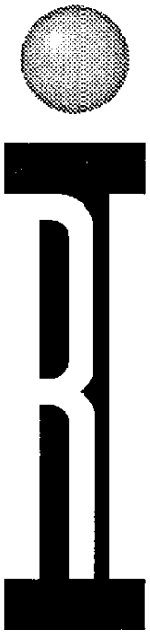
RI 7100A Microwave Test System On-Site Training Seminar

Installation & Maintenance



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Training Seminar Outline

- **Introduction**
- **Preparing for the System Installation**
- **System Configuration**
- **System Setup & Startup**
- **System Operation**
- **System Software Backup**
- **Diagnostics and System Recovery**
- **Preventative Maintenance**

Training Seminar Outline (Continued)

- **Repair Policy**
- **Other Topics**

RI 7100A Microwave Test System

- **ATE System**
- **0.1 - 8 GHz**
- **Production & Device Characterization**
- **High Speed & High Volume Testing**
- **Simple, Modular Hardware**
- **Object Oriented Software**
- **Graphical User Interfaces**

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System Components

- **System Rack & System Instruments**
- **RFIC/MMIC Test Head**
- **Test Fixtures/RF Family Cards & DUT Interface**
- **System Computer & System Software**

Test System Block Diagram

System Receiver

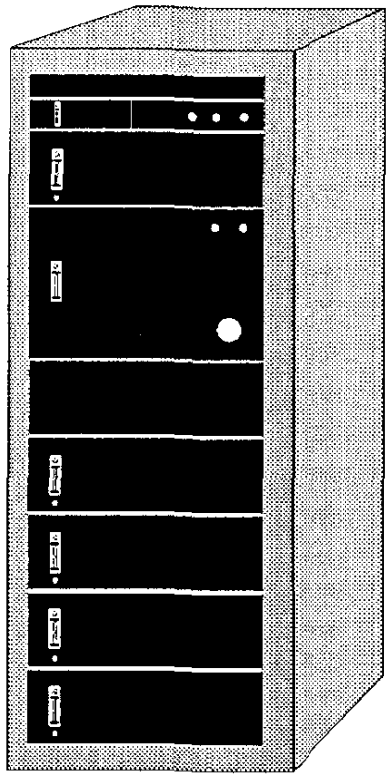
System Local Oscillator

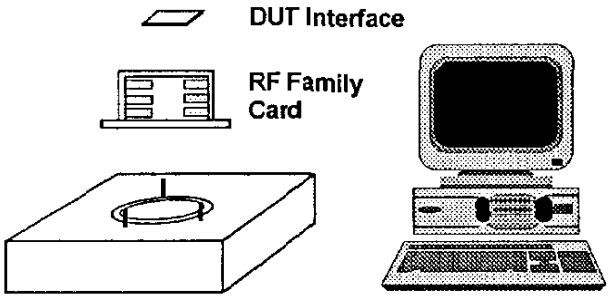
RF System Matrix

Source 1 (RF Stimulus)

Source 2 (RF Intermod)

System Power Supply





RFIC/MMIC Test Head & DUT Controller

System Computer, RI Fiber Link & System Interface

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System Software

- **Graphical User Interfaces**
- **Test Panels & Buttons**
- **Copy & Paste Buttons to Create Test Plans**
- **On Screen Help**

Typical System: Physical Characteristics

- **Weight: 940 lbs (426 kg)**
- **AC: 100, 120, 200, 240 Vac**
  50 - 60 Hz, 3000 VA maximum
- **AC Receptacles Required**
  System Rack: Two 10A Line Receptacles
  System Computer: two Standard Line Receptacles
- **Operating Conditions: 18 to 30 degrees C**
  Non-Operating Conditions: 0 to 40 degrees C
- **Special Plumbing & Gas Requirements: None**

General Comments

- **System Installation is Provided by Roos Instruments**
- **The System is on Rollers and can be moved**
- **Please Leave Room for Access to the Back of the System**
- **The Test System is connected to the System Computer by the RI Fiber Link - RIFL (2 fiber cables)**
- **<u>Please Follow ESD Procedures</u>**

Equipment List

- RF Family Card/Test Fixture and DUT Interface
- RFIC/MMIC Test Head & Programmable DUT Controller
- System Receiver
- RF/Microwave Stimulus Sources
- RF System Matrix & System Power Supply
- System Rack & Test Head Manipulator
- System Computer w/RIFL Interface
- System Software

RF Family Card/Test Fixture & DUT Interface

- **Functions:**
  - **Custom DC, LF & RF Signal Conditioning**
  - **Specialized Signal Routing to Test Head**
  - **Physical Interface to Part Handler or Prober**
- **Typical Configuration Contains:**
  - **DUT Interface and Fixturing**
  - **RF/Microwave Switches**
- **Connections:**
  - **DUT Contacts**
  - **DC, LF & Digital Inputs/Outputs to the DUT Controller**
  - **RF Inputs/Outputs to Test Head's RF Test Ports**

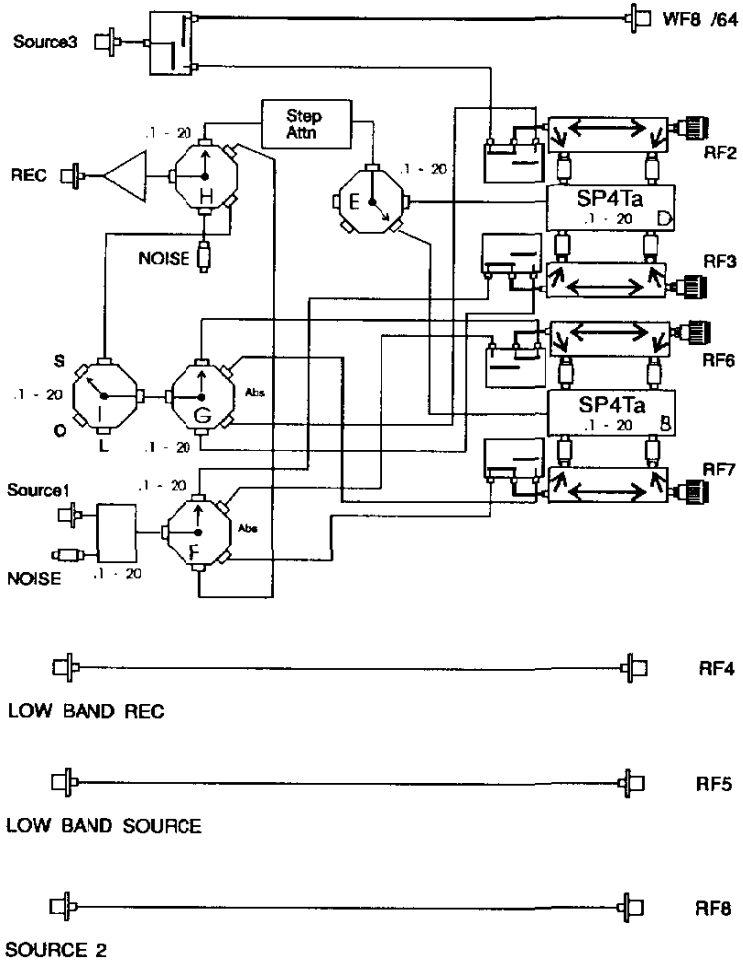
RFIC/MMIC Test Head

- **Functions:**
  - **RF Signal Routing - DUT to Sources & System Receiver**
  - **RF Signal Separation - S Parameters**
  - **Provide Noise Source - Noise Figure**
- **Contains:**
  - **RF Switching**
  - **Ovenized S Parameter Test Sets**
  - **RF Noise Sources**
  - **RF Pre-Amps**
  - **RIFL Interface and Switch Control**

RFIC/MMIC Test Head (Continued)

- **Connections:**
  - **RF Stimulus Sources (1 thru 3, via RF System Matrix)**
  - **System Receiver (Rec, Low Band Rec, via System Matrix)**
  - **Four RF Test Ports (2, 3, 6 & 7)**
  - **Two LF Test Ports (4 & 5)**
  - **RIFL Interface (2 connections)**
  - **DC Power Connector**

4 Port RF Test Head Block Diagram



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RI 7100A Test Head Switch Definitions

Switch Descriptions

B Single Pole 4 Throw switch for incident and reflected signals for RF6 & RF7
D Single Pole 4 Throw switch for incident and reflected signals for RF2 & RF3
F Source switch to connect Source 1 or Noise Source RF3, 6, 7 or switch I
G Receive switch to connect direct RF2, 3, 6 and 7 to switch I
H Receive Select switch from switch B or D (coupled ports), switch I, G or system cal noise source
I Bi-State Load switch for L1 and L2

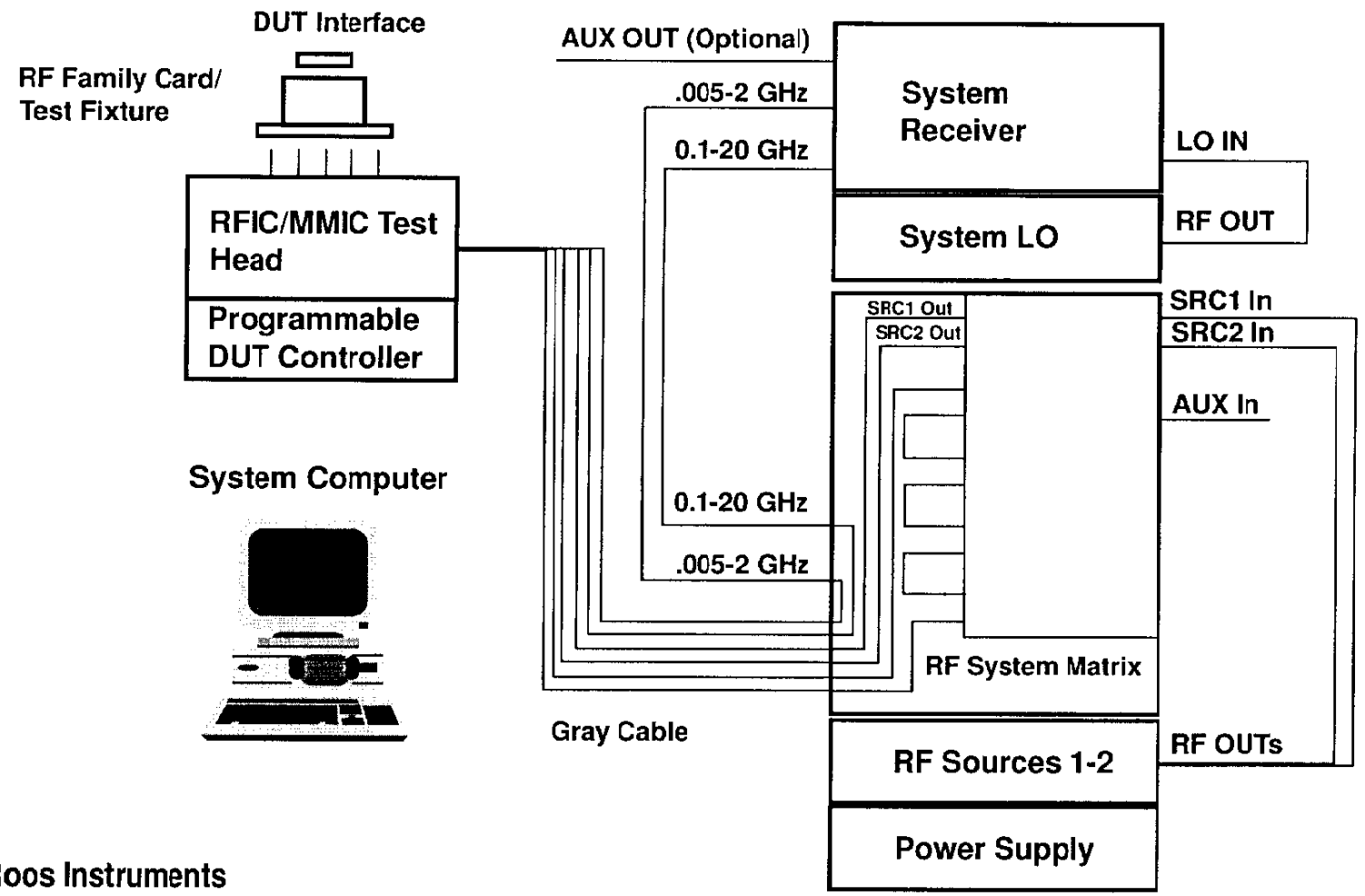
Port Coupler Switch

RF2 connected to source 3 or switch G (Receive)
RF3 connected to switch F (noise source or source 1) or switch G (Receive)
RF6 connected to switch F (noise source or source 1) or switch G (Receive)
RF7 connected to switch F (noise source or source 1) or switch G (Receive)

RF System Matrix

- **Functions:**
  - **RF Signal Conditioning**
  - **Combine RF Intermod Tones**
- **Contains:**
  - **Six Plug-in RF Slots**
  - **One Dual Attenuator/Amplifier/Combiner Module**

RF System Matrix - RF Connections



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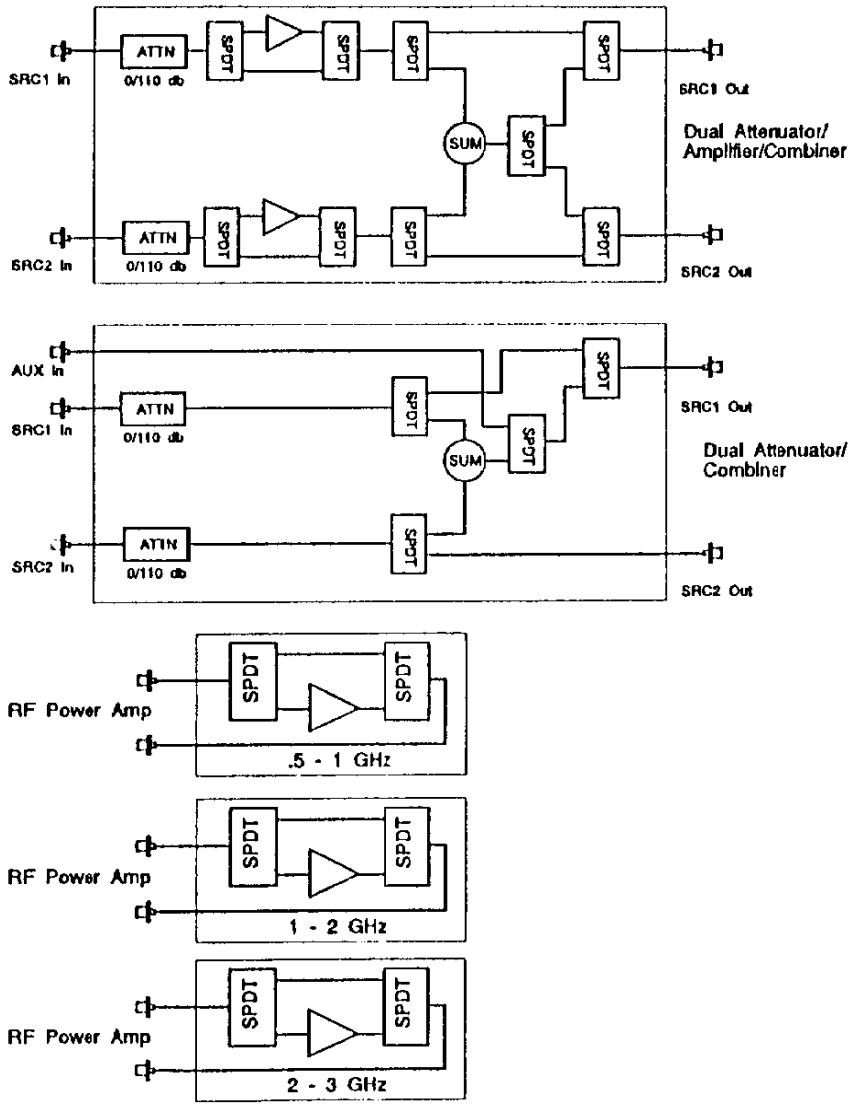
RF System Matrix (Continued)

- **Connections:**
  - **Rec Input from Test Head (Gray Cable)**
  - **SRC1-3 Outputs to Test Head (Gray Cable)**
  - **RF Output to System Receiver (Front Panel)**
  - **RF Source Inputs (RF Sources 1-3, Rear Panel)**
  - **RIFL Interface (2 connections, Rear Panel)**
  - **AC Power (1 Connection per Module, Rear Panel)**

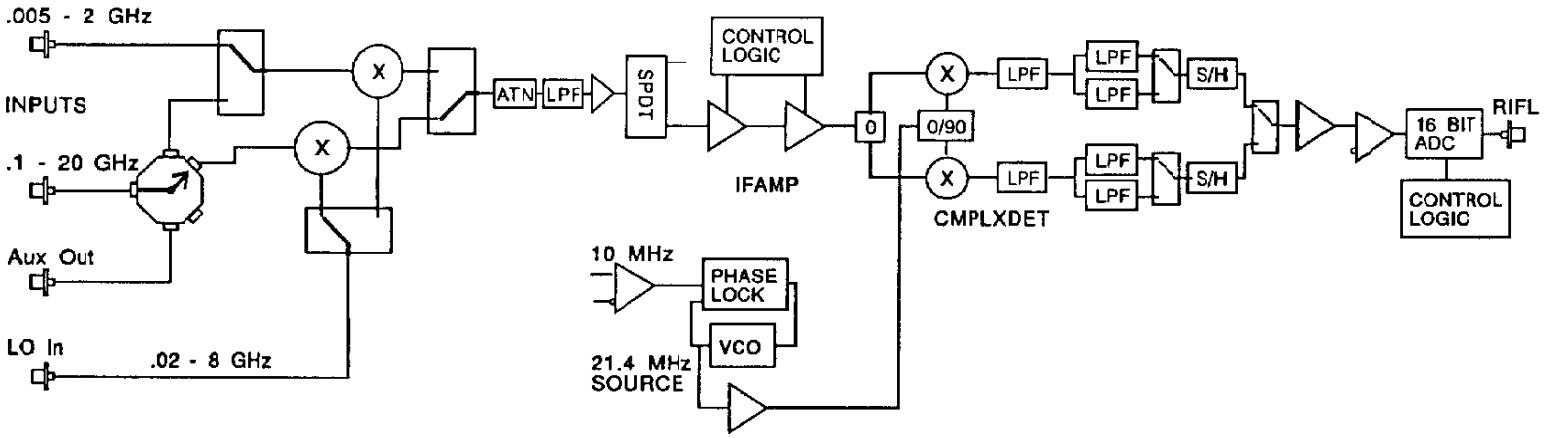
RF System Matrix Modules Available



System Receiver

- **Function:**
  - **Down Convert RF Signals to IF**
  - **Perform all RF Signal Measurements**
- **Process:**
  - **Down Convert RF Signals**
  - **Condition IF Signals**
  - **Create I & Q Signal Components**
  - **Condition I & Q Signals**
  - **Sample and Digitize I & Q Signals**
  - **Send Digitized Data to System Computer (via RIFL)**

System Receiver Block Diagram



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System Receiver (Continued)

- **Contains:**
  - **RF/Microwave Down-Converter (Mixers & Switches)**
  - **Aux Output to External Spectrum Analyzer (Optional)**
  - **Mother Board w/plug-in Receiver Modules**
  - **RIFL Interface Module**
  - **RIFL to GPIB Decoder Module (Optional)**
  - **Power Supplies**

System Receiver (Continued)

- **Connections:**
  - **0.1 - 20 GHz Input from Test Head (via RF Matrix)**
  - **0.005 -2 GHz Input from Test Head (via RF Matrix)**
  - **LO Input from System LO (System Local Oscillator)**
  - **AUX OUT to External Spectrum Analyzer (Optional)**
  - **RIFL Interface (2 Connections)**
  - **GPIB Interface (Optional)**
  - **AC Power Receptacle**

RF/Microwave System Sources

- **Function:**
  RF Stimulus to DUT or System Local Oscillator
- **Typical Settings:**
  RF Level, Frequency, RF ON/OFF
- **Connections:**
  RF Output to:
    2 Sources to Test Head (via RF System Matrix)
    1 Source to System Receiver (System LO)
  RIFL Interface
  AC Power Receptacle

Programmable DUT Controller

- **Functions:**
  - **DC Bias (Force & Sense)**
  - **DUT Control Signals**
  - **DC & LF Measurement**
  - **LF Stimulus Signals (Including I & Q Tones)**
- **Contains Application Specific Plug-in Modules:**
  - **CW & Pulsed Bias**
  - **Digital Control Lines**
  - **DC Voltage Measurement**
  - **Base Band Analyzer**
  - **Arbitrary Waveform Synthesizer**
  - **Low Noise Clock Output (/64 Output)**

Programmable DUT Controller (Continued)

- **Connections:**
  - **DC, Digital & LF I/O to Test Fixture (via Test Head)**
  - **Packaged Part Handler &/or Prober Control Interface**
  - **DC Input from Power Supply in System Rack**
  - **RIFL Interface**

System Computer

- **Functions:**
  - **User Interface**
  - **System Management**
  - **Test Plan Generation & Execution**
  - **Measurement Control and Signal Processing**
  - **Data Analysis**
- **Contains:**
  - **IBM Compatible Personal Computer**
  - **OS/2 Operating System**
  - **RI System Software & SQL Relational Data Base**
  - **System/RIFL Interface**

System Computer (Continued)

- **Connections:**
  - **RIFL Interface**
  - **Input/Output Ports (mouse, keyboard & printer)**
  - **Modem Interface (Optional)**
  - **Computer Network Interface (Optional)**
  - **2 AC Power Receptacles**

