34972A lab training and customer demo guide

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Contents

34972A Lab training and customer demo guide

Introduction:

This Lab and demo guide is an all inclusive document providing both training and tools to be used for 34972A customer demo's, Lunch & Learn events and trade show discussions.

This document is broken into three sections:
1) **Customer facing demo quick guide** – high level guide to be used as an outline for customer demo's. These single sheet guides are recommended for customer facing demo's. The demo's described in this section are a subset of the Lab training. As such the details are not described (but can be found in Lab training section).
2) **Lab training** – to be completed prior to customer facing activities. The 34972A Lab training is designed to give hands-on experience configuring the 34972A, initiating measurements and collecting data using BenchLink DataLogger software. At the end of this lab students will be prepared to discuss and demonstrate key features of the 34972A with customers.
3) **Appendices** with setup instructions – information used to setup lab and demo's.

At the end of this training the student will know:
- How to make DUT connections to the 34901A module.
- Learn how to demonstrate the 34972A, LXI interface and Benchlink DataLogger to your customers.
   - ✓ How to set-up and make various measurements using the front panel.
   - ✓ How to use the 34972A built-in web server and control capabilities to setup and monitor channels.
   - ✓ How to scan channels, monitor channels, and log data with the 34972A and the BenchLink DataLogger 3 software.
- Understand major differences from Benchlink DataLogger 3 and Benchlink DataLogger Pro.

34972A Customer facing demo quick guide

Below are summaries of demonstrations that you can use for customer facing events. For details & training see the lab section of this document. It is assumed that the HW and SW setups are already completed. Items to stress are marked *(italics).*

All software files for these demos and games are contained on the demo cube flash drive.

5 Minute Manual demo

1. Remove module from 34972A and show interconnect– *(ease of connections)*
2. Replace module into 34972A <with power on> – (*hot plug-in capability)*
3. Configure channel 101-103 for 10k thermistor measurement *(stress multiple measurement modes including various temp sensors (TC's) volts, ohms, frequency)*
4. Setup for a 1 second scan and start scanning.
5. Press monitor button, show temperature channel 101-103 by turning knob
6. Turn-on heater and show channel 101 temperature increasing
7. Items to discuss and stress:
    a. *(Up to 120 temp channels using thermocouples)*
    b. *(LAN based LXI interface with easy-to-use built-in web-server)*
    c. *(Benchlink DataLogging software for advanced datalogging & control)*

10 Minute LXI web-server based demo

1. Open web browser, enter 34972A IP address and open 34972A homepage *(no additional software required other than common web browser and Java)*.
2. Select Remote-control radio button (34972A uses Java for advanced control and monitoring features).
3. Configure scan:
    a. Include channels 101-103 set to 10K thermistor measurement
    b. Interval = 2 seconds
    c. Duration = 20 scan's
4. Start scan, then open view data window – point out data accumulating in memory
5. Within 10 seconds of starting scan, pinch with fingers and hold thermistor 5
6. Select view data and show tabular results with timestamps
7. When scan is done (40 seconds), use Select All and Copy to copy data
8. Paste data into Microsoft Excel for analysis *(ease of transferring data into commonly available spreadsheet tools. This approach also works on Linux, using Java and Linux based spreadsheet)*

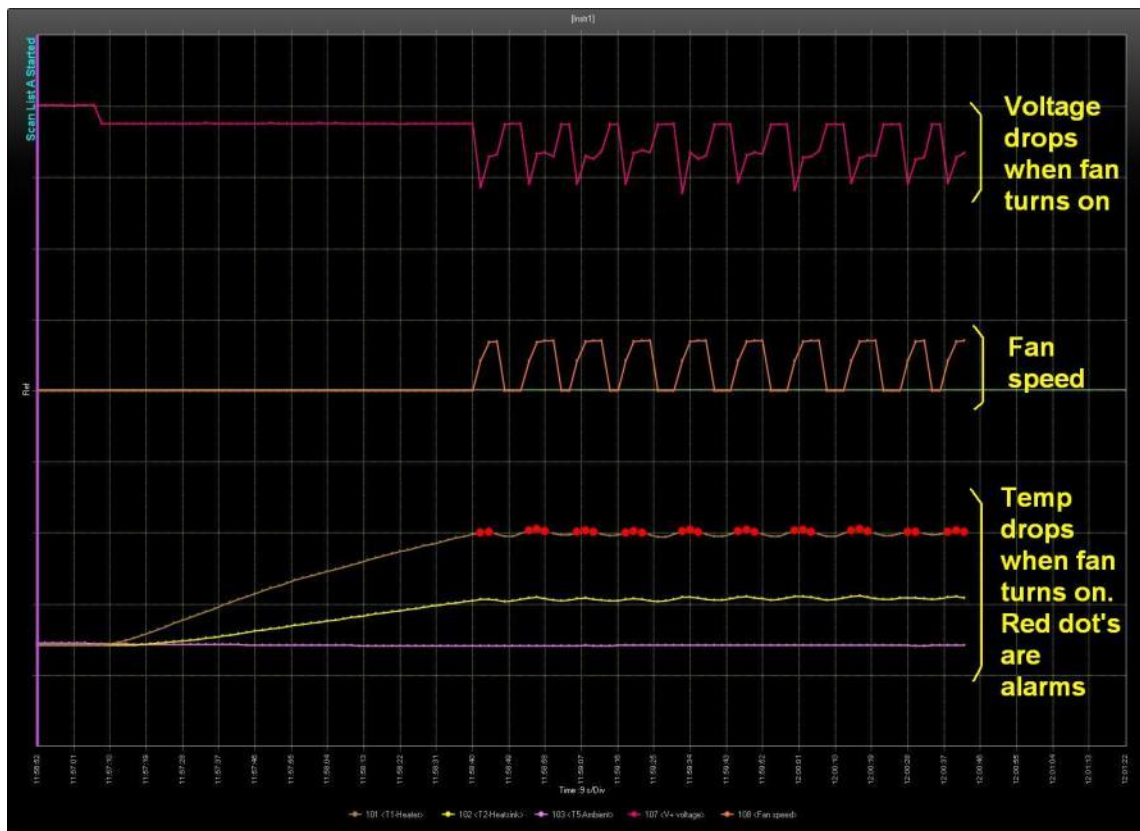## Solar cell game using Excel (trade show or after lab game)

