

Certifying Radian RD-2X Series Reference Standards with the RS703
Laboratory Calibration System

Hardware and Software Requirements

- 1) RD-20, RD-21, or RD-23 Reference Standard (Device Under Test - DUT's)
- 2) RS703 Automated Laboratory Test System
- 3) 120V VAC Auxilliary Power Input Cable (Radian part no. 194015)
- 4) Right Angle Current Adaptors (Radian part no. 5460060)
- 5) BNC-BNC Input Cable (Radian part no.'s RM-1C, RM-2C, RM-3C)

Any work with the RS-703A Automated Calibration System, RS-703A accessories, energized standards and energized meters can present the danger of electrical shock. The RS-703A and its accessories should be operated by qualified personnel. The information provided in this instruction set is intended to serve as a guide for properly qualified electric utility personnel. This instruction set is not intended to replace existing electric utility safety procedures and those listed in the Handbook for Electricity Metering.

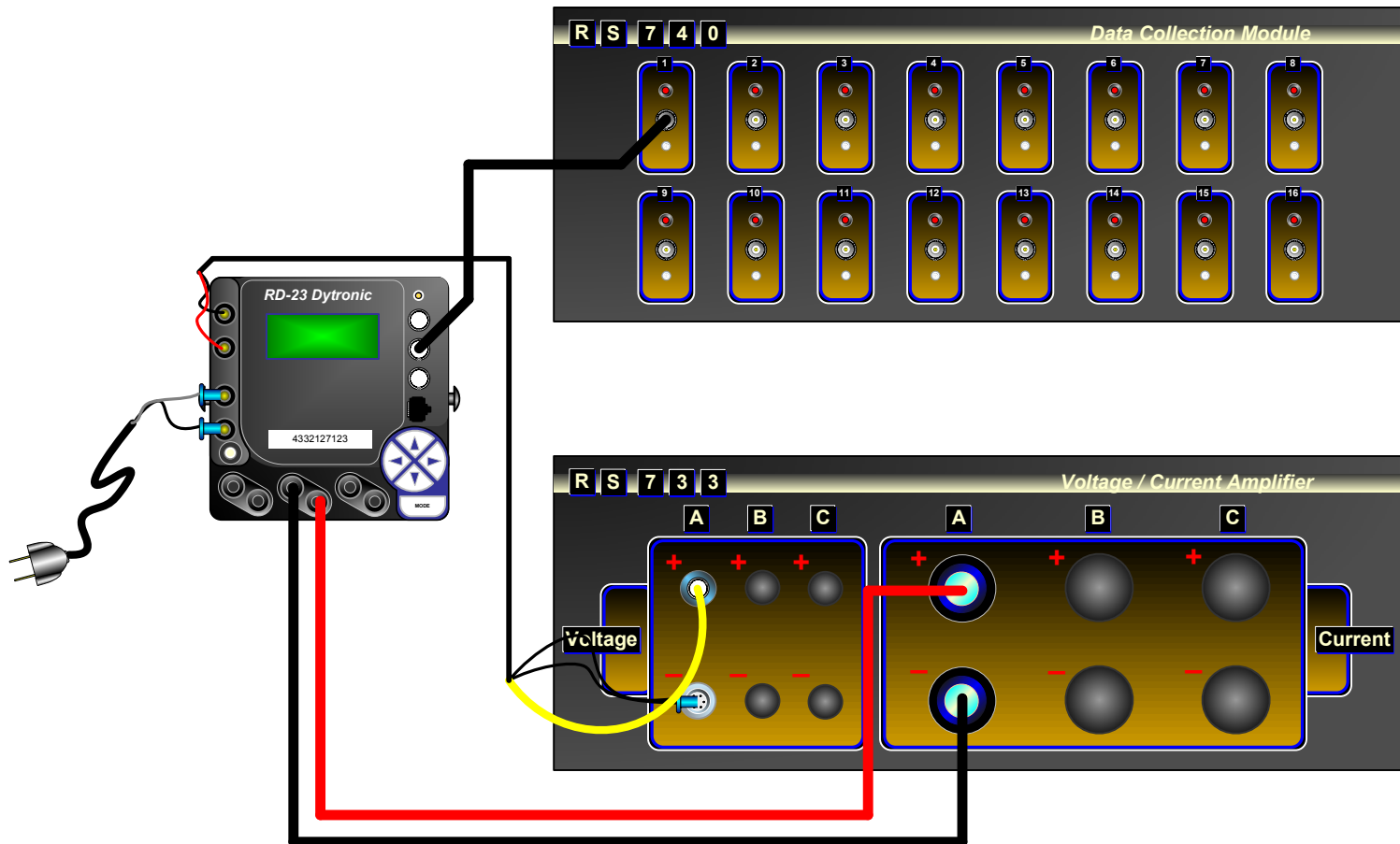
Operation of the RS-703A should not be conducted if the work area is wet or damp. Operation should also not be conducted if flammable gases or fumes are present in the work area. When using the RS-703A never make voltage and current connections/disconnections when the system is live. For service or repairs to the RS-703A contact Radian Research, Inc. Do not attempt to service or make modifications to the RS-703A due to the risk of electrical shock.

Radian Research, Inc. assumes no liability for failure to comply with existing applicable safety precautions as well as those listed in this warning statement.

Hardware Setup

1. With the 703 System completely powered OFF, ensure the following:
 - a) the external potential (BNC and LEMO connectors) and current (locking connectors) cables are securely connected to the RS-733 front panel
 - b) the control PC's monitor, mouse, and keyboard are connected
 - c) the 703's main power cable is connected to the power source

2. Make all the necessary hardware connections, as shown in the diagram below.



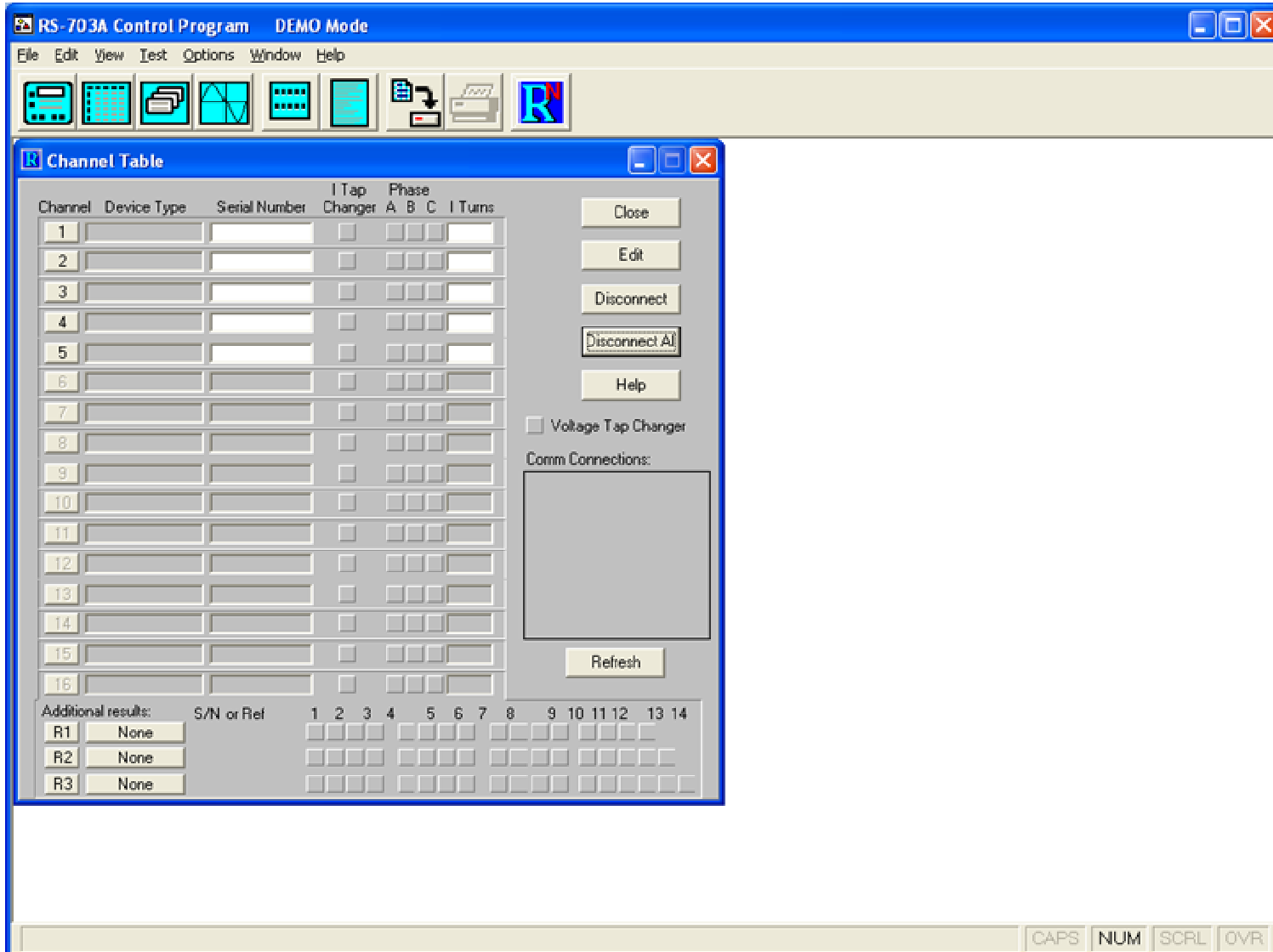
Hardware Setup

- 2.a. Using a 120V VAC Auxilliary Power Input Cable, apply 120VAC to the DUT's auxiliary power input.
- 2.b. Using a BNC-BNC cable, connect port two of the DUT to channel one of the RS-740 front panel.
- 2.c. Using the External Potential Cable, connect the potential output to the DUT's potential input.
- 2.d. Using the External Current Cable and Right Angle Current Adaptors, connect the current output to DUT's "B" current input.
3. Ensure that the DUT is configured as follows (consult the reference standard's operations manual for details):
 - a) Port 2: Wh
 - b) Pulse Constant: 0.00001 Wh/Pulse
 - c) Port Polarity: "+"
4. Turn the system on by rotating the key switch 90° clockwise. The system will turn on and the cooling fan will start.
5. Turn on the computer by switching both the back and front power switches to the ON position.

