automatically sequences to *Connect Product To Start*. Accept, forces the Horizon to *Connect Product To Start*, while Cancel returns to *Test Configuration*.

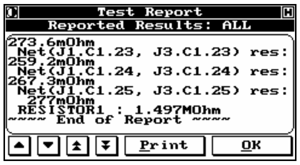


Insert your product in the appropriate connectors. The Horizon will detect when the product is inserted and automatically start the test. If your product passes, the green Pass light will be lit and a positive tone will sound; if it fails, the red Fail light will be lit and a negative tone will sound.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

The system performs the standard low voltage tests (Continuity and Isolation), then scans for the Resistors.



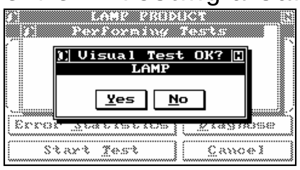
On the test is complete, the display will change, instructing you to disconnect the product. Disconnecting the product updates the statistics database and automatically resets the system to test the next product. Inserting the next cable starts the process again.



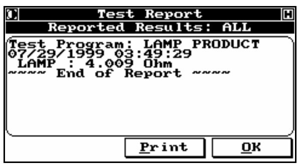
While the screen still prompts the user to disconnect the product you may select **Diagnose** to view the results of the last test.

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



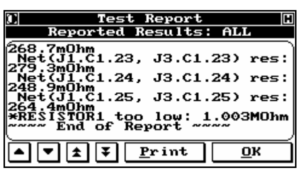
When testing a product with an embedded illuminating component such as a bulb, the test program halts for confirmation of illumination from the operator.



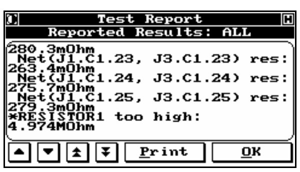
The diagnostic (test report) for a passed product, list the component with the measured load in resistance (or selected output – resistance, voltage, or current).

5.4.6 Error Reporting for Resistors

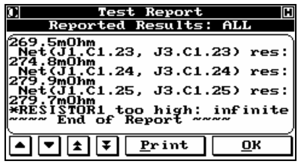
All of the same errors are available in this mode as for general cable testing. The following additional error screens cover the special circumstances associated with embedded resistors.



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



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

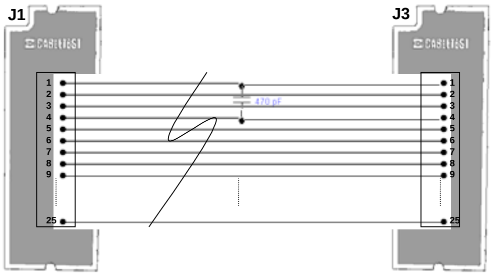
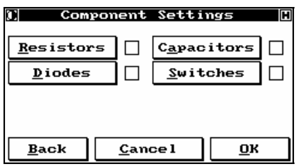
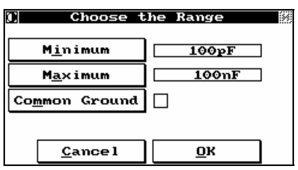


Figure 5-3: PUT with embedded Capacitor



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.

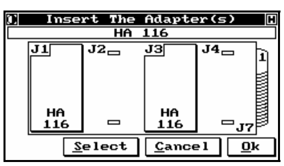


Select **Common Ground** for capacitors tied to a common point.

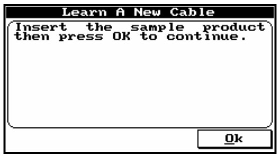
Enter the minimum and maximum expected values.

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**.

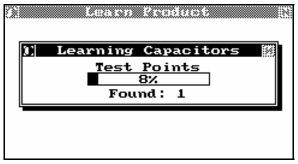


Insert the adapters that you will need to test your product; select **Ok** when done to go to the *Learn A New Cable* window.

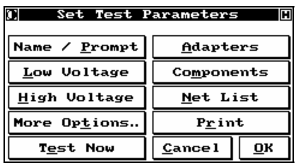


Next, insert your cable as instructed and select **Ok** to continue the learning process.

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.

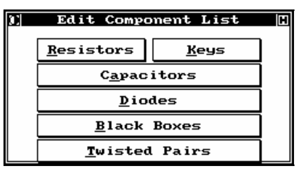


While the Horizon is learning your cable, a number of status screens will appear, including one that indicates how many capacitors it is finding that meet the search criteria you set up. When it has completed learning your cable, the *Set Test Parameters* menu is displayed.



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.

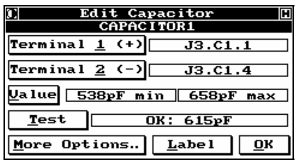


Then select **Capacitors**.

The Horizon found one capacitor. Select **Edit** to show more details and bring up the *Edit Capacitor* menu.

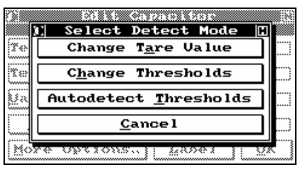
In the example shown, Terminal 1 of the first capacitor (Cap1) is connected to pin 1 of the first connector on the adapter located at J1. Select **Terminal 1** to view more details of this net. The *Select Net* menu appears.

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.



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%.

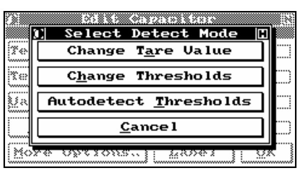


Select **Change Tare Value** if you wish to alter the tare value. The value is a measurement of capacitance at the test level of the system. For example if you are testing from a test fixture, the tare capacitance should be altered to include the capacitance of the fixture.

Select **Change Thresholds** if you wish to alter the tolerance for the component.

Enter a new tare value and select **Enter** to accept.

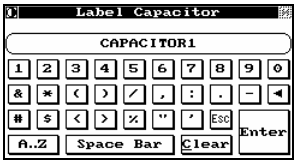
Every time this screen is accessed the default tare value (calculated during the system Capacitance Tare) will be displayed. Selecting enter will restore the default value.



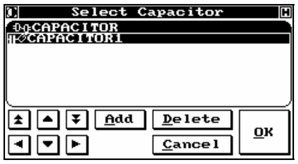
Select **Change Thresholds** to input a specific tolerance you may enter the minimum and maximum expected values.

Enter the minimum and maximum threshold

Select **Label** to assign a label to the component.

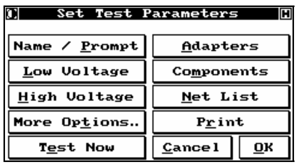


Enter a label and select **Enter** to accept.

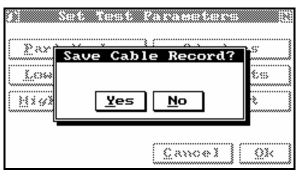


All of the needed changes have been entered, so select **Cancel** to return to *Set Test Parameters*.

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.

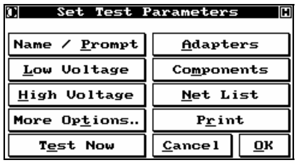
Test Program as CBL File

`\datab\cables\main\capacitor.cbl` For greater detail see section **9**.

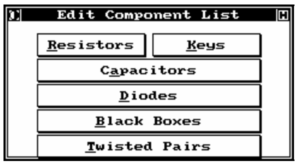
```
*CABLE*,CAPACITOR,1
  *STAR*
  *THRESHOLD*,61
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,
    J1.C1.4,,
    J3.C1.4,,
  *NET*,,
    J1.C1.5,,
    J3.C1.5,,
  *NET*,,
    J1.C1.6,,
    J3.C1.6,,
  *NET*,,
    J1.C1.7,,
    J3.C1.7,,
  *NET*,,
    J1.C1.8,,
    J3.C1.8,,
  *NET*,,
    J1.C1.9,,
    J3.C1.9,,
  *NET*,,
    J1.C1.10,,
    J3.C1.10,,
  *NET*,,
    J1.C1.11,,
    J3.C1.11,,
  *NET*,,
    J1.C1.12,,
    J3.C1.12,,
*NET*,,
    J1.C1.13,,
    J3.C1.13,,
  *NET*,,
    J1.C1.14,,
    J3.C1.14,,
  *NET*,,
    J1.C1.15,,
    J3.C1.15,,
  *NET*,,
    J1.C1.16,,
    J3.C1.16,,
  *NET*,,
    J1.C1.17,,
    J3.C1.17,,
  *NET*,,
    J1.C1.18,,
    J3.C1.18,,
  *NET*,,
    J1.C1.19,,
    J3.C1.19,,
  *NET*,,
    J1.C1.20,,
    J3.C1.20,,
  *NET*,,
    J1.C1.21,,
    J3.C1.21,,
  *NET*,,
    J1.C1.22,,
    J3.C1.22,,
  *NET*,,
    J1.C1.23,,
    J3.C1.23,,
  *NET*,,
    J1.C1.24,,
    J3.C1.24,,
  *NET*,,
    J1.C1.25,,
    J3.C1.25,,
  *CAPACITOR*,,CAPACITOR1
    J3.C1.1,,
    J3.C1.4,,
    *VALUE*,5.38652e-10,6.58352e-10
    *TARE*,1.41919e-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).



From *Set Test Parameters*, select **Components** and the *Edit Component List* dialog appears.

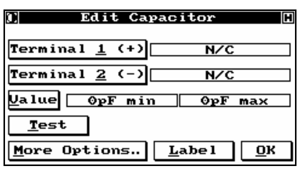


Select **Capacitors**.

Select **Add** to manually enter this component.
Add as many capacitors as you have in your product.

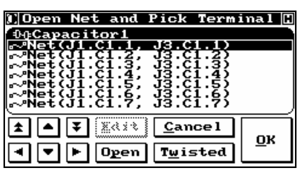
Adding capacitors increments existing capacitors by 1. Each new capacitor will be C1 and the current C1 becomes C2, the current C2 becomes C3 etc…

Highlight the first and select **Edit** to set the components properties.

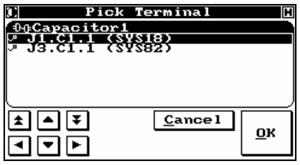


The **Edit Capacitor** dialog opens with no information present.

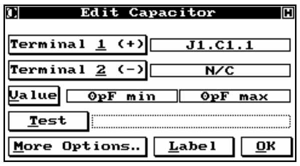
Select **Terminal 1 (+)** to assign it the proper net.



The *Select Net* dialog appears.
Using the arrow keys, scroll the cursor to highlight the correct net/pin location for Terminal 1.
Select **Open** to select a pin.

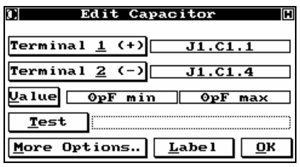


Highlight a pin and select **Ok** to accept the location of Terminal 1.

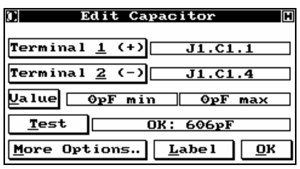


The first terminal is displayed.

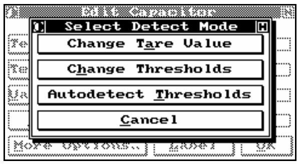
Repeat the above operation for Terminal 2.



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.

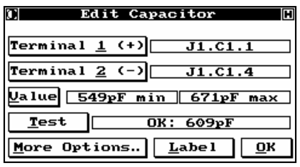


Three value options are available:

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.

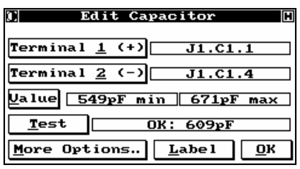
Change Tare Value: This allows the user to manually alter the capacitance tare value. This may be useful in scenarios that include test fixtures with long interface cables.



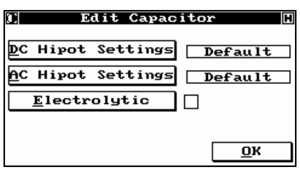
The threshold is displayed.

Select **Ok** to return to the *Capacitor List* dialog.

5.5.3 Programming Capacitors – Advanced Options

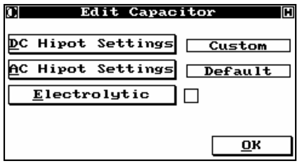


From the *Edit Capacitor* dialog, select **More Options…**



The **More Options** are as follows:

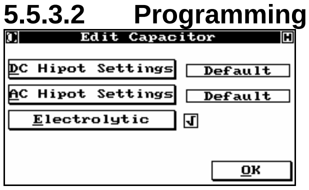
5.5.3.1 Programming Capacitors – Advanced Options – HIPOT



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.

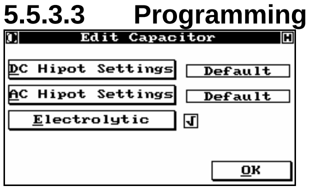
In order to change local HiPot variables, the global setting for the High Voltage test must be set to Linear.

5.5.3.2 Programming Capacitors – Advanced Options – Electrolytic



Electrolytic capacitors can be tested with the Horizon by selecting the Electrolytic option.

5.5.3.3 Programming Capacitors – Advanced Options – Test Stimulus



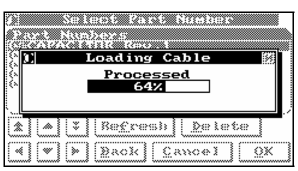
Toggle **Stimulus** to select between the Horizon's 50µA and 5mA sources.

5.5.4 Testing a Cable with Capacitors

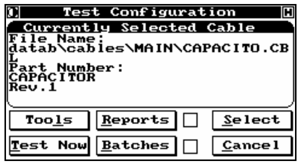
Testing a product with embedded components is the same as testing any other cable or harness. For details, consult Section 4.

Select the product you wish to test.

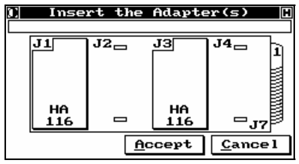
Highlight and select **Ok** to continue.



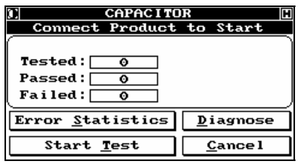
The test program is loaded.



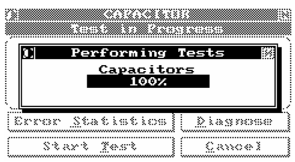
Select **Test Now** to begin testing the selected cable product.



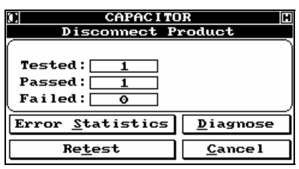
Insert the required adapters.



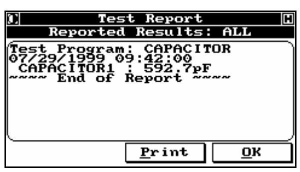
Insert your product in the appropriate connectors. The Horizon will detect when the product is inserted and automatically start the test. If your product passes, the green Pass light will be lit and a positive tone will sound; if it fails, the red Fail light will be lit and a negative tone will sound.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



The system performs the standard low voltage tests (Continuity and Isolation), then scans for the Capacitors.



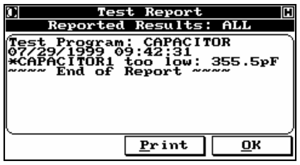
Once the test is complete, the display will change, instructing you to disconnect the product. Disconnecting the product updates the statistics database and automatically resets the system to test the next product. Inserting the next cable starts the process again.



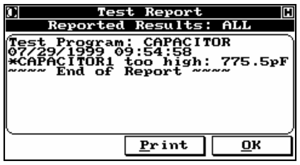
Prior to disconnecting the tested product, the user can select **Diagnose** to view the results of the last test.

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.



The measured capacitance is too low.



The measured capacitance is too high.

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.

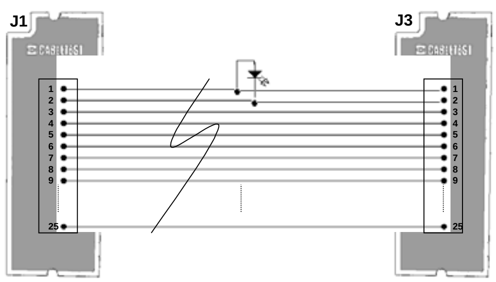
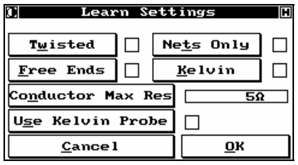


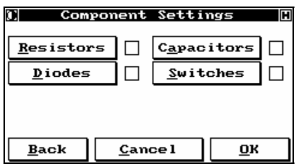
Figure 5-4: PUT with embedded Diode



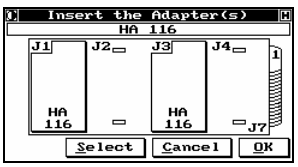
As with resistors and capacitors, diodes are learned automatically through the customized path. From the *Main Menu*, select **Program Cable**, followed by your password; then select **Learn New Cable – Customized**. The *Learn Settings* menu appears. You must change the **Conductor Max Res.** from ‘Quick Scan’ to a specific resistance. The ‘Quick Scan’ setting is intended for wire only cables. 5Ω 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.

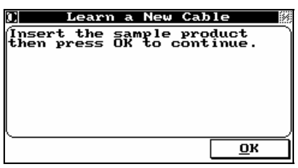
Select **Conductor Max Res.**, enter the desired value (or accept the default 5Ω), select **Enter**, and then push **Ok** to go to the *Component Settings* screen.



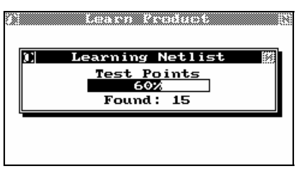
Select **Diodes** to indicate to the Horizon that your cable has an embedded diode(s). A confirming check mark will be displayed. Select **Ok** to continue the learning process.



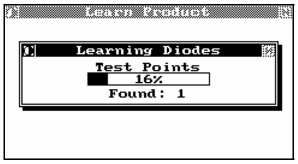
Insert the appropriate adapters.
Select **Ok** to continue.



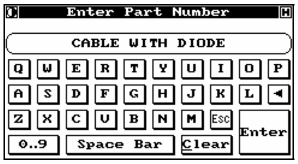
Insert the product.
Select **Ok** to continue.



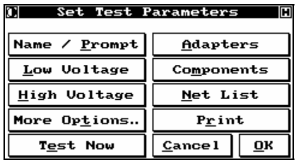
The net list is learned.



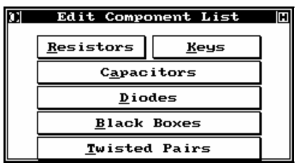
The Horizon scans for diodes in your product.



Label the product under test.



If you want to review the parameters, select **Components**. This is always recommended as a "sanity check", especially if you have not programmed diodes, or diodes of this type, before.

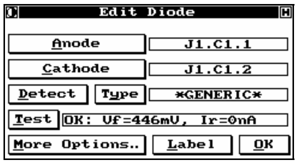


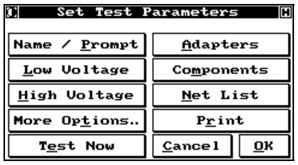
Then select **Diodes**. The *Edit Diodes* dialog is shown.

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 **Edit** to view the details of the learned component.

Table 1 Diode Types

Type	**V_{fmin}[V] @50μA**	**V_{Fmax}[V] @50μA**	**I_{Rmax}[μA] @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





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

`\datab\cables\main\diode.cbl` For greater detail see section **9**.