1. Using Microsoft Excel open file *SolarCell game.xls* (located on demo cube flash drive)
2. Using laser pointer, run solar cell game as described in lab
3. Keep a running track of individual's score, give away prizes on the hour

10 Minute Benchlink DataLogger based demo or tradeshow continuous display

1. Start up Agilent Benchlink Datalogger software (*Stress that BLDL-3 is free and BLDL-Pro for purchase provides advanced measurement & control features*)
2. Open **BLDL-Pro quick demo** configuration (verify that target 34972A is correct)
3. Show **Configure Scan Lists** tab (*stress ease of setups*):
   a. Checkbox for scan inclusion (*all of the channels shown are available for scan*)
   b. Name Column (*readable names makes data interpretation easier*)
   c. Function column (*ease of selecting measurement mode – voltage, temp, frequency…*)
   d. Range/Ref and Res columns (*accuracy & speed of scan trade-offs*)
   e. Limit type Column (*setting limits and issuing alarms, and value for external control*)
4. Show Scan and Log Data tab (stress *ease* of scan time & duration setups)
5. Start scan and show Quick Graph tab
6. Turn on heater and let run for at least a few minutes (can run continuously at trade shows)
7. Navigate the graph showing features (*double click for full screen, alarms, tabular data display*)
8. End graph should look similar to shown below (*alarms controlling temperature*).
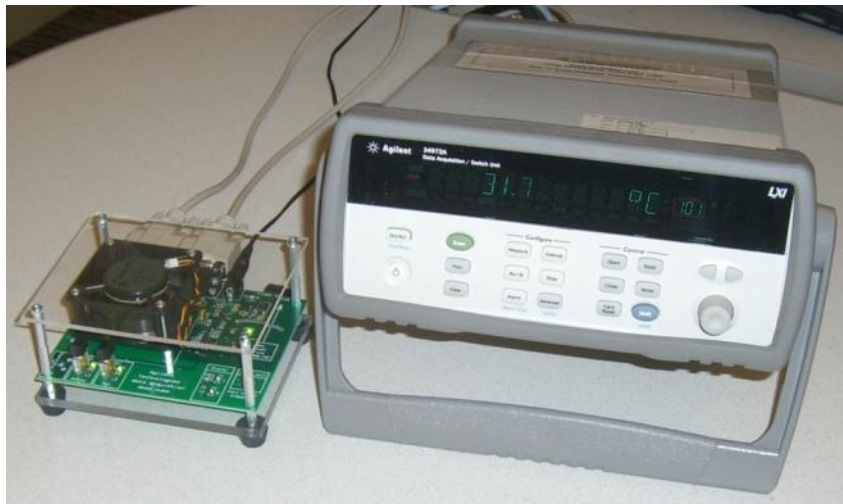
34972A Training Lab

Example data acquisition task; heat flow

Heat and temperature have a profound impact on material characteristics and as such, temperature is one of the most common physical phenomena measured. The span of industries requiring temperature characterization is vast. Heat flow and temperature profiling is usually performed using a data acquisition instrument, and one of the most popular data acquisition solutions is the Agilent Technologies 34970A and the recently released 34972A.

In this example, the temperature performance of a heater and heat dissipation methods need to be characterized. Temperature rise, thermal conductivity, and airflow effectiveness need to be evaluated. This lab will focus on two tools of the temperature profiling: The data acquisition hardware (34972A) and the software required to perform high channel, long duration temperature profiling.

The device under test (DUT) in this case is an Agilent provided PC assembly known as the *demo cube* (Agilent part number ET56380) and 34901A pre-wired module (ET56381). The demo cube has been developed to assist in basic concept training, and can also be used to demonstrate product capabilities to customers.

Lab material

1. Agilent P/N 34972A
2. Computer with LAN interface & LAN cable
3. P/N ET56380 - Demo cube kit containing:
    a. Demo cube PCA with power supply
    b. DB9F-DB9M pass through cable
    c. USB extension cable
4. P/N ET56381 - 34901A module with pre-wired cable