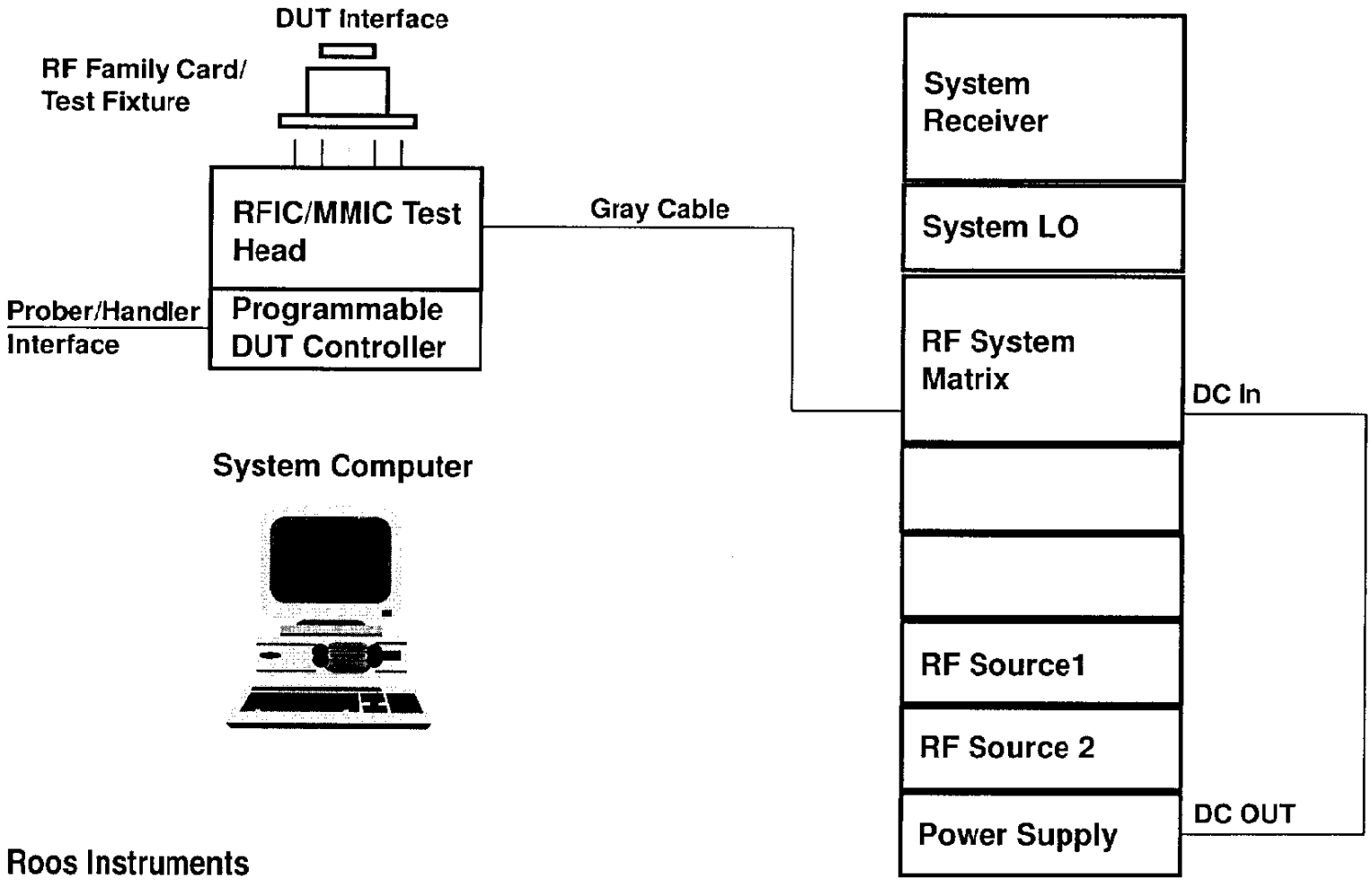
System Setup and Start-up: Check List

- **Verify that all Instruments are Present (See Check List)**
- **Verify that all Cable Connections are Properly Connected (See Check List)**
- **Verify that the Test Fixture, Test Head and Part Handler (or On-Wafer Prober) are Properly Connected**
- **Perform System Turn-on (See Check List)**
- **Perform Software Start-up (See Check List)**
- **Perform System Verification (See Check List)**

System Instrumentation: Check List

- **RF Family Card/Test Fixture and DUT Interface**
- **RFIC/MMIC Test Head & Programmable DUT Controller**
- **System Receiver**
- **4 RF/Microwave Sources**
- **RF System Matrix & System Power Supply**
- **System Rack & Test Head Manipulator (Optional)**
- **System Computer**
- **System Software**
- **RIFL Interface (Plug-in card in the System Computer)**

DC, LF & Digital Control Connections



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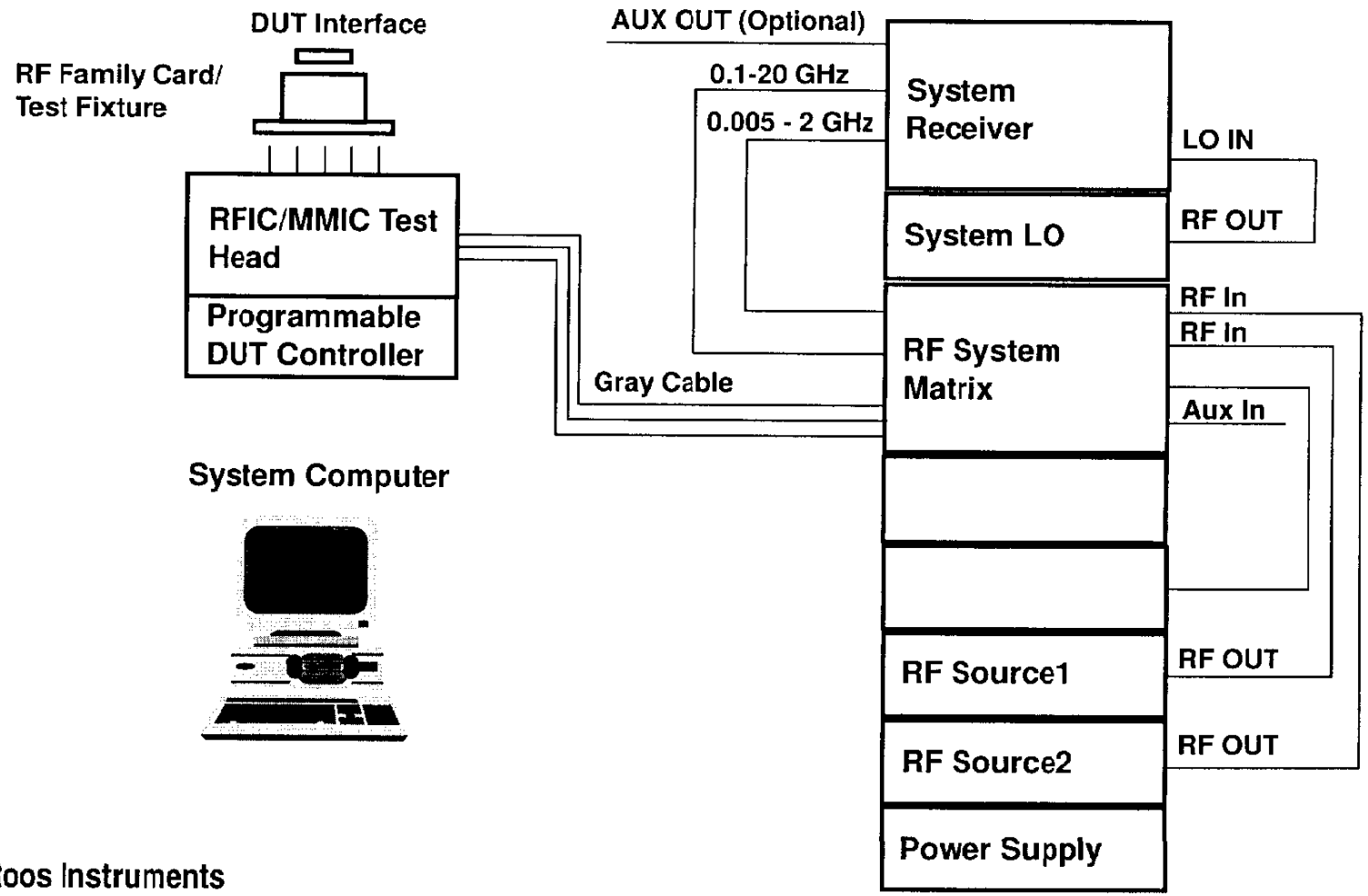
System Cable Connections: Check List

- **RF & IF**
- **DC, LF & Digital**
- **10 MHz Time Base/Frequency Reference**
- **RIFL**
- **GPIB**
- **AC and/or DC Power**

RF and IF Signal Connections



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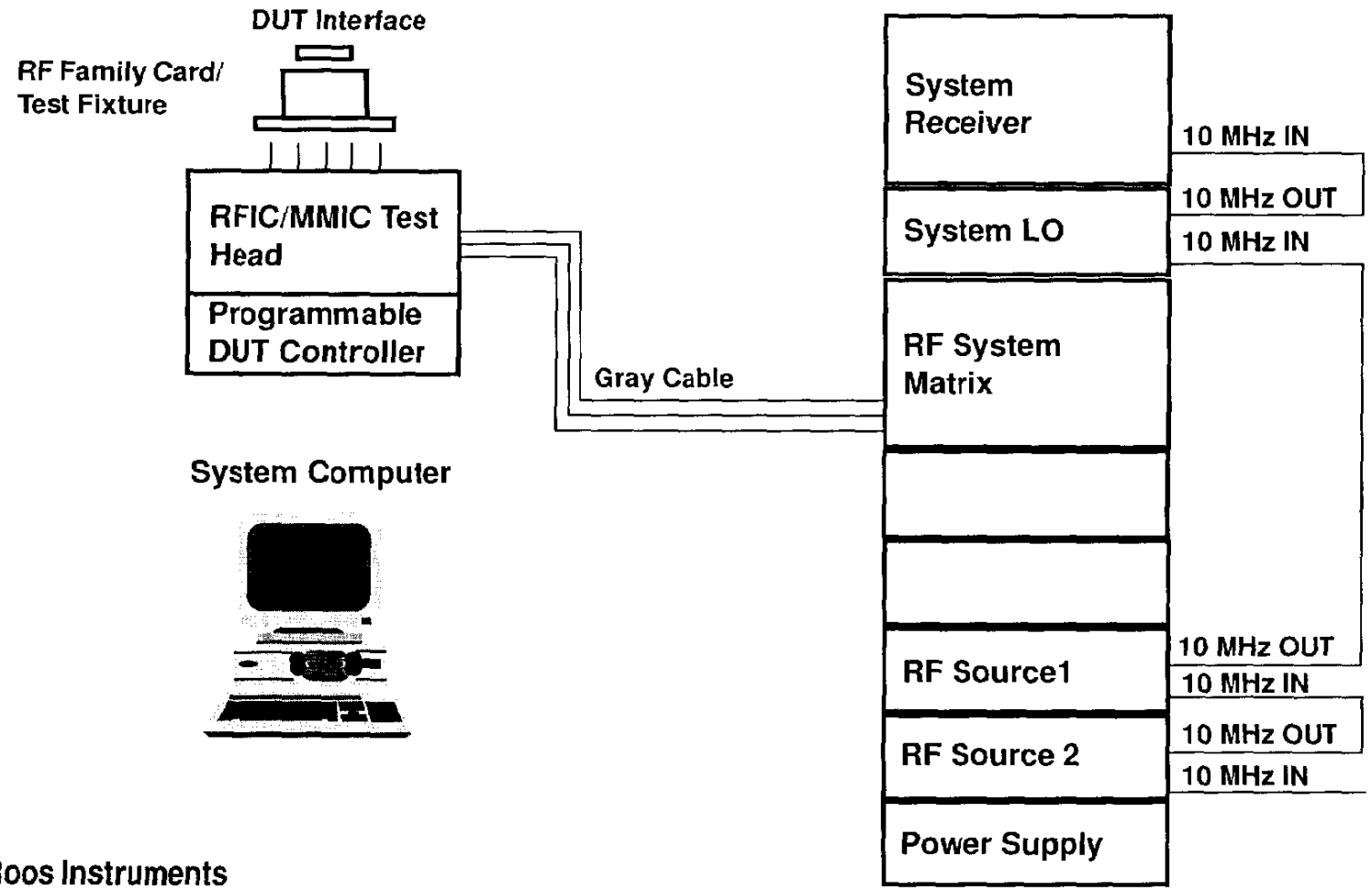
10 MHz Time Base/Frequency Reference



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RI Fiber Link (RIFL) Connections

- **Connect:**

  Blue Cable Connectors to Blue Sockets

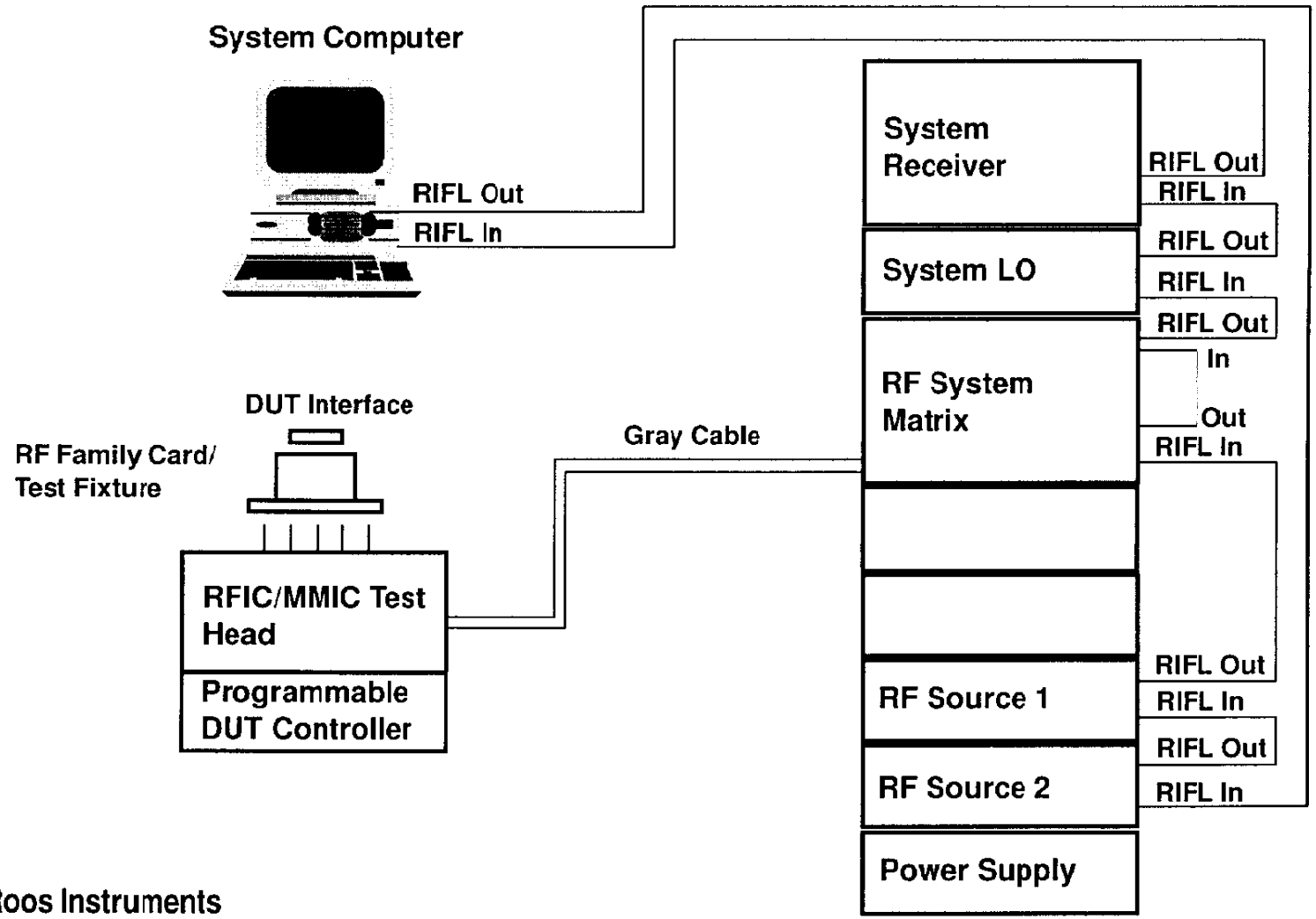
  Gray Cable Connectors to Gray Sockets

- **Comments:**

  RIFL Out: Gray Sockets

  RIFL In: Blue Sockets

RIFL Connections (Continued)



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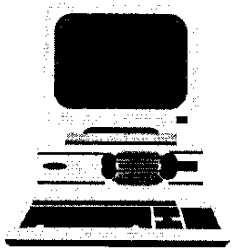
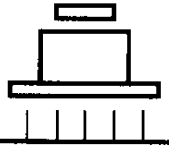
GPIB Connections

System Computer



DUT Interface

RF Family Card/
Test Fixture



RFIC/MMIC Test Head

Programmable DUT Controller

System Receiver

GPIB

to External GPIB Instruments

System LO

RF System Matrix

RF Source 1

RF Source 2

Power Supply

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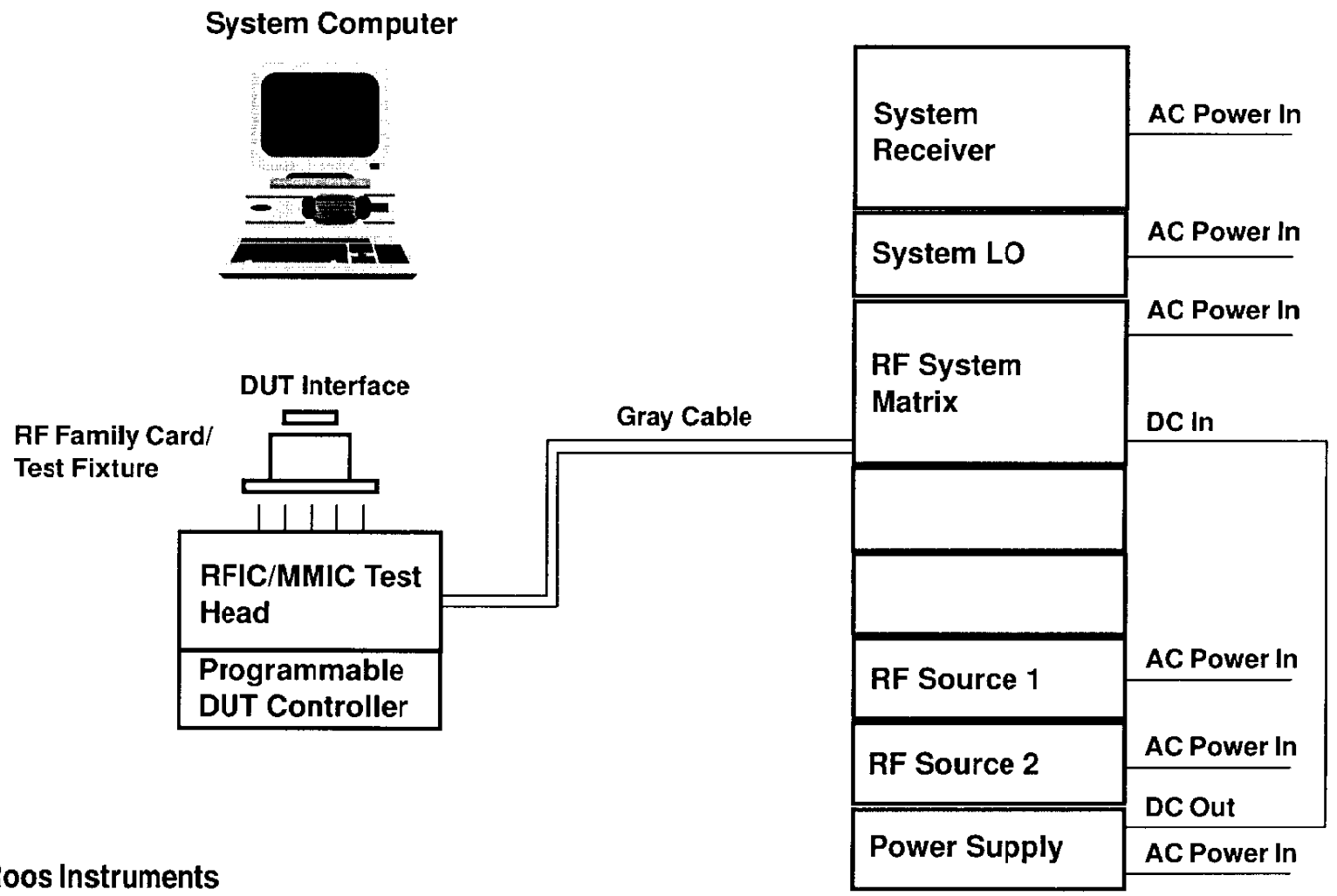
AC and DC Power Connections