```
*CABLE*,LED,1
  *CONTINUITY*,0,5
  *STAR*
  *THRESHOLD*,61
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *NET*,,
    J1.C1.1,,
    J3.C1.1,,
  *NET*,,
    J1.C1.2,,
    J3.C1.2,,
  *NET*,,
    J1.C1.3,,
    J3.C1.3,,
  *NET*,,
    J1.C1.4,,
    J3.C1.4,,
  *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,,
  *NET*,,
    J1.C1.9,,
    J3.C1.9,,
  *NET*,,
    J1.C1.10,,
    J3.C1.10,,
  *NET*,,
    J1.C1.11,,
    J3.C1.11,,
  *NET*,,
    J1.C1.12,,
    J3.C1.12,,
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  *NET*,,
    J1.C1.23,,
    J3.C1.23,,
  *NET*,,
    J1.C1.24,,
    J3.C1.24,,
  *NET*,,
    J1.C1.25,,
    J3.C1.25,,
  *DIODE*,,
    J1.C1.1,,
    J1.C1.2,,
    *GENERIC*
*END*
```

5.6.2 Programming Diodes – Auto learn, Special Case – Phantom Diodes

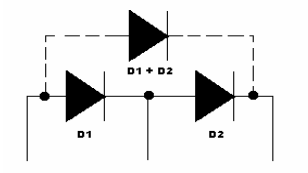
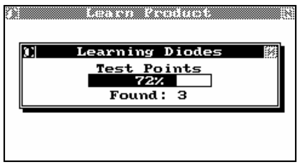
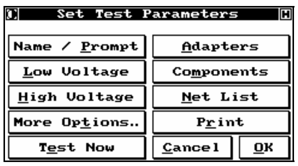


Figure 5-5:
Phantom Diodes

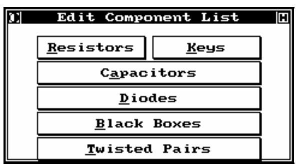
Depending on how the diodes are wired, the Horizon could find a “phantom diode” that is a combination of diodes 1 and 2 as illustrated by the dashed line. This could either show up as a third diode, or as a single diode. In either case, a careful examination of the components learned will reveal if this has happened, and if so, which occurred.



Auto learning the above configuration resulted in 3 found components.



Select **Components** to enter the *Set Test Parameters* menu.



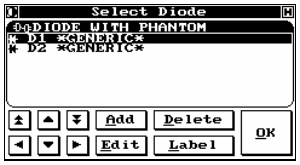
Select **Diodes** to view the found components.

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**.

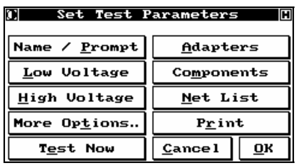
Confirm deletion with a **Yes**.



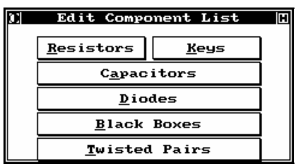
Once the Diode list is correct, select **Ok** to return to the *Set Test Parameters* menu.

5.6.3 Programming Diodes – Manual

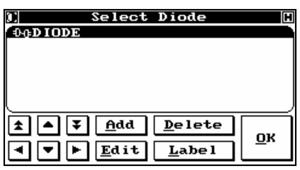
Even when you program embedded diodes manually, the NetList must have already been automatically learned (see Section 4 for details).



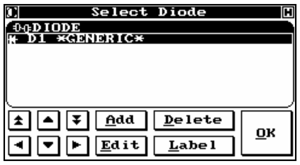
From *Set Test Parameters*, select **Components** and the *Edit Component List* dialog appears.



Select **Diodes**.

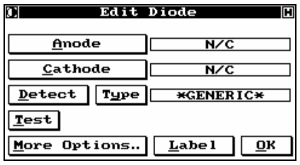


The *Select Diode* dialog box is empty if no diodes were detected during the learn process, or if you did not select the **Diode** option within a custom learn.

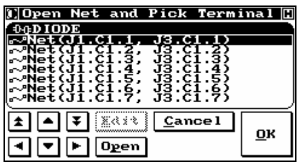


Select **Add** to manually enter this component.
Add as many Diodes as you have in your product – the new diodes are automatically selected as Generic.

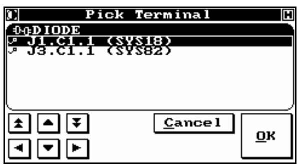
ⓘ Adding diodes increments existing diodes by 1. Each new resistor will be D1 and the current D1 becomes D2, the current D2 becomes D3 etc…
Highlight the first and select **Edit**.



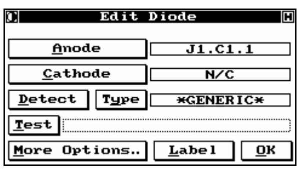
The **Edit Diode** dialog opens with no information present.
Select **Anode** to assign it the proper net.



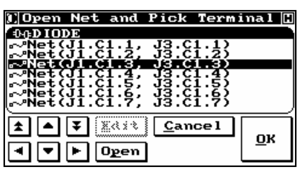
The *Select Net* dialog appears.
Using the arrow keys, scroll the cursor to highlight the correct net/pin location for the Anode.
Select **Open** to select a pin.



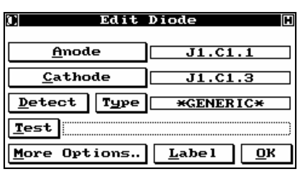
Highlight a pin and select **Ok** to accept the location of Terminal 1.



The first anode terminal is displayed.

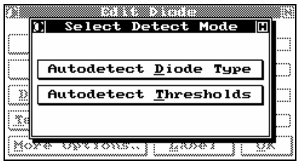


Repeat the above operation for the Cathode.

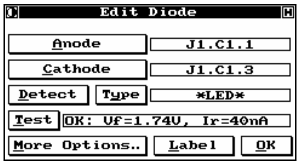


With the anode and cathode properly identified, you now need to program the type of diode embedded.

If your product is attached with the proper diode in place, select **Detect** to automatically set the type and values.

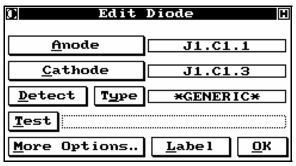


You can either **Autodetect Diode Type** or **Autodetect Thresholds**.
The diode types preset are listed in
Table 1 Diode Types. If your component does not conform to one of these types, select **Autodetect Thresholds** to learn the component attached.

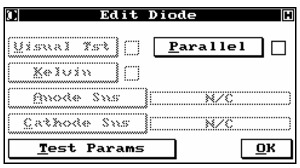


The threshold is displayed.
To manually edit the thresholds of the component select **More Options**.
Select **Ok** to return to the resistor list.

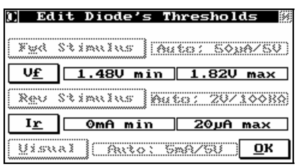
5.6.4 Programming Diodes – Advanced Options



From the *Edit Diode* dialog, select **More Options**.

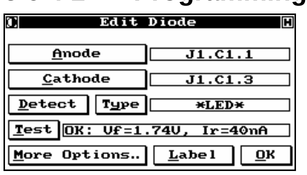


From the **More Options** dialog select **Test Params** to manually edit the Diode's Thresholds.

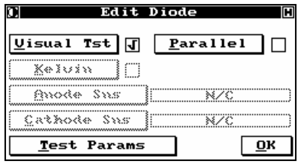


Should you wish to alter the forward and reverse values, select either **Vf** or **Ir** to enter the minimum and maximum values.

5.6.4.1 Programming Diodes – Advanced Options – LEDs

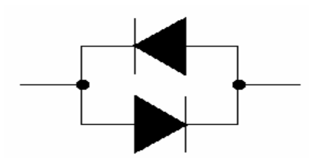


The advanced option for the LED allows the user to set a visual test on the component.
Select **More Options**.

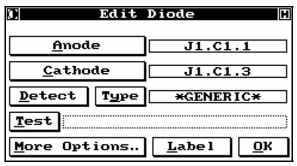


Select **Visual Tst** to enable the visual confirmation during testing.

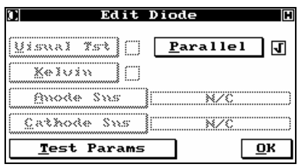
5.6.4.2 Programming Diodes – Advanced Options - Diodes in Parallel



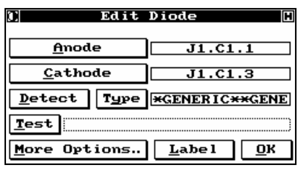
The Horizon is capable of auto-detecting diodes in parallel. If you are manually entering diodes you will need to open the more options for the component and select Parallel to properly identify the component.



Select **More Options** from the *Edit Diode* dialog.

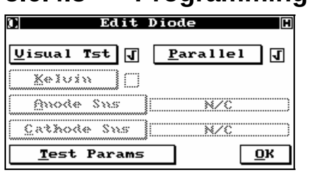


Select **Parallel** to properly define the component.
Select **Ok** to return to the *Edit Diode* dialog.

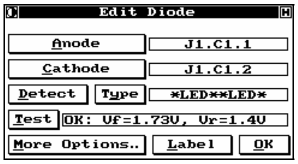


The diode is now identified as being in parallel by the duplication of its type.

5.6.4.3 Programming Diodes – Advanced Options - BI-colour LED's



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.



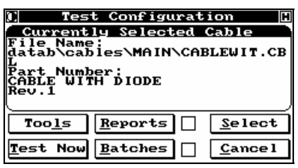
The component settings will be properly displayed.
With Test selected the Vf, Vr will be displayed as well the component will light in both directions.
A special labeling format is available for the BI-coloured LED.
Select **Label** to continue.

<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.

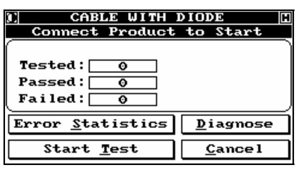
5.6.5 Testing Cables with Diodes

The testing procedure for a product with embedded components is the same as testing any other cable or harness. For details, consult Section 4.

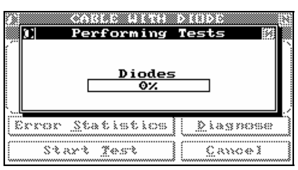
Select the proper cable and push **Test Now.** You will be instructed to insert the proper adapters, then to insert the cable to be tested. Inserting the cable will automatically start the test.



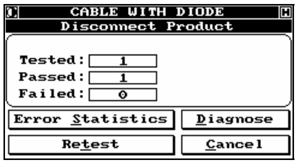
Select **Test Now** to begin testing the displayed part.



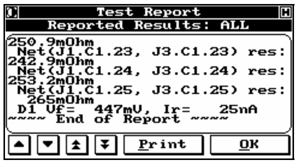
Insert the product to begin the test.



After the net list is verified for continuity and isolation, the system scans for the diodes.

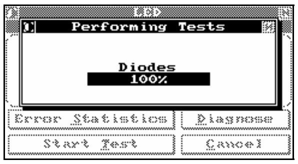