Software Setup

Opening Application:

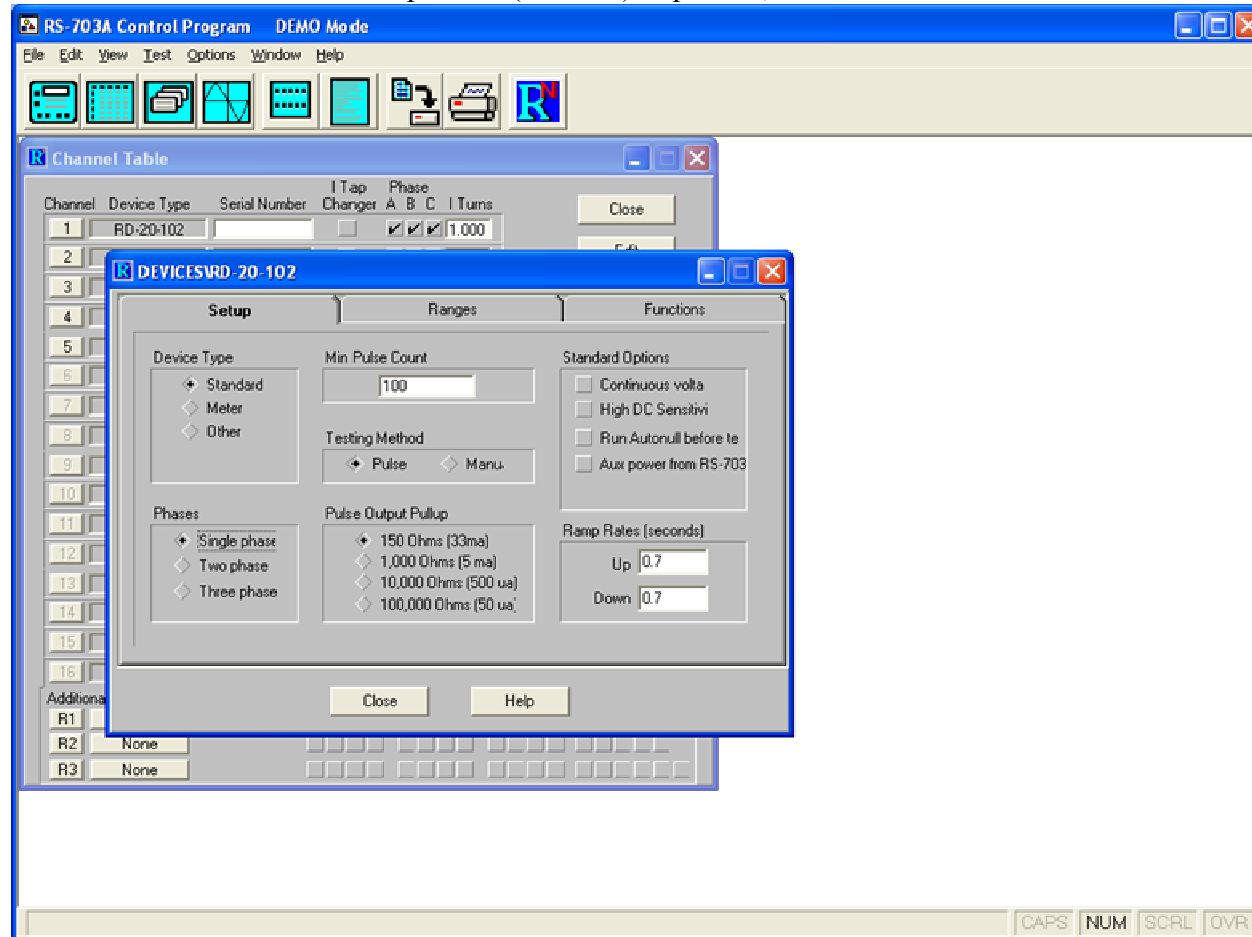
1. Open the 703 Control Software by double-clicking the application's icon, located on the computer's desktop. A pop-up screen will briefly flash on the screen, and a short delay will follow. The control application will then open and proceed with a self diagnostic routine.
2. Wait until the diagnostic routine is completely finished. The application opens with the *Channel Table* window open



Software Setup

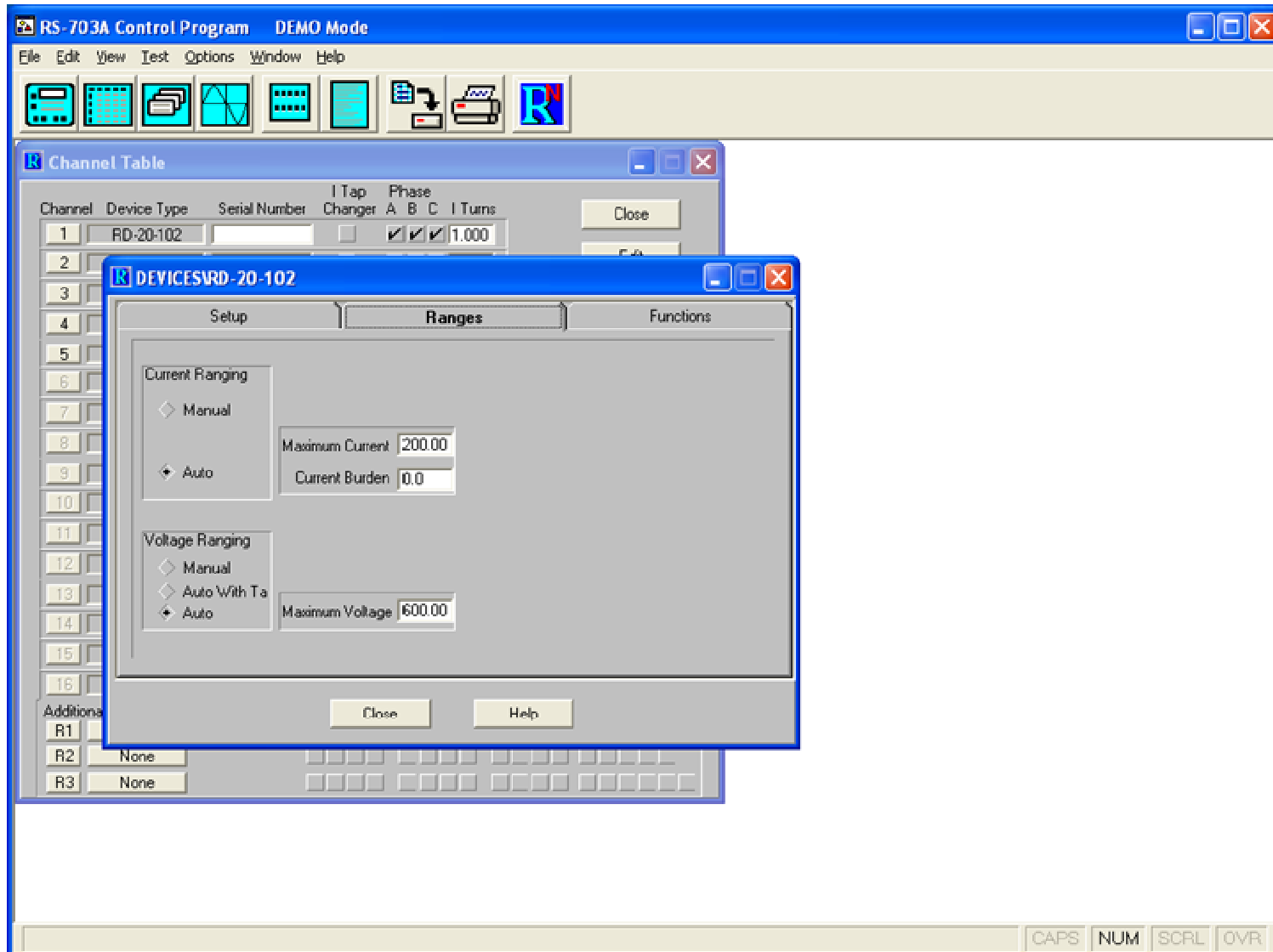
2. Re-click on the *Channel 1* selection box. The associated device's configuration card will be displayed. Ensure that the device is configured as follows:

Setup tab:
 Device Type: Standard
 Phases: Single phase
 Min Pulse Count: 100
 Testing Method: Pulse
 Pulse Output Pullup: 150 Ohms (33ma)
 Standard Options:
 Ramp Rates (seconds): Up = 0.7, Down = 0.7



Software Setup

Ranges tab:
 Current Ranging: Auto
 Maximum Current: as specified by DUT's specifications
 Current Burden: 0.0
 Voltage Ranging: Auto
 Maximum Voltage: as specified by DUT's specifications