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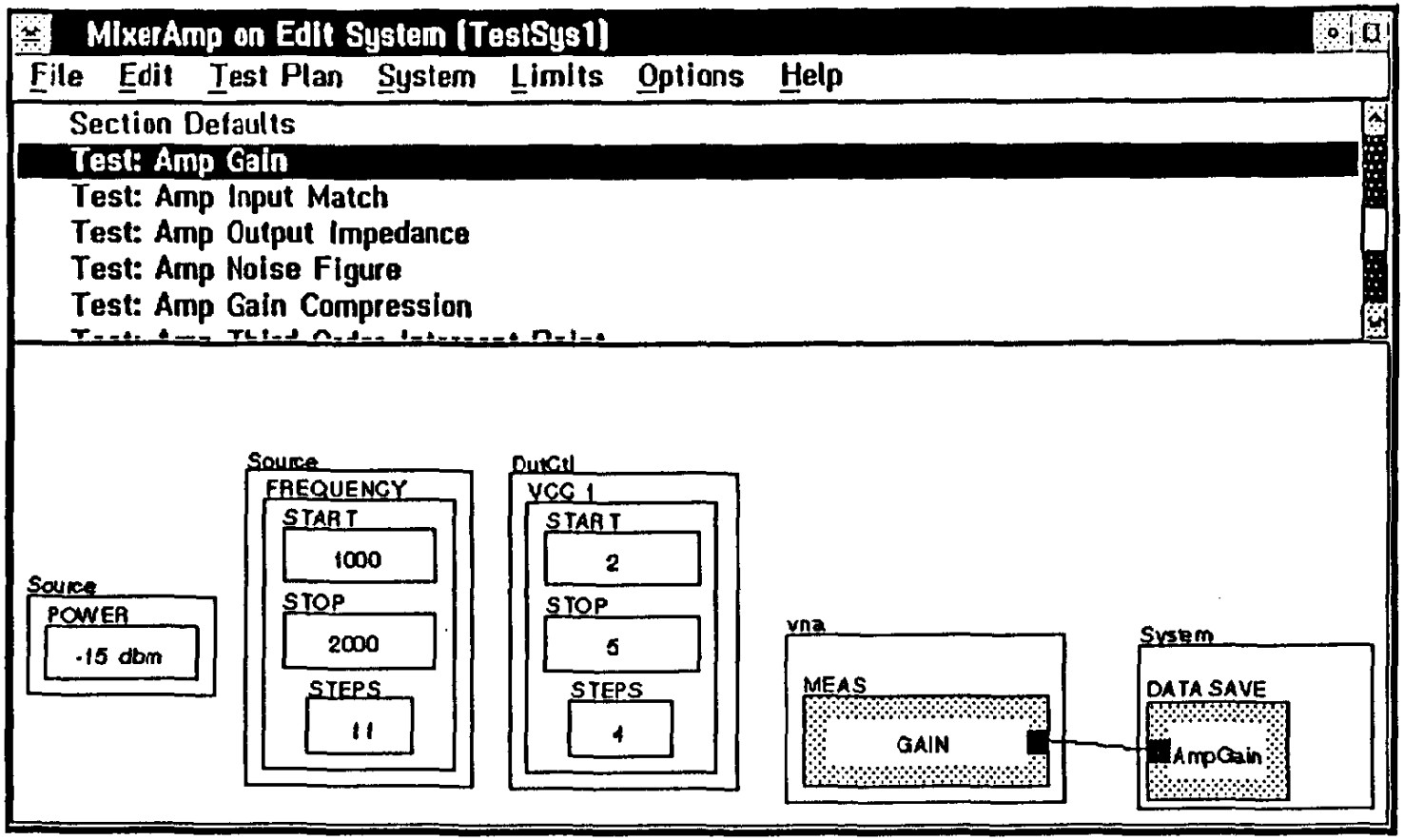
Typical Test Plan



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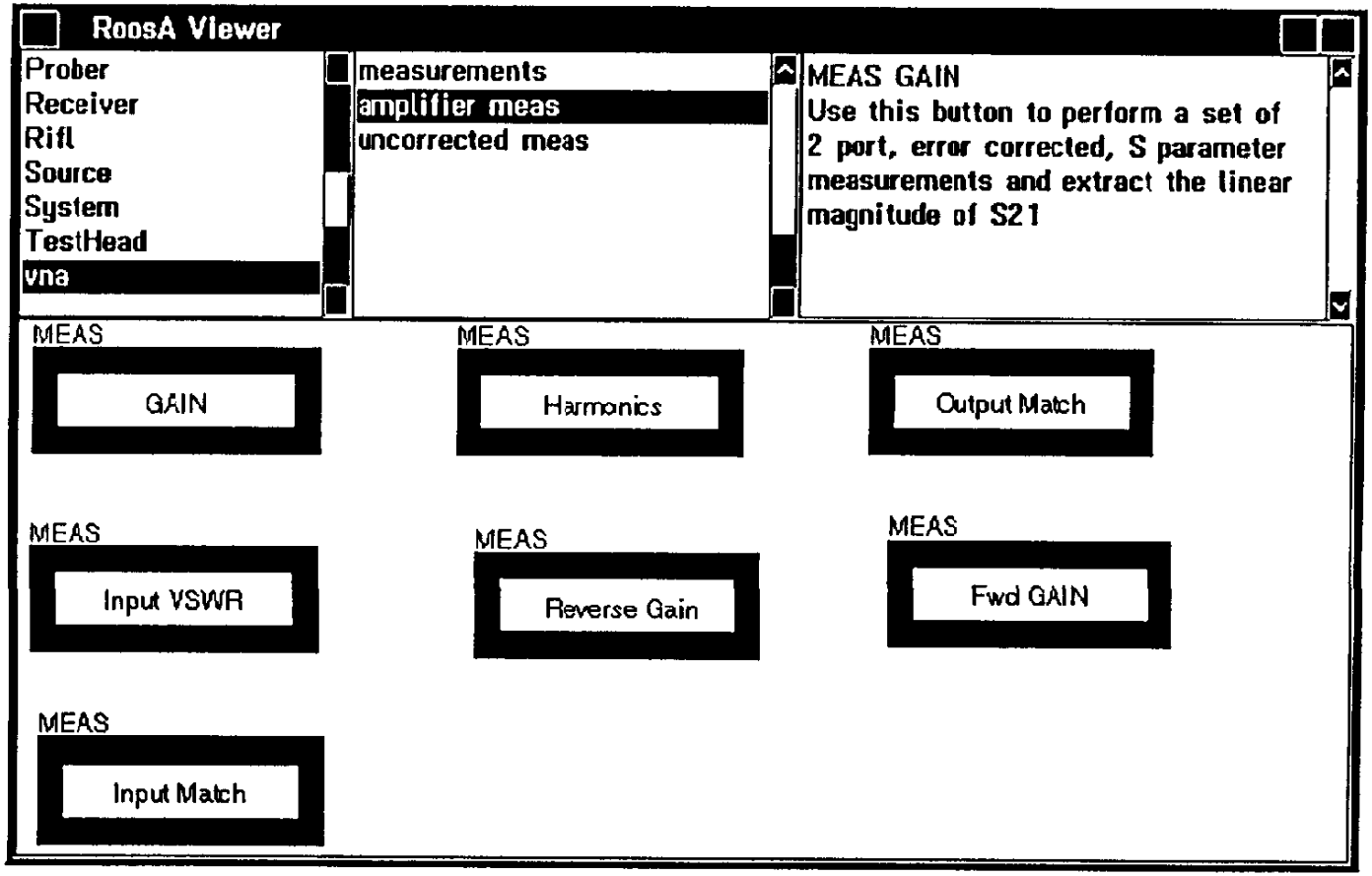
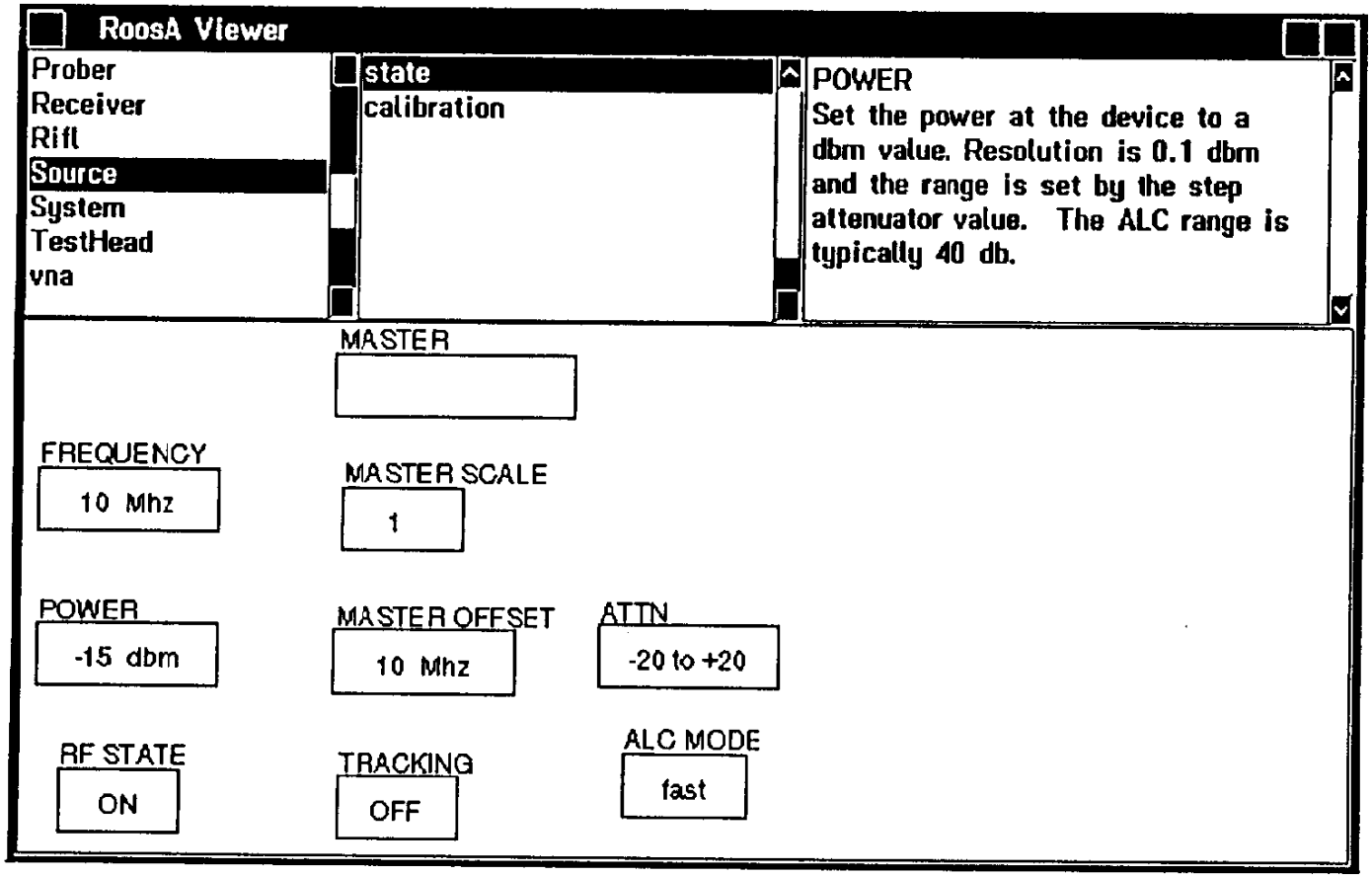
Measurement Buttons



Measurement State Buttons



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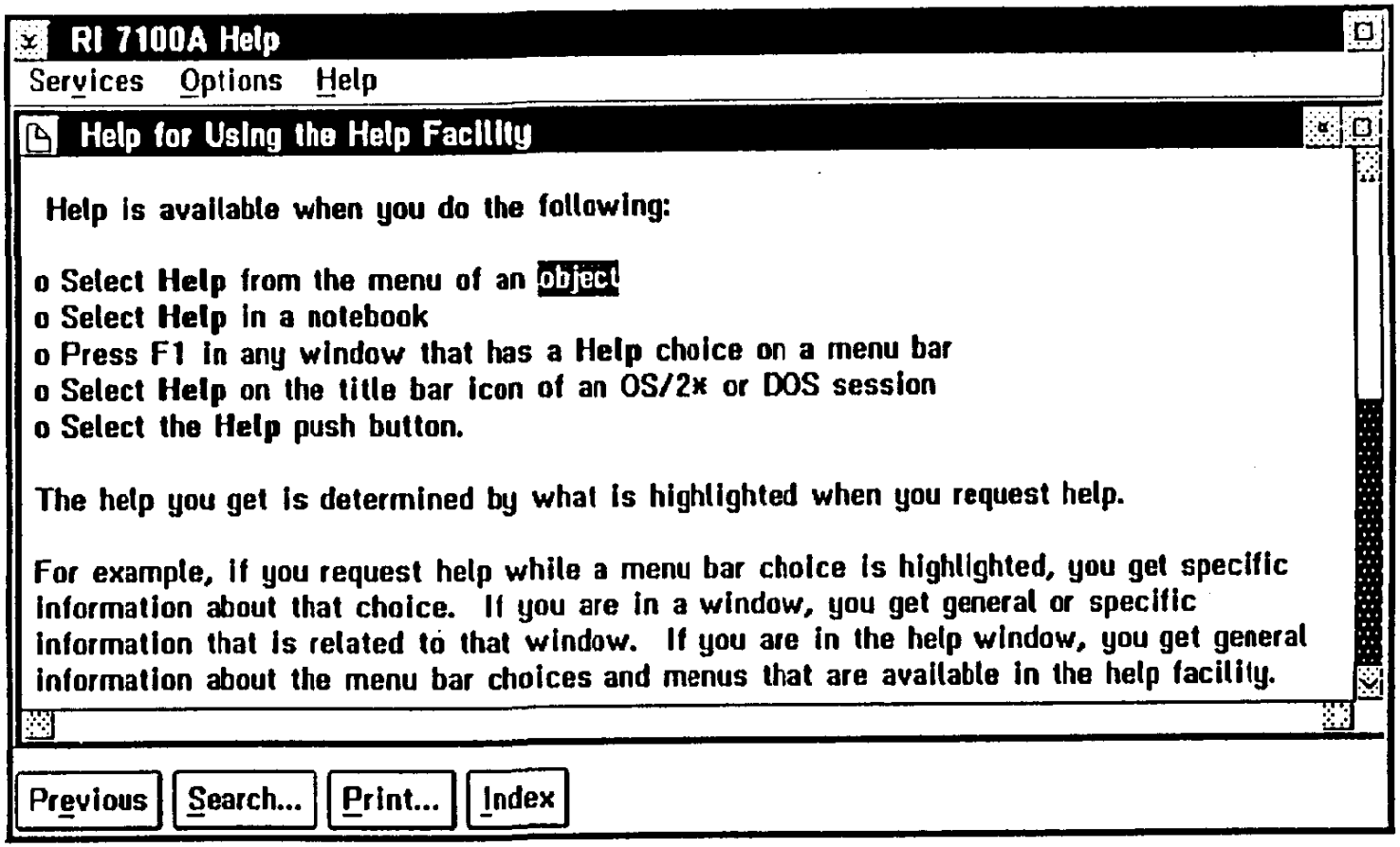
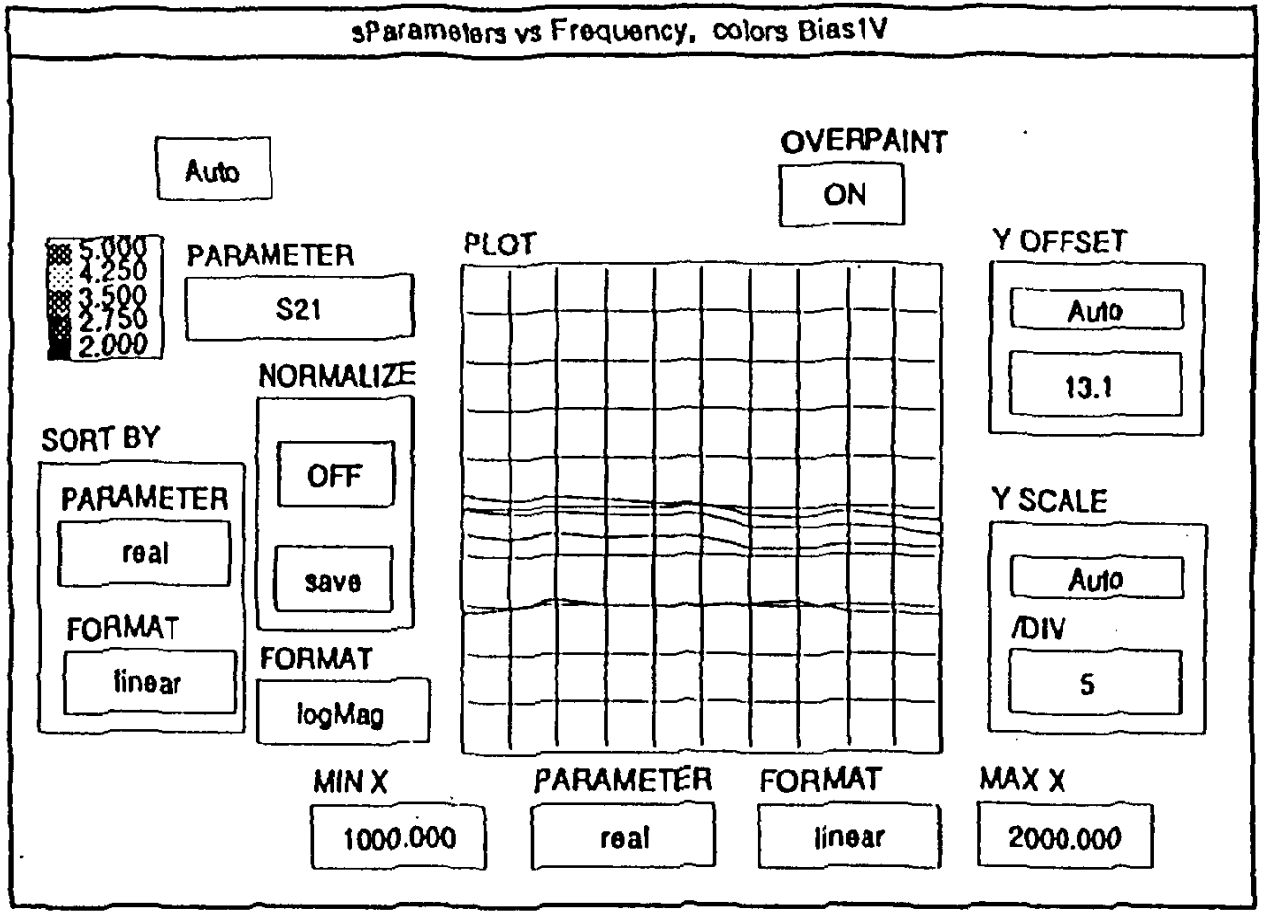
On-Screen Help



RI Data Viewer



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System Turn-on: Check List

- **Turn on the System Rack**
- **Turn on the Computer Peripherals**
- **Turn on the System Computer**

Software Start-up: Check List

- **Open the RI Application**
  - **Select Ri Apps Icon & Double-Click mouse button 1**
  - **System: Opens RI Application & Displays Msg Window**
- **Logon to the System**
  - **Select Menu Choices: System & Logon...**
  - **System Opens: Users Container Window**
  - **Select your User Name & Double-Click mouse button 1**
  - **System will turn your User Name Object *Red***

Software Start-up: Check List (Continued)

- **Start the System**

  Select the Title Bar on the RI Message Window

  System: Message Window is now the Active Window

  Select the Menu Choices: System & Start-up

  System: Presets the System Instrumentation

  System will display the Status of each Instrument and "Fiber link connected &/or Hardware Mode" if OK

Software Start-up: Check List (Continued)

- **Starting the System (Continued)**
  - **Check the Status of each instrument**
    - **All of the Instrument Displays should be on**
    - **All of the RIFL Status Indicators should be**
      - **RIFL is OK**
      - **Blinking Red Light - RIFL is Active**
      - **Red Light - RIFL is Blocked**
      - **Light Off - Instrument Off**
  - **If the System Displays an Error &/or Warning message**
    - **Correct the Problem Discovered**
    - **Select the Menu Choices: System & Start-up again**
- **System Start-up is Complete**

Automated Testing: Check List

- **Verify and/or Perform System Setup & Start-up**
- **Configure DUT Interface & Test Fixture for DUT**
- **Open: Handler Container Window & Select Handler**
- **Open: Test Exec Container Window**
- **Open: DUT's Package Test Exec**
- **Enter 1st Part's: Lot, Sublot and Part #**
- **Select Green Button, Automated Testing will Begin**
- **Halt Testing: Select Red Stop or Pause Button**
- **Resume Testing: Select Green or Button**

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System Software Recovery

- **First Choice:**

  Press & Hold the Ctrl Key and Press the Break Key

  Halts RI Apps Program & Displays Error Dialog Box

  Select Ok to close the Error Dialog Box

  Select the RI Message Window

  Select Menu Choices: System & Quit...

  Select Yes to close RI Apps

  Perform System Software Start-up

  Perform Automated Testing Procedure

  Repeat the Testing of the Last Part

Recommended Responses (Continued)

- **Second Choice:**
  - **Press & Hold the Ctrl Key and Press the Esc Key**
  - **System displays Error Dialog Box after many seconds**
  - **Select OK to Close the Ri Apps Program**
  - **Perform System Software Start-up**
  - **Perform Automated Testing Procedure**
  - **Repeat the Testing of the Last Part**

System Software Recovery

- First Choice:

  Press & Hold the Ctrl Key and Press the Break Key

  Halts RI Apps Program & Displays Error Dialog Box

  Select Ok to close the Error Dialog Box

  Select the RI Message Window

  Select Menu Choices: System & Quit...