At the end of the test, disconnect the product to reset the system for the next test.

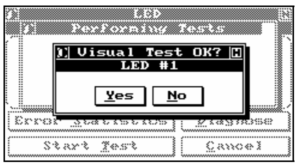


Prior to disconnecting the product, if the user selects **Diagnose** the results of the last test will be displayed.

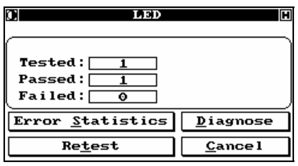
5.6.6 Testing LEDs and BI-LEDS



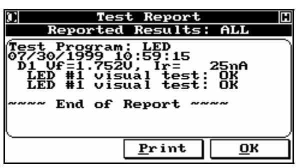
The same tests are performed for LEDs as with diodes and will include the same error results. However once the standard diode test is complete (and passed) a visual test (if selected) will be preformed.



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.



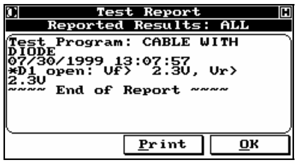
At the end of the test, disconnect the product to reset the system for the next test.



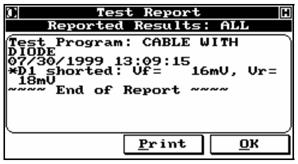
Prior to disconnecting the product, if the user selects **Diagnose** the results of the last test will be displayed.

5.6.7 Error Reporting for Diodes

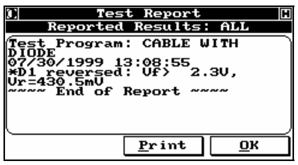
All of the same errors are available in this mode as for general cable testing. In addition, a number of extra screens track diode specific faults.



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 50µA for a Generic Diode: see
Table 1 Diode **Types**) '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.

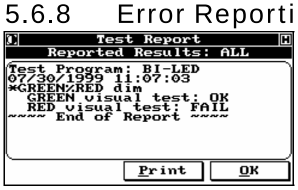


Diode (D1) is shorted. The Horizon measures and reports the reverse voltage across the short.



The diode is present but it is installed backwards.

5.6.8 Error Reporting for LEDs and BI-LEDS



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.

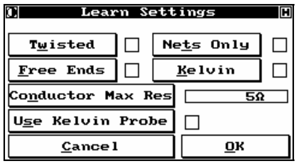
5.7 Four Wire or "Kelvin" Testing

5.7.1 Introduction

There are two methods for creating Kelvin measurement test programs for the Horizon.

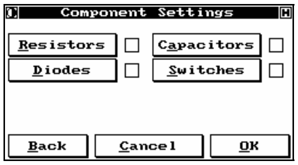
ⓘ The first method is to utilize the Kelvin adapter features discussed in section 6. If you choose to learn your test fixture as a Kelvin adapter, you need not read this procedure.

The second method would be to utilize standard Horizon adapters and **learn** your Kelvin fixture for a specific test program.



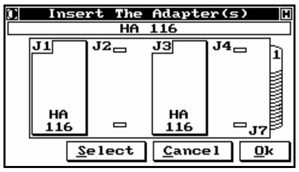
To learn a cable using a Kelvin fixture, select Program Cable from the *Main Menu*, then, from the *Programming Cable* menu, select Learn New Cable – Custom.

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**.

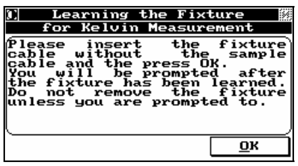


Add any components at this time.

Select **Ok** when through.

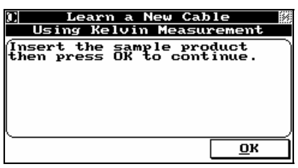


Insert the adapters needed for the cable being tested and select **Ok**.

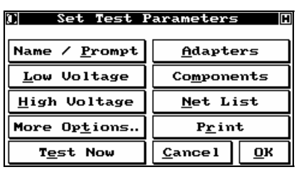


The Horizon must first learn the Kelvin fixture. During this process, the system will automatically determine which test points are being used for two wire measurements and which for four-wire.

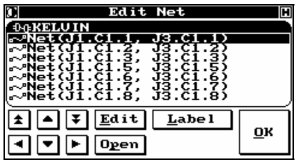
Insert the fixture (adapter cabling) only and select **Ok** to start learning.



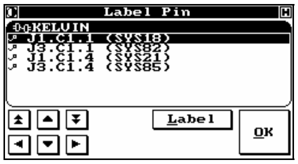
After learning the fixture, the Horizon will learn the sample cable. Insert the cable, making sure that all connections are completely seated, then select **Ok** to start the process.



To verify the product has been properly learned, select **Net List**.



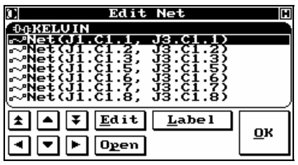
Highlight the Kelvin net you wish to verify.
Select Open to view all of its connections.



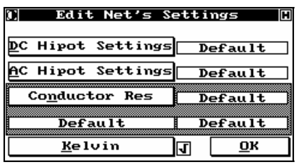
All four test points are included within this net. In this example the J1.C1.1 and J3.C1.1 are a Kelvin node as are J1.C1.4 and J3.C1.4. The connection between these two nodes is the product under test.

To verify this connection, the net must be Kelvin.

Select **Ok** to return to the *Edit Net* dialog.



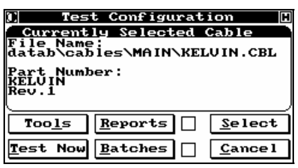
Select **Edit** to view the nets parameters.



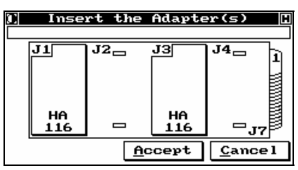
The **Kelvin** option is checked – the net is Kelvin.

5.7.2 Testing a Cable using Kelvin

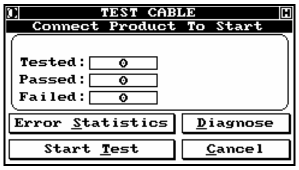
The procedure for testing a cable using "Kelvin testing" is the same as testing any other cable or harness. (For more details, consult Section 4.)



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*.



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

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.

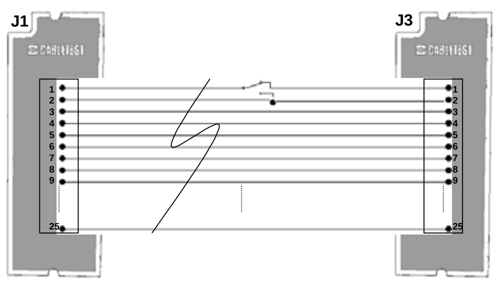
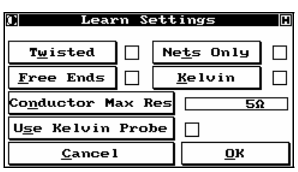
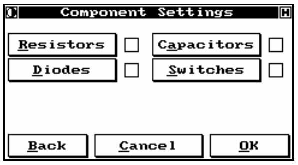


Figure 5-6: PUT with embedded Switch - in OPEN position

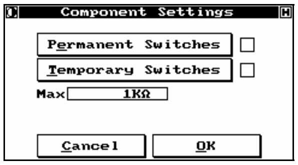


As with resistors and capacitors, switches are learned through the customized path. From the *Main Menu*, select **Program Cable**, followed by your password, then **Learn New Cable – Customized**. The *Learn Settings* menu appears. You may change the **Conductor Max Res**. From 'Quick Scan' to a specific resistance.

Select **Ok** to go to the *Component Settings* screen.



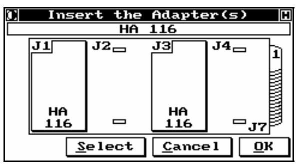
Select **Switches** to indicate to the Horizon that your cable has an embedded switch(es). The *Component Settings* menu will open.



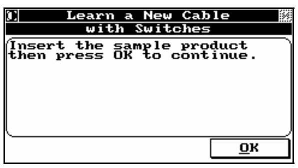
In the *Component Setting* screen, you have two available options.

Permanent Switches: Used for mechanical switches.
Temporary Switches: Used for momentary switches, such as membrane switches.

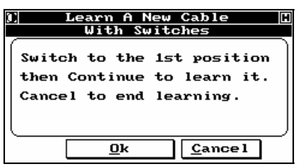
5.8.2 Programming Switches - Permanent



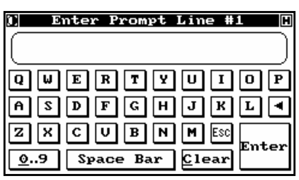
Insert the appropriate adapters.
Select **Ok** to continue.



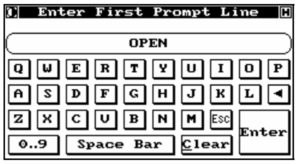
Insert the product into the adapters.
Select **Ok** to continue.



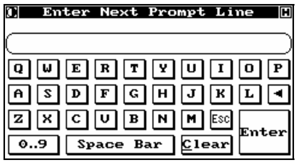
The Horizon instructs you to set your product in the first switch position.
After this is done, select **Ok**.



The Horizon learns the first net list.
You will be asked to enter a prompt. The purpose of this prompt is to instruct the operator what action to take to prepare the cable to be tested in its first configuration.



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.

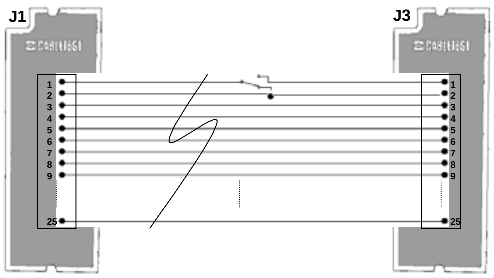
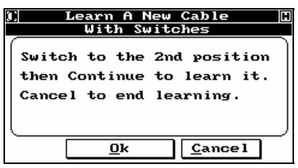
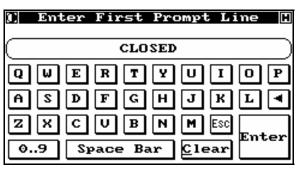


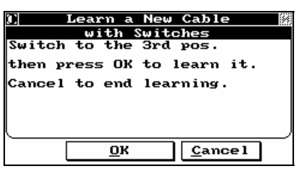
Figure 5-7: PUT with embedded Switch - in CLOSED position
\



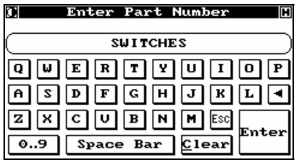
Place your product in the second switch position.
Select **Ok** to continue.



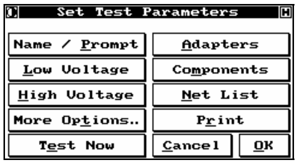
The second net list is learned.
You are prompted to enter the prompt that will appear prior to the second switch position.
Select Enter to confirm the prompt.



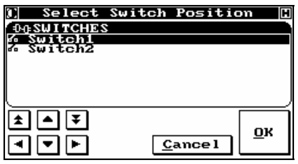
If no more switch positions are required, select **Cancel** to exit the learn cycle.



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

\datab\cables\main\switch.cbl For greater detail see section **9**.