Software Setup

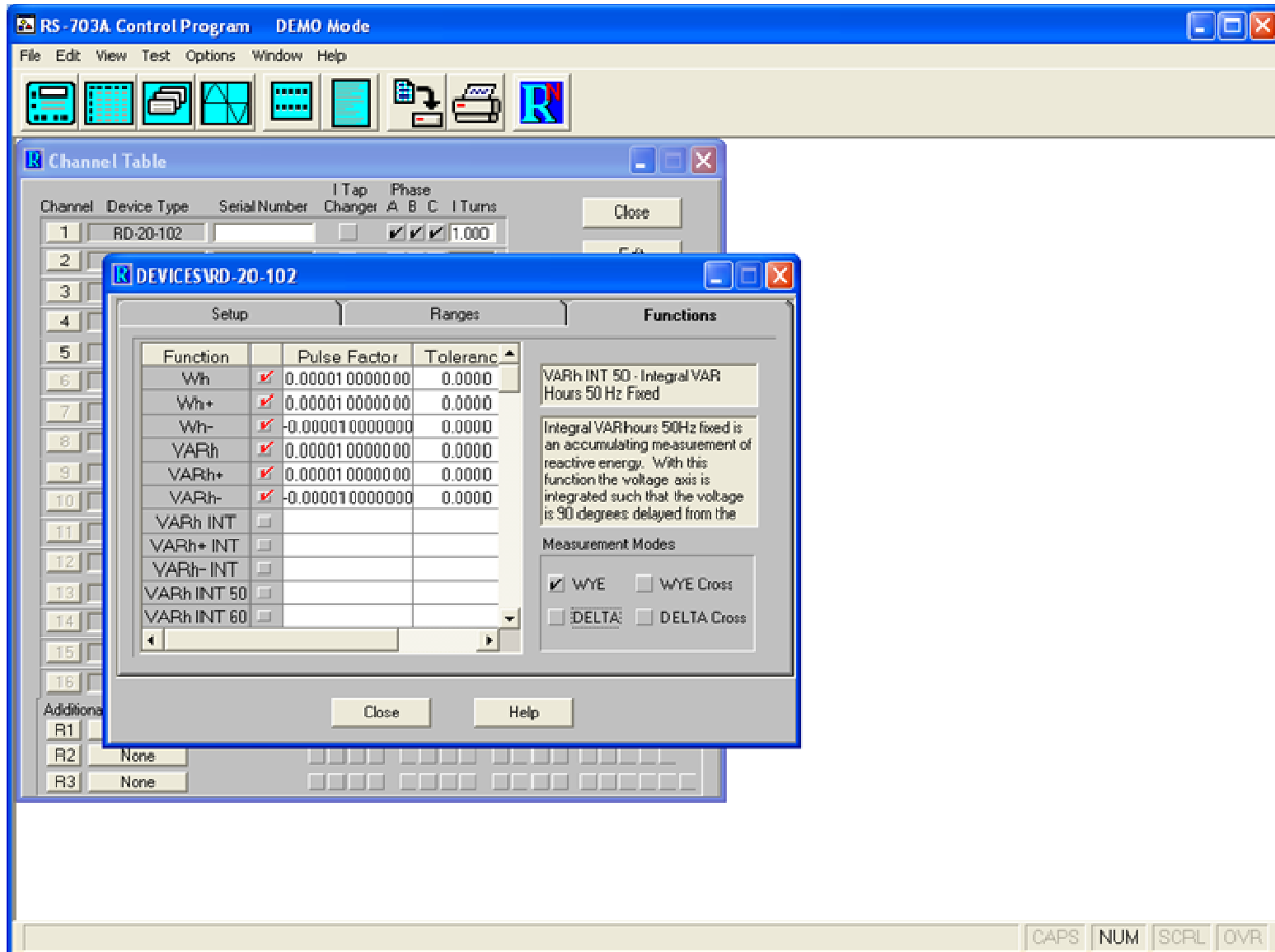
Functions tab:

Function: select functions applicable to DUT's supported measurement parameters

Pulse Factor: 0.00001

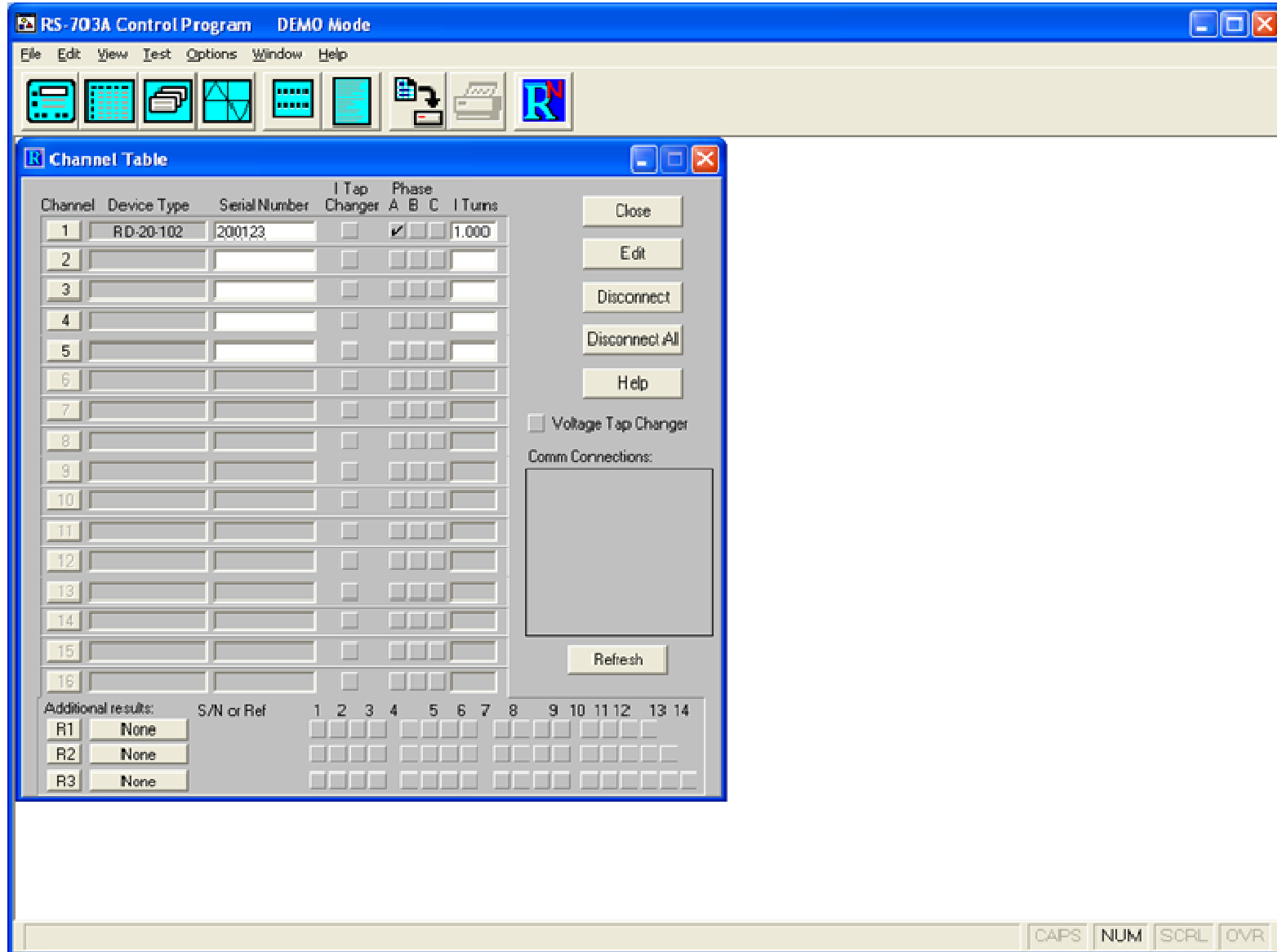
Tolerance: as specified by DUT's specifications

Measurement Modes: check Wye only



Software Setup

3. Select *Close*. If prompted, save any unsaved changes.
4. Enter the DUT's serial number.

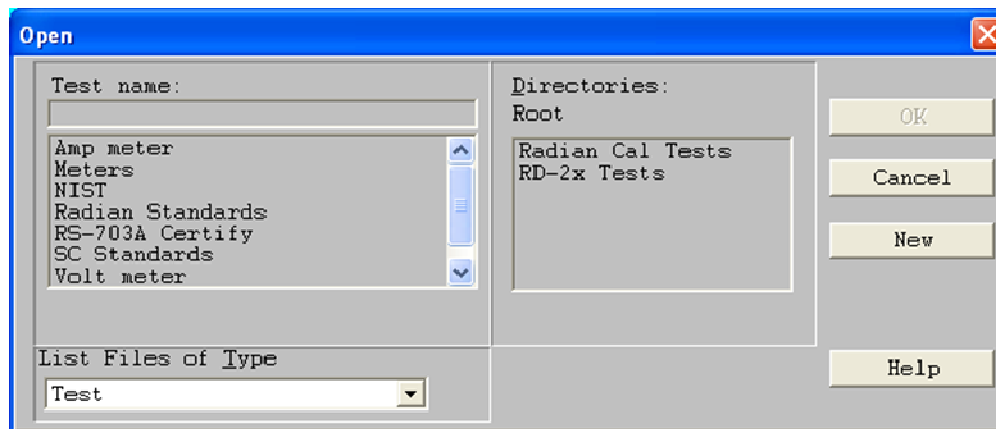
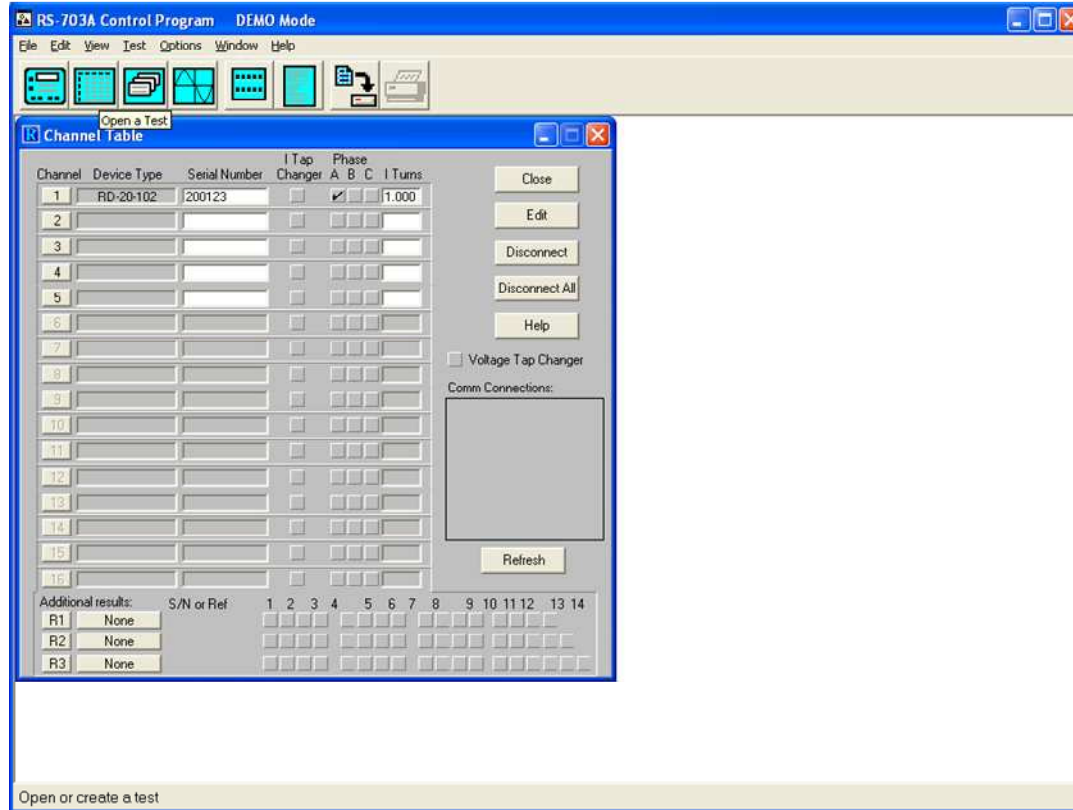