  Select Yes to close RI Apps

  Perform System Software Start-up

  Perform Automated Testing Procedure

  Repeat the Testing of the Last Part

Recommended Responses (Continued)

- **Second Choice:**

  Press & Hold the Ctrl Key and Press the Esc Key

  System displays Error Dialog Box after many seconds

  Select OK to Close the Ri Apps Program

  Perform System Software Start-up

  Perform Automated Testing Procedure

  Repeat the Testing of the Last Part

Recommended Responses (Continued)

- **Last Choice:**

  Press and Hold Ctrl & Alt and Press the Delete Key

  This Reboots the Computer

  Perform System Software Start-up

  Perform Automated Testing Procedure

  Repeat the Testing of the Last Part

- **Note: The System saves each part's test data after all of the tests have been performed**

Documenting Software Errors

- **If you find a Software Bug, Please help us by Faxing the following information about the bug to Roos Instruments:**
  - **Description of the Bug Found**
  - **Procedure to Duplicate the Bug**
- **An Error Log Fax Sheet is Provided in Your Notebook**

Re-Booting the Entire System Software

- **Insert the Emergency Boot Disk 1 into Floppy Drive A**
- **Turn On the System Computer or press the Reset switch**
- **Insert the Emergency Boot Disk 2 into Floppy Drive A when Prompted**
- **Insert the Emergency Boot Disk 3 when [A:\] is displayed**
- **Insert the Back-up Tape with the Last System Back-up**
- **Enter the command SR & press the Enter key**
- **Follow the instructions provided by the system**

Re-Booting the System Software (Continued)

- **The System will begin restoring the System Software and Data Base Files. This process takes approximately 30 seconds/MByte**
- **Remove the Tape and Disk when finished**
- **Press and Hold Ctrl & Alt and Press the Delete Key to restart the System**

Suggested Preventative Maintenance Schedule

- **Daily and/or After System Start-up**
  - **Check Connections:**
    - **Part Handler/On-Wafer Prober**
    - **Test Fixture/Family Card**
    - **Test Head Connections**

Suggested Preventative Maintenance Schedule

- **6 Month Intervals**
  - **Perform DC Calibration**
  - **Perform Source Power Calibration**
  - **Perform Receive Power Calibration**
  - **Perform Test Head Calibration**
  - **Perform Noise Source Calibration**

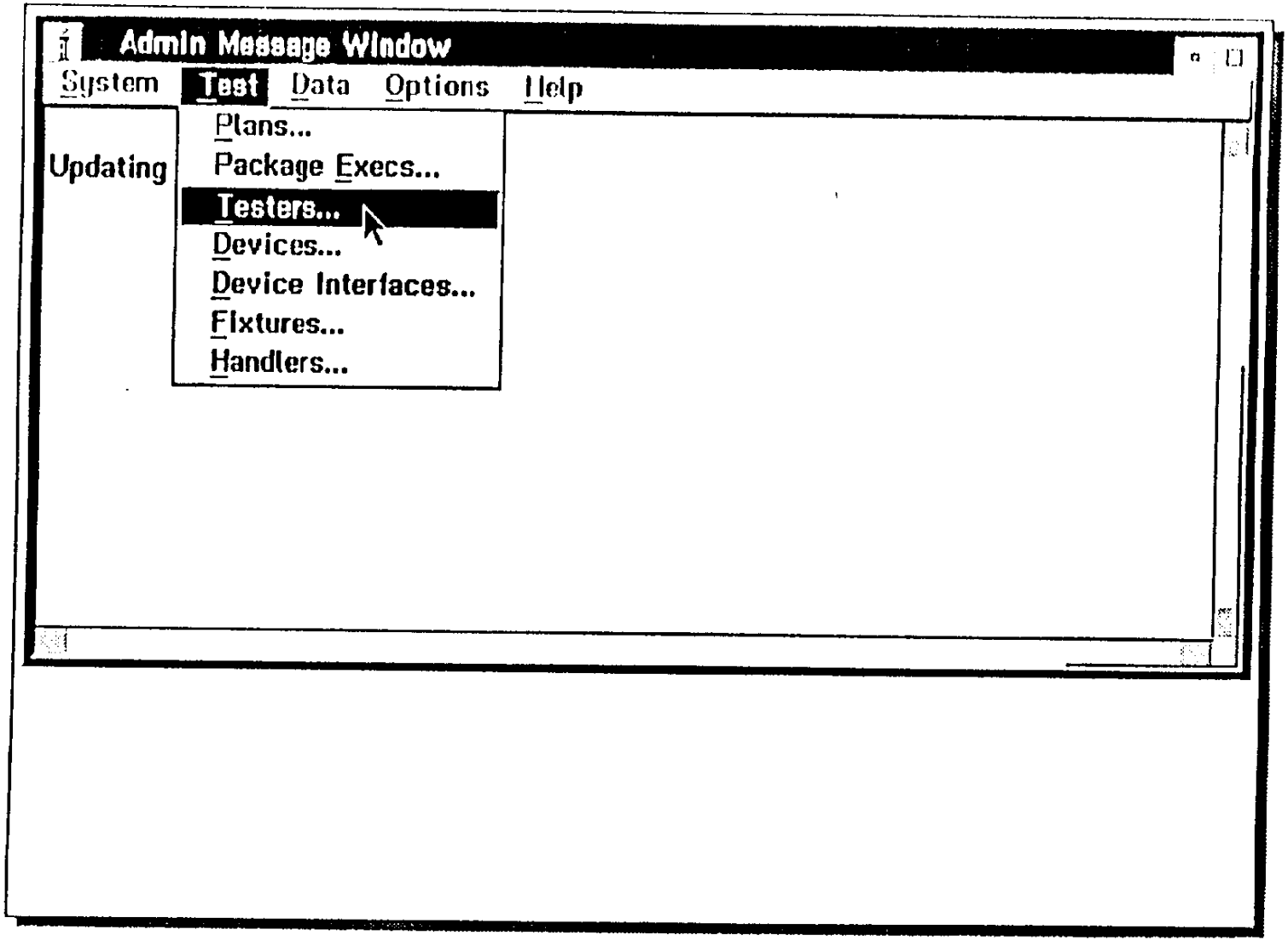
Calibration Test Plans

- **Calibration Requires Admin Privileges or Higher**
- **Each Physical Instrument has a Separate Set of Cal Tests**
- **System Calibration is required every 6 months**
- **RI will Perform the Calibrations for the First Year**
- **The Cal Test Exec leads the Operator thru the Cal Procedure**
- **Required Calibration Standards:**
  RF Power Meter, 51/2 Digits DVM & System Calibration Kit

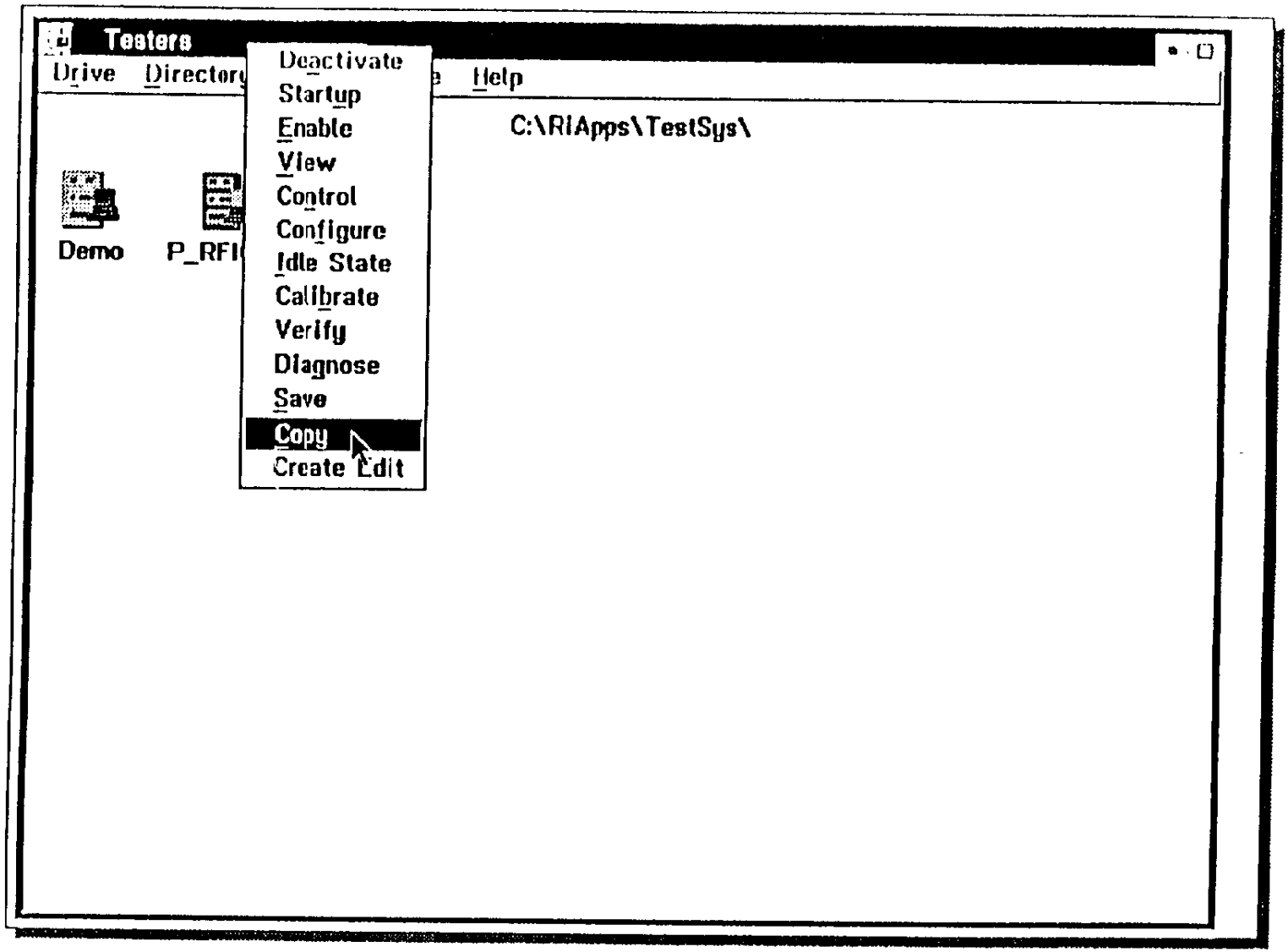
System Calibration Procedure

- **Logon to Tester with Admin or Higher Privileges**
- **Open Tester Container Window & Copy Tester**
- **Add the Power Meter to the Test System Configuration**
- **Activate the Calibration Fixture**
- **Open the Calibration Test Executive**
- **Calibrate One Instrument or RF Test Port at a Time**
  (Select and Run Cal & Verify Test Plans in the Order Shown)
  (Carefully Follow the Operator Prompts on the Monitor)
- **The System will Automatically Save Calibration Data**

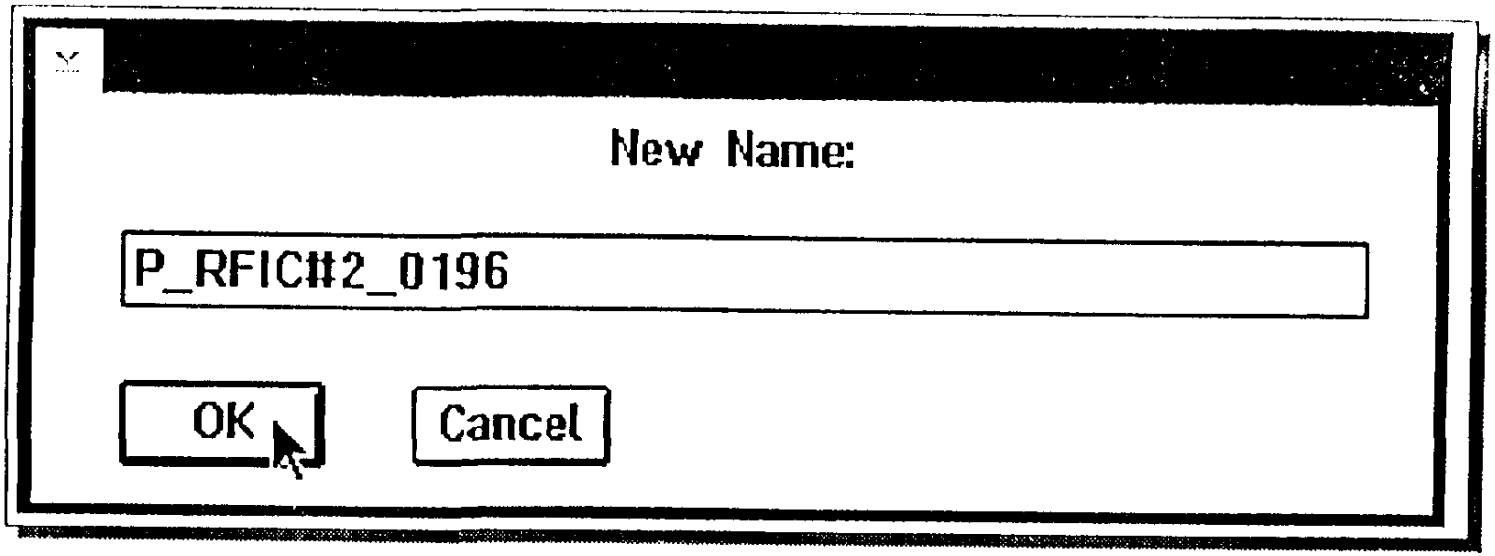
Tester Calibration Procedure - Opening the Testers Container Window



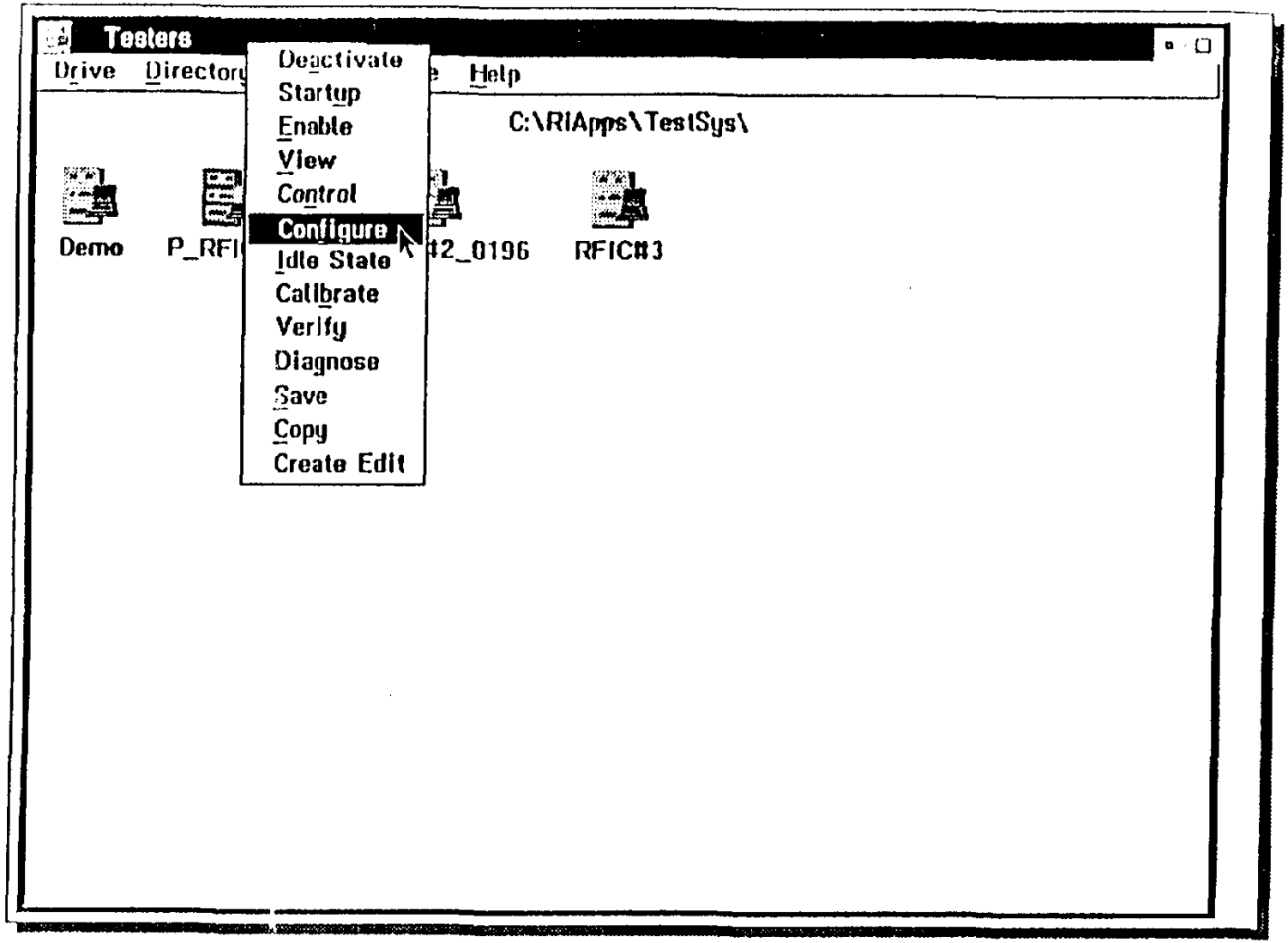
Creating a Backup Copy of the Tester



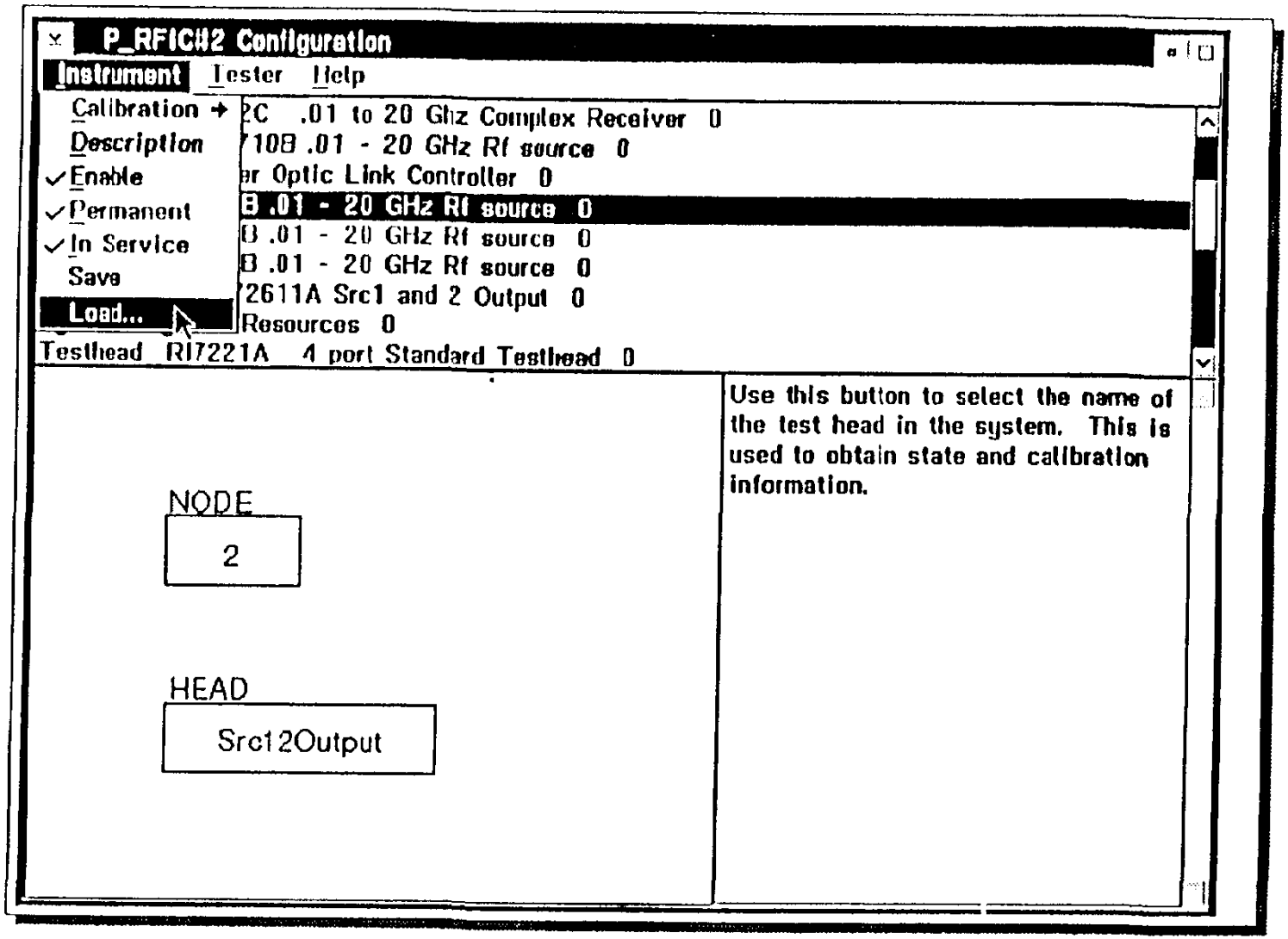
Entering the Tester Backup Copy Name



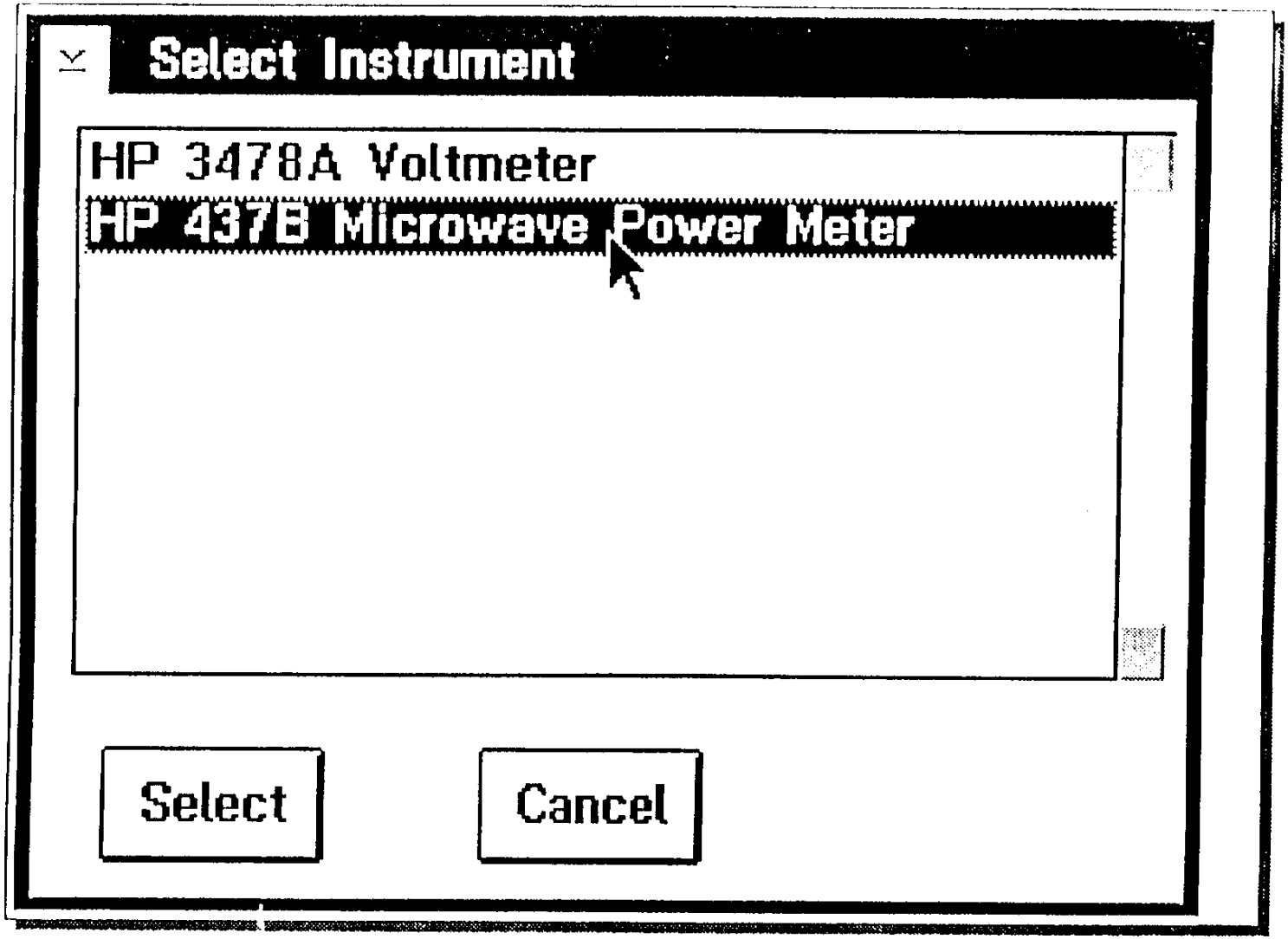
Opening the Tester Configuration Manager Window