Understanding the *Demo Cube*

Please become familiar with the demo cube and its contents, since it will provide the easiest and most effective method to demonstrate the 34972A to prospective customers. Figure 1 show key sections of the demo cube (see appendix A for schematic and additional information). This demo cube can also be used with the 34970A.
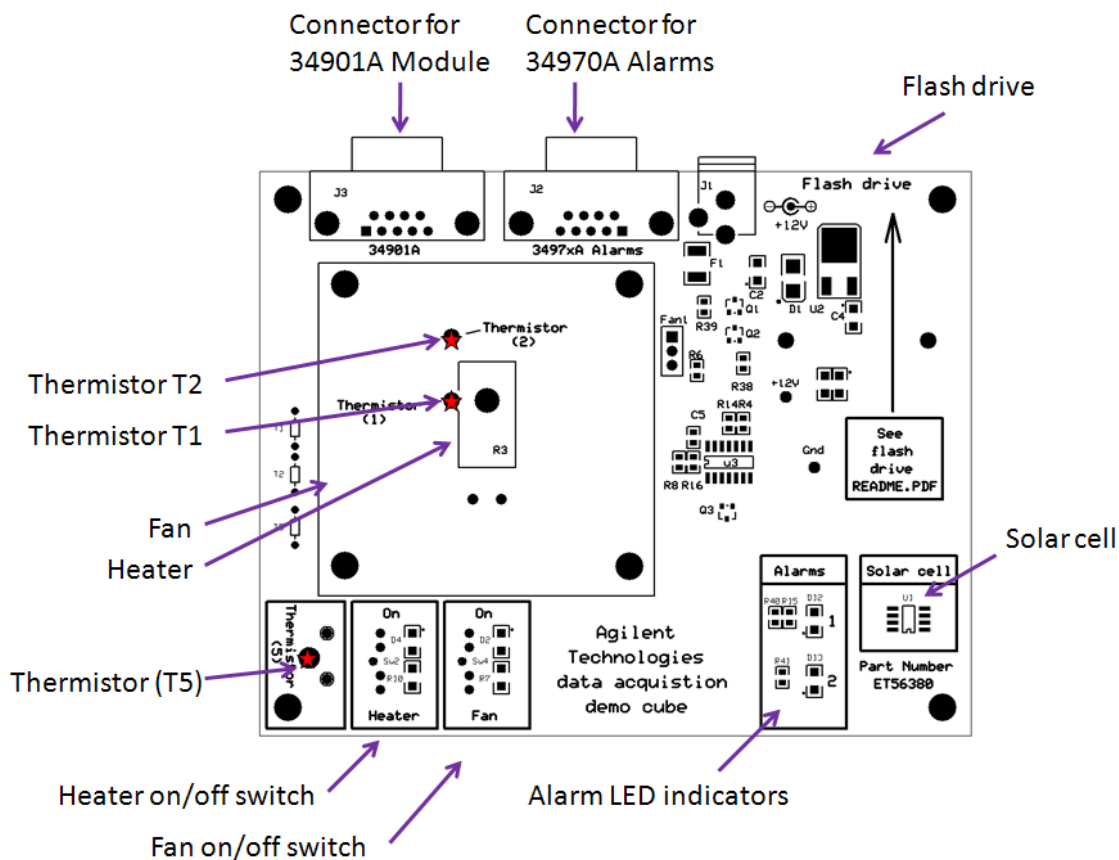

Figure 1 – Demo Cube top view and key components

Six measurement points are located on the demo cube and are wired into the 34901A module. Table 1 shows the connections of the 34972A to the demo cube when connected to the 34901A module using ET56381 pre-wired assembly.

Channel	Demo Cube measurement point	Measurement configuration
101	Thermistor T1 (heater tab)	TEMPERATURE -> THERMISTOR -> TYPE 10 KOHM
102	Thermistor T2 (opposite side of heater)	TEMPERATURE -> THERMISTOR -> TYPE 10 KOHM
103	Thermistor T5 (ambient temperature)	TEMPERATURE -> THERMISTOR -> TYPE 10 KOHM
104	Solar cell connection	DC VOLTS -> 10 V RANGE -> 5 ½ DIGITS
105	No connection	--
106	No connection	--
107	+12V supply	DC VOLTS -> AUTORANGE -> 5 1/2 DIGITS
108	Fan tachometer	FREQUENCY -> 10 V RANGE -> 5 1/2 DIGITS

Table 1 Demo Cube / 34901A connections

Assembly demo set, inspect and verify demo connections

Figure 2 shows the required connections this lab. Inspect your setup and verify these connections. Remove the 34901A module from the 34972A slot 100 by pressing in on the plastic tab and pulling the module out (you can remove and install 34972A modules even with the power on). Visually inspect the wire connections. All of the 34970A modules have been designed for easy access, and connections can quickly be made using a single screw-driver.
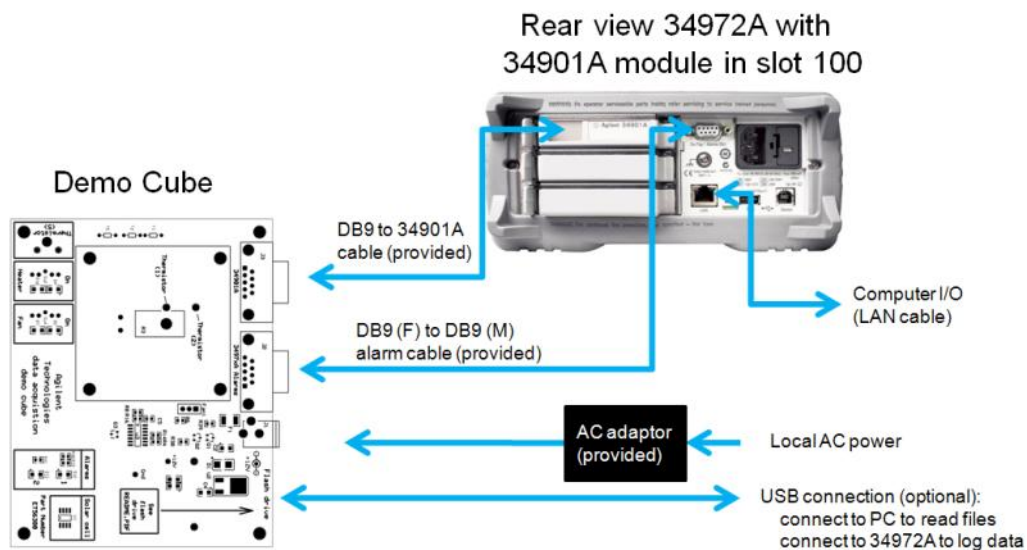

Figure 2 – Demo cube to 34972A connections

Re-install the 34901A module and verify operation of the *demo cube* by toggling fan and heater on/off switches (figure 1). You should hear the fan turn on and the LED's will light indicating the heater/fan on state. Leave all *demo cube* switches in the off (LED's off) state.