5. Ensure that *I Tap Changer* is unchecked, only *Phase A* is checked, and *I Turns* is set to 1.000.

Software Setup

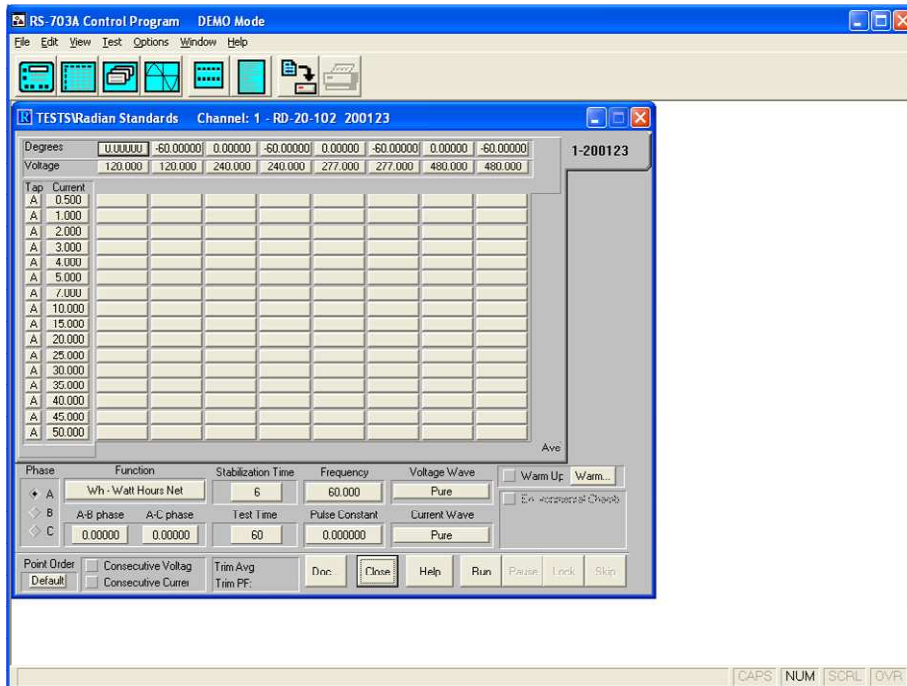
Test Setup:

1. From the icon menu bar, select the *Open a Test* icon. A *Open* window will appear.

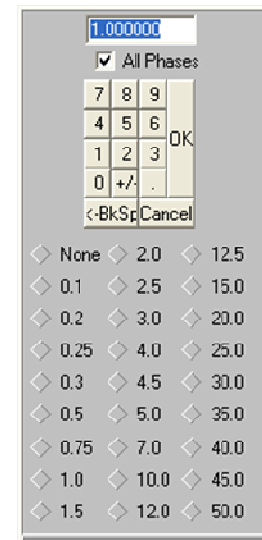


Software Setup

2. From this window, select "Radian Standards" from the list provided. Select *OK*. The selected *Test* window will appear, with the previously associated DUT's serial number listed on the right-hand tabs.



3. This *Test screen* will include all the test points to be executed. Any of the Current, Voltage, and/or Phase values can be modified by clicking on that particular value.



4. Ensure that the test options are configured as follows:

- Phase: A
- Point Order: select per user's preference
- Function: Wh - Watt Hours Net
- A-B phase: 0.0
- A-C phase: 0.0
- Consecutive Voltage: unchecked
- Consecutive Current: unchecked
- Stabilization Time: select per user's preference
- Test Time: select per user's preference
- Frequency: 60.000 (US); 50.000 (International)
- Pulse Constant: 0.00001
- Voltage Wave: Pure *see Appendix 3
- Current Wave: Pure *see Appendix 3
- Warm Up: unchecked

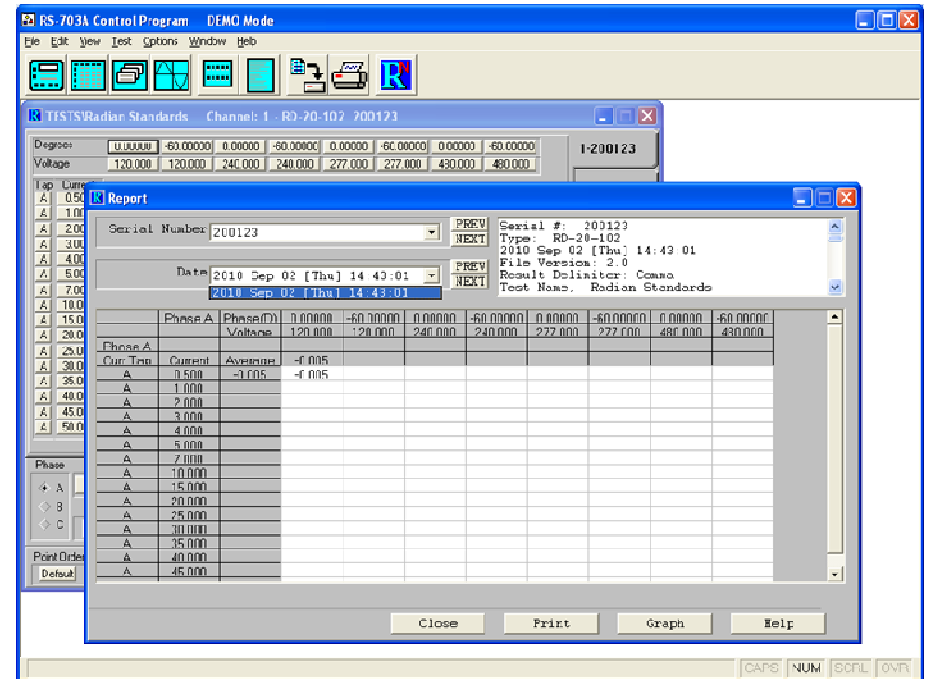
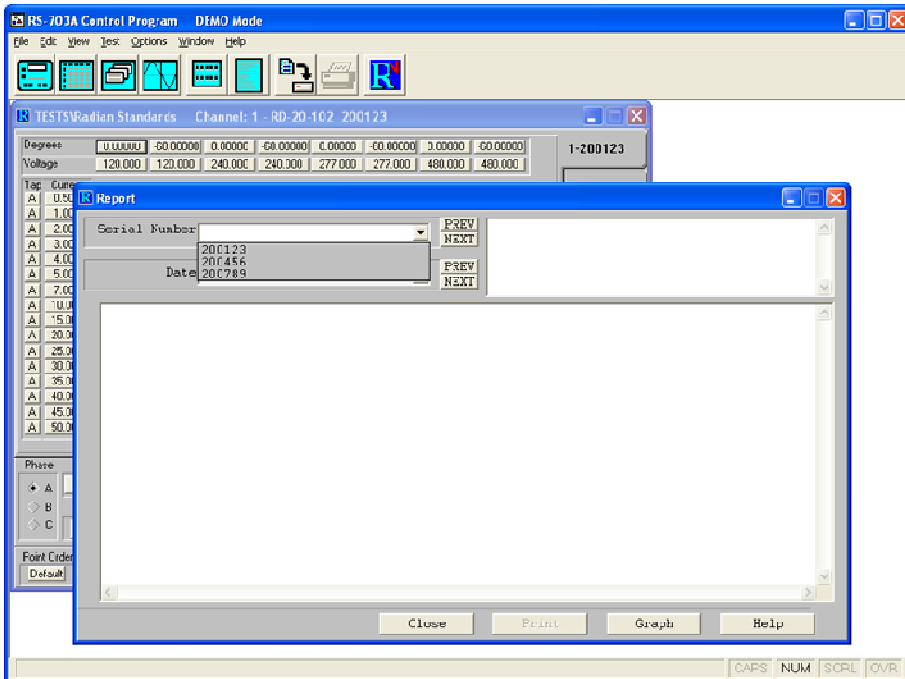
Running A Test

1. Select *Run*. The test will automatically start with the first test point and continue until all test points have been executed.

Saving, Viewing, and Exporting Results Data

2.a. From the *Serial Number* drop-down menu, select the desired serial number.

2.b. From the *Date* drop-down menu, select the desired date. The desired results data will appear.