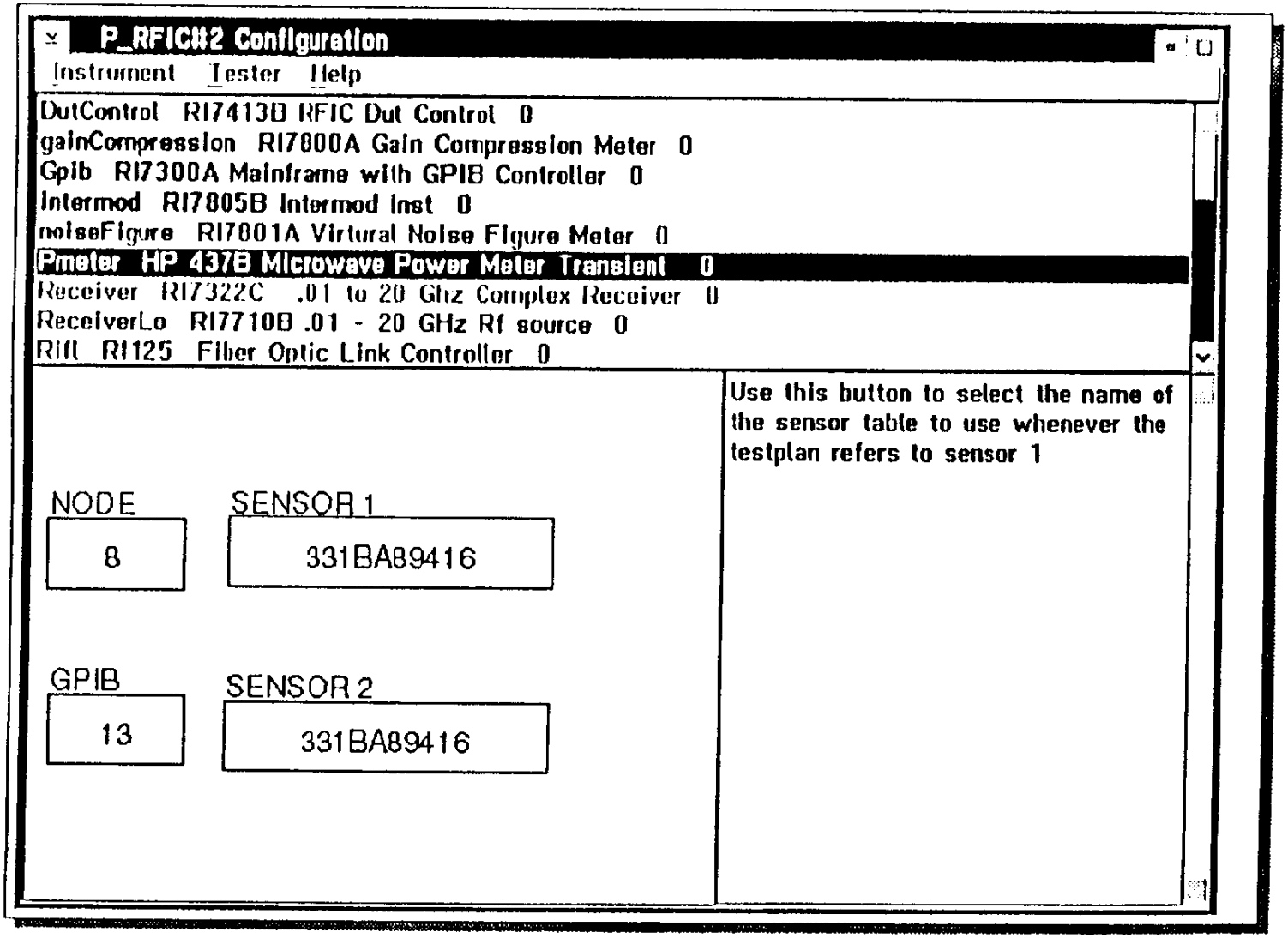
Adding a Calibration Instrument to the Tester



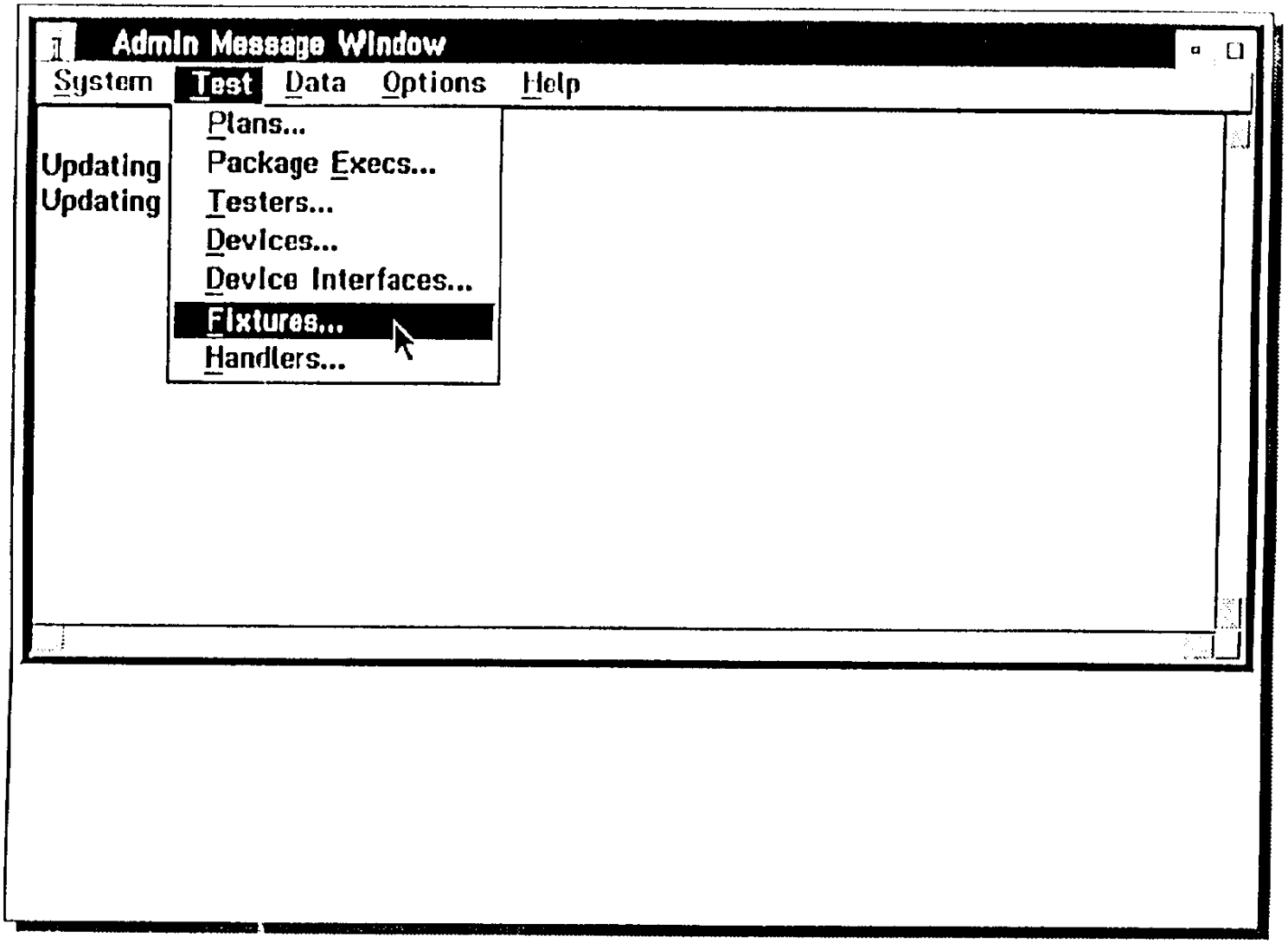
Adding a RF Power Meter to the Tester



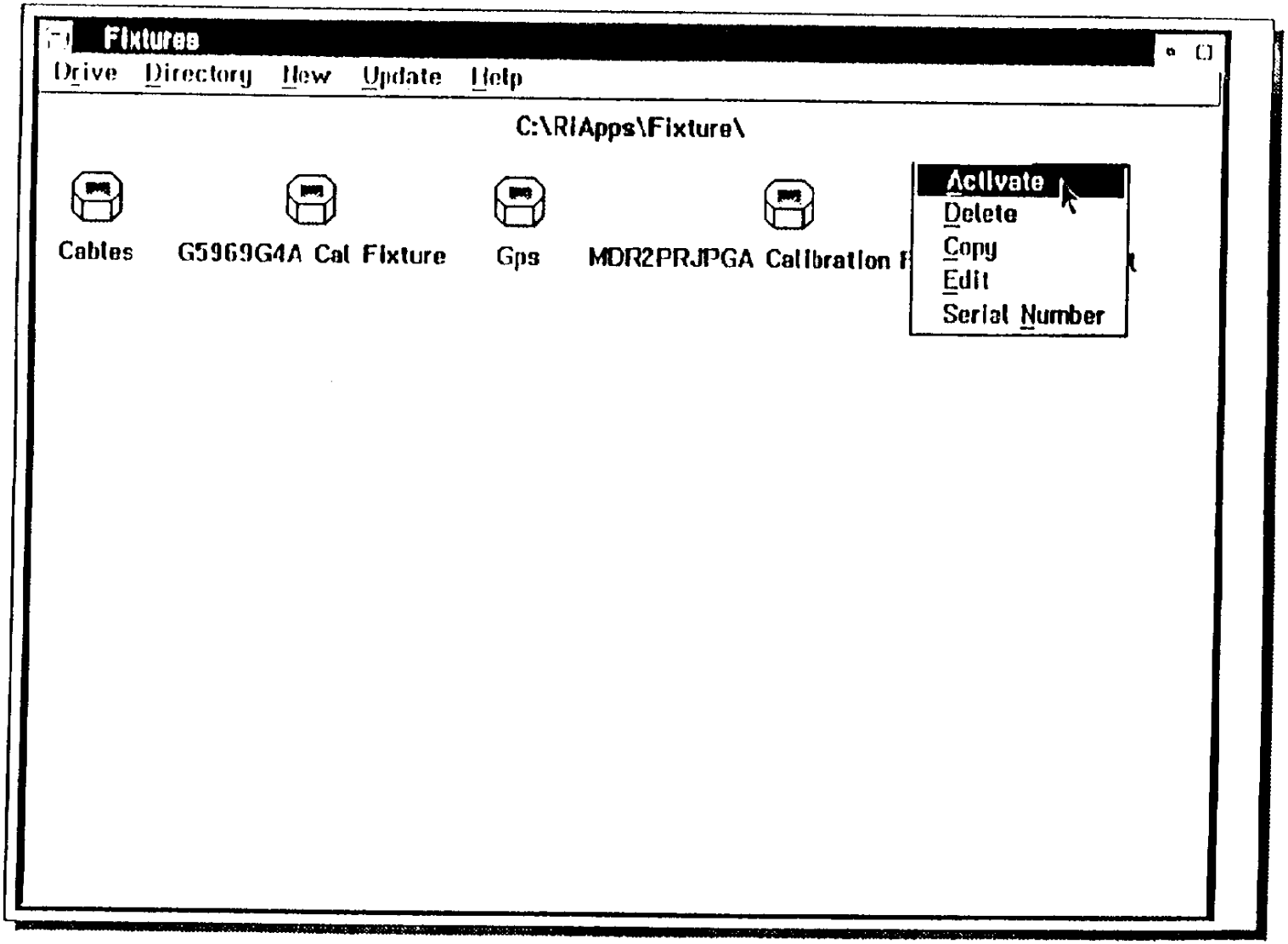
Selecting the RF Power Sensor to Use with the RF Power Meter



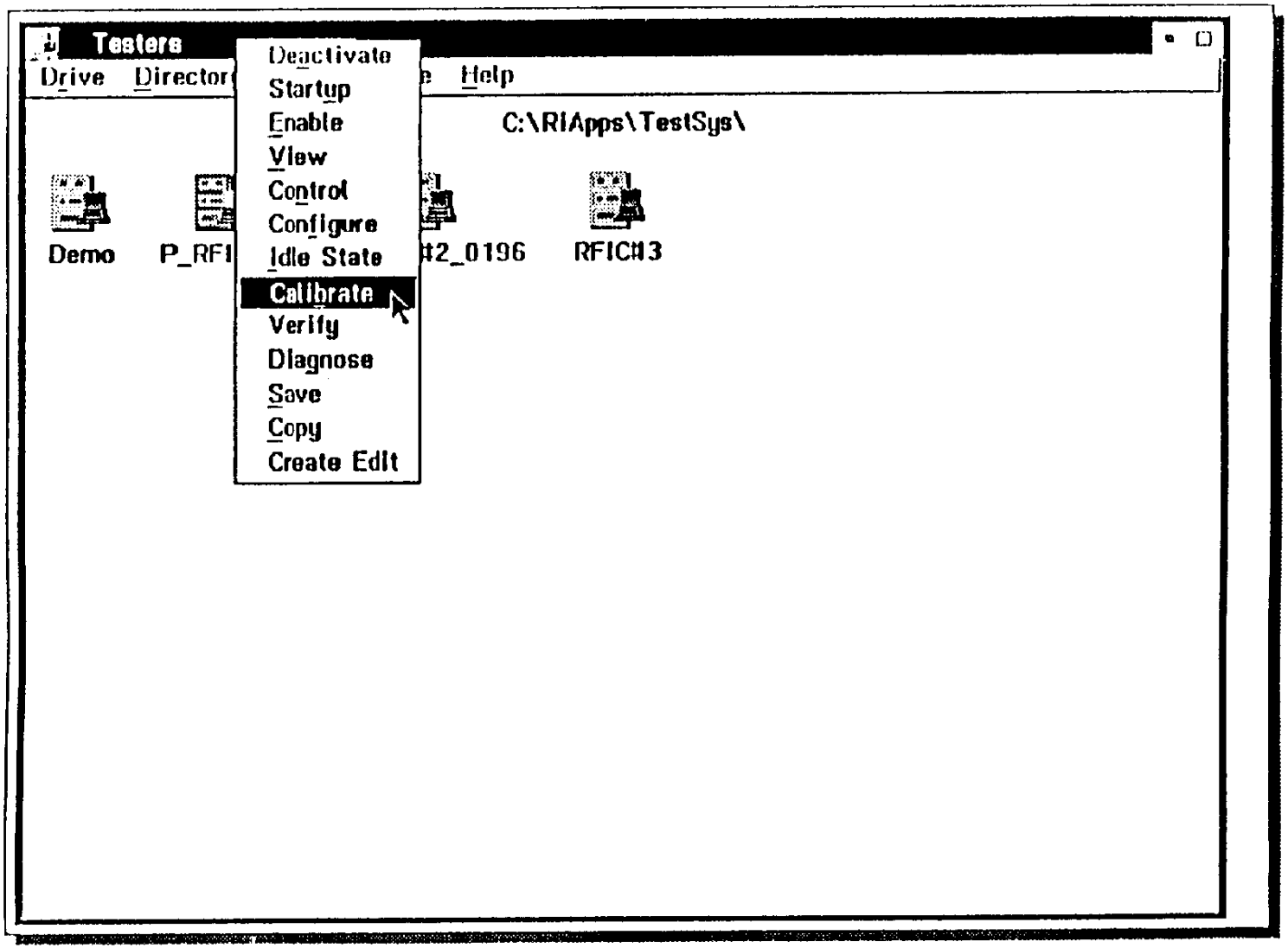
Opening the Fixture Container Window



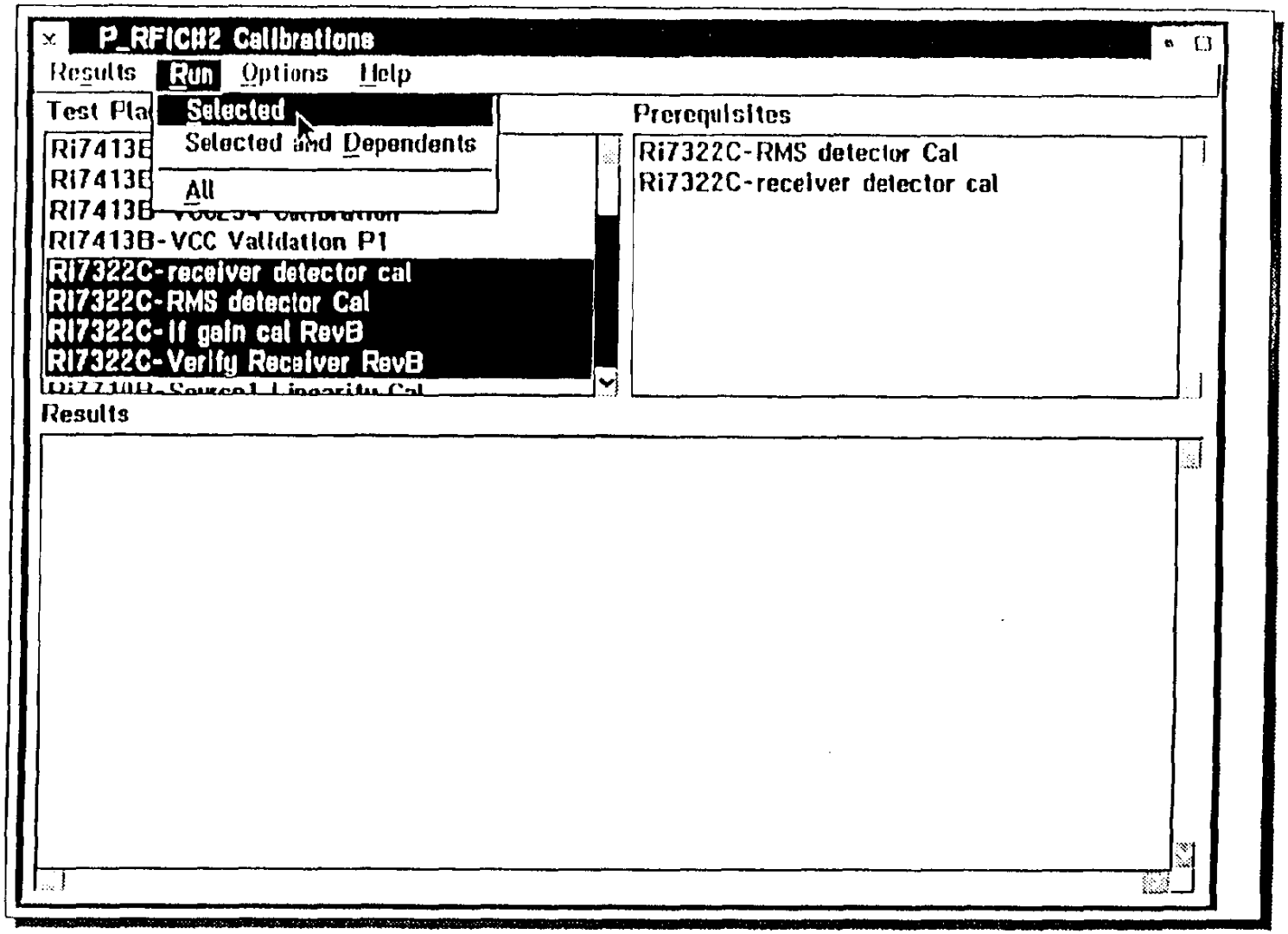
Activating the Calibration Fixture



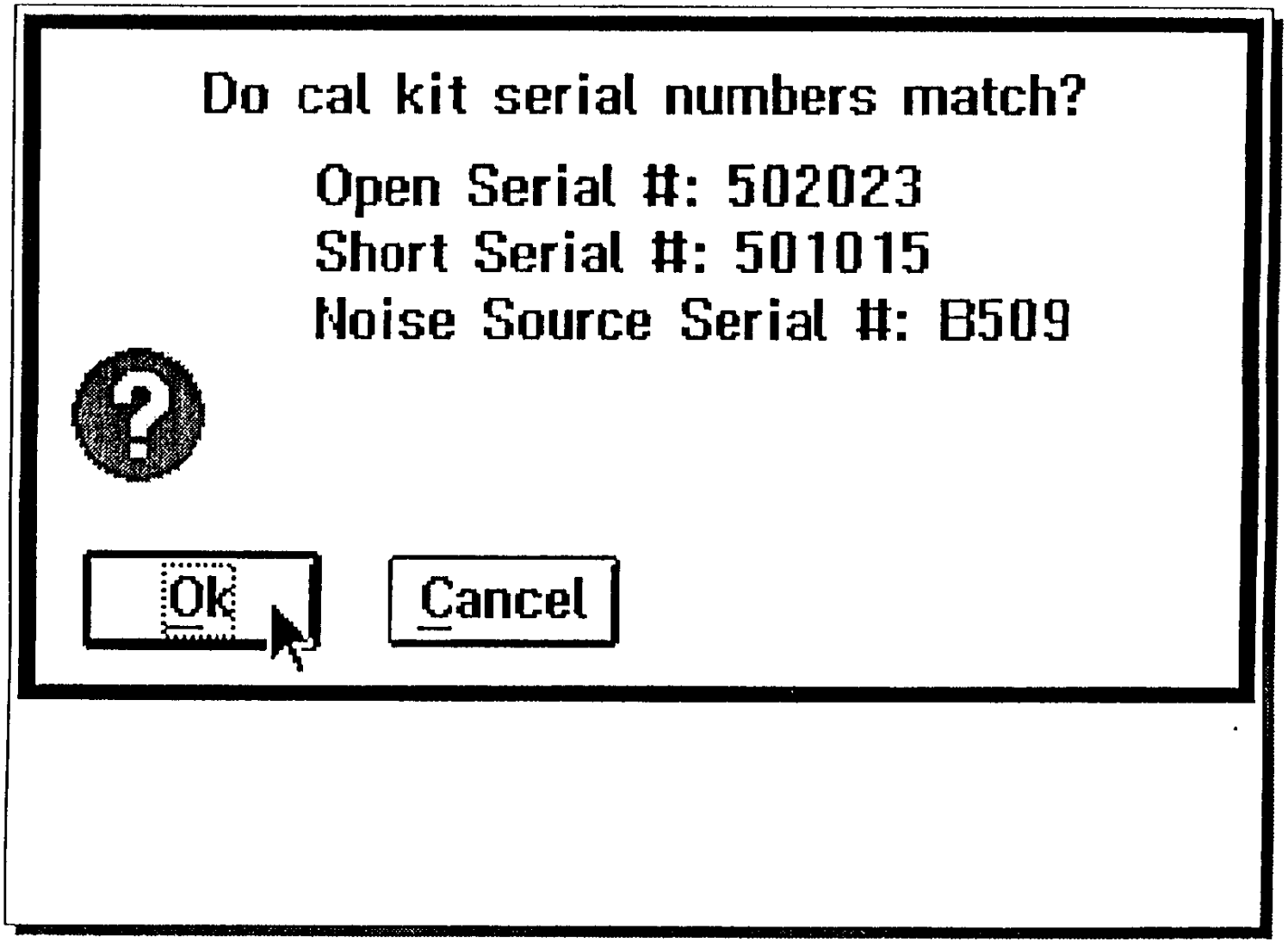
Opening the Calibration Test Exec for the Tester