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Making 34972A measurements from the front panel

The 34972A channels can be selected and measurements made from the front panel. This section of the lab will introduce you to these manual control methods. Refer to figure 3 for this portion of the lab.
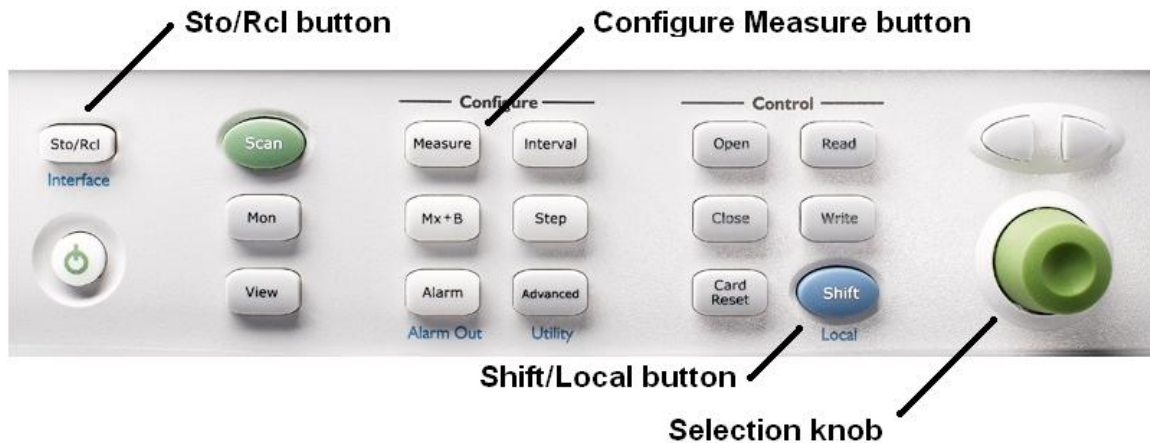

Figure 3 - 34972A front panel and key buttons for this lab

The demo cube measurement points are connected to the 34970A channels as listed in table 1. For this portion of the lab we'll measure the thermistor temperature connected to channel 103. The 34972A supports various temperature sensors, including a variety of thermocouples (Type B,E,J,K,N,R,S,T), Thermistor (2.2k, 5k & 10k) as well as RTD's.

Channel 103 is connected to thermistor T5, which is a 10kohm thermistor. Here are the steps to measure the temperature on Channel 103:

1) If the display shows **REM** in the upper left, the 34972A is in remote mode. **If this is the case**, press the blue **Shift** button once to set into local mode.

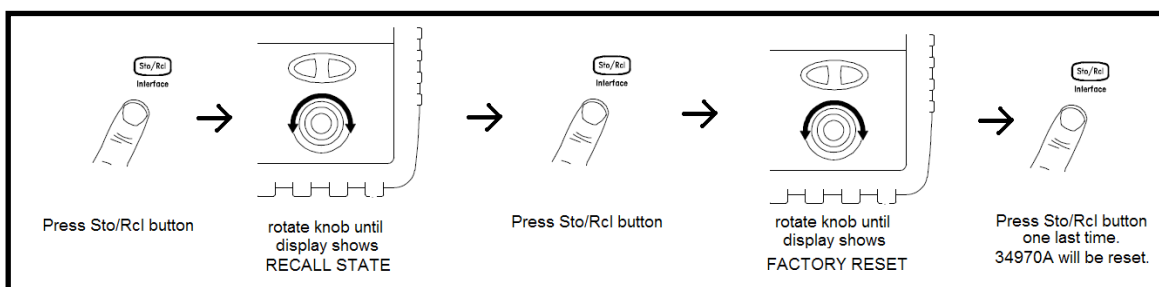2) Set 34972A into Factory Reset state by pressing **Sto/Rcl** button, and selecting menus as shown in figure 4.

Figure 4 – Reset 34970A into factory reset state

3) Now that the 34972A is in a reset state, configure it to show the temperature at channel 103. See table 2 for a step by step process. Setting up for a measurement is accomplished through a series of selections using the 34972A **knob** and **Measure** button (figure 5). After completing the sequence listed in table 2, the temperature will be displayed and should be approximately 24 deg C.

Step	description
1	Rotate knob until **CHANNEL 103** is displayed
2	Press **Measure** button
3	Rotate knob until **TEMPERATURE** displayed
4	Press **Measure** button
5	Rotate knob until **THERMISTOR** is displayed
6	Press **Measure** button
7	Rotate knob until **TYPE 10 KOHM** is displayed
8	Press **Measure** button
9	Rotate knob until **UNITS deg C** is displayed
10	Press **Measure** button
11	Rotate knob until **DISPLAY 0.1 deg C** is displayed
12	Press Measure button
13	Press **MON** (Monitor) button

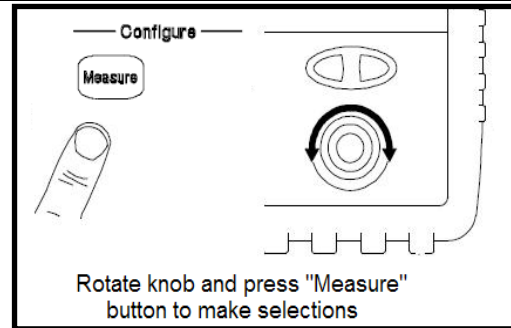Rotate knob and press "Measure" button to make selections

Table 2 – Button sequence for simple channel measurement

Figure 5 – Configuration accomplished using selection knob and Measure button

4) *Optional* - setup and monitor channel 107 (+12V supply) and channel 108 (Fan tachometer) using the settings as described in table 1 and process described in table 2 as a guide. While monitoring the fan (Ch 108), toggle the fan switch on and off and watch as the fan speed changes.

5) *Optional – scanning:* After setting up channels 103, 107 and 108 for measurements as described above, setup a 1 second scan by:
   a. Press the **Interval** button twice to get the display to show "H:M:S 00:00:10:000"
   b. Use the **knob** to set the time to 1 second
   c. Press the **Interval** button two more times to complete a continuous scan setup
   d. Press the green **Scan** button to start the scan.
   e. Press the **Mon** Monitor button to show channel 108. The Mon feature allows monitoring one channel during the course of a scan. While viewing channel 108, turn on and off the fan and watch the speed change.
   f. To stop the scan, press and hold the **Scan** button

End of Manual portion of the lab.