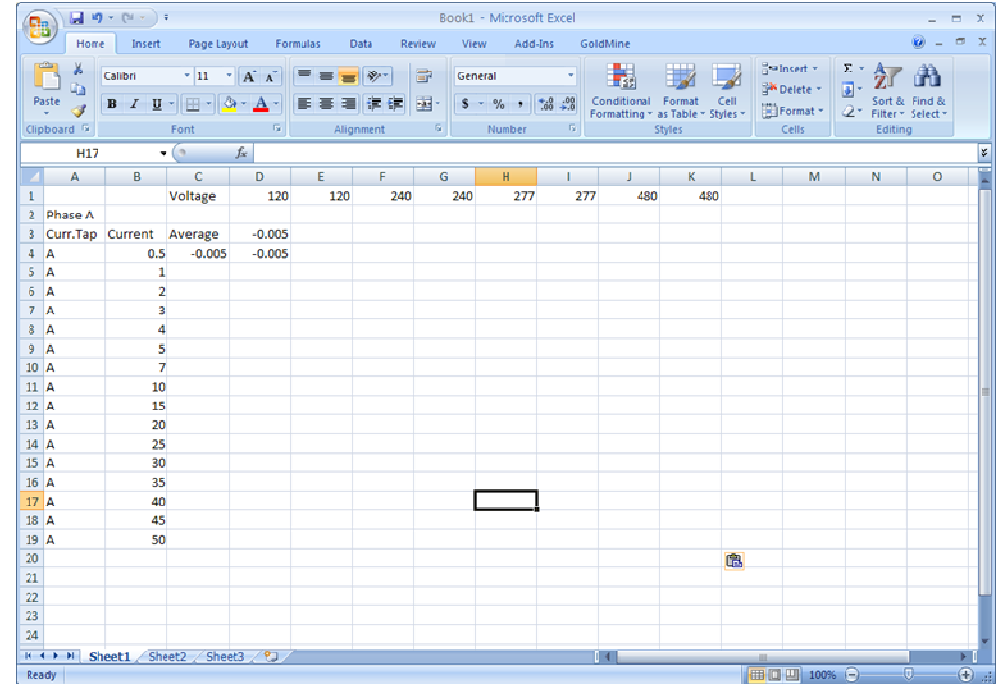
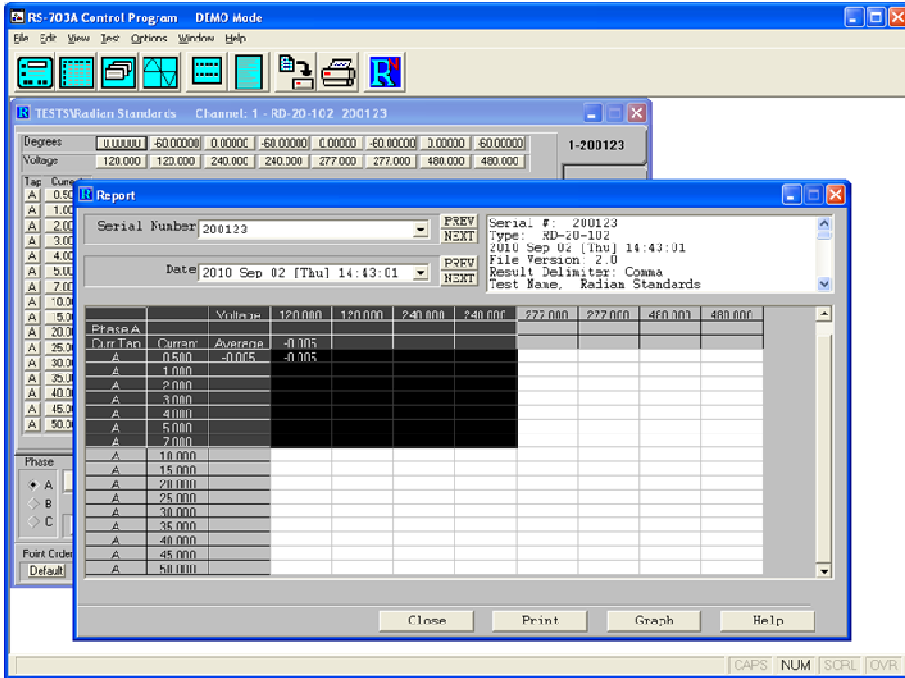


Saving, Viewing, and Exporting Results Data

3. To export the data into an Excel spreadsheet, use the mouse to highlight the entire test results grid. Copy the data by simultaneously pressing the [Ctrl] key and the [C] key.

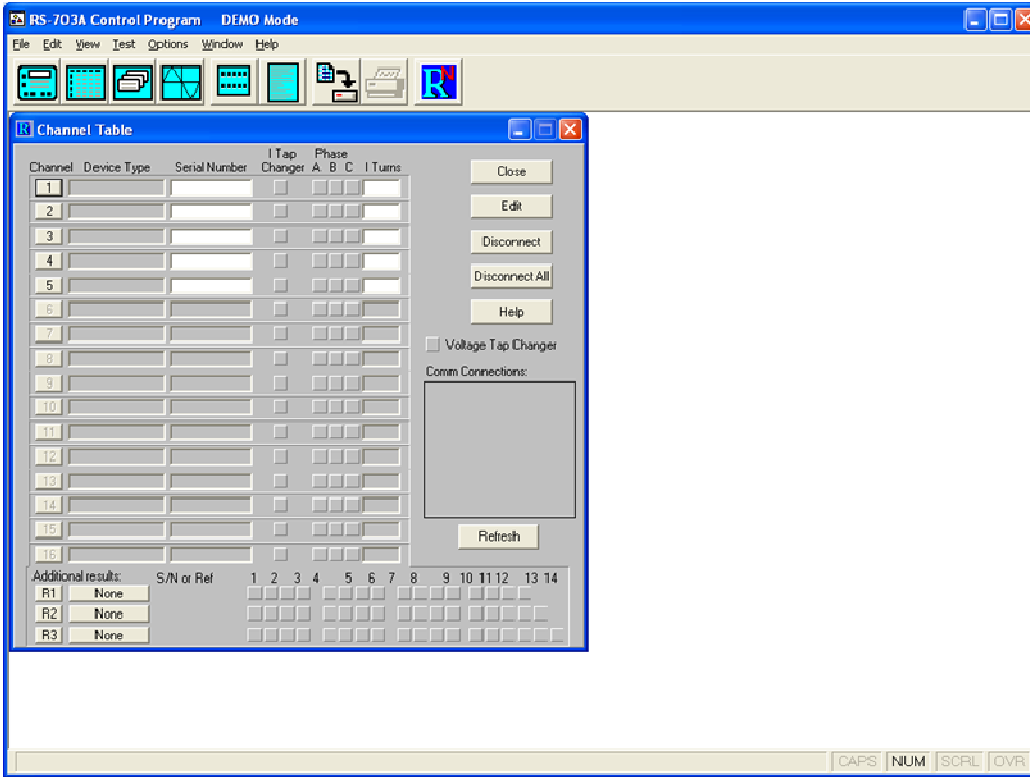
4. Open a new Microsoft Excel spreadsheet.

5. Paste the data by simultaneously pressing the [Ctrl] key and the [V] key.

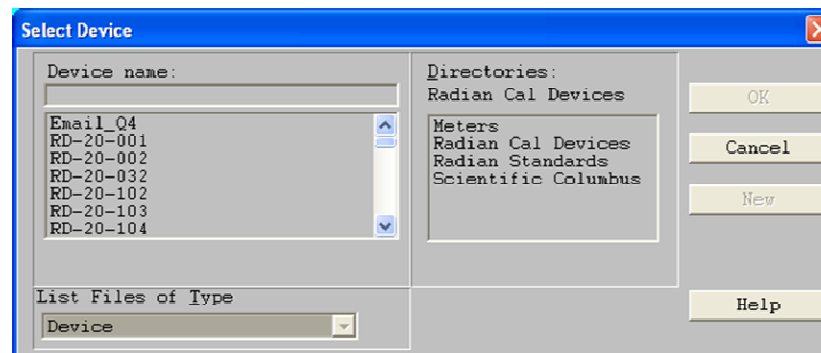


Appendix 1: Creating and Configuring a New Test Device

1. To create a new test device, click on the *Channel 1* selection box. A *Select Device* window will appear.



2. From this window, select the *New* button. A *new device* configuration window will appear.



Appendix 1: Creating and Configuring a New Test Device

3. Ensure that the device is configured correctly:

Setup tab:

Device Type: Standard

Phases: Single phase

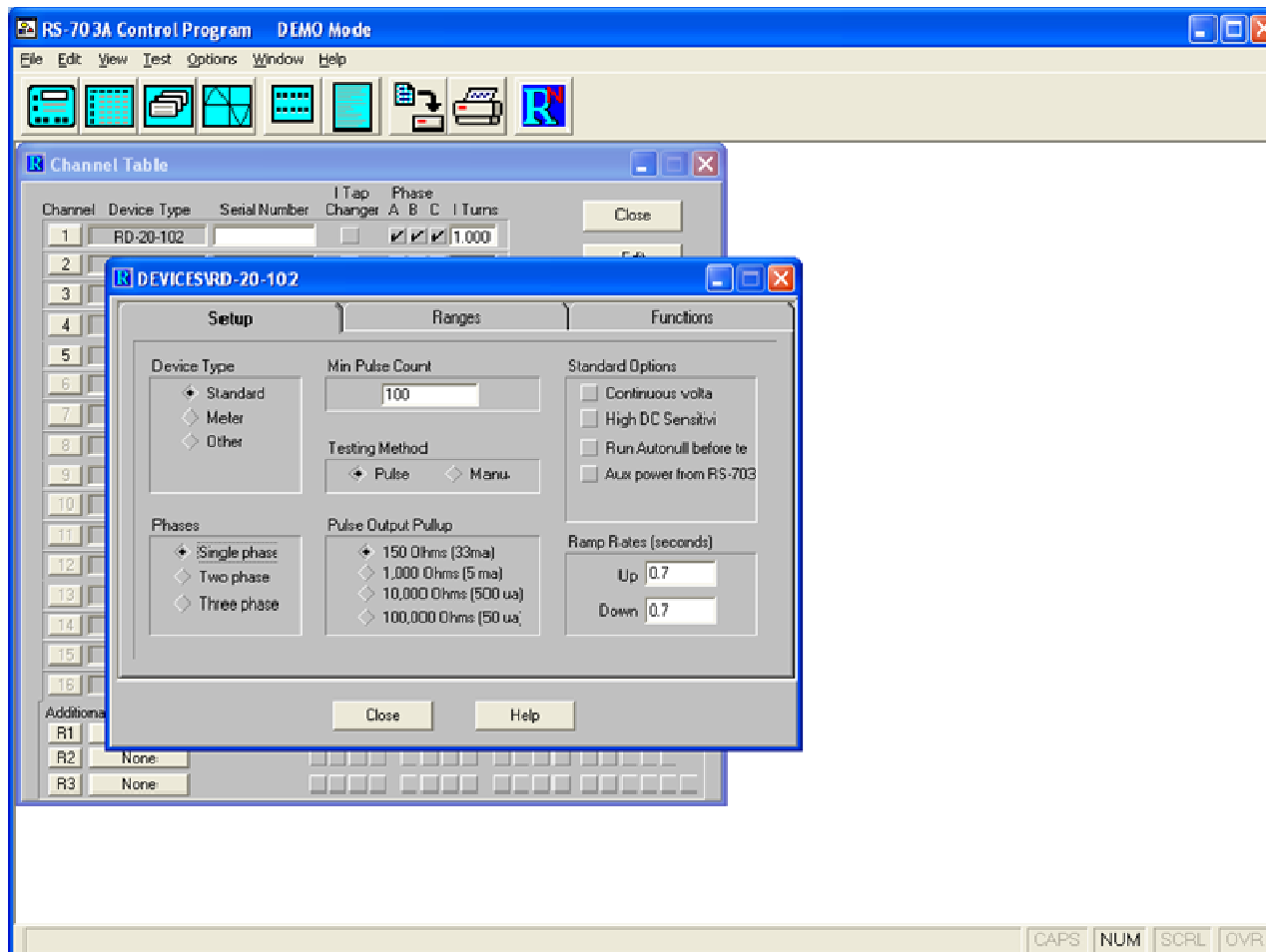
Min Pulse Count: 100

Testing Method: Pulse

Pulse Output Pullup: 150 Ohms (33ma)