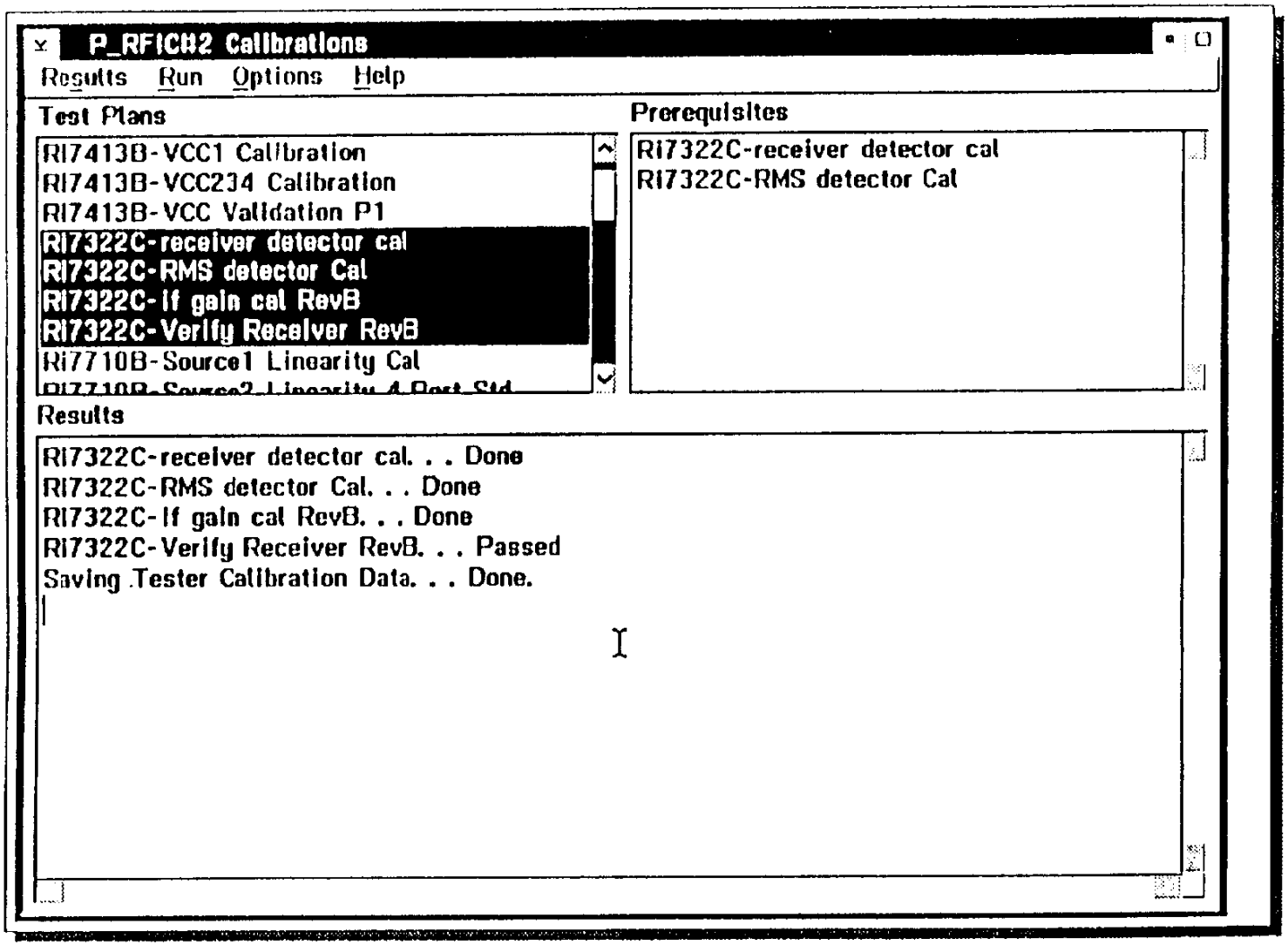
Selecting and Running the Calibration & Verification Test Plans



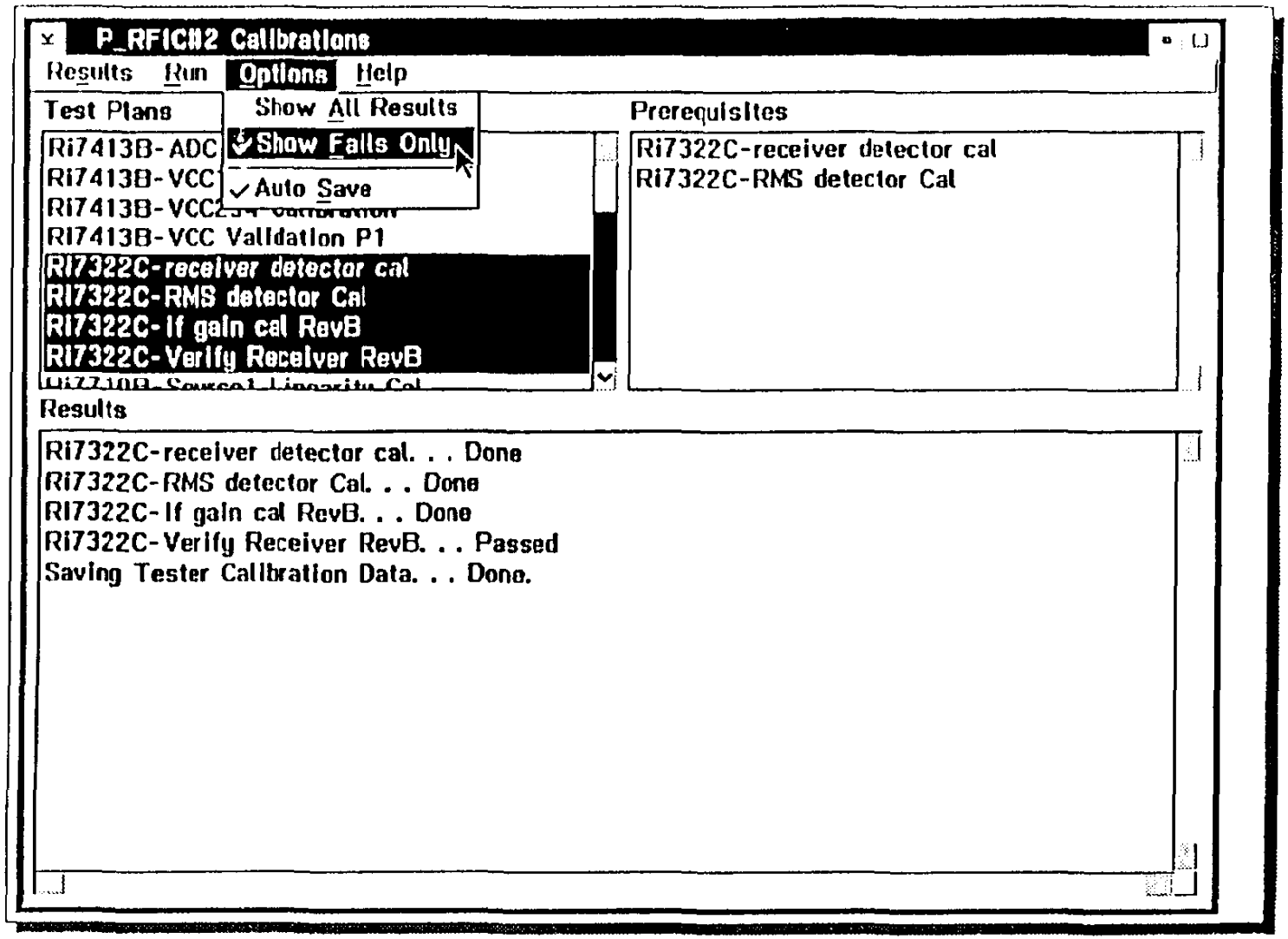
The System Checks to Make Sure that You are Using the Correct Standards



The Cal Test Exec Runs Each Test Plan Selected and Saves the Cal Data



The Test Exec Will Display all the Data or Only Failed Data



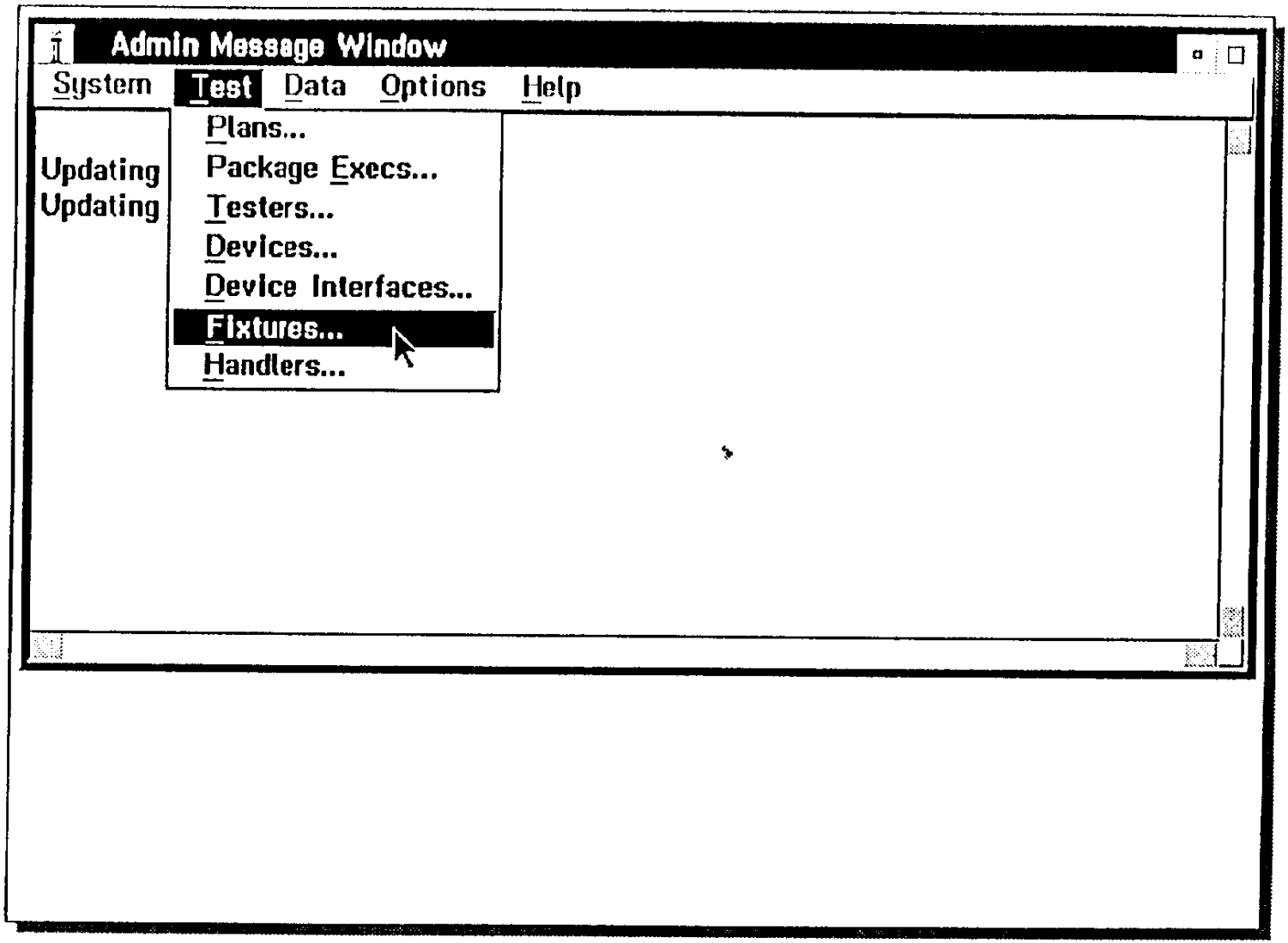
Verification Test Plans

- **Verification Testing Requires Supervisor Privileges or Higher**
- **The Verify Test Exec leads the Operator thru the Verify Process**
- **Required Verification Standards: System Calibration Kit**

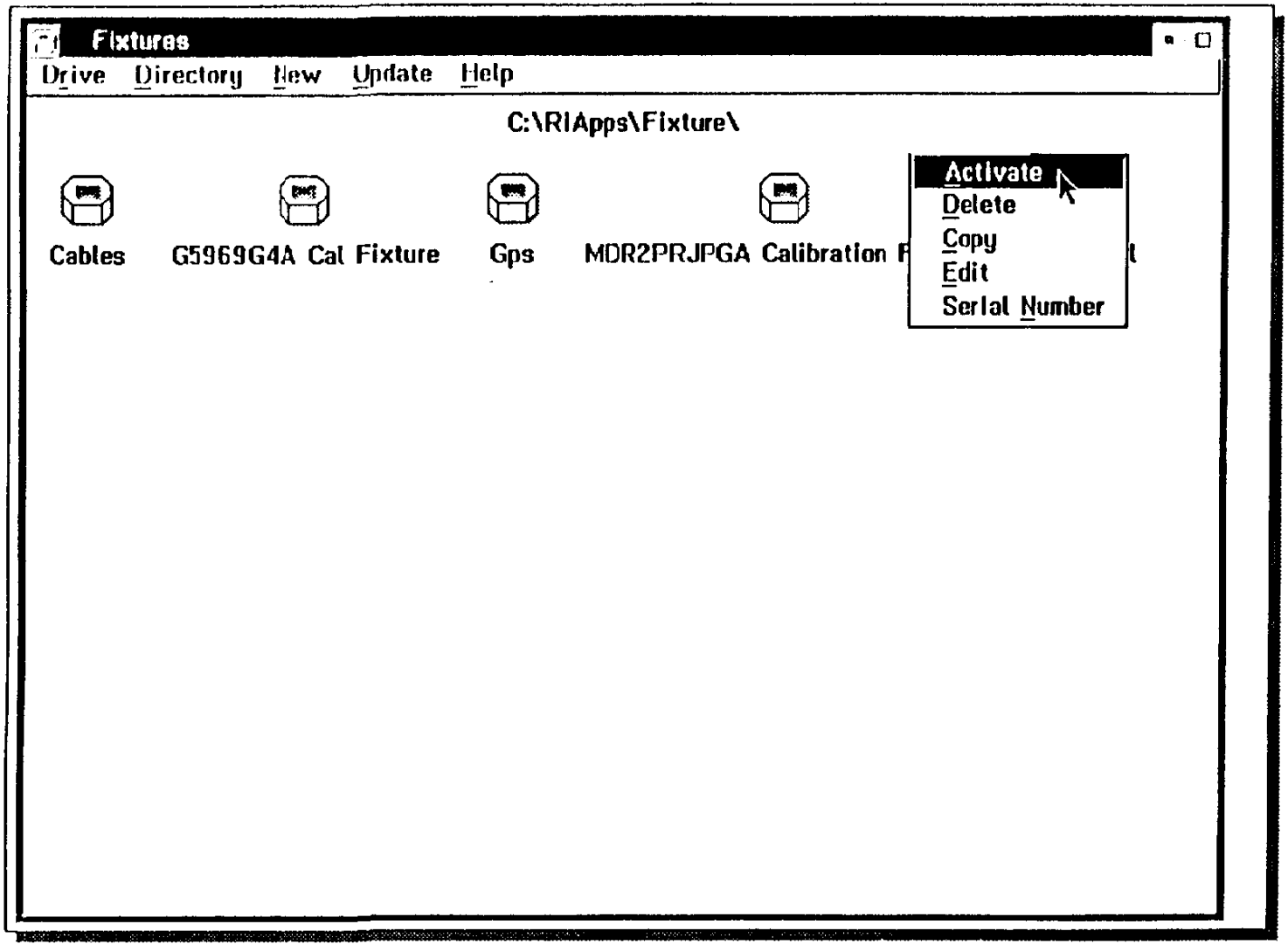
System Verification Procedure

- **Logon to Tester with Supervisor or Higher Privileges**
- **Activate the Calibration Fixture**
- **Open the Verification Test Executive**
- **Run all of the Verification Test Plans (Select: Run & All)**
- **If Tester Fails Verification, Re-Check Connections & Verification Standards and Re-run Verification Tests**
- **If Tester Fails Verification a 2nd Time, Follow Diagnostic Procedure**

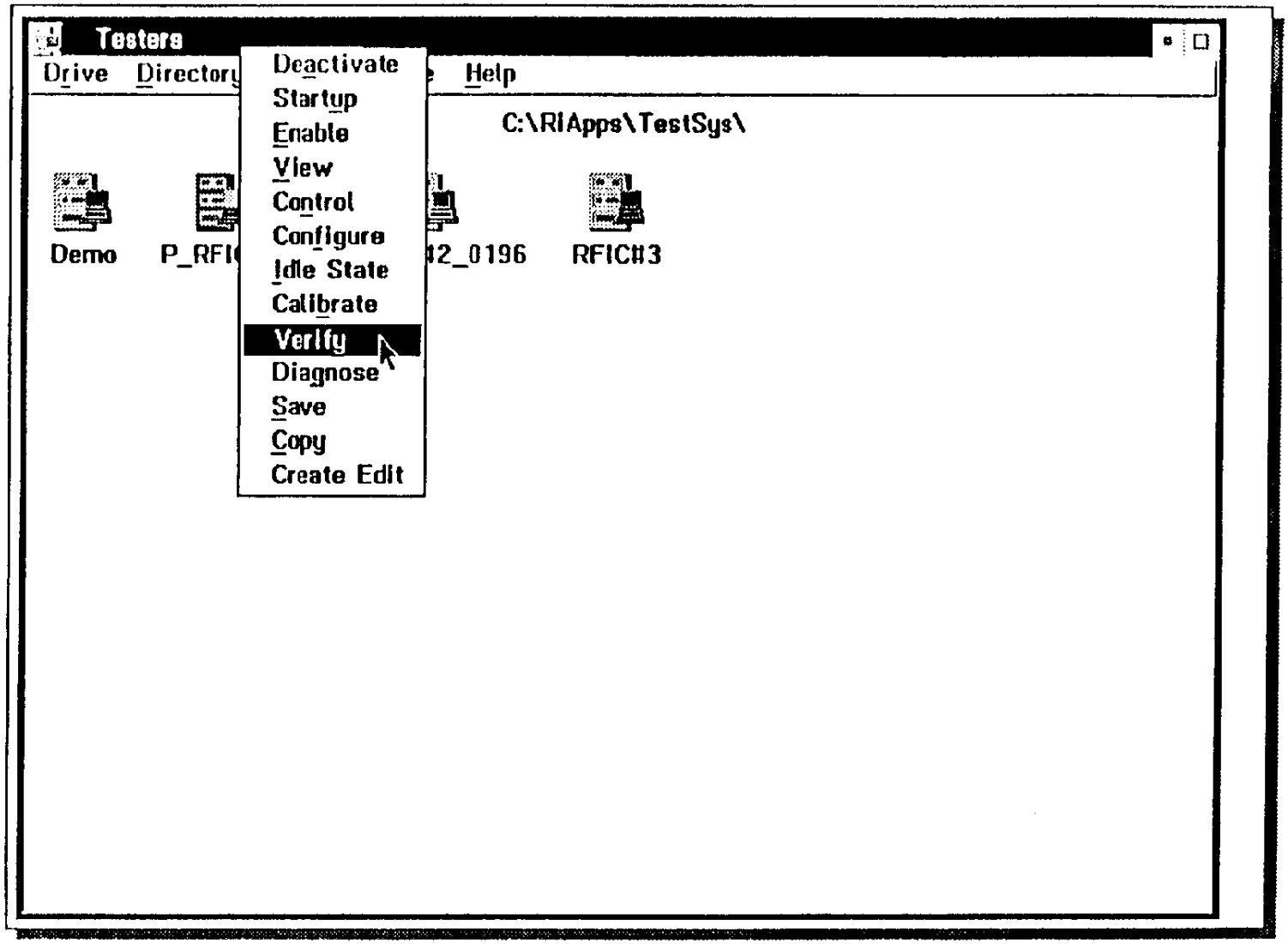
Verification Testing - Opening the Fixtures Container Window