Proceed to *Basic data logging using 34972A LXI web-server with remote control*.

Basic datalogging using 34972A LXI web-server with remote control

The first section described how the 34972A can be configured for measurements using the front panel. However, this method is seldom used for large channel count setups. Most often many channels are measured for extended periods of time (also known as a scan). The front panel manual entry method can be tedious for setting up more than a few channels and scans. Instead, software methods are typically used to setup and control the 34972A.

The 34972A supports various software methods to configure and run scan's. Three of the most common methods are:

1) Use the 34972A **LXI (LAN)** built-in web server and remote control features
2) Use 34826A Benchlink DataLogger (free) for easy datalogging applications
3) Use 34830A Benchlink DataLogger-Pro for advanced datalog and control (purchased product)

This section of the lab will introduce you to the powerful 34972A LXI control features. All LXI (**L**AN e**X**tensions for **I**nstrumentation) products have a built-in web server. The 34972A LXI interface is the easiest and fastest method for users to setup scan's and capture results.

Steps for LXI interface Lab

I. Connect LXI interface and open a 34972A Web-server homepage
II. Create and configure scan list using 34972A remote control features
III. Configure, start and monitor scan results
IV. Save results into CSV format and display using Microsoft Excel spreadsheet

I. **Connect LXI interface and open 34972A Web-server homepage**
If lab station is not already setup, see Appendix E and F for details on configuring and connecting the 34972A demo. To use the built-in web server, determine the IP address for the 34972A:

- Connect LAN cable directly from your PC to 34972A
- Turn on PC and 34972A and wait approximately 1 minute for PC and 34972A's to negotiate IP address.
- Determine the 34972A IP address by pressing the following buttons:
  o Press blue **Shift** button once (see figure 3)
  o Press **Sto/Rcl (Interface)** button six (6) times until display shows *IP ADDRESS*
  o Wait 1 second, and IP address will be displayed, record the IP address.

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Open up your Web browser and type in the IP address of the 34972A. The 34972A homepage will open as shown in figure 6. Note the buttons on the far left of the screen. Using the curser, hover over the buttons to see specific functions for each button.   Click on the second button from the top (1) to access the **Remote Control** window. The remote control feature uses Java, and it may take several seconds to half a minute for Java to start (Java is available for free at www.java.com).

Figure 6, 34972A web-server homepage

II.   Create and configure scan list using 34972A remote control features

You should now see the remote control window similar to Figure 7. Follow these steps to create a scan list.

1) Select **Allow Full Control**
2) With the mouse (or touchpad) move the cursor, hover over channel 101 and press the **right** mouse (touchpad) button. The window **Channel 101 Configuration** will appear.
3) Check the **Enable Measurement (Include in Scan List)** box
4) Use the **Function** drop-down box to select **Temp 10k Therm**
5) Use the **Integration Time** drop-down box to select **0.2 PLC; < 0.00001 x Range**
6) Click **Apply** button

7) Press the **Copy Settings…** button. When the **Copy Channel 101 Configuration** window appears, type **102:103** into the text box and press **OK**

8) Press the **OK** button to close the **Channel 101 Configuration** window and press **OK** to close the **Channel 101 Configuration** window.
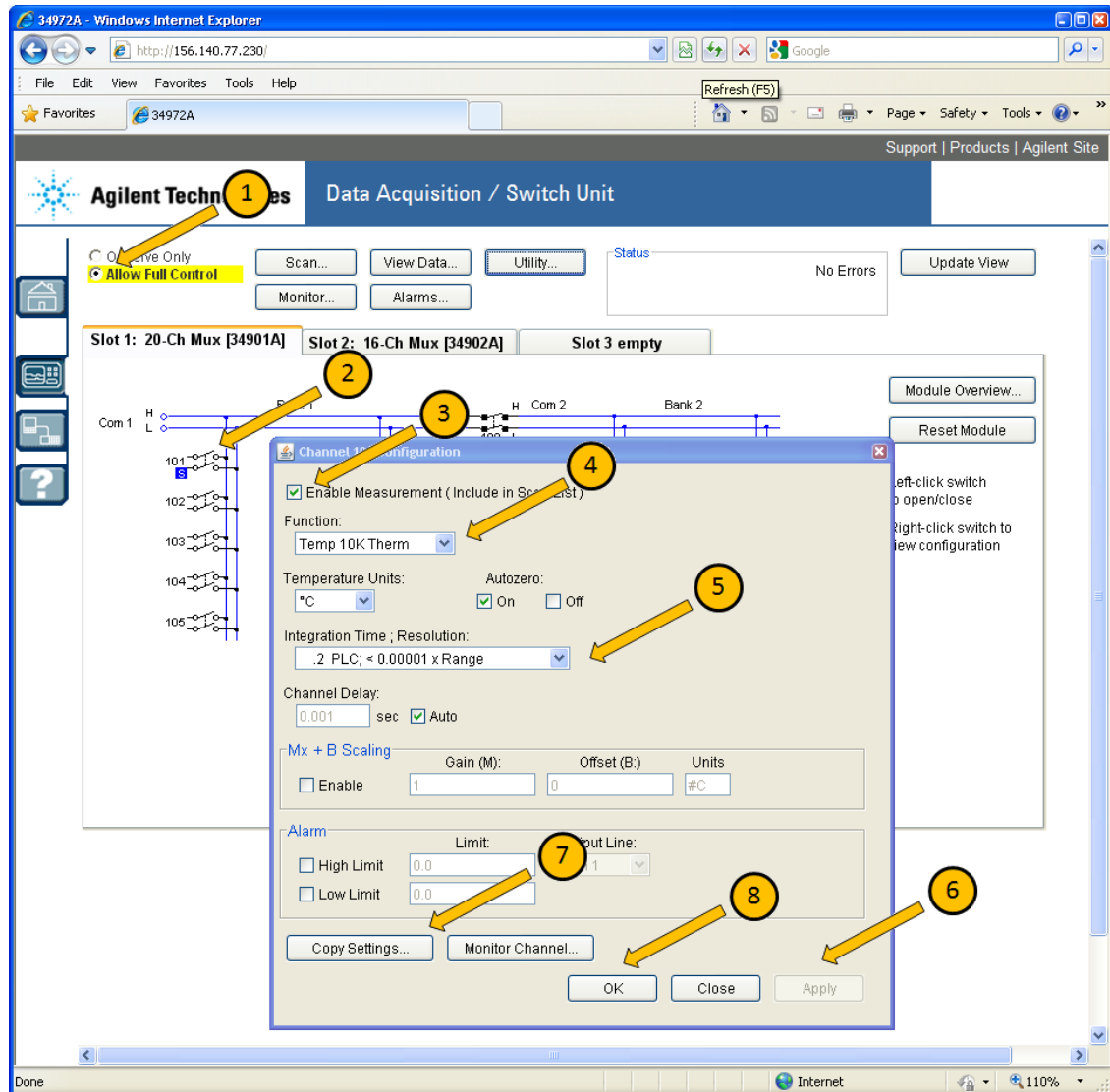