```
*CABLE*,SWITCHES,1
  *STAR*
  *THRESHOLD*,61
  *ADAPTER*,HA 116,
    *POSITION*,J1
  *ADAPTER*,HA 116,
    *POSITION*,J3
  *SWITCH*,,
    *CHAIN*
    *PROMPT*
OPEN
    *NET*,,
      J1.C1.1,,
      J3.C1.1,,
    *NET*,,
      J1.C1.2,,
      J3.C1.2,,
    *NET*,,
      J1.C1.3,,
      J3.C1.3,,
    *NET*,,
      J1.C1.4,,
      J3.C1.4,,
    *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,,
    *NET*,,
      J1.C1.9,,
      J3.C1.9,,
    *NET*,,
      J1.C1.10,,
      J3.C1.10,,
    *NET*,,
      J1.C1.11,,
      J3.C1.11,,
    *NET*,,
      J1.C1.12,,
      J3.C1.12,,
    *NET*,,
      J1.C1.13,,
      J3.C1.13,,
    *NET*,,
      J1.C1.14,,
      J3.C1.14,,
    *NET*,,
      J1.C1.15,,
      J3.C1.15,,
    *NET*,,
      J1.C1.16,,
      J3.C1.16,,
    *NET*,,
      J1.C1.17,,
      J3.C1.17,,
    *NET*,,
      J1.C1.18,,
      J3.C1.18,,
    *NET*,,
      J1.C1.19,,
      J3.C1.19,,
    *NET*,,
      J1.C1.20,,
      J3.C1.20,,
  *SWITCH*,,
    *CHAIN*
    *PROMPT*
CLOSED
    *NET*,,
      J1.C1.1,,
      J1.C1.2,,
      J3.C1.1,,
      J3.C1.2,,
    *NET*,,
      J1.C1.3,,
      J3.C1.3,,
    *NET*,,
      J1.C1.4,,
      J3.C1.4,,
    *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,,
    *NET*,,
      J1.C1.9,,
      J3.C1.9,,
    *NET*,,
      J1.C1.10,,
      J3.C1.10,,
    *NET*,,
      J1.C1.11,,
      J3.C1.11,,
    *NET*,,
      J1.C1.12,,
      J3.C1.12,,
    *NET*,,
      J1.C1.13,,
      J3.C1.13,,
    *NET*,,
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      J3.C1.14,,
    *NET*,,
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      J3.C1.15,,
    *NET*,,
      J1.C1.16,,
      J3.C1.16,,
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      J3.C1.17,,
    *NET*,,
      J1.C1.18,,
      J3.C1.18,,
    *NET*,,
      J1.C1.19,,
      J3.C1.19,,
    *NET*,,
      J1.C1.20,,
      J3.C1.20,,
*END*
```
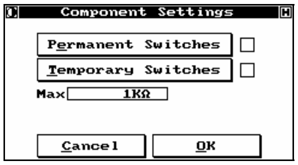

5.8.3 Programming Switches – Temporary (Membrane Switches)

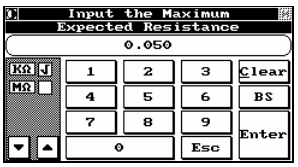
Temporary switches are also known as Keys. They are seen by the Horizon as a component.



In the *Component Setting* screen, you have two available options.

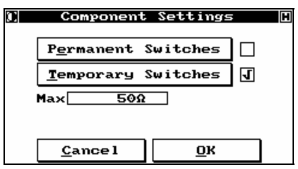
Permanent Switches: Used for mechanical switches.
Temporary Switches: Used for momentary switches, such as membrane switches.

Select **Temporary Switches**.



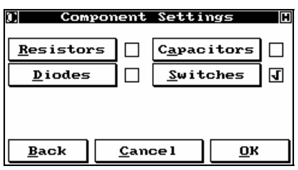
Input the maximum expected resistance for the embedded switch. In the example shown, the highest expected value is 50Ω.

Select **Enter** when through to return to *Component Settings* menu.



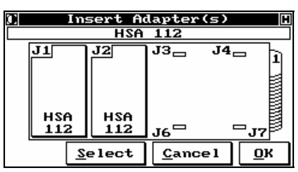
Notice that the **Temporary Switches** box is now checked and the maximum resistance value has changed.

Select **Ok** to continue.



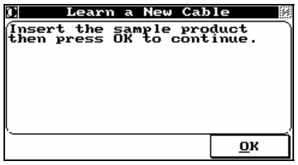
Notice that the **Switches** box is checked, indicating to the Horizon that your cable has an embedded switch (es).

Select **Ok** to continue the learning process.



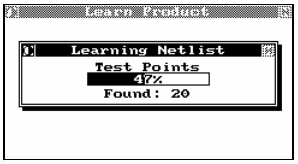
Insert the appropriate adapters.

Select **Ok** to continue.



Insert the product into the adapters.

Select **Ok** to continue.



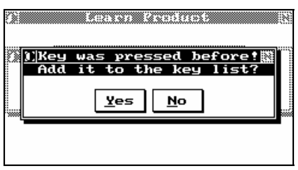
The net list is learned.

Press and hold the momentary switch. Once the measured resistance is displayed, release the switch.

Enter a label name and select **Enter** to accept.

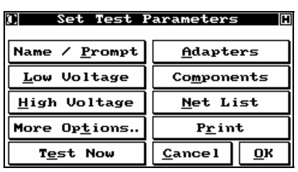
Press and hold to measure the next momentary switch.

With no more switches to press, select **Done**.



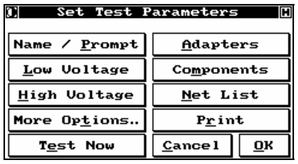
If the same switch (key) has been pressed twice, then the *Key was pressed before!* screen will appear.

Selecting **Yes** will accept the switch and selecting **No** will continue without accepting the switch.

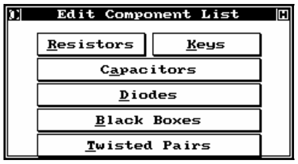


From this point on, the process is identical to that for any other cable. You do not have to do anything else to finish programming and to test this cable with embedded switches.
Select **Ok** to save the test procedure in the internal database.

5.8.4 Manual Entering Temporary Switches (Keys)



From the *Set Test Parameters* menu, select **Components** and the *Edit Component List* dialog appears.



Select **Keys**.

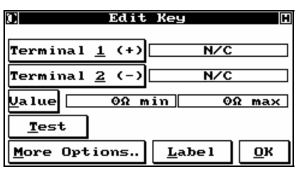
The *Select Key* dialog box is empty if no keys were detected during the learn process, or if you did not select the **Switches** option within a custom learn.

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.

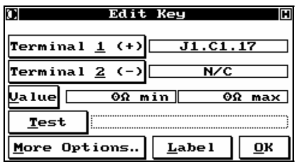
Select **Terminal 1 (+)** to assign it the proper net.

The *Open Net and Pick Terminal* dialog appears.

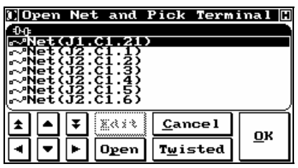
Using the arrow keys, scroll the cursor to highlight the correct net/pin location for Terminal 1

Select **Open** to select a pin. If the net only has a single pin, select **Ok**.

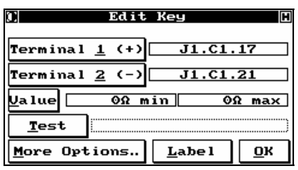
Highlight a pin and select **Ok** to accept the location of Terminal 1.



The first terminal is displayed.

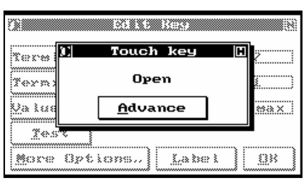


Repeat the above operation for Terminal 2.



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.



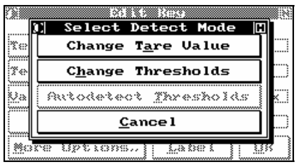
Press and hold the key on the product.

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.

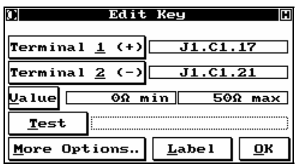
The Horizon engages the measurement circuitry to display the value of resistance between the selected terminals.

Select **Value** to set the tolerance



Select **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.

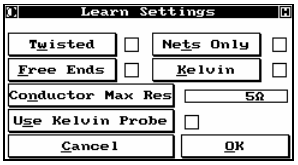
In general a four-wire resistance measurement setup consists of:
1) The Horizon system,
2) The Kelvin test fixture and
3) The product to be tested.

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

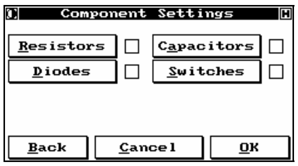
2) Learning the cable's NetList.

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.

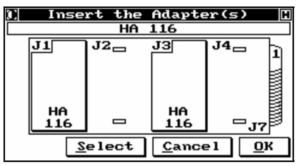


From the

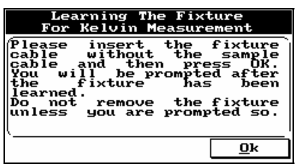
Select **Kelvin** and then select **Ok**.



Select **Switches** and then select **Ok**.

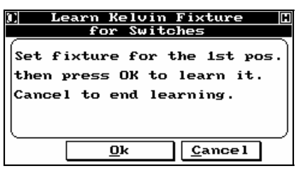


Have the adapter(s) and the Kelvin test fixture connected to the system in their proper positions. If standard Horizon adapters are used the system will auto-detect them in most cases



After the adapter(s) / Kelvin fixture(s) are properly inserted select **Ok** to get to this screen.

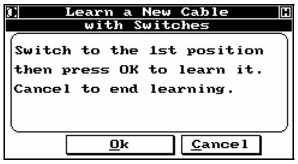
By selecting **Ok** the system starts learning the configuration of the Kelvin fixture. The product that is supposed to be tested must not be connected at this time since it will affect inadvertently the learning of the Kelvin fixture's structure.



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.

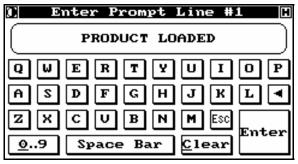
This screen asks you to make sure that the Kelvin fixture is configured for the first testing step.

Select **Ok** when the fixture is configured properly.



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**.

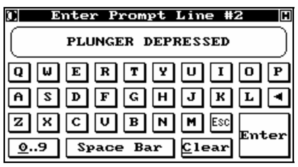


After the first switching position (first test step) is learned you are asked to enter up to three prompt lines.

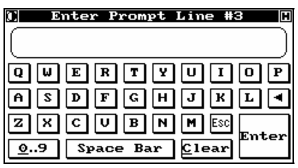
Of course you will enter your own message, something that reflects the step being performed.

The prompt lines are displayed at the test time for the operator to know how to configure the product under test.

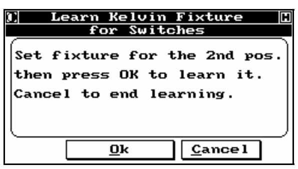
When Horizon is operated in an automated mode, the display message is rather informative, telling which step is being performed.



This is an example of a second prompt line.



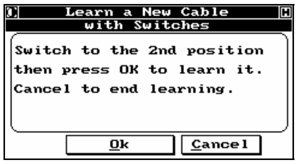
If you don't need the third prompt line, just select **Esc**. You can actually skip by selecting **Esc** in any of the three prompt line screens. All subsequent (if any) prompt line screens will be skipped.



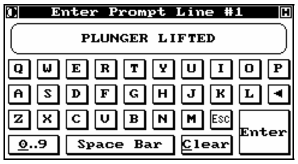
Now, once the first switching position (first test step) is completely defined, the system prompts you for the second switching position.

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.

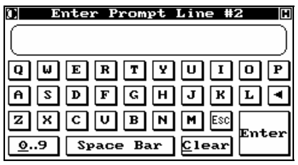


After the Kelvin fixture is learned in its second configuration, you are prompted to connect the product under test in its second configuration.

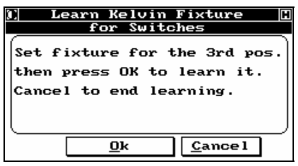


Again, after the product's second test step configuration is learned, you can enter up to three prompt lines.

Selecting **Esc** will skip past the current and any subsequent prompt line screens.



This is an example of a blank prompt line.

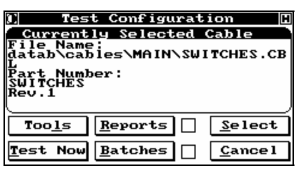


You are now prompted for the third switching position. If the cable is to be tested in two distinct switching positions only, select **Cancel** here to go to the next step.

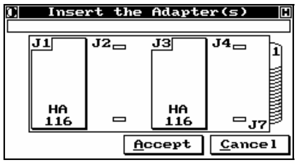
5.8.6 Testing Cables with Switches

The testing procedure for a product with embedded components is the same as testing any other cable or harness. For details, consult section 2.

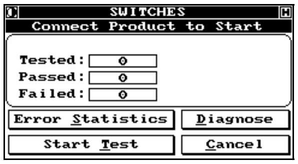
Highlight the product you wish to test.
Select **Ok** to continue.



Select **Test Now** to begin testing the listed product.

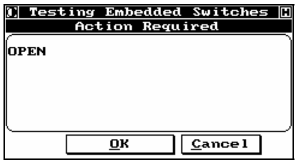


Insert the required adapters.



Connect the product you are testing to begin the test cycle.

If the test doesn't automatically begin, select **Start Test**.

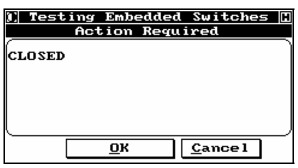


The first instructional prompt you programmed will be displayed. Flashing at the top is the message 'Action Required.'

After the instructions are carried out, push **Ok** and the Horizon will completely test the first configuration.

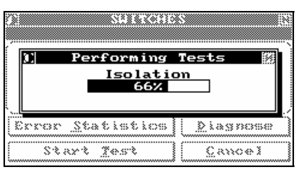
Regardless of the **Palm Switch** settings (set within the *System Setup*), you may use a Palm Switch to advance the Horizon through a test with switch positions.

All programmed tests are performed.

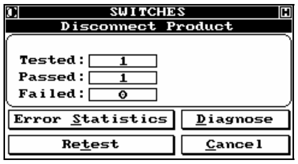


If the test for the first configuration is successful, the Horizon will display any required prompts for the next configuration.

Select **Ok** or use the Palm Switch to continue.



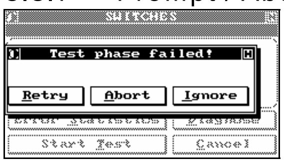
All programmed tests are performed.



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



Under General in the System Setup, user's of the Horizon have the option to enable and disable a feature specific to Switch Tests.

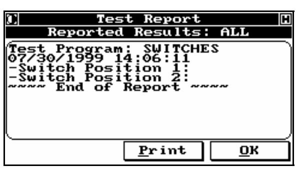
The option is labelled FAIL. Please review section 3 for greater detail on setting the option.

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.

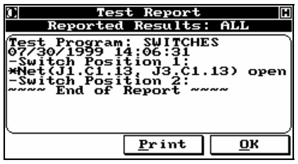
Prompt During a test with multiple states (switches) a failure will cause the Horizon to prompt the user to select either Abort, Retry or Ignore.



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.



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

CABLETEST

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.

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.)

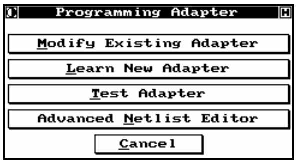
As part of the learning process, the Horizon effectively can recalibrate itself to the surface of the fixture. The net effect is greater testing accuracy of your products, with much less chance of erroneous results.

You should learn a fixture after it is built, even if it is based on CableTest supplied adapters.

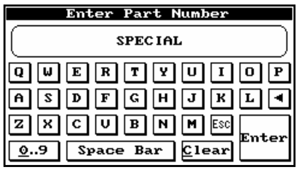
Can I build my own adapters?
If you would like to build some or all of your own adapters, contact your CableTest Representative for details. After they are built, each will need to be learned using the following procedures.

6.2 Learning an Adapter

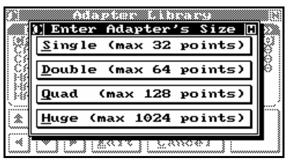
To learn an adapter, select **Edit Adapter** from the *Main Menu*. The *Adapter Library* dialog appears.



Selecting **Learn New Adapter** starts the process for incorporating a new adapter into the library and brings up the *Enter Part Number* screen.



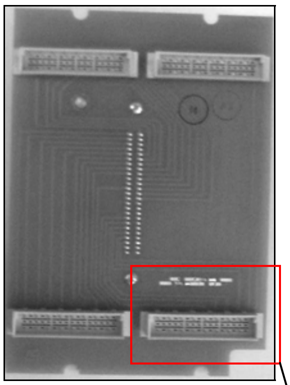
Input the desired name or part number for the adapter. The name can be up to 30 characters long, and can include any valid, visible ASCII character, including #( )?/, etc. When you have finished typing the name, select **Enter** to accept the input and display the *Enter Adapter's Size* screen.



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.

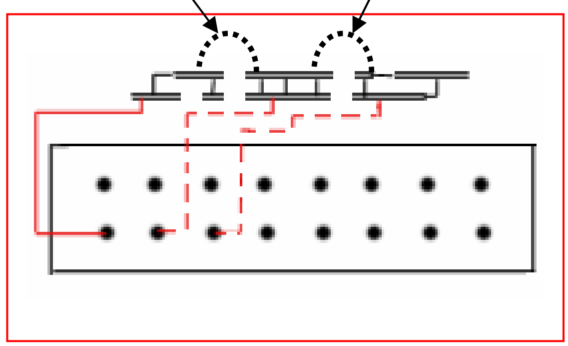
Single, Double, Quad or Huge, have nothing to do with the number of connectors on an adapter, nor with the number of points used, but only with the maximum number of test points available. For example, a Single might have three DB9's mounted on it for a total of 27 pins with 5 unused. It also has nothing 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.

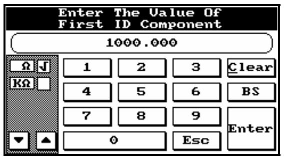
If you select **Huge** as the adapter type, since Huge does not self-ID, the Horizon will skip the next few steps and go directly to the *Enter Number Of Connectors* dialog.



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**



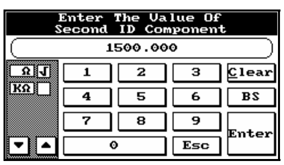


The Horizon will automatically measure the value of the component, if any are present, mounted in the first ID location. If this value is what you expected, select **Enter** to accept it and go to the *Enter Second ID Type* menu. In the example shown, it is a 1000Ω resistor. If it is not what you expected, check the value of the component before going on.

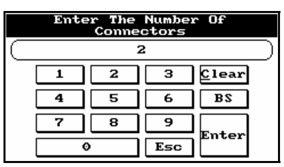
If you have not mounted any components as yet, or you plan to install new values, you can override the measured value at this time, but don't forget to install the proper values later. Otherwise, the Horizon will not correctly self-ID the adapter.

The recommended range for ID resistors is between 100Ω and 100kΩ. 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%.

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.

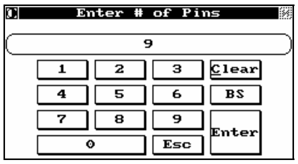


The Horizon automatically measures the value of the component, if any are present, mounted in the first ID location. If this value is what you expected, select **Enter** to accept it. In the example shown, it is a 1500Ω resistor.

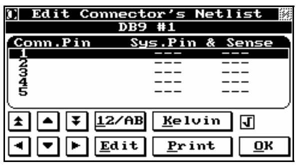


Input the number of connectors mounted on your adapter. Remember, there is no restriction as to the number and type of connectors that can be used on one adapter, so long as the total number of test pins does not exceed the maximum for the adapter type selected (32 for a Single, 64 for a Double, and 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.

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*.



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

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.

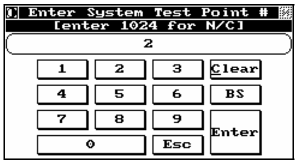
Using the provided ground probe, touch the tip to each connector pin in its standard numbering sequence. The Horizon maps the connector pin to its corresponding system pin (column one) and displays a pin map similar to the one at the left. The second column (Sense) is reserved for the special case, Kelvin 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.



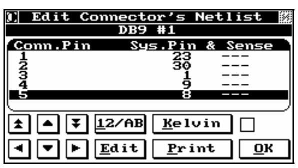
You can manually enter system pins or define a point as NC (not connected) by highlighting the Conn. Pin and selecting **Edit**. Enter the associated system pin number, select **Enter**, and you will return to *Enter Connector 1's Netlist*. Continue in this manner until all pin numbers have been mapped. When finished, select **Print** and/or **BACK** as above.

Enter 1024 for N/C (not connected) pins.

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.

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.

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.



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

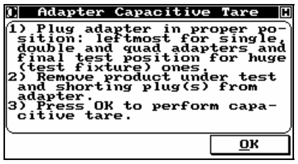
ID Components: Re-enter or re-detect values of id components.

Connector List: Edit connector names and pin mapping of an adapter.

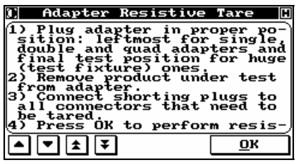
6.3 *Taring the Adapter/Fixture*

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.

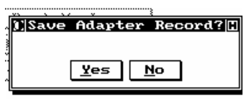


Cap Tare: For increased capacitance measurement accuracy, the capacitance of the adapter may be learned and utilized as a tare value.



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.

To tare a connector you must have a minimum of three (3) test points.



Select **Ok** to save the learned adapter.

Cancel prompts the operator to confirm abandoning the new adapter.

Adapter as ADP File

`\datab\adapters\special.adp` For greater detail see section 9.1.3.