Standard Options:

Ramp Rates (seconds): Up = 0.7, Down = 0.7



Appendix 1: Creating and Configuring a New Test Device

Ranges tab:

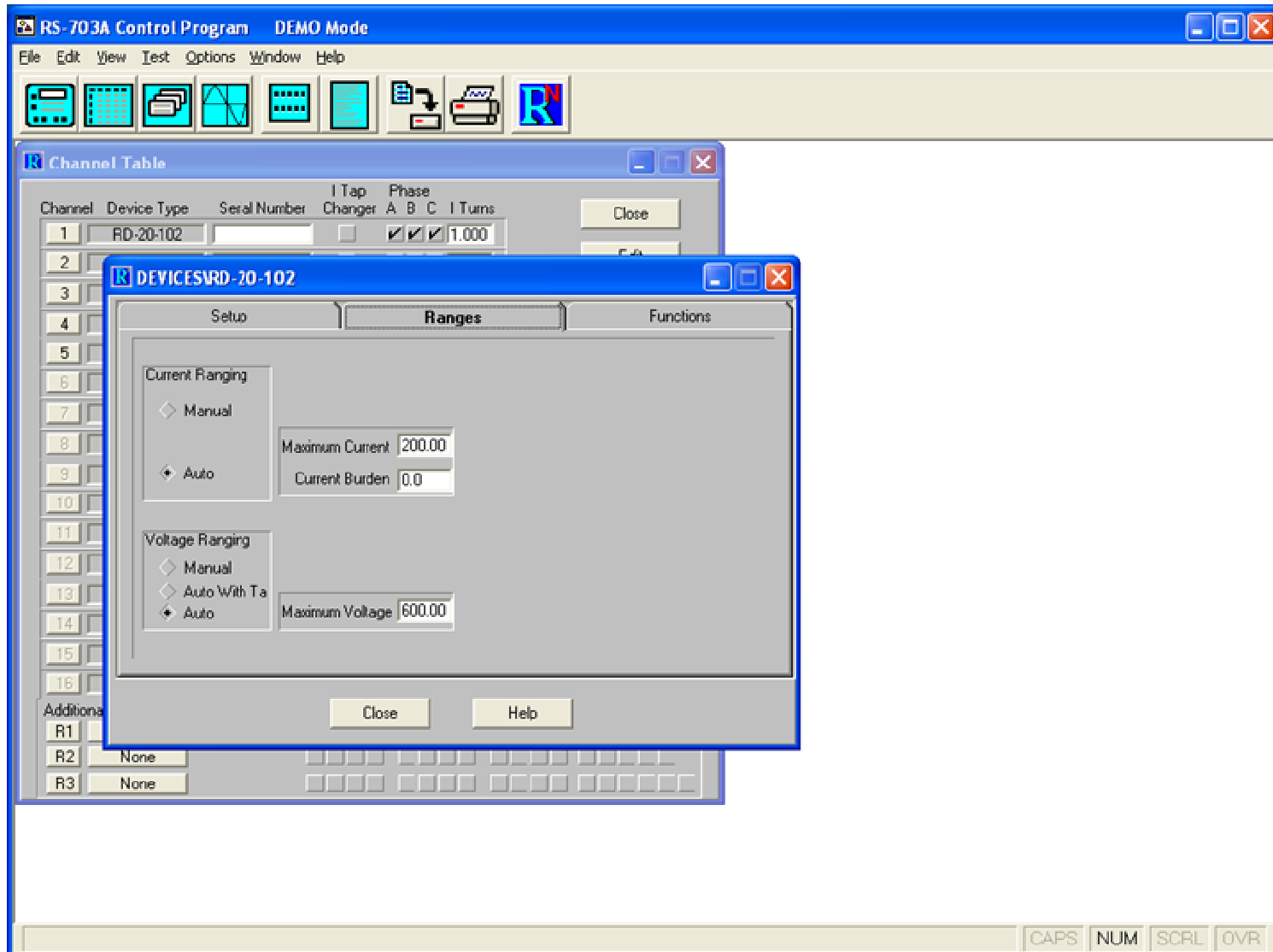
Current Ranging: Auto

Maximum Current: as specified by DUT's specifications

Current Burden: 0.0

Voltage Ranging: Auto

Maximum Voltage: as specified by DUT's specifications



Appendix 1: Creating and Configuring a New Test Device

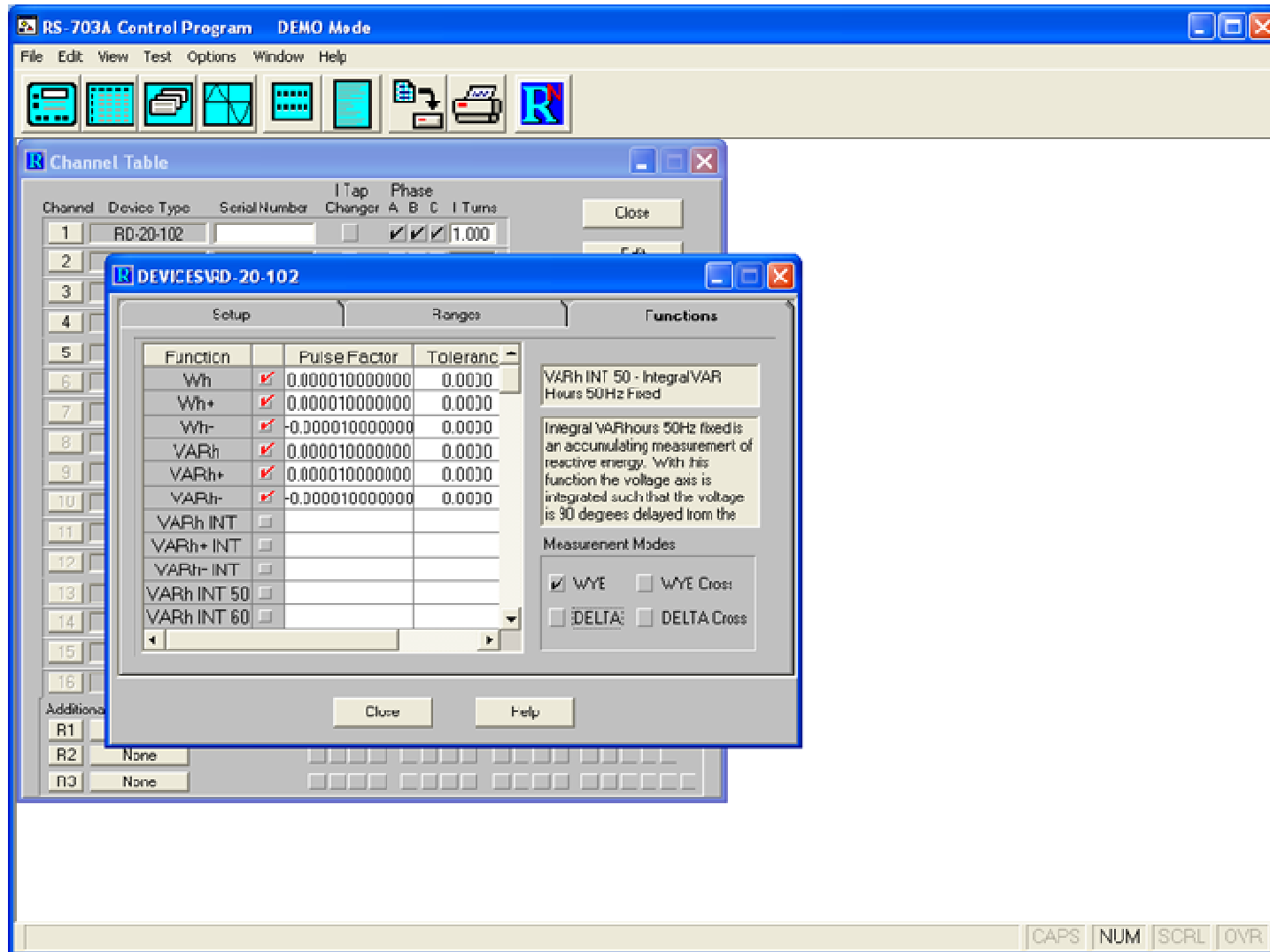
Functions tab:

Function: select functions applicable to DUT's supported measurement parameters

Pulse Factor: 0.00001

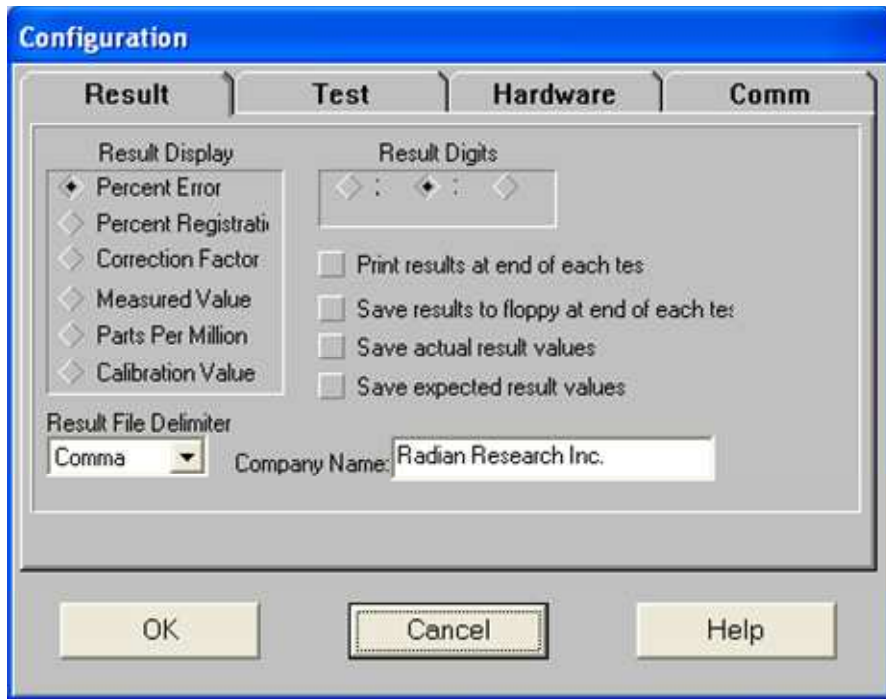
Tolerance: as specified by DUT's specifications