Figure 7, 34972A Remote Control window

At this point you will see a small blue icon next to channels 101-103 ( ). This means they are included in the scan list.

III.   Configure, start and monitor scan results

In the next steps we will configure the time between scan's and total number of scan's. We'll start the scan and monitor the results. Start by pressing the **Scan…** button to open the **Scan Control** (**SC**) window. Next follow these steps using Figure 8 as a guide:

- Set the **Trigger Source** to **Interval Scan** (**SC1**)
- Set **Scan interval** to **2 sec** (**SC2**)
- Set **Trigger Count** to **20** (may need to deselect the **Infinite** checkbox first)(**SC3**)
- Press the **Apply** button (**SC4**) and
- Press the **Start Scan** button (**SC5**); you should hear relays click as the 34972A scans
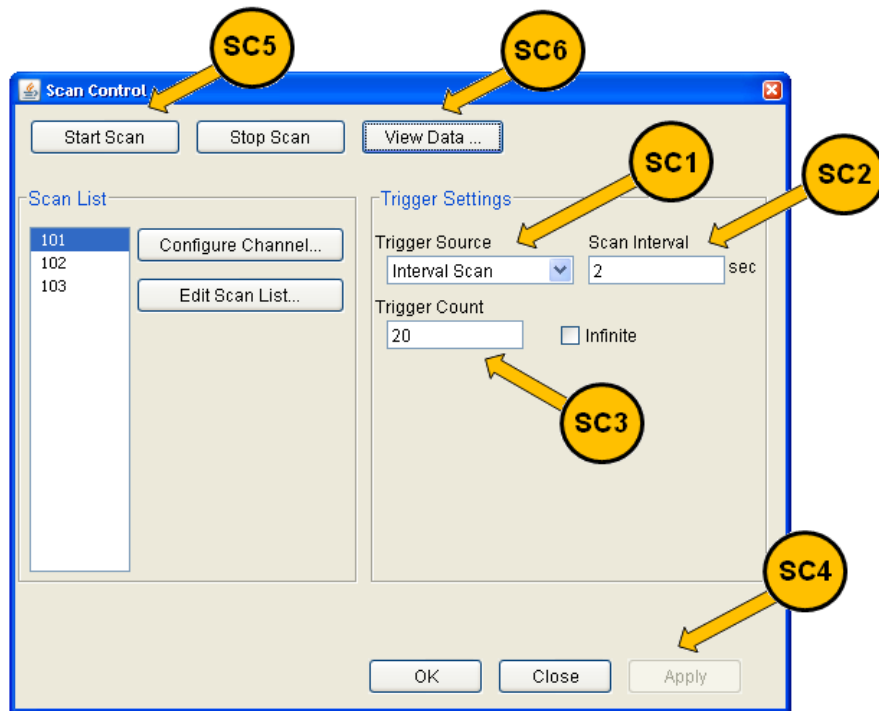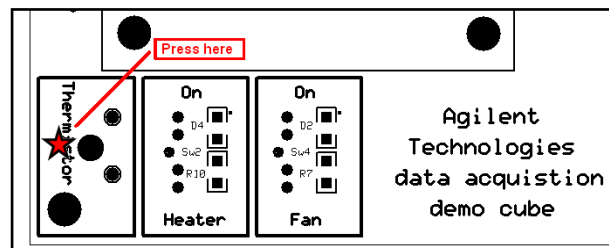- Press the **View Data…** button (**SC6**) and the **View Data** (**VD**) window (figure 9) will open