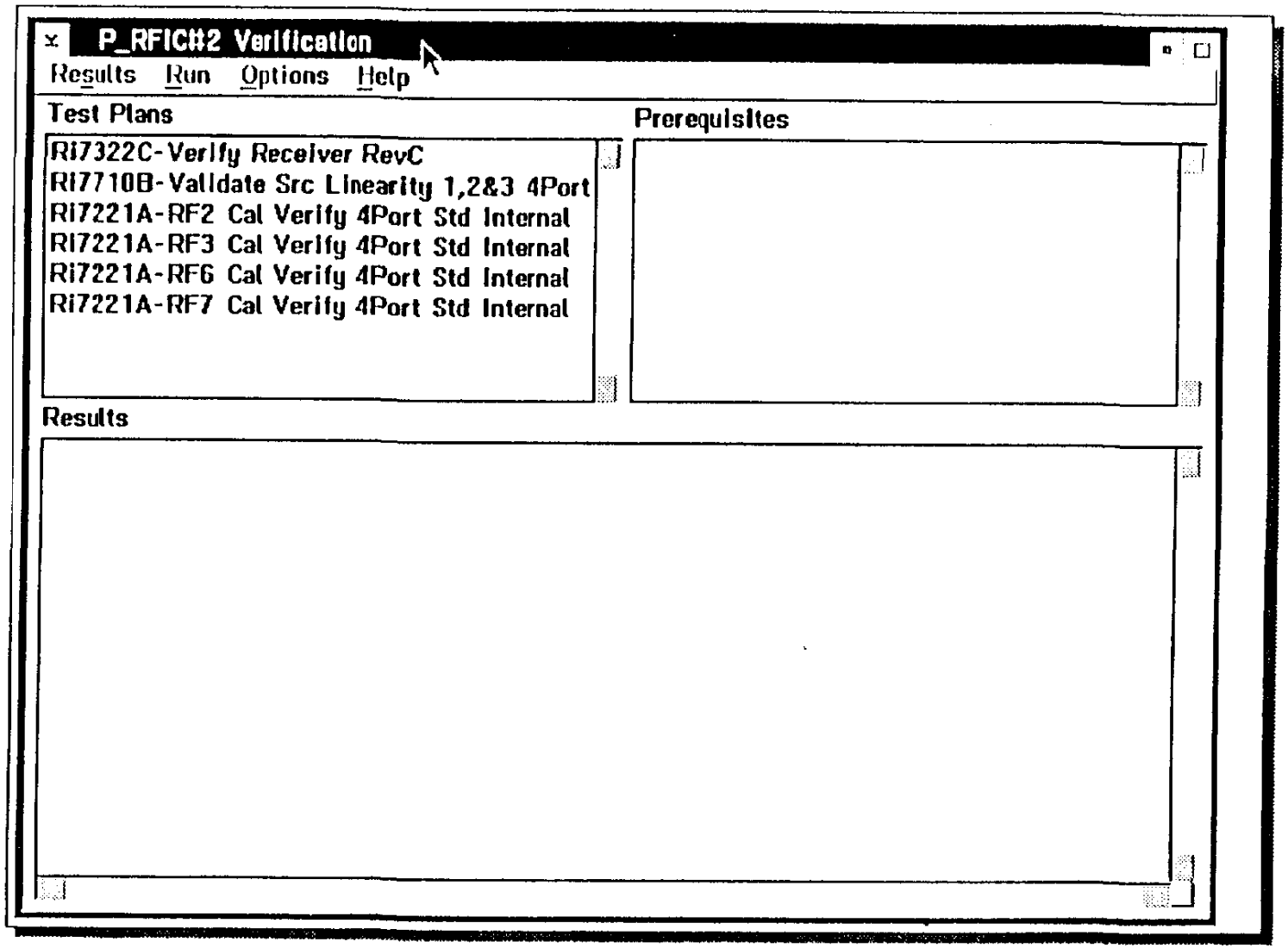
Verification Testing - Activating the Calibration Fixture



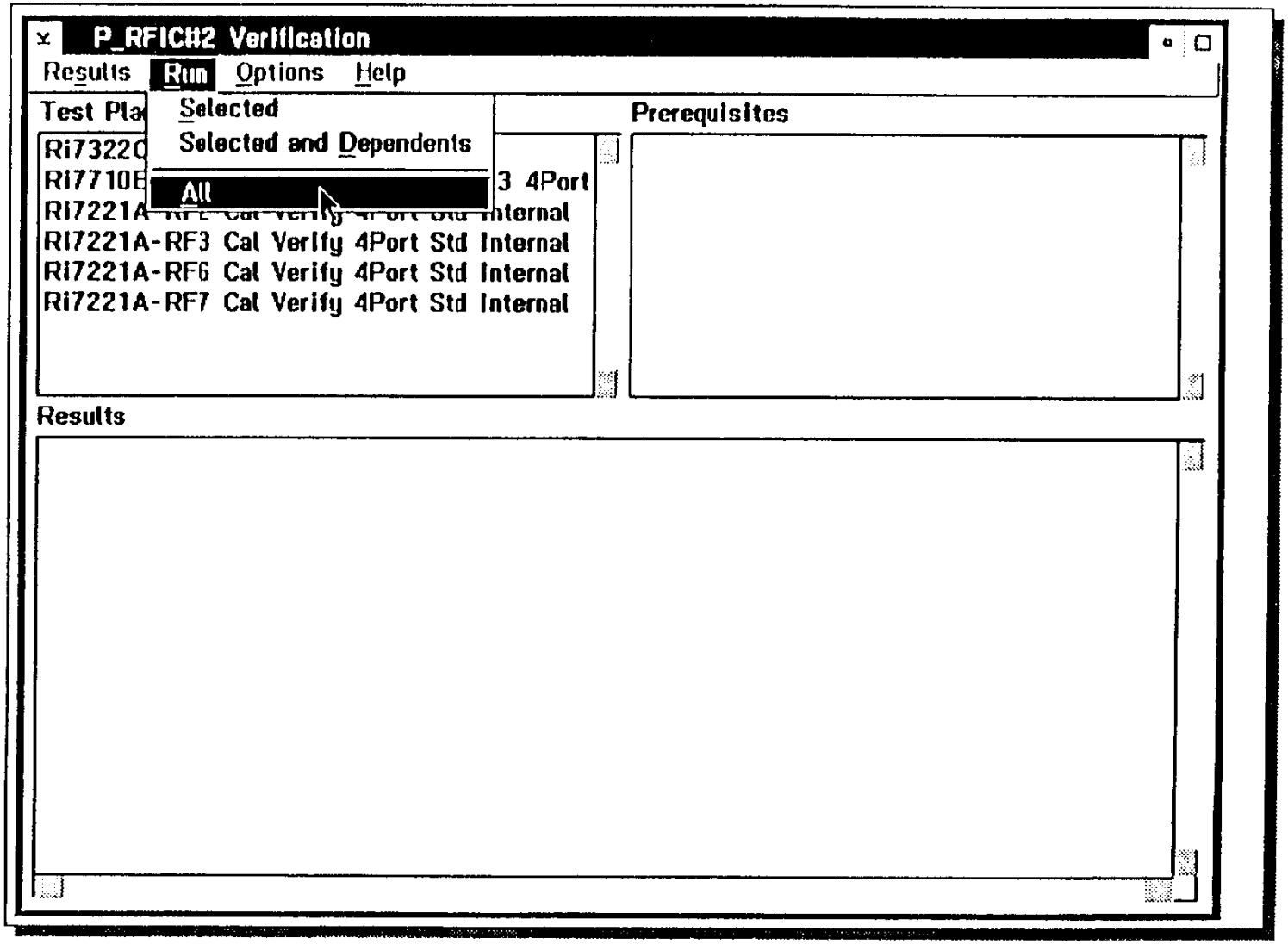
Opening the Verification Test Exec



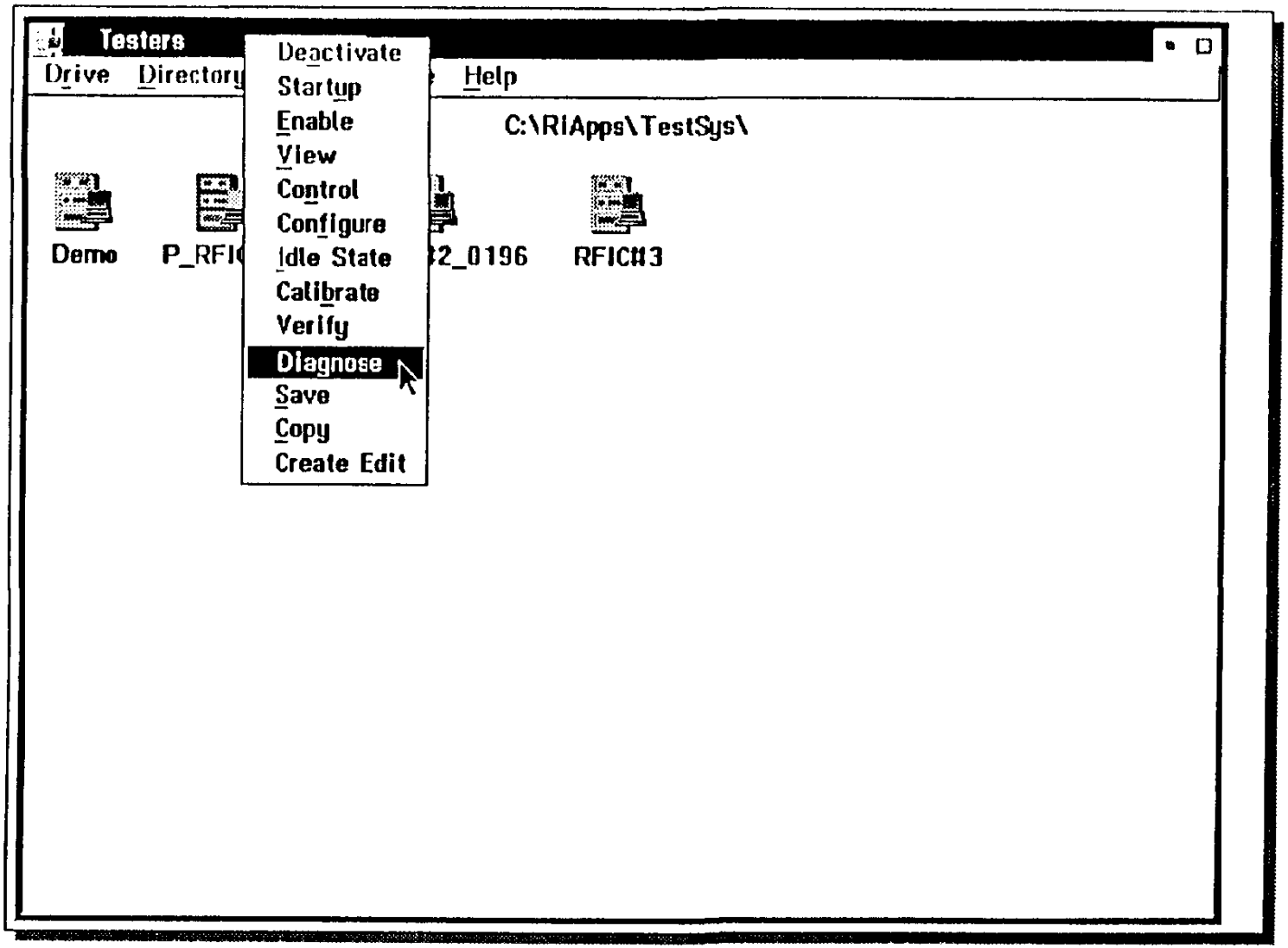
Verification Test Exec and Test Plans



Running All of the Verification Test Plans



System Diagnostic Testing - Opening the Diagnostic Test Exec



System Diagnostics - Things to Consider

- **Carefully Review the Error Messages Provided**
- **Determine if a Single Point Failed or Multiple Points Failed**
- **Look for Common Errors or Related Errors**
- **Carefully follow any Operator Prompts Provided**
- **Use the F1 Help text &/or Use the Menu Choices: File & Interpret to obtain more Information**
- **Recheck all Connections and Source Displays**

System Diagnostics (Continued)

- **Re-connect the DUT**
- **Verify that the Fixture Connections are securely fastened to the Test Head**
- **Run the Test Plan or Test Exec Again**
- **Perform the System Diagnostic Procedure**
- **Don't Hesitate to ask for our Help**

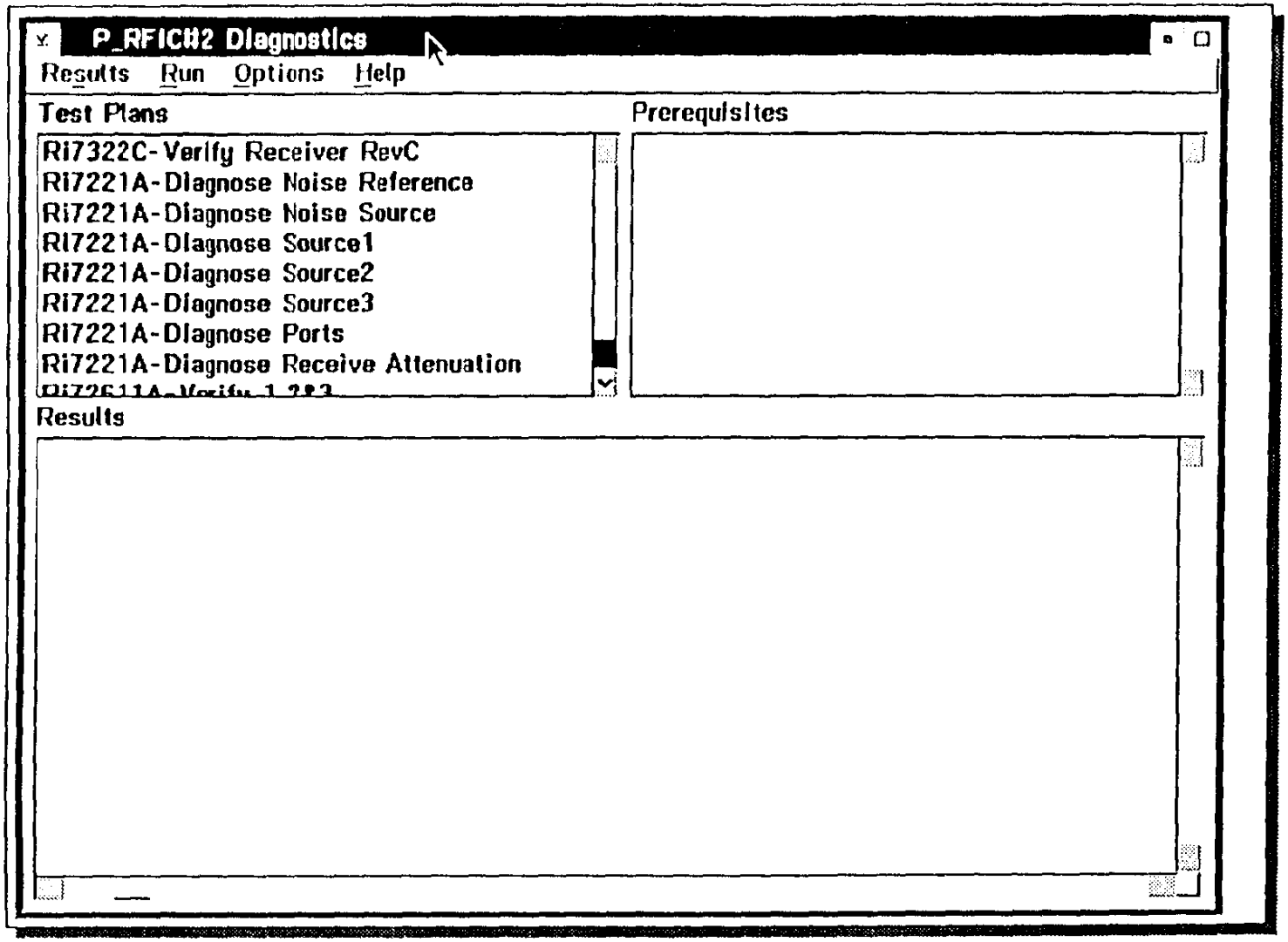
System User Diagnostics Tools

- **Menu Choice: Help or F1 - Help Windows**
- **Error Messages in the Message Window**
- **User/Operator Prompts**
- **Diagnostics Test Executive**
- **Multiple Data Viewers for Inspecting Test Results & Calibration Data**
- **Test System Manual Control Panels**
- **Error.log file**

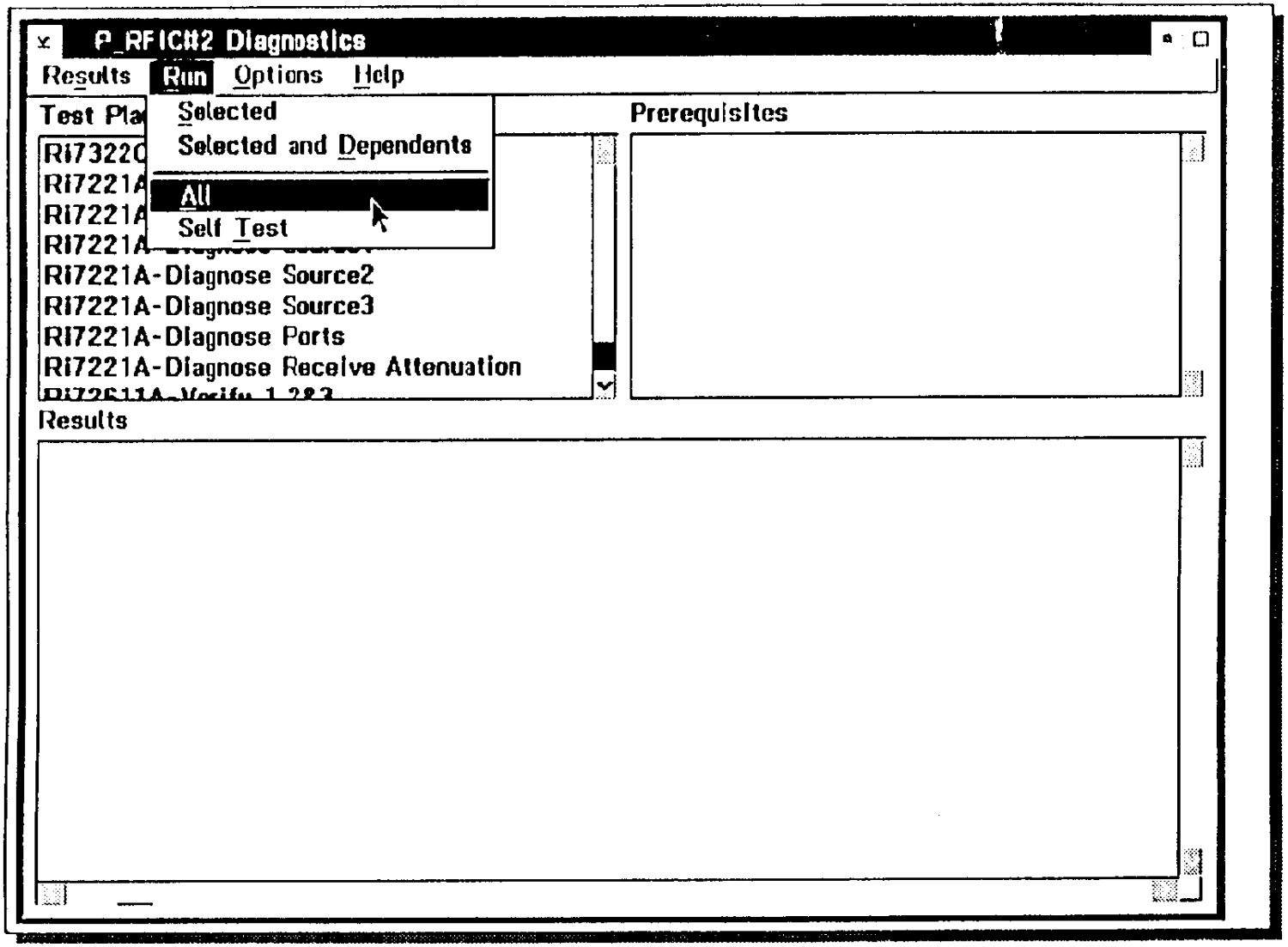
System Diagnostic Procedure

- **Logon to Tester with Admin or Higher Privileges**
- **Open Tester Container Window**
- **Select the Tester**
- **Open the Tester's Diagnostic Test Executive**
- **Run all of the Diagnostic Test Plans**
  (Select: Run & All)
  (Carefully Follow the Operator Prompts on the Monitor)
- **Report Failures to Roos Instruments**