```
*ADAPTER*,SPECIAL
*SIGNATURE*,1,1000,1,150
0
*SIZE*,1
*CONNECTOR*,DB9 #1,
12,1,,,,
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,,,,
```

This file can be edited using any text editor or word processor, however if you use a word processor it is imperative to save the file as **Text Only**, otherwise you will not be able to utilize it.

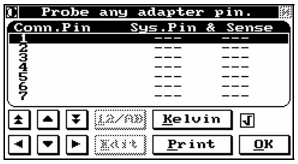
6.4 Testing a New Adapter

If you create an adapter for the Horizon, it is a good idea to test it before entering it into the database.

This feature is also useful for troubleshooting existing adapters and fixtures.

From the *Main Menu* select **Edit Adapter**.

From the *Programming Adapter* menu, select **Test Adapter**.



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
                          a
                          b
                          c
                          d
                          e
                          f
                          g
                          h
                          k
                          m
                          n
                          p
                          q
                          r
                          s
                          t
                          u
                          v
                          w
                          x
                          y
                          z
                          A
                          B
```

Save the new file as 'Text Only' using up to 8 characters and the CNV extension.

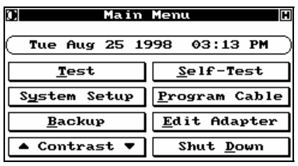
E.g. **example.CNV**

ⓘ 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.

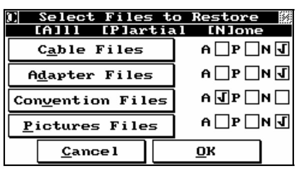
C:\v4.0\datab\convent

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.



From the *Main Menu* of the Horizon, select **Backup**.

Select **Restore**.



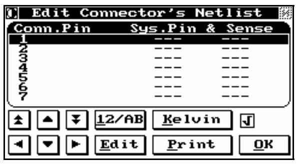
Toggle **Test Programs** and **Adapter Files** to the **N** position (the check mark will appear next to the N).
Select **Next** to continue.

The file(s) will be copied.

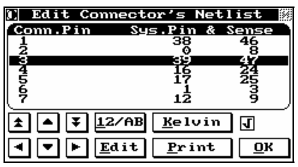
You will be prompted whether you wish to restore from another disk.
If you have no other files to restore or copy to the database, select **No**.

6.5.1 Special Case: The Kelvin Adapter

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.



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.

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

```
\datab\adapters\kelvin.adp
```

```
*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,,,
.
.
.
```

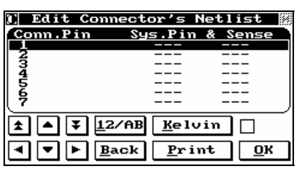
6.5.2 Special Case: Shorted Pins

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:

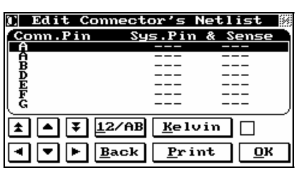
The first important step is to create a convention (as described in 0) that represents the adapter as it exists.

For example, if pins 1 and 3 were shorted together, you must give them identical labels:

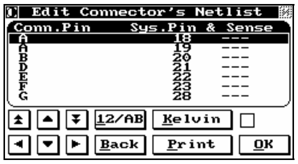
```
*CONVENTION*, Short Example,10
A
A
B
D
E
F
.
.
.
```



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.



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.

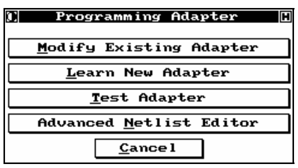
Adapter as ADP File

\datab\adapters\shorted.adp

```
*ADAPTER*,SHORTED,
*SIGNATURE*,3,00000000,3,00000000
*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
```

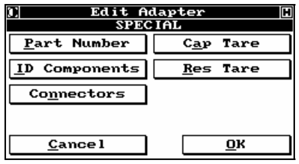
6.6 Editing an existing Adapter

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.

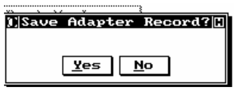


Select **Modify Existing Adapter** to edit an adapter.

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.



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.



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

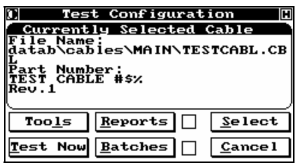
As part of your test procedure, you can include reports for each cable tested. These reports can either be printed or saved to file.

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.

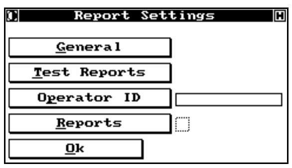
If you wish to have different report settings for individual test programs, see section 9.1.5. Setting up reports

Reports are setup up from the *Test Configuration* menu.

From the *Main Menu*, select **Test** to access the *Test Configuration* menu.



Select **Reports**.



Select **General** for *General Report Settings*.

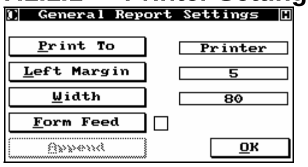
7.1.1 Print, Save to File, or Both

Select **Print To** to select the target for reports.

Printer: Writes reports to the parallel port of the Horizon
File: Writes reports to a log file.

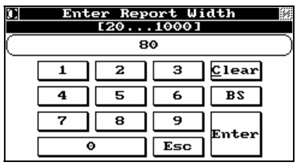
Select both options sets the setting to **Multiple**. Reports will be printed and written to the log file.

7.1.1.1 Printer Settings



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.

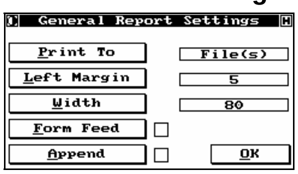
To set the width of the page, select **Width**:
The *Enter Report Width* dialog appears. Enter a width from 20 – 1000.



The default settings should suit most printers.

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

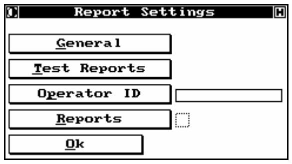


When the Print To 'File(s)' option is selected, the system saves the test results and the errors to two files. The .ALL file contains any report option that has been enabled, including the errors. The .ERR file contains only the errors. The file names are created from the product name by using the first few characters.

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.

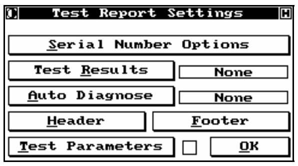
Disabled (no check mark) each test overwrites the existing log.



Selecting **Ok** returns you to the *Report Settings* menu.

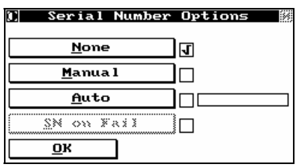
7.1.2 Report Settings

Select **Test Reports** to configure the reports for your test.



7.1.2.1 Serial Numbers

To serialize a product you are testing, select **Serial Number Options**.

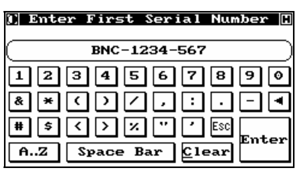


The *Serial Number Options* dialog appears.

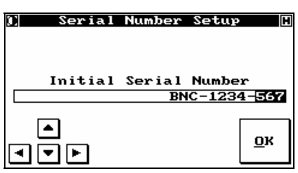
Manual Mode: The operator will be prompted for a serial number at the end of each test.