Measurement Modes: check Wye only

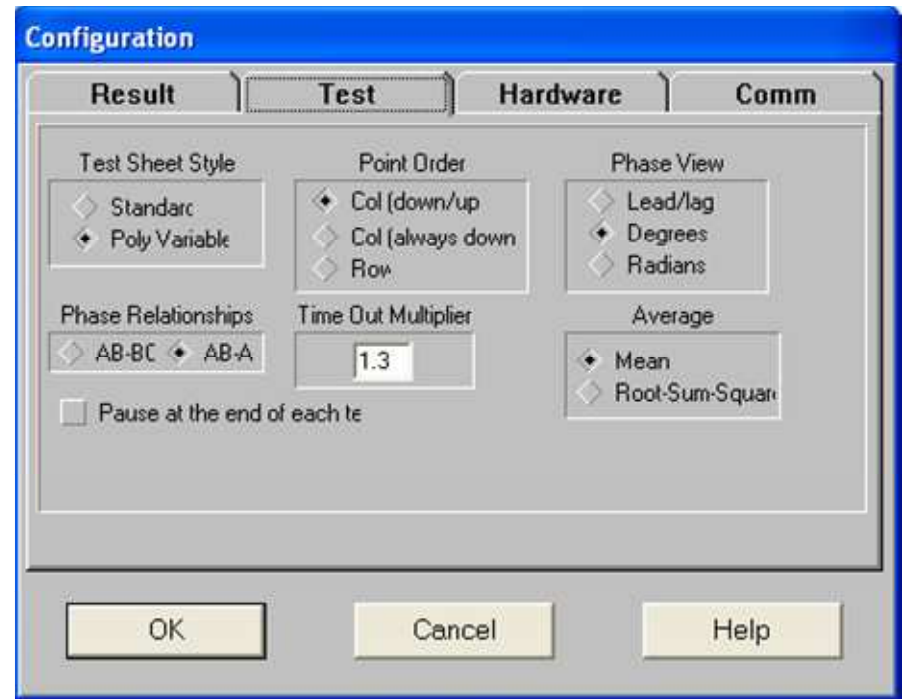


4. Select Close. If prompted, save any unsaved changes.

Appendix 2: Options/Configure Menu

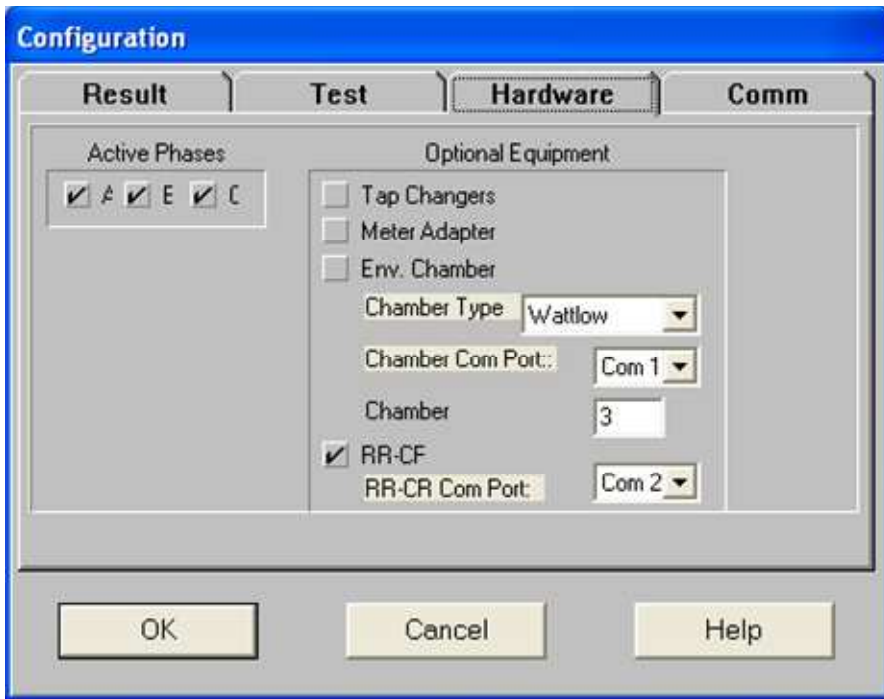


This screen allows the user to select how the resulting data will be displayed, the file type, the number of significant digits in the results data, and the company name.

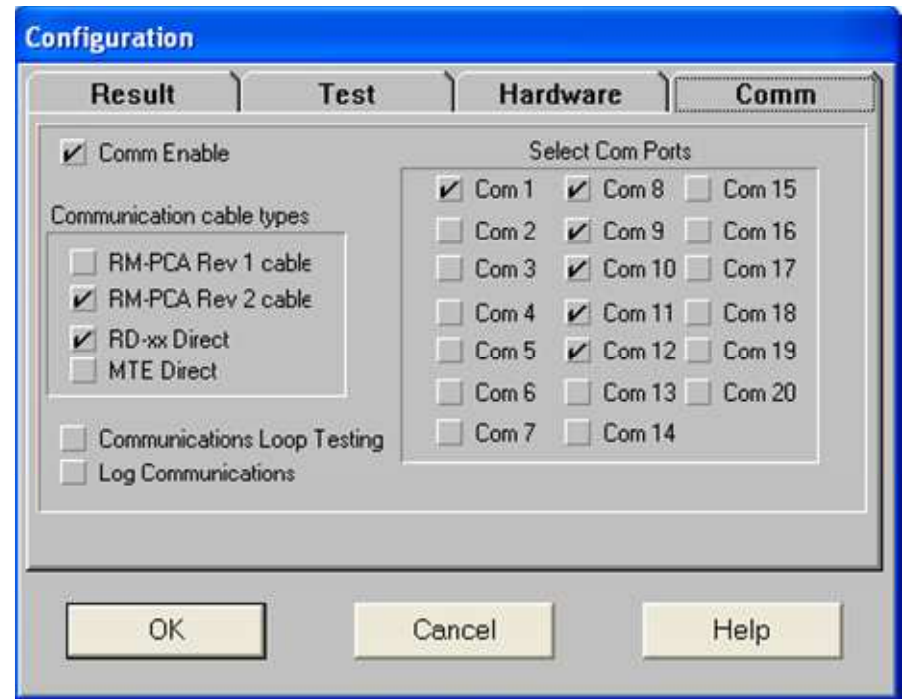


This screen allows the user to select the type of test (standard and poly-variable), the phase relationships, the test point order, the time-out delay, the power factor display, and the averaging method.

Appendix 2: Options/Configure Menu



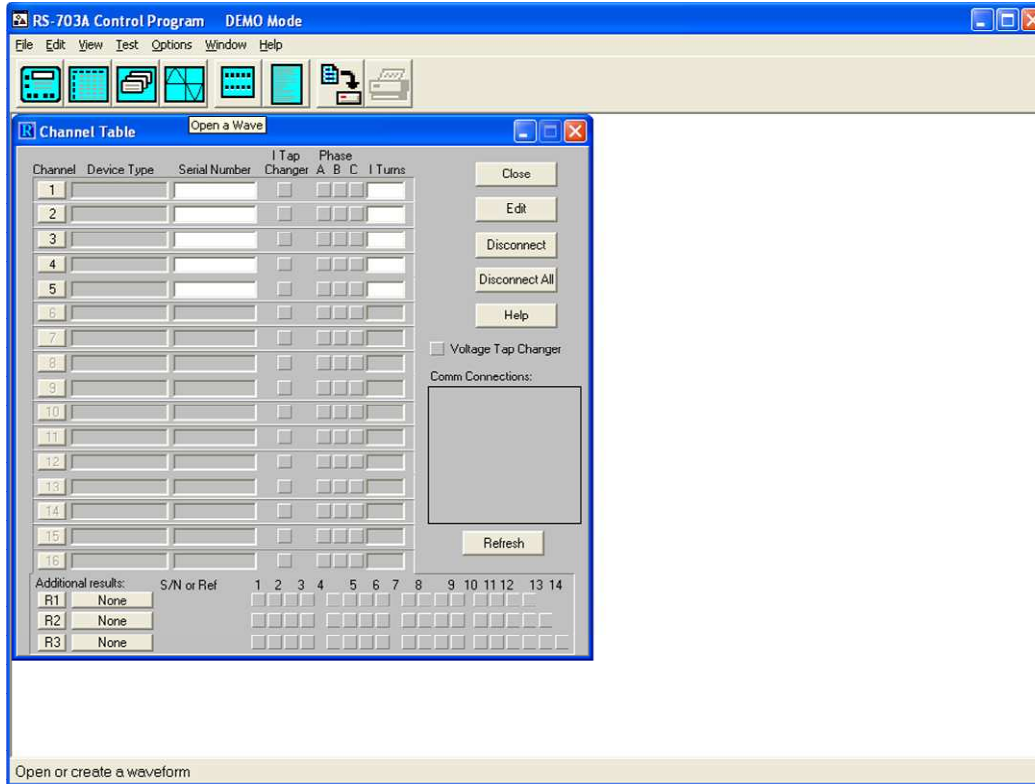
This screen allows the user to select the active phases and configure a temperature chamber control.



This screen allows the user to configure the serial communications to the devices under test.