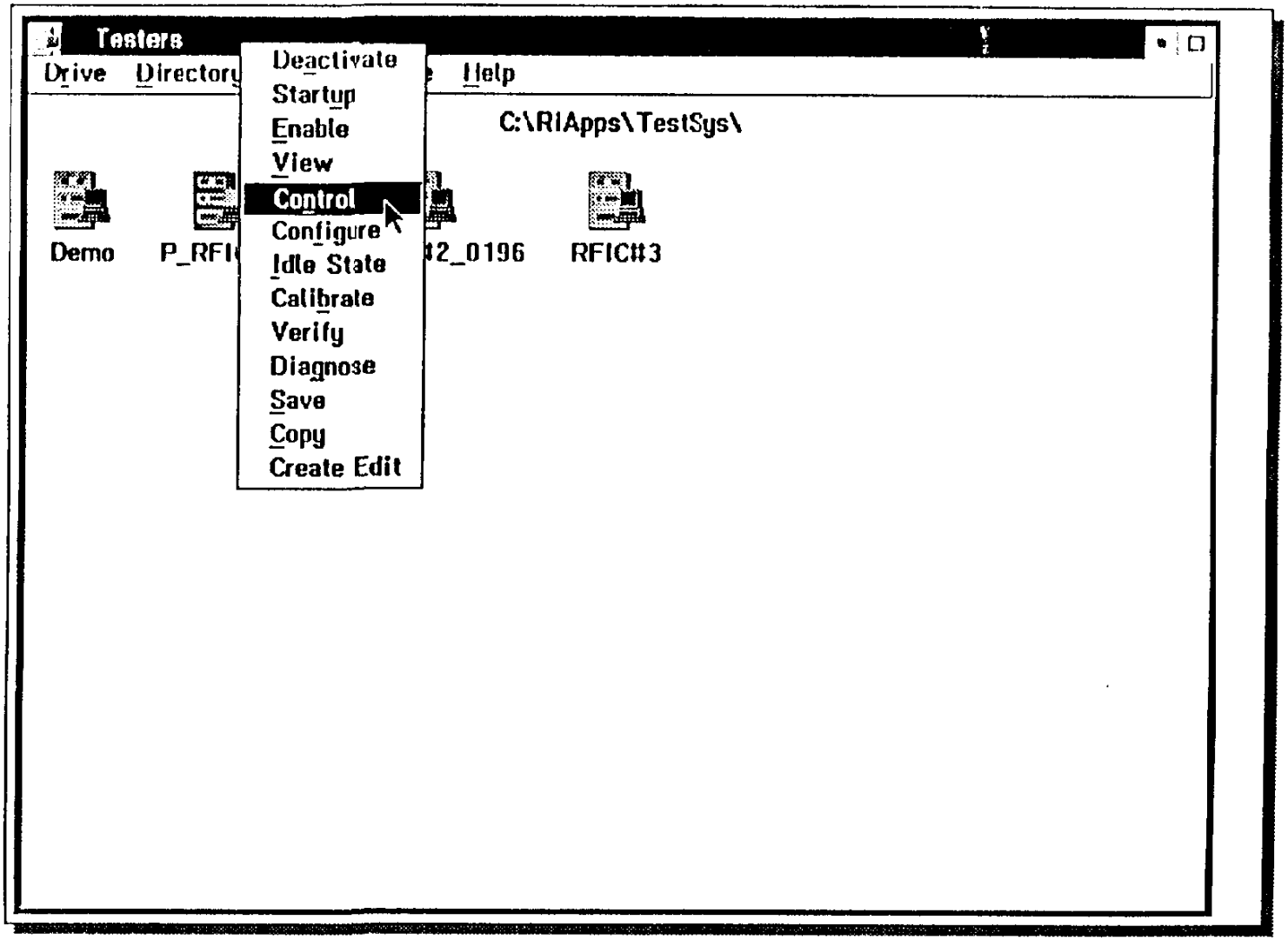
Diagnostic Test Executive and Test Plans



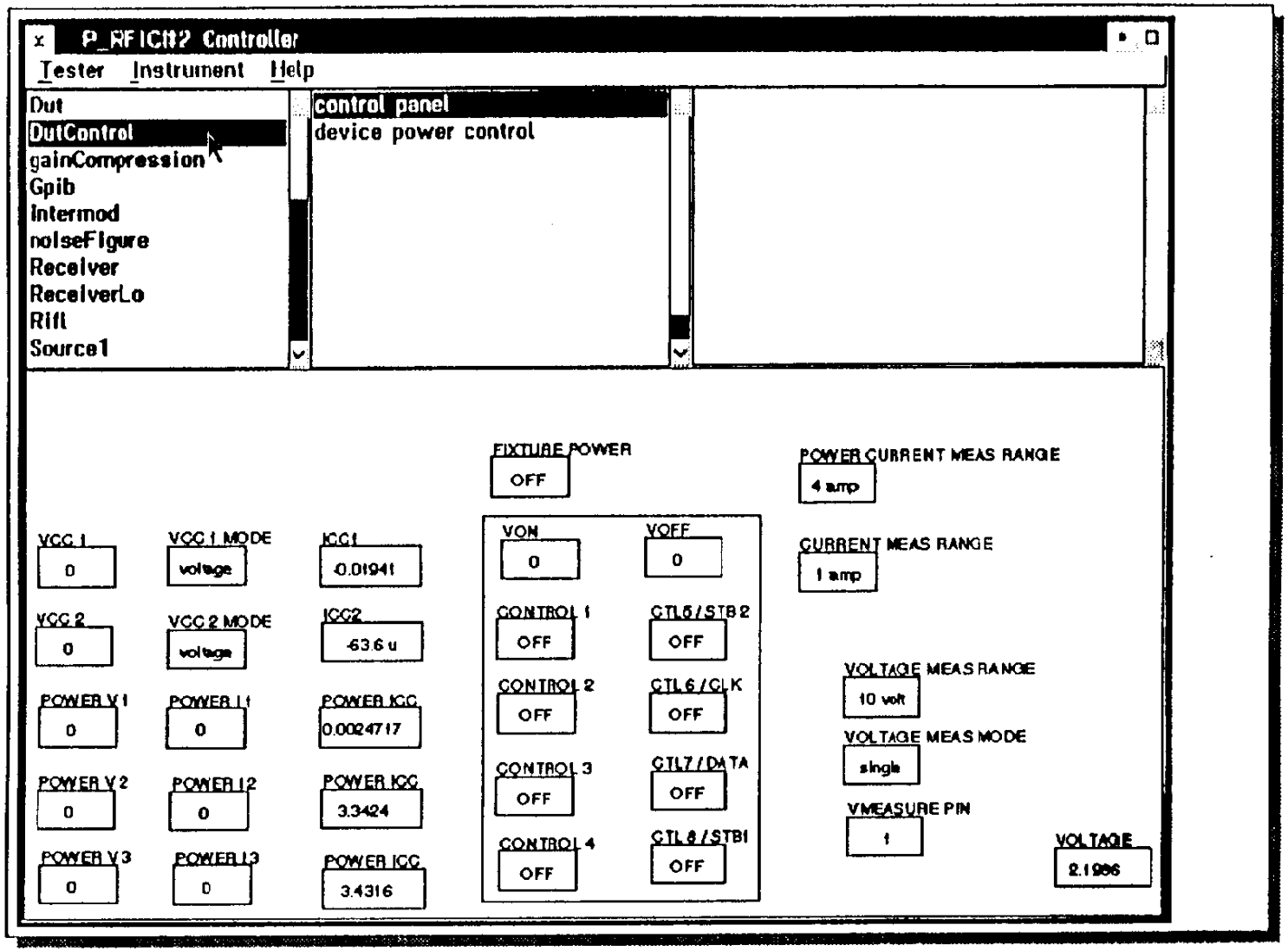
Running All of the Diagnostic Test Plans



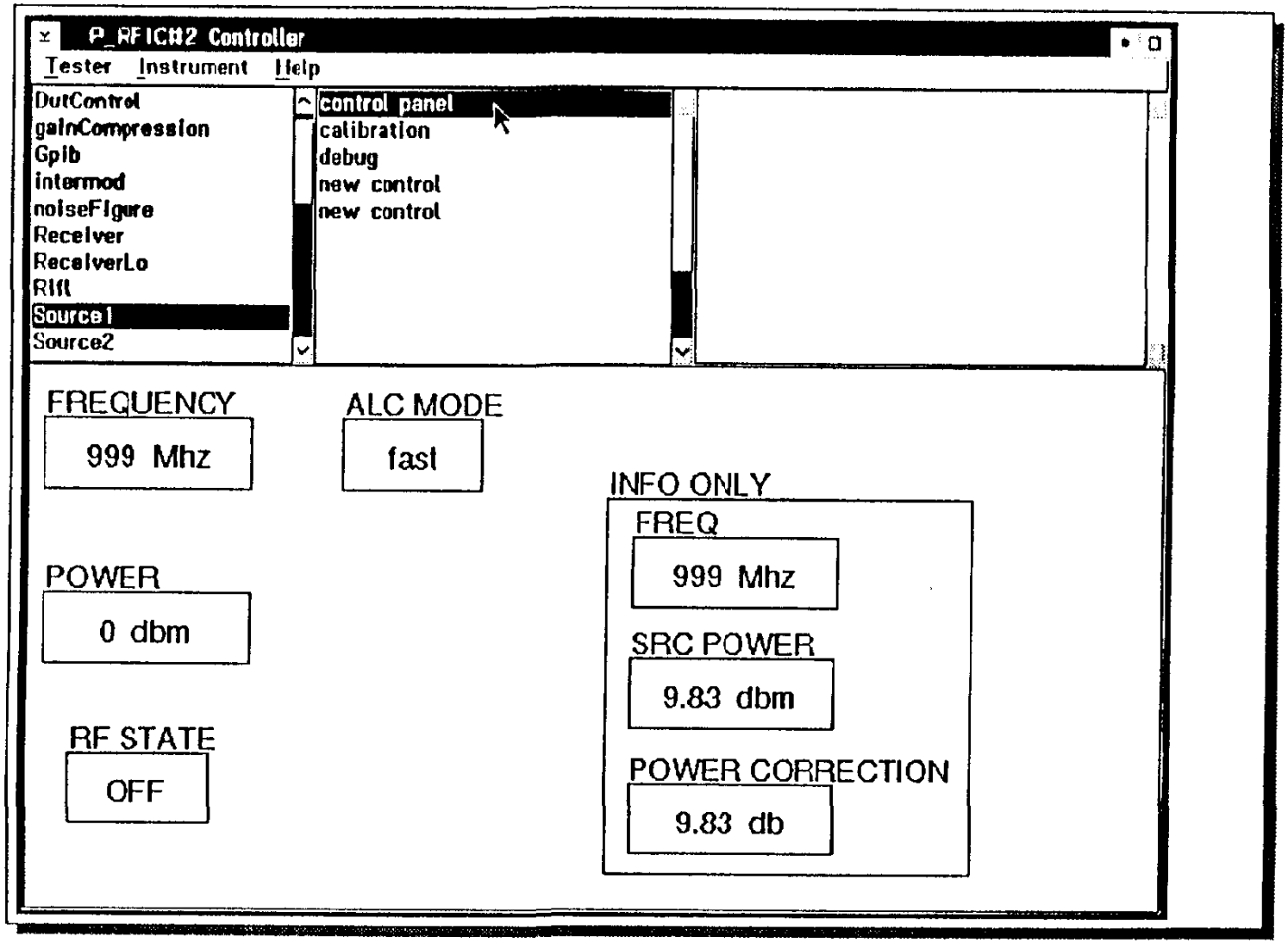
Manually Controlling the Tester - Opening the Tester Control Panel



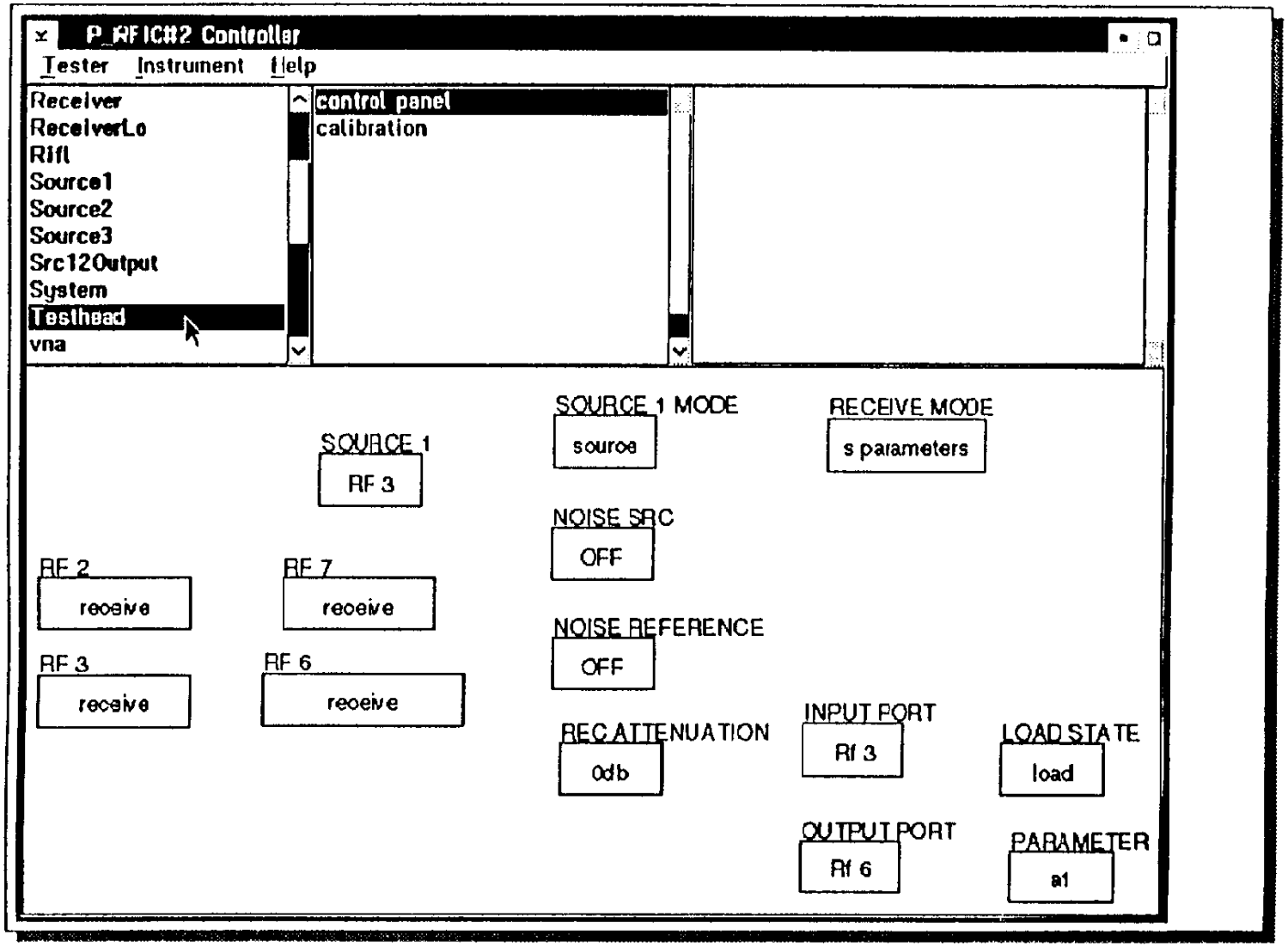
Manual Control of the Programmable DUT Controller



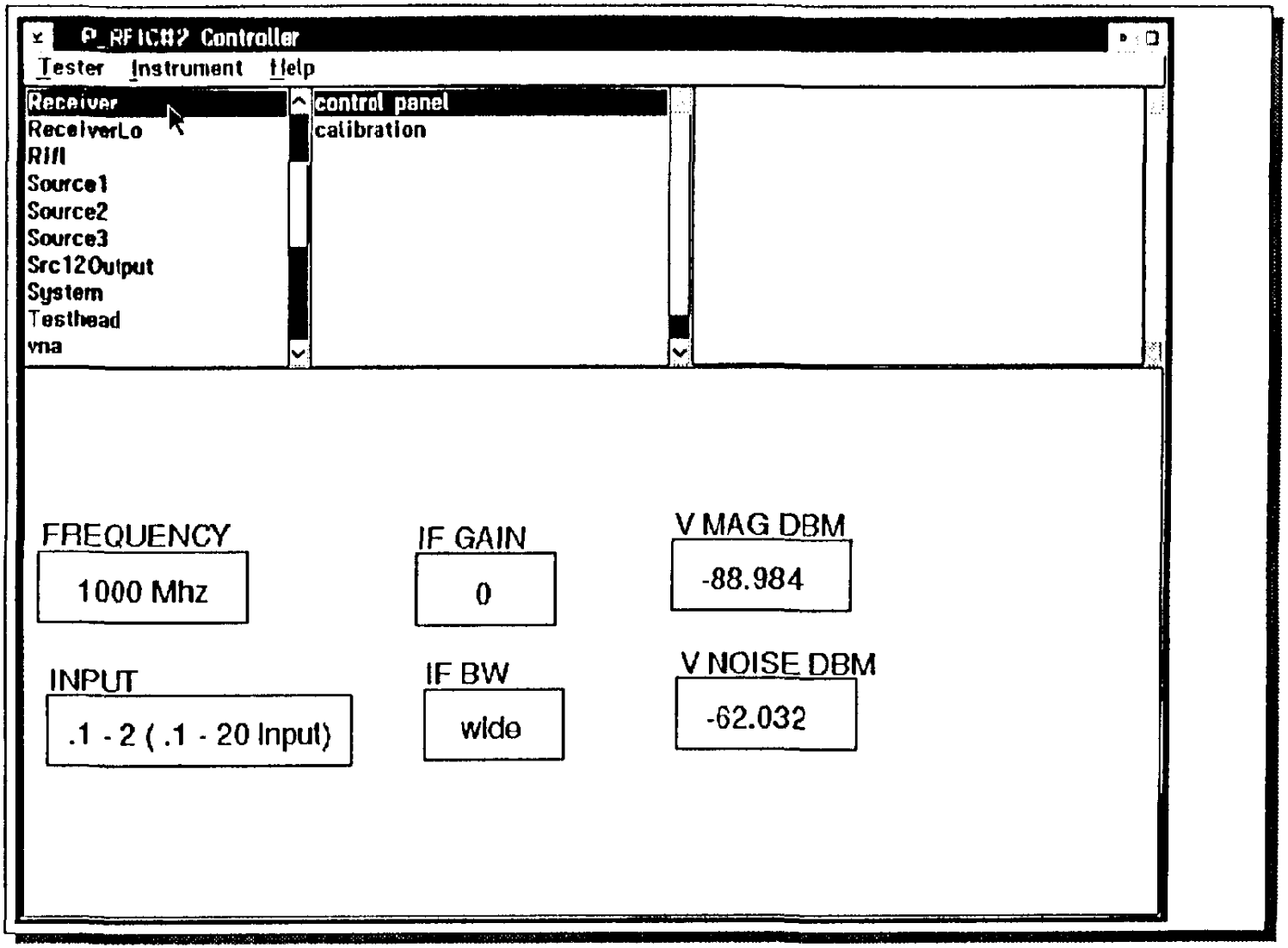
Manual Control of the RF Sources



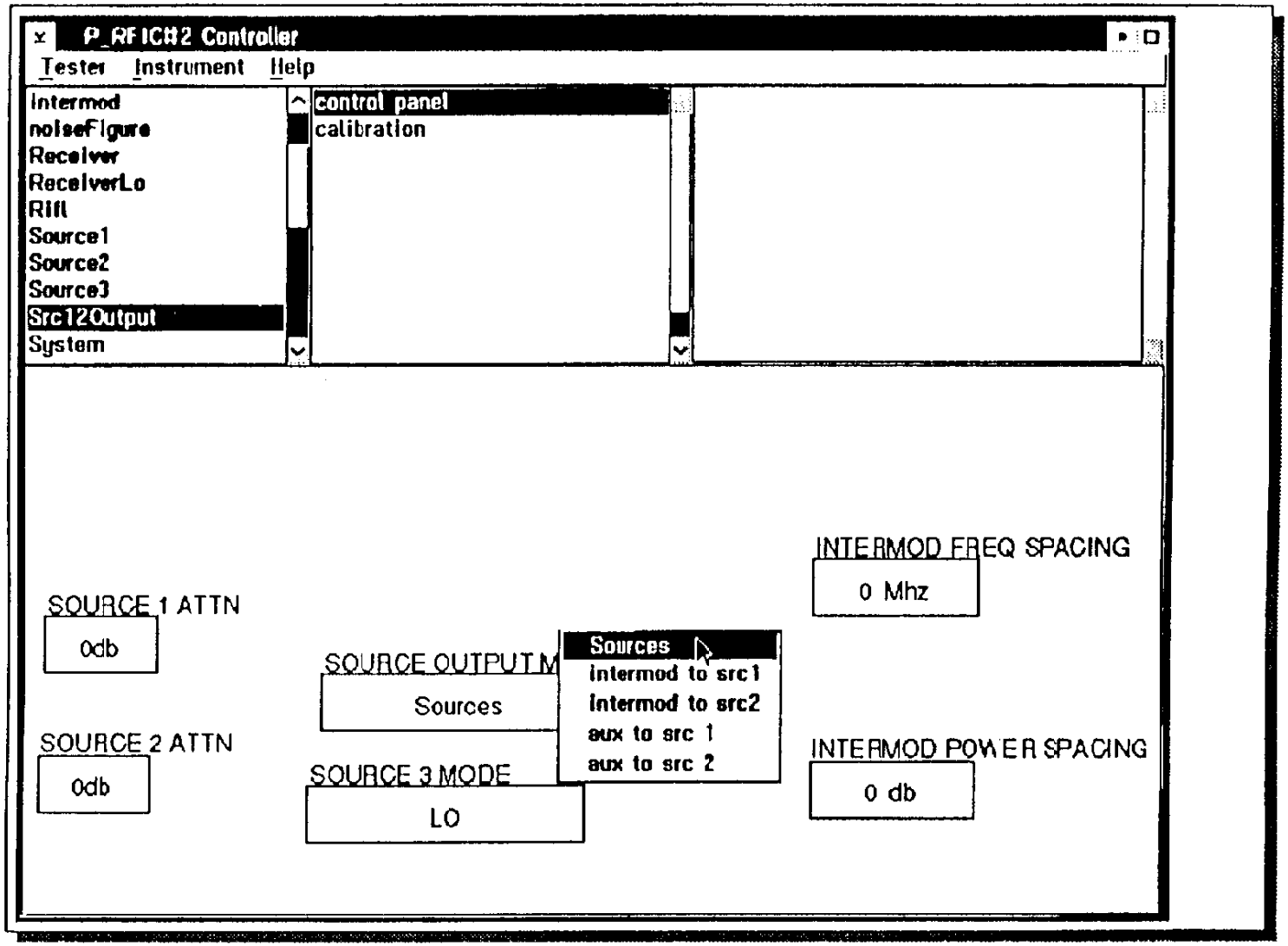
Manually Setting the Signal Paths in the RFIC Test Head



Measuring Signals with the System Receiver



Manually Setting the RF Source Modules



Repair Process

- Follow System Computer's User Diagnostics
- Reconfigure Microwave Sources if Necessary
  All of the Microwave Sources are Identical
- Request Replacement Part from RI
- RI to Provide Replacement Part
- RI Module Exchange Program Support Provided
- Service Support also Available from Wiltron

Software Management: Things to Consider

- **System Data Base: IBM DB2/2**
  Please consider taking in a DB2/2 Class.

End of Training

Enjoy Using the Systems

Roos Instruments