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.

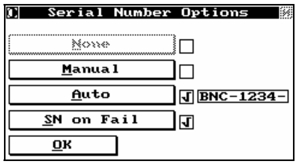


To setup an automatic serial number, enter the first serial number (up to 30 characters) and select **Enter**. The serial number can be comprised of both numbers and letters. The serial number will be advanced either alphabetically or numerically (depending on which is required) after each subsequent 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.



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 from 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.

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 from passed products and included on failed products.
All Results are included for both passed and failed products.

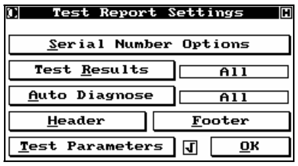
7.1.4 Header and Footer

Header and Footer information can be added to the Printed and Logged reports

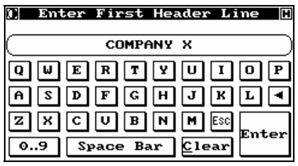
The Header and/or Footer can exist in two manners:
1) The first is on a per test cycle basis.

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.



From the *Test Report Settings* menu, select **Header**.

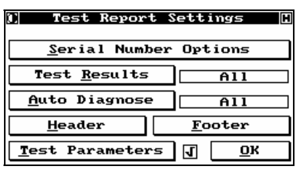


The number of lines for the Header is unlimited.
The width of each line is limited by the maximum character width of the sheet to be printed on.

Enter the first line and select **Enter** to move to the next line.

Enter the next line and select **Enter**.

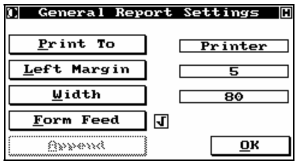
If all the lines are entered, select **ESC** to exit.



Select **Footer** to enter Footer information.

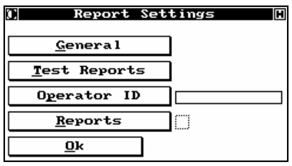
Enter the first line of your footer and select **Enter** to continue.

When all lines are enter, select **ESC** to exit.

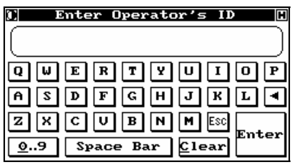


For Headers and Footers to operate correctly you MUST set the reports to have a form feed after each tested product.

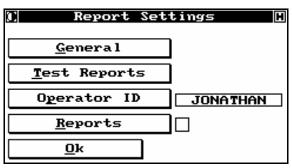
7.1.5 Operator ID



Select **Operator ID** to include the name of the operator for this test session.

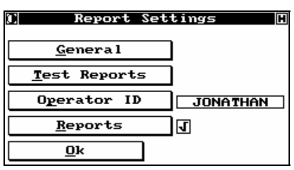


The ID can be up to 30 characters in length.

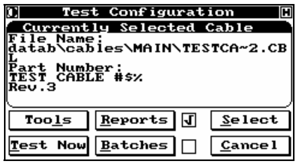


Select **Enter** and you will be returned to the *Report Settings* menu. Note the operator's name is present.

7.1.6 Enable Reports



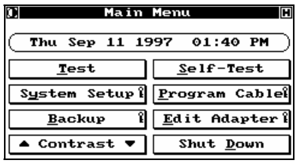
The final setting is to select the reports to be activated. By selecting **Reports**, a check mark appears in the neighbouring square.



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:



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*.

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.

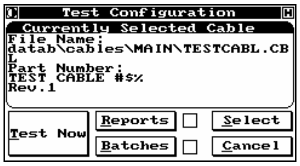
You can read the log files saved to your diskette by using any text editor on your personal computer. The files are located in a subdirectory labelled ‘logs’ and another subdirectory labelled after the serial number of the Horizon the files originated; and, all the files have extensions .ALL and .ERR.

7.2 Batches

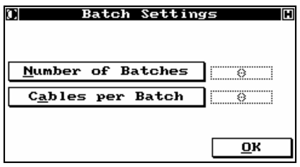
In many shops, it is often the case where the products (cables or harnesses) must be sorted or packaged in lots. It goes without saying that each product in the lot must be a good product. While this sounds trivial, in the press of running a production floor, keeping this straight can prove to be difficult. The Horizon has a special feature designed to help you if this is your situation.

7.2.1 Setting Up Testing By Batches

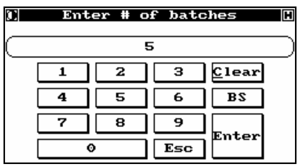
The **Batches** feature is set up from the *Test Configuration* menu accessed by selecting **Test** on the *Main Menu*.



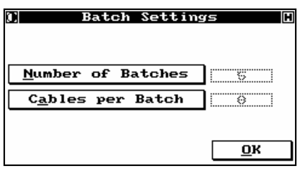
From this menu, select **Batches** to set up the batch parameters needed for a given product. Note that the operator must set this up for each testing session where batches are needed. In that way, using the batch feature is straightforward and will not require any special attention by supervisory personnel. Selecting **Batches** brings up the *Batch Settings* dialog.



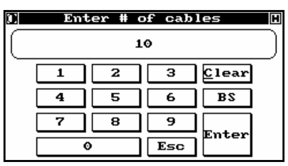
Select **Number Of Batches** to input the desired number of batches; select **Cables Per Batch** to enter the number of cables per batch needed.



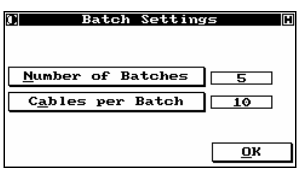
The example requirement calls for five batches of ten cables each. Selecting **Enter** enters the number of batches.



Select **Cables per Batch**.

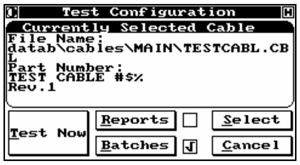


Selecting **Enter** inputs the number of cables per batch.

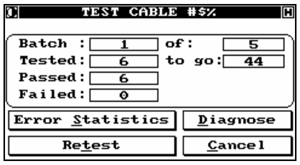


The *Batch Settings* menu shows that the data has been entered correctly. Select **Ok** to return to the *Test Configuration* dialog.

Once the values become active (not shaded) the batches feature has been enabled.

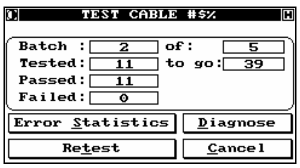


Note that the box by **Batches** now has a check mark indicating that the Horizon will keep track of each lot as the cables are tested. Select **Test Now** to continue testing.



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*.

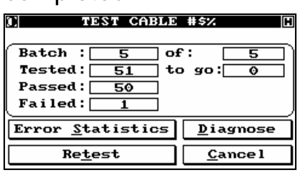
The Horizon will indicate when each batch is filled with good cables. The user is prompted to acknowledge the completion of a batch.



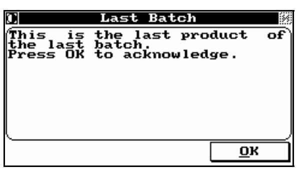
The start of a new batch.

7.2.2 Batch Completion

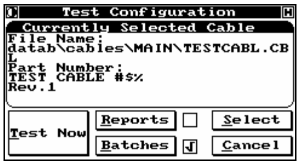
The Horizon automatically recognizes when a batch or set of batches has been completed.



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.



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*.

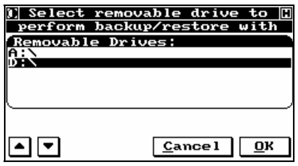
8 BACKUPS AND RESTORES

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:

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.

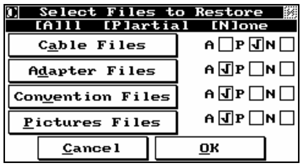
The *Backup – Restore Shell* offers the user to easily perform backups and restores of the test program files and adapter library.

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.

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.

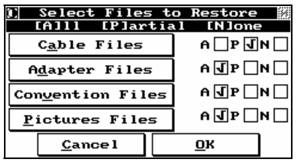
Another good use of the backup/restore function is to transfer test programs or adapter library files between systems. When multiple systems are used to test the same product, you can learn the product on one system, then use the diskette to transfer the test program to other systems.

Select **Backup** to begin.



Select the Items to wish to backup by toggling the button to either **A**, **P, or N**.

A = ALL
P = Partial
N = None



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 '**-**'.

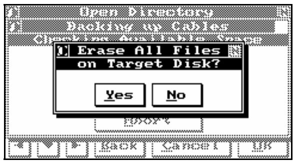
Using the arrow keys, highlight the test program to be backed-up and press **Select**. A check mark will appear in the left hand column indicating that the test program is selected.

More than one test program can be selected for backup. When you satisfied, select **Ok** to continue.

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.



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.

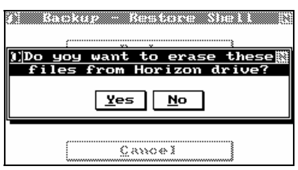
As files are being backed-up, the progress bar indicates the remaining space on the disk and the progress of the total backup.

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.

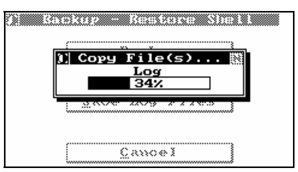
Select **Ok** to return to the *Backup - Restore Shell* screen.

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 disk to a floppy diskette.

8.1.2 Performing Restores

Select **Restore** to begin restoring backed-up files from a floppy to the Horizon.

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

Once the restore is complete, this screen will appear. Remove the diskette from the floppy drive.

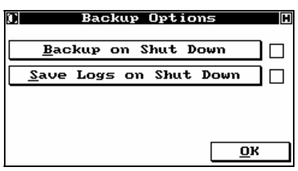
Once the diskette is removed, the *Restore Report* screen will display all files restored. Use the arrow keys to scroll through the list.

Select **OK** to return to the *Backup - Restore Shell* screen.

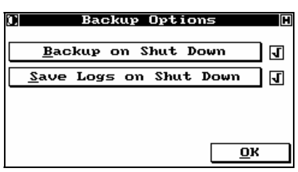
8.1.3 Auto-Backups

Allows the user to perform a backup and/or save log files each time the system is exited.

To setup the auto-backup feature, select **More Options** from the *Backup-Restore* dialog.



Check either or both of the two options to enable them.



Selecting either Shut Down options places a check mark next to the item.

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:

ID Header

```
*CABLE*,AWP-1001GT,1
```

Adapter Interface

```
  *ADAPTER*,AATEST,
    *POSITION*,J5
```

Test Parameters and Prompts

```
  *STAR*
  *THRESHOLD*,61
  *DCHIPOT*,50
    *IR*,5e+07
    *DWELL*,2
    *REGULAR*
    *LINEAR*
```

NetList

```
  *NET*,,
    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.

ⓘ 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
```

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).

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 C*n* 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          ID Header
  *ADAPTER*,AATEST,           Adapter Interface
    *POSITION*,J5
    *CONNECTOR*,1,P
    *CONNECTOR*,2,K
  *STAR*                      Test Parameters and Prompts
  *THRESHOLD*,61
  *DCHIPOT*,50
    *IR*,5e+07
    *DWELL*,2
    *REGULAR*
    *LINEAR*
  *NET*,,                     Netlist
    .P.1,,
    .K.3,,
  *NET*,,
    .P.2,,
    .K.6,,
  *NET*,,
    .P.3,,
    .K.10,,
  *NET*,,
    .P.4,,
    .K.5,,
  *NET*,,
    .P.5,,
    .K.9,,
  *NET*,,
    .P.6,,
    .K.8,,
  *NET*,,
    .P.7,,
    .K.1,,
  *NET*,,
    .P.8,,
    .K.7,,
  *NET*,,
    .P.9,,
    .K.2,,
  *NET*,,
    .P.10,,
    .K.4,,
*END*
```

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).

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.

ⓘ 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 0Ω and 5Ω limits is specified.

```
*CONTINUITY*,0.0,5.0
```

ⓘ The continuity minimum and maximum thresholds must always be given in [Ω]. For example a 1KΩ 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 1MΩ. 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 [Ω].

```
*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.