Figure 8, 34972A Scan Control window

While the scan is running, place your thumb on the *demo cube* Thermistor 5 and hold (see image right).
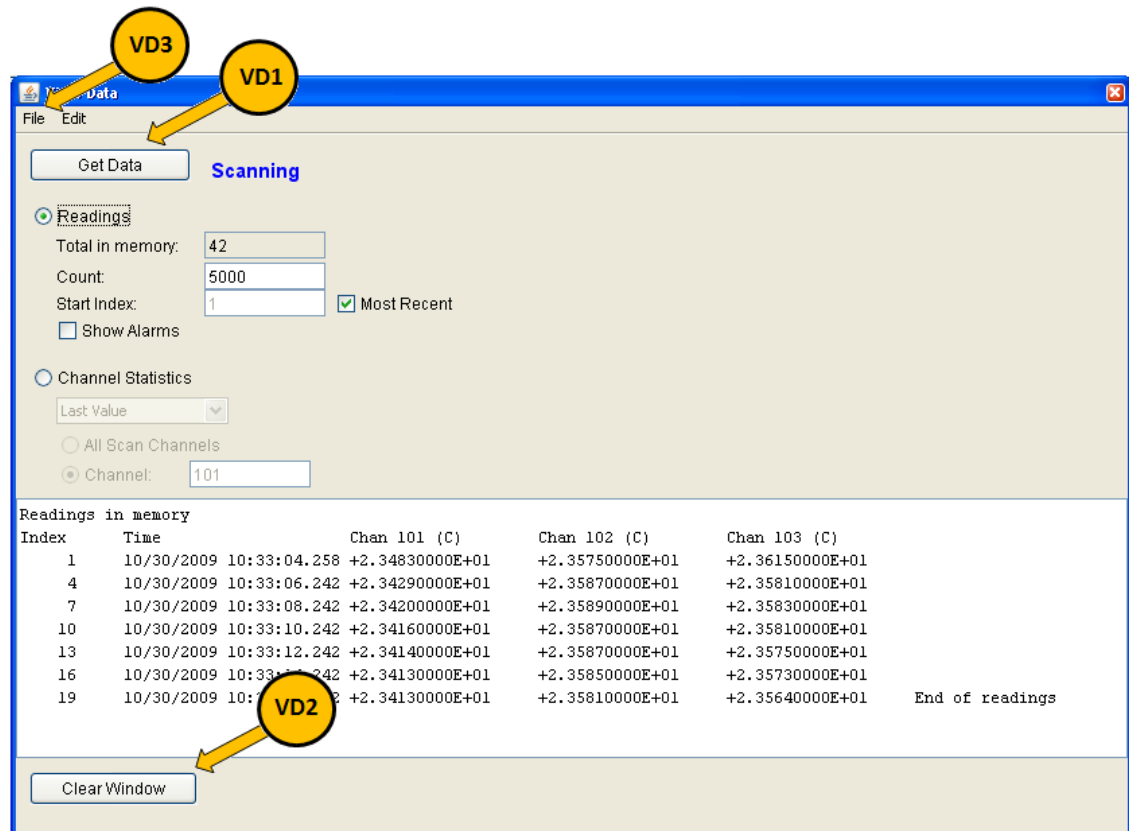

Figure 9, 34972A View Data window

Monitor the scan in process by pressing the **Get Data** (**VD1**). Notice if you press **Get Data** multiple times while the scan is running the data captured up to that point is displayed. This allows monitoring a scan in process. Press **Clear Window** (**VD2**) button to clear the window.

When the scan is completed (40 seconds), press **Clear Window** (**VD2**) and then **Get Data** (**VD1**) to get a clean view of all the data.

IV. <u>Save results into CSV format and display using Microsoft Excel spreadsheet</u>
Store the data by pressing **File -> Save As… (VD3)** and then save the data to a CSV file on your desktop. Use Microsoft Excel (if available) and open the CSV file. *Optional* - using Excel's graphing feature, select the columns and create a graph similar to one shown in figure 10.
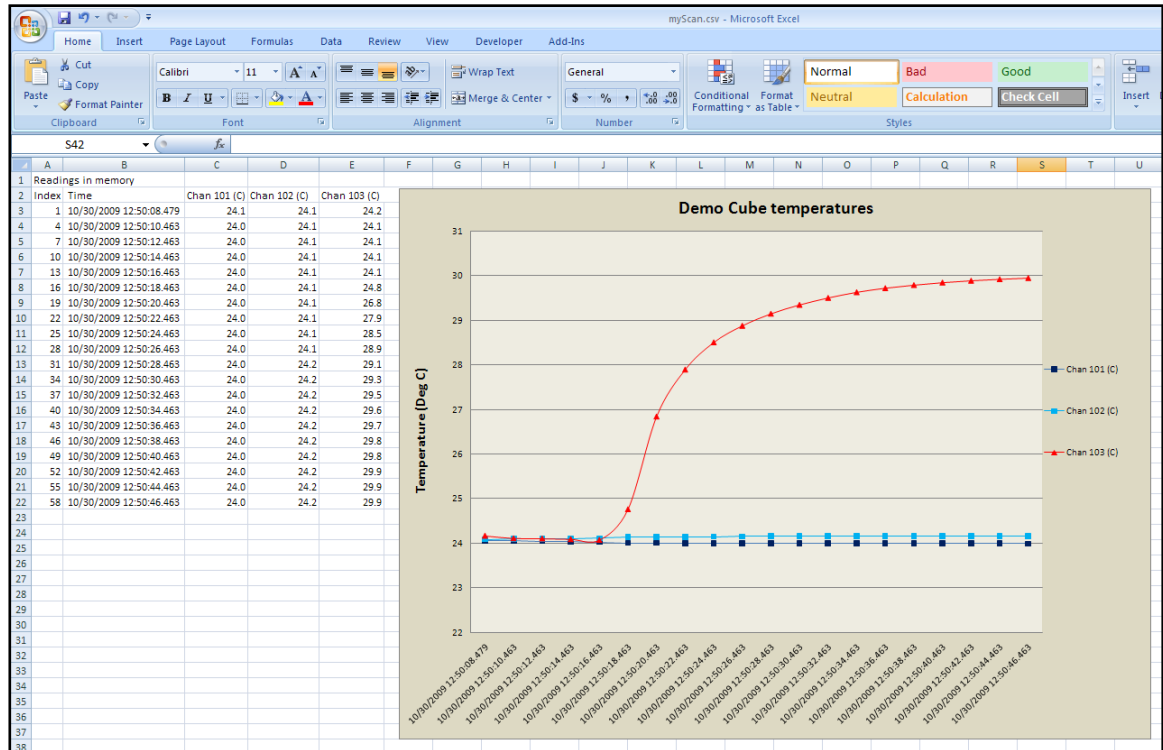
Figure 10, Demo cube thermal plot, Chan 103 (red trace) is thermistor 5

The 34972A built in LXI Web –server with powerful control and monitor features allow scan setup and execution to be done very quickly. The results can be saved in a CSV format, and simple tools such as Microsoft Excel may be used for data analysis and display.