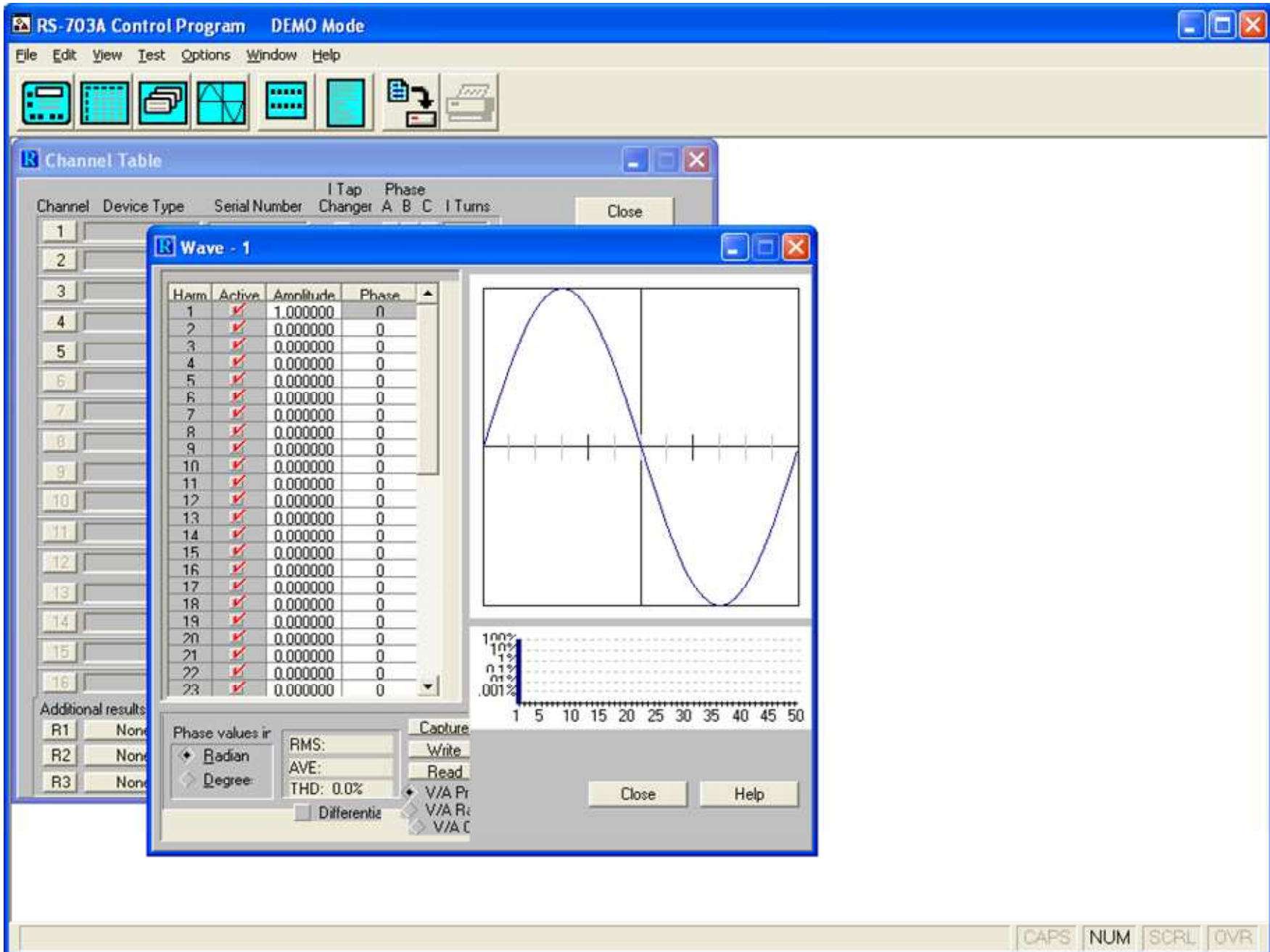
Appendix 3: Creating Voltage and Current Signals with Harmonic Content

1. Click on the *Open a Wave* icon. A *Open* window will appear.



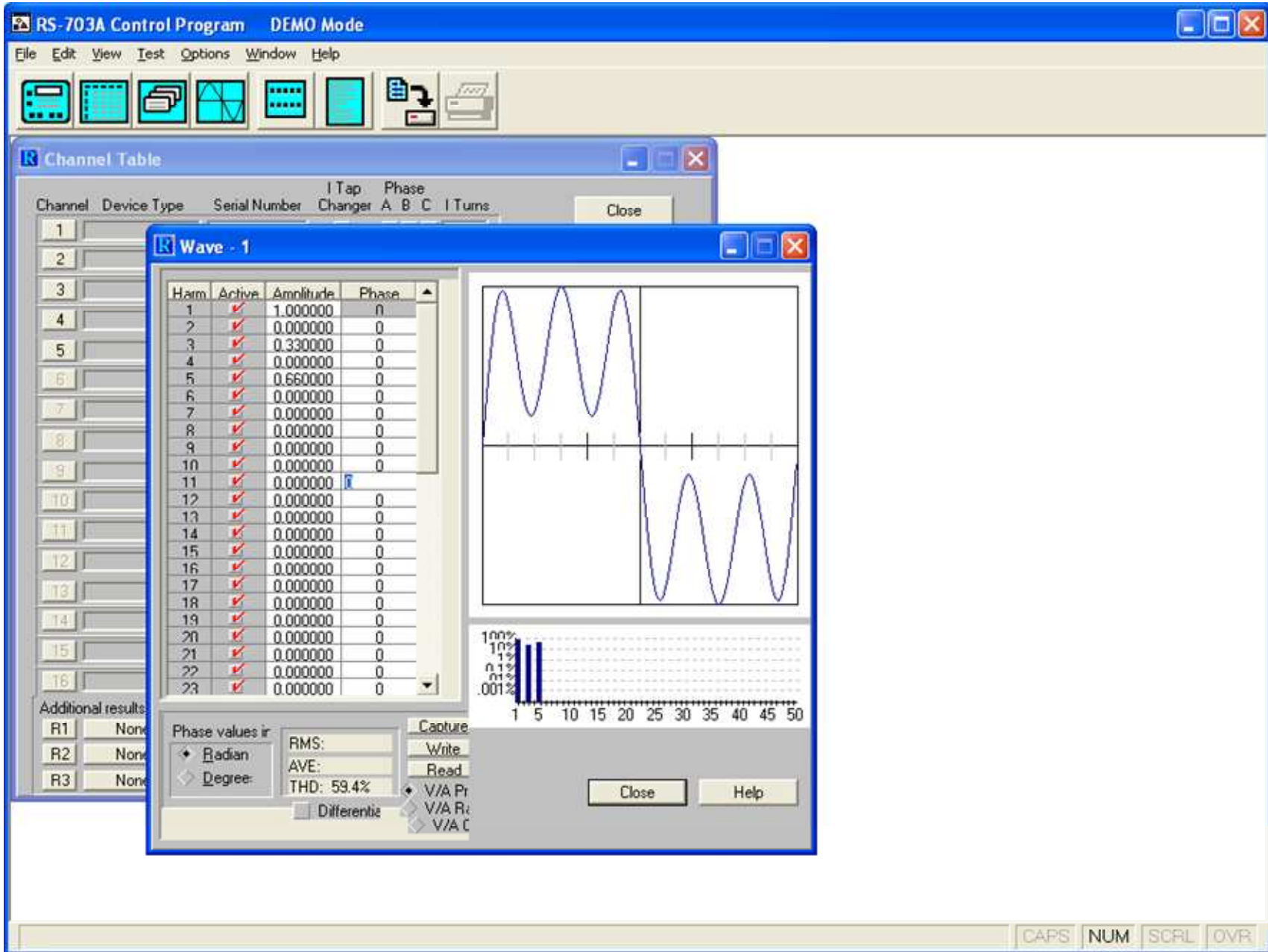
Appendix 3: Creating Voltage and Current Signals with Harmonic Content

2. Select the *New* button. A new *Wave* configuration window will appear.



Appendix 3: Creating Voltage and Current Signals with Harmonic Content

3. Enter the harmonic amplitude and phase parameters. The displayed waveform will change accordingly. Select the *Close* button and save changes when prompted.



The screenshot shows the RS-703A Control Program in DEMO Mode. The main window displays a Channel Table and a Wave - 1 dialog box. The Wave - 1 dialog box contains a table of harmonic parameters and a waveform graph.

Harm	Active	Amplitude	Phase
1	<input checked="" type="checkbox"/>	1.000000	0
2	<input checked="" type="checkbox"/>	0.000000	0
3	<input checked="" type="checkbox"/>	0.330000	0
4	<input checked="" type="checkbox"/>	0.000000	0
5	<input checked="" type="checkbox"/>	0.660000	0
6	<input checked="" type="checkbox"/>	0.000000	0
7	<input checked="" type="checkbox"/>	0.000000	0
8	<input checked="" type="checkbox"/>	0.000000	0
9	<input checked="" type="checkbox"/>	0.000000	0
10	<input checked="" type="checkbox"/>	0.000000	0
11	<input checked="" type="checkbox"/>	0.000000	0
12	<input checked="" type="checkbox"/>	0.000000	0
13	<input checked="" type="checkbox"/>	0.000000	0
14	<input checked="" type="checkbox"/>	0.000000	0
15	<input checked="" type="checkbox"/>	0.000000	0
16	<input checked="" type="checkbox"/>	0.000000	0
17	<input checked="" type="checkbox"/>	0.000000	0
18	<input checked="" type="checkbox"/>	0.000000	0
19	<input checked="" type="checkbox"/>	0.000000	0
20	<input checked="" type="checkbox"/>	0.000000	0
21	<input checked="" type="checkbox"/>	0.000000	0
22	<input checked="" type="checkbox"/>	0.000000	0
23	<input checked="" type="checkbox"/>	0.000000	0

The waveform graph shows a complex periodic signal. Below the graph is a THD (Total Harmonic Distortion) bar chart showing the relative amplitudes of the harmonics. The THD value is 59.4%.

Additional results for R1, R2, and R3 are shown as None. The Phase values are set to Radian. The RMS value is 1.000000, the AVE value is 0.000000, and the THD is 59.4%.