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 100MΩ 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 100μA 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.

```
*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 100MΩ 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.

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:

```
[*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 0.0Ω and max 0.1Ω 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>
```

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

ⓘ 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)

ⓘ 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,
```

```
*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 1KΩ and the second has 1.5KΩ. 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,H
    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
.
.
.
```

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)
C	A	1
C	B	3
C	C	5
C	D	7
C	E	9
C	F	11
C	G	13
C	H	15
C	J	17
C	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

Ambient Temperature:	Operating	$0^{o}C$ - $55^{o}C$
	Non-Operating	$0^{o}C$ - $45^{o}C$
Temperature Gradient:	Operating/Non-Operating $30^{o}C$/hr max, without condensation	
Relative Humidity:	Operating/Non-Operating 8% - 80% non-condensing	
Vibration:	Operating	2.45 m/s^2 (0.25G)
	Non-Operating	11.76 m/s^2 (1.2G)
Shock:	Operating	29.4m/s^2 (3G)
	Non-Operating	490 m/s^2 (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:	50µA
Threshold:	~80kΩ[1]
Voltage Limit:	5V

MEASUREMENT SPECIFICATIONS

Resistance:

2-Wire Measurement[2]

0.1Ω to 2MΩ	±2.5%, ±20mΩ	Resolution: 1mΩ or 3 digits
2MΩ to 10MΩ	±7.0%, ±1KΩ	Resolution: 3 digits
10MΩ to 25MΩ	±15%, ±10KΩ	Resolution: 3 digits
25MΩ to 50MΩ	±30%, ±10KΩ	Resolution: 3 digits

4-Wire (Kelvin) Measurement[3]

10mΩ to 400Ω	±2.5%, ±10mΩ	Resolution: 1mΩ or 3 digits

4-Wire(Kelvin) HCS Resistance Measurement:

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:

Voltage	50 - 1000VAC	±12%, ±1V	Resolution: 1V
	50 - 1067VAC	±12%, ±1V	Resolution: 1V
Current:	min: 5mA, typical: 8mA, max: 10mA		
Frequency	50Hz – 60Hz	±15%	

Measurement[6]

Leakage Current	5µA - 5 mA	±12%, ±5µA	Resolution: 1µA
IR[4]	10MΩ - 200MΩ	±12%	Resolution: 3 digits

[1] Actual value may vary between different systems.
[2] The low range 2-wire resistance measurement specifications rely on tared fixtures.
[3] For resistances of more than 400Ω these measurements default to 2-wires.
[4] @1000VAC

Arc Detection	Automatic		
HiPot Type	Mass or Linear		

High Voltage DC *(Optional):*

Programmable:			
Voltage	50 - 1000VDC	±4.0%, ±1V	Resolution: 1V
	50 - 1500VDC	±4.0%, ±1V	Resolution: 1V
Current:	min: 2mA, typical: 2.5mA, max: 5mA		
Measurement[6]			
Leakage Current	1μA - 5 mA	±4.0%, ± 1μA	Res: 1μA or 3 digits
IR[5]	10MΩ - 1.5GΩ	±4.0%	Resolution: 3 digits
Arc Detection	Automatic		
HiPot Type	Mass or Linear		

High Current *(Optional):*

Programmable:			
Current	1mA to 500mA	±2.5%, ±1mA	Resolution: 1mA
	1mA to 1A	±2.5%, ±1mA	Resolution: 1mA
Voltage	1 to 28VDC	±2.5%, ±0.1V	Resolution: 0.1V
Measurement[6]**:**			
Voltage	0V – 2.5V	±2.5%, ±2mV	Res: 1mV or 3 digits
	2.5V - 28V	±2.5%, ±25mV	Res: 10mV or 3 digits
Current	1mA – 0.1A	±2.5%, ±1mA	Res: 0.5mA or 3 digits
	0.1mA to 1A	±2.5%, ±5mA	Res: 2.5mA or 3 digits
Kelvin Resistance	1mΩ to 400Ω	±2.5%, ±1mΩ	Res: 1mΩ or 3 digits
MilliVolt Drop	1mV - 3V	±5.0%, ±1mV	Res: 1mV or 3 digits

[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.

Table 1: Mass HiPot Routine - Product Under Test is 'Good', no faults exist.

Test Phase	Net Number															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
2	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-
3	+	+	+	+	-	-	-	-	+	+	+	+	-	-	-	-
4	+	+	-	-	+	+	-	-	+	+	-	-	+	+	-	-
5	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-

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*.

Table 2: Splitting caused by current overload due to mass grouping

Test Cycle	Net Number																
	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!	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	-

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.

Table 3: Splitting caused by excessive current leakage due to mass grouping

Test Cycle	Net Number																
	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!	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	-

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.

Table 4a: 'Bad' PUT – Arc between 2 nets during Mass HiPot (Binary search for fault)

Test Cycle	**Net Number**																
	Condition	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
1	**Pass!**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
2	**ARC!**	+	+	+	+	+	+	+	+	-	-	-	-	-	-	-	-
2a	**ARC!**	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-
2b	**Pass!**	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2c	**Pass!**	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2d	**ARC!**	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-
2e	**Pass!**	-	-	F	+	-	-	-	-	-	-	-	-	-	-	-	-
3	**Pass!**	-	-	F	-	+	+	+	+	-	-	-	-	-	-	-	-
4	**Pass!**	+	+	F	+	-	-	-	-	+	+	+	+	-	-	-	-
5	**ARC!**	+	+	F	-	+	+	-	-	+	+	-	-	+	+	-	-
5a	**Pass!**	+	+	F	-	+	+	-	-	-	-	-	-	-	-	-	-
5b	**ARC!**	-	-	F	-	-	-	-	-	+	+	-	-	+	+	-	-
5c	**Pass!**	-	-	F	-	-	-	-	-	+	-	-	-	-	-	-	-
5d	**Pass!**	-	-	F	-	-	-	-	-	-	+	-	-	-	-	-	-
5e	**Pass!**	-	-	F	-	-	-	-	-	-	-	-	-	+	-	-	-
5f	**ARC!**	-	-	F	-	-	-	-	-	-	-	-	-	-	+	-	-
6	**Pass!**	+	-	F	-	+	-	+	-	+	-	+	-	+	F	+	-

Table 4b: 'Bad' PUT – Arc between 2 nets during Mass HiPot (Linear 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!	-	-	F	+	-	-	-	-	-	-	-	-	-	-	-	-
2e	Pass!	-	-	F	-	+	-	-	-	-	-	-	-	-	-	-	-
2f	Pass!	-	-	F	-	-	+	-	-	-	-	-	-	-	-	-	-
2g	Pass!	-	-	F	-	-	-	+	-	-	-	-	-	-	-	-	-
2h	Pass!	-	-	F	-	-	-	-	+	-	-	-	-	-	-	-	-
3	Pass!	+	+	F	+	-	-	-	-	+	+	+	+	-	-	-	-
4	ARC?	+	+	F	-	+	+	-	-	+	+	-	-	+	+	-	-
4a	Pass!	+	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-
4b	Pass!	-	+	F	-	-	-	-	-	-	-	-	-	-	-	-	-
4c	Pass!	-	-	F	-	+	-	-	-	-	-	-	-	-	-	-	-
4d	Pass!	-	-	F	-	-	+	-	-	-	-	-	-	-	-	-	-
4e	Pass!	-	-	F	-	-	-	-	-	+	-	-	-	-	-	-	-
4f	Pass!	-	-	F	-	-	-	-	-	-	+	-	-	-	-	-	-
4g	Pass!	-	-	F	-	-	-	-	-	-	-	-	-	+	-	-	-
4h	ARC!	-	-	F	-	-	-	-	-	-	-	-	-	-	+	-	-
5	Pass!	+	-	F	-	+	-	+	-	+	-	+	-	+	F	+	-

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.

Table 5: 'Bad' PUT – Splitting due to excessive current leakage during Mass IR Test

Test Cycle	Net Number																
	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!**	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+

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.

Table 6: Sequential or 'Linear' Testing

Test Cycle	Net or Net Group Number															
	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+

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.

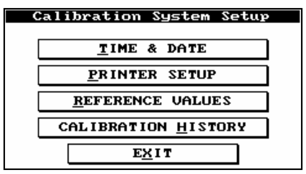
Using the Calibration Equipment

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.

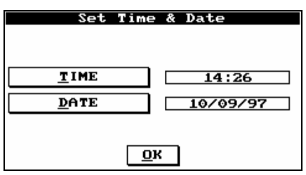
For example, if your system has 128 test points, you must detect two cards, usually assigned as number 0 and 1. Therefore on the screen, the squares number 0 and 1 should be highlighted. If a MUX card is detected but does not pass a self test, its corresponding position on the screen will be displayed 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

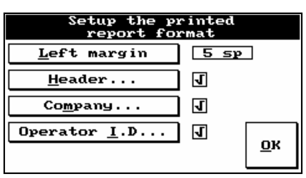
From the *Main Menu* screen you have the following options:
CALIBRATION. By selecting this option you can choose the source of the reference components used in method, from the ones built in the calibration board (INTERNAL) or the ones that you can connect to the external jacks (EXTERNAL).
SYSTEM SETUP 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



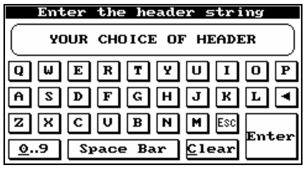
Selecting **SYSTEM SETUP** produces the *Calibration System Setup* menu.



Selecting **TIME & DATE** allows you to properly set the values to accurately log the calibration verification.



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.

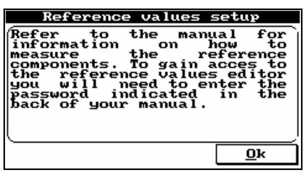


By selecting **Header**… you can enter this information where relevant or disable their function entirely.

By selecting **Company**… you can enter this information or disable it.

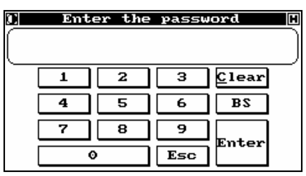
By selecting **Operator I.D**… you can enter this information or disable it.

When selected (a check mark present next to it) then information entered will be included in the printed report, otherwise it will be omitted.

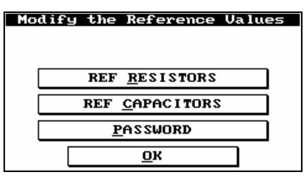


Selecting **REFERENCE VALUES** from the *Calibration System Setup* menu, and the message to the left appears.

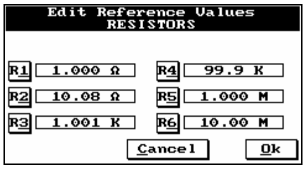
Do not alter the **Reference Values** unless they match the values measured on the Calibration Board.



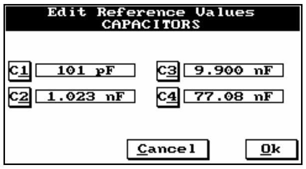
Pressing **Ok** the Horizon prompts you to enter the appropriate password. Your password is supplied when you purchase your calibration verification kit.



Select **REF RESISTORS** to alter their reference values.



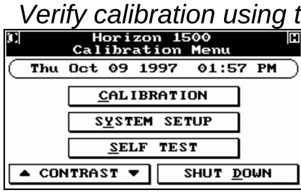
Select the resistor value you would like to alter. Refer to the schematic of the calibration board to select the correct resistor.



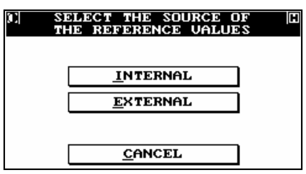
Select **REF CAPACITORS** from the *Modify the Reference Values* menu to alter their reference values. Select the Capacitor you would like to alter. Refer to the schematic of the calibration board to select the correct capacitor.

Select **PASSWORD** from the *Modify the Reference Values* menu to select a new password to protect your reference values.

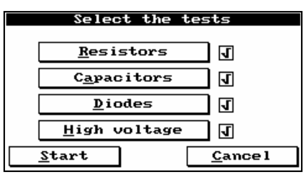
Verify calibration using the internal reference components



To select calibration verification press **CALIBRATION** on the *Calibration Menu*.



Select **INTERNAL** to use the components of the calibration board to perform the verification test.



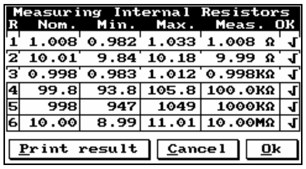
Select the tests you would like to perform. A test will be included if a check mark is present next to the option.

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.

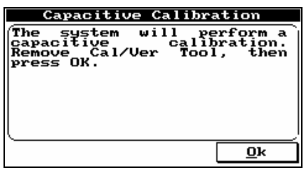

Measuring Internal Resistors

R	Nom.	Min.	Max.	Meas.	OK
1	1.008	0.982	1.033	1.008 Ω	√
2	10.01	9.84	10.18	9.99 Ω	√
3	0.998	0.983	1.012	0.998KΩ	√
4	99.8	93.8	105.8	100.0KΩ	√
5	998	947	1049	1000KΩ	√
6	10.00	8.99	11.01	10.00MΩ	√

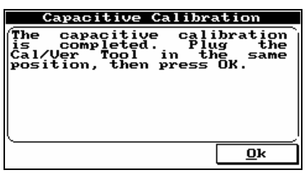
The 6 resistance values are measured by the Horizon and compared to the list of reference values.

The 6th value of 10MΩ is at the end of the tolerance spectrum for the Horizon and will have a tolerance of up to 10% from the reference value.

Press **Ok** for the next test.

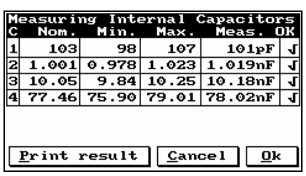


Prior to performing the Capacitance Verification, the user is prompted to remove the Calibration Verification Tool from the unit to perform a capacitance tare.



Remove the tool and select **Ok**.

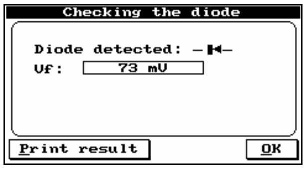
When prompted, replace the tool and select **Ok** to continue.


Measuring Internal Capacitors

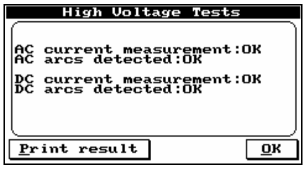
C	Nom.	Min.	Max.	Meas.	OK
1	103	98	107	101pF	√
2	1.001	0.978	1.023	1.019nF	√
3	10.05	9.84	10.25	10.18nF	√
4	77.46	75.90	79.01	78.02nF	√

The second test, capacitance, measures the 4 capacitor values and compares them to the listed reference value.

Press **Ok** for the next test.



The third test is a diode test. The test notes the diode orientation (a successful test) and measures the forward voltage.

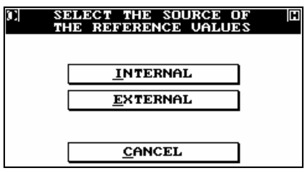


The fourth test is a high voltage test, measuring the AC and DC currents and the detection of AC and DC arcs.

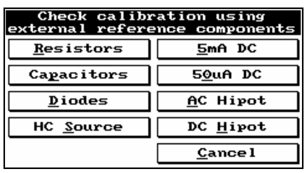
The system continuously scans until **Ok** is selected.

During each of the tests you have option to Print result,

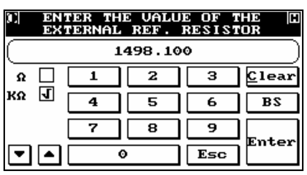
Verify calibration using external reference components



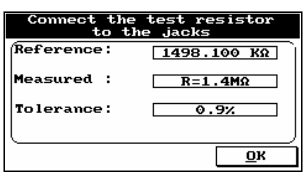
Choosing the **EXTERNAL** option in the *SELECT THE SOURCE OF THE REFERENCE VALUES* menu allow the user to test there own measured components.



To verify resistance measurement, select **Resistors**.