End of LXI control portion of the lab.
Proceed to Basic datalogging using Agilent Benchlink Datalogger software.

Basic datalogging using Agilent Benchlink Datalogger software

As presented earlier, the 34972A supports three different software tools to configure and run scan's:

1) Use the 34972A LXI (LAN) built-in web server and remote control features
2) Use 34826A **Benchlink DataLogger 3 (free)** for easy datalogging applications
3) Use 34830A **Benchlink DataLogger-Pro (purchased product)**

This section of the lab will demonstrate using the Agilent Benchlink Datalogger with the 34972A. This section of the lab can be run on either Benchlink Datalogger 3 (BLDL-3) or Benchlink Datalogger Pro (BLDL-Pro). For basic data logging the operation of the two are very similar. Depending on which version of BLDL you are using the graphics will vary slightly, but the overall task flow will be the same. Differences will be pointed out in the text. The last section of the lab is optional, and requires the use of BLDL-Pro.

We'll describe the process to open, modify, start, view and store a scan:

Step 1) Start Benchlink DataLogger & open an existing configuration
Step 2) Verify communications with the 34972A
Step 3) Inspect and modify channels in the list
Step 4) Start the scan
Step 5) View and customize the graph
Step 6) Stop the scan and export the data

If not already completed, install Agilent I/O Libraries and BLDL-3 or BLDL-Pro software as described in appendix B.

NOTE: 34972A must be configured in the Agilent Connection Expert (ACE) before the BLDL software will communicate to the 34972A. To configure in ACE, see **Appendix F: Installation configuration and verification**.

NOTE: The 34972A must be configured in Agilent Connection Expert (ACE) before the BLDL software will communicate to the 34972A. See Appendix D: Installation configuration and verification.

Step 1) Start Benchlink Datalogger & open existing configuration

- Double-click the BLDL-Pro icon on the desktop. Depending on your installation you may see the welcome window displaying buttons for licensing and getting started help. If so press the Close button. NOTE: BLDL-Pro can be installed and used at no charge up to 30 days for evaluation.

- The user interface will open (figure 11). NOTE: BLDL-Pro has 5 tabs and BLDL-3 only has 4 tabs. The tabs are identical except BLDL-Pro has an extra tab called **Configure Events** (not used in this section of the lab).
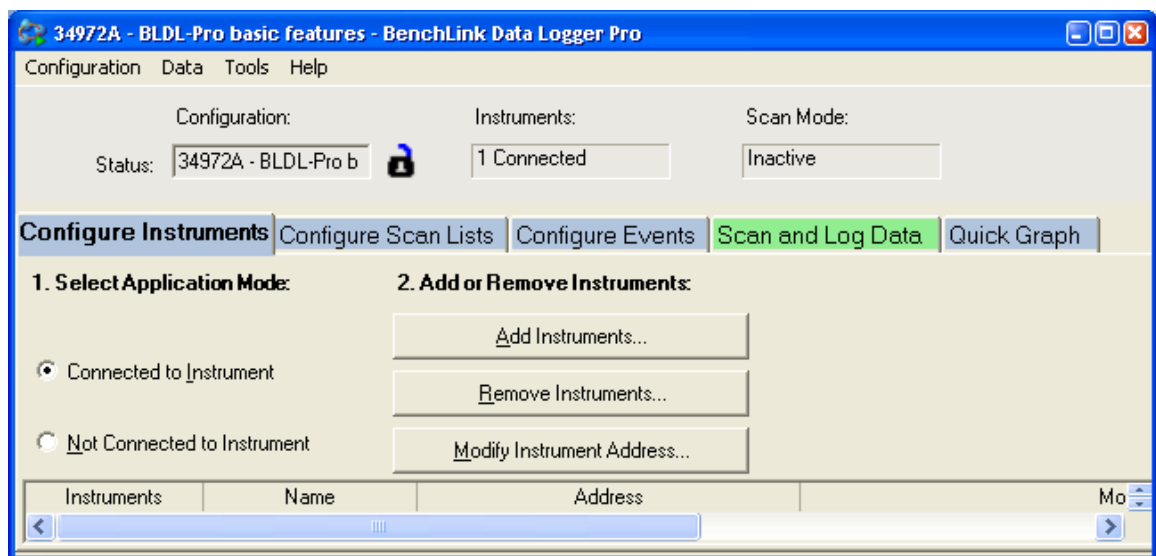

Figure 11 – BLDL-Pro user interface

- A Configuration file has already been created for this lab. Click **Configuration -> Open** and from the Configuration list select **34972A-BLDL-Pro basic features.** Press **Open** to open the configuration (figure 12).
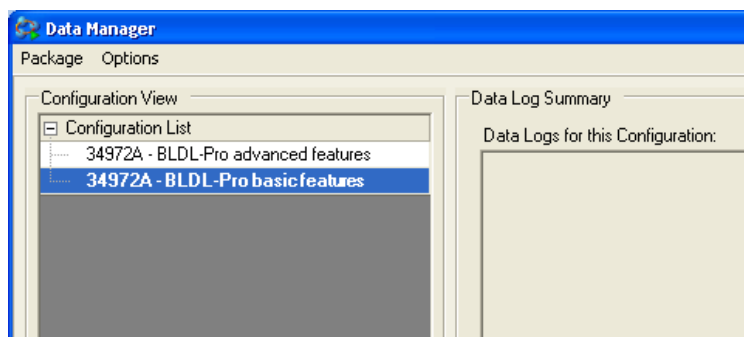

Figure 12 – Open configuration 34972A-BLDL Lab

Step 2) Verify target 34972A

- When the configuration opens, notice that the **Instruments** column now shows a 34972A (figure 13). BLDL configurations include instrument information with them. When this configuration was created the target instrument was a 34972A at address TCPIP0::156.140.77.230::inst0:INSTR