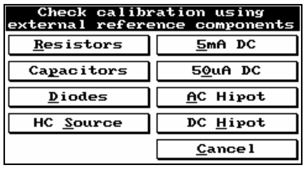


Measure your resistor and enter the value.



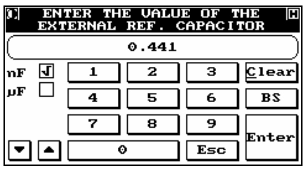
Connect the resistor to the external jacks on the calibration board. The Horizon measures the value and compares it to the value you entered as a reference value. The tolerance between the two is given.

Press **Ok** to return to the *Check calibration using external reference components* menu.

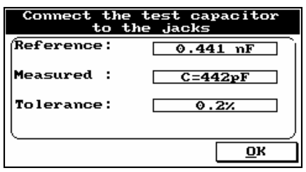


To verify capacitance measurement, select **Capacitors**.

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.

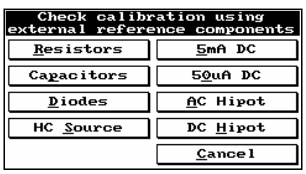


Measure the capacitance of your component using an extremely reliable tool, such as a bridge. Enter the measured value.

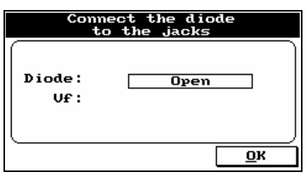


Connect the component to the external jacks on the calibration board and the Horizon measures the value comparing it to the reference value entered. The tolerance between the two values is reported.

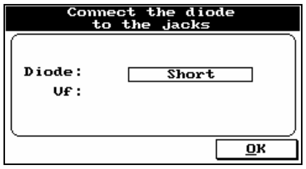
Press **Ok** to return to the *Check calibration using external reference components* menu.



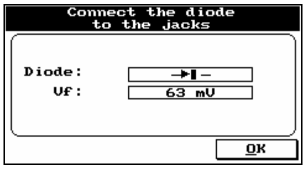
Select **Diodes** to verify the Horizon detects polarity and forward voltages through the diode junction.



The Horizon correctly reports the absence of a diode.

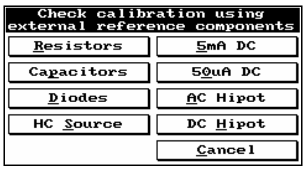


The Horizon correctly reports a short between the diode terminals.

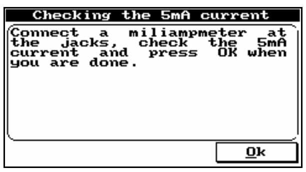


The Horizon correctly reports the polarity and the forward voltage of the diode.

Press **Ok** to return to the *Check calibration using external reference components* menu.



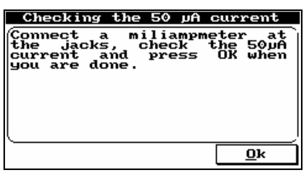
The Horizon uses two fixed currents to perform it measurements. Select **5mA DC** to verify the value and **50µA DC** to verify the value.



Use an ammeter to measure the current through the two jacks.

An example measurement from a Horizon was 4.946mA

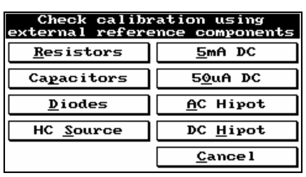
Press **Ok** to return to the *Check calibration using external reference components* menu.



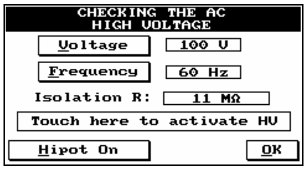
Select **50µA**. Use an ammeter to measure the current through the two jacks.

An example measurement from a Horizon was 49.97µA.

Press **Ok** to return to the *Check calibration using external reference components* menu.



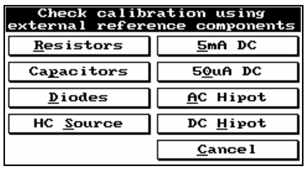
Select **AC Hipot** to verify the AC hipot card in your machine (should you have this feature installed).



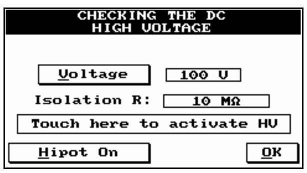
As a safety precaution, the high voltage will only be present and be maintained as long as the touch screen is pressed.

Using a voltmeter, the potential across the jacks can be 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.

Press **Ok** to return to the *Check calibration using external reference components* menu.

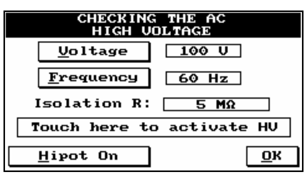


Select **DC Hipot** to verify the DC hipot card in your machine (should you have this feature installed).

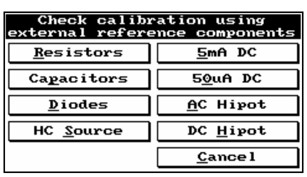


As a safety precaution, the high voltage will only be present and be maintained as long as the touch screen is pressed.

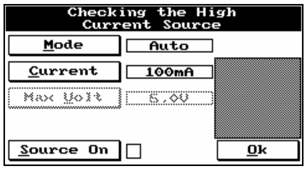
Using a voltmeter, measure the potential across the jacks to be compared to the applied voltage. Once the voltmeter is across the jacks, the internal resistance of the meter will be displayed as the **Isolation R**[esistance]. You can also use this feature to measure known values of high resistance across the jacks to test how well the Horizon measures these values with the high voltage.



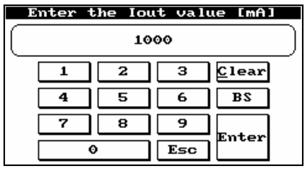
Example of using the high voltage to measure a resistor value. The measured resistance of 4.964MΩ was placed across the external jacks and the AC voltage was applied.



Select **HC Source** to verify the High Current Source of your Horizon.

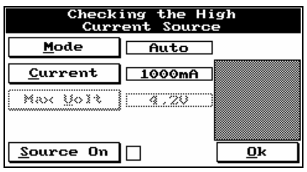


Select **Current**.



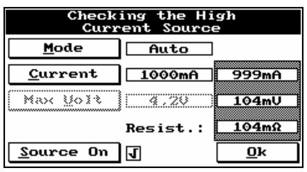
Enter the maximum current of the HC Source in your machine… either 500mA or 1A.

Select **Enter**.



Using the Calibration Tool, place an ammeter between the jacks.

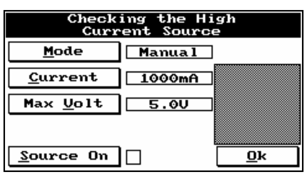
Select **Source On**.



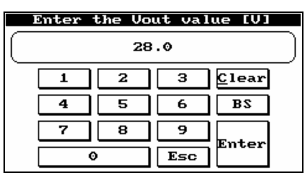
Check the ammeter reads the correct current. The shaded portion of the screen shows the Horizon measurements. Compare those with your meter's measurements.

Select **Source On** to turn off the High Current Source, and then select **Mode**.

Mode set to 'Manual' makes the **Max Volt** option available.

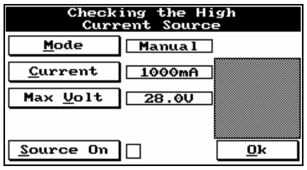


Select **Max Volt**.



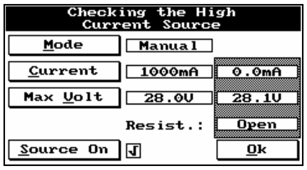
Enter the maximum voltage the High Current Source can sustain: 28V.

Select **Enter**.



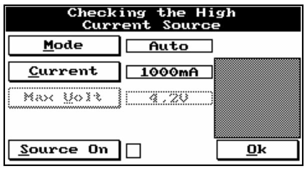
Using the Calibration Verification Tool, place a voltmeter across the jacks.

Select **Source On**.



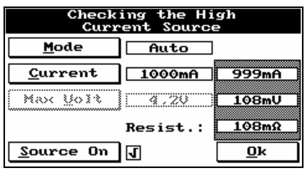
Check the voltmeter reads the correct voltage and compare it to value read by the Horizon in the shaded area on the screen.

Select **Source On** to turn off the High Current Source.



Select **Mode** to return to ‘Auto’.
Select a low value resistor, example 0.1Ω, and place it between the jacks of the Calibration Verification Tool.

Select **Source On**.

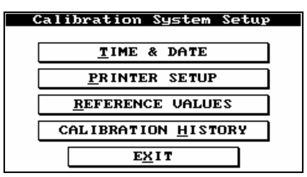


Check the measured value of the resistor, shown in the shaded area, to the known value of the component.

Calibration History

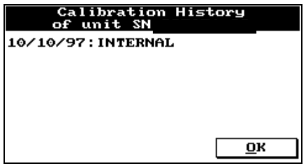
Once you have performed calibration verification for the first time on your Horizon, a log is taken of the date and type of verification (Internal or External).

To view calibration history. Select **SYSTEM SETUP** from the *Calibration Menu*.



Select **CALIBRATION HISTORY** from the *Calibration System Setup* menu.

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

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

C	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

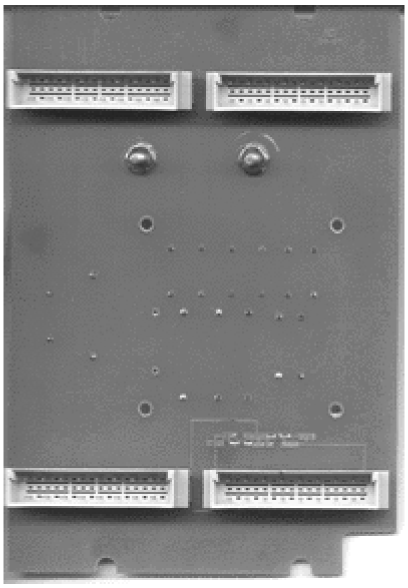
Introduction:
The Horizon 1500 Calibration Verification Tool is composed of several components that are utilized by the Calibration Verification Software to verify that the Horizon 1500 is within specifications

Necessary Equipment:
Philips Screwdriver
Kelvin Clips

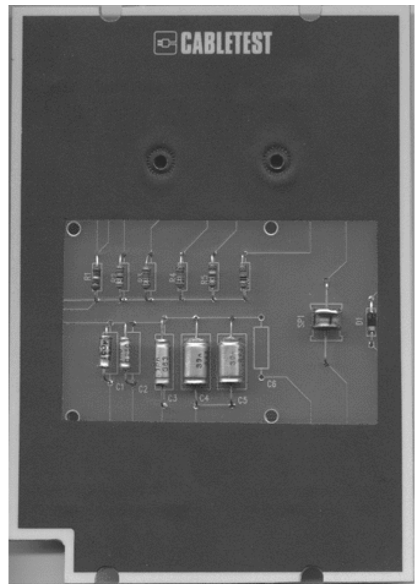
Instruments	*Critical Specifications*	*Recommended Model*
DMM (Ω 2W / Ω 4W)	4 Digit DC Accuracy	HP34401A
LCR Bridge	4 Digit Accuracy	SRS SR715/SR720

Calibration Conditions:
Warm up time: N/A
Temperature: 23°C +/-2°C

1. Remove the Protective Shell from the tool.

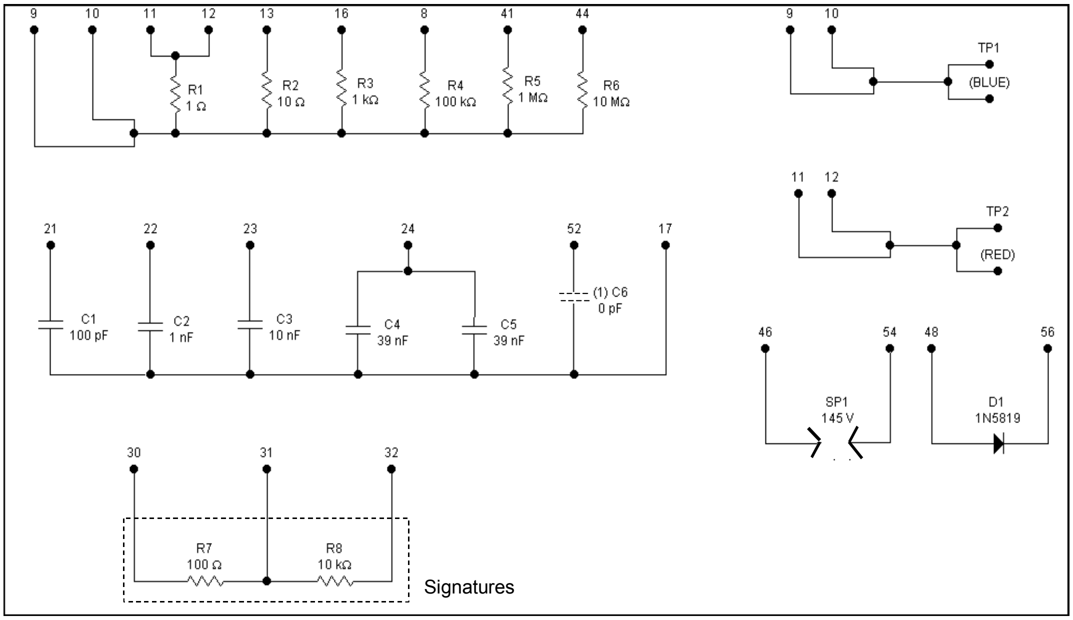


Remove the 4 screws holding the shell in place.



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 = 100000Ω

R5 = 1000000Ω
R6 = 10000000Ω

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	→ Serial Number of Card
1000	→ mΩ
10000	→ mΩ
1000	→ Ω
100000	→ Ω
1000000	→ Ω
10000000	→ Ω
100	→ pF
1000	→ pF
10000	→ pF
78000	→ 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:______________(mΩ)
R2:______________(mΩ)
R3:______________(Ω)
R4:______________(Ω)
R5:______________(Ω)
R6:______________(Ω)

CAPACITORS:
C1:_____________(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 location for increased measurement accuracy.
Conventions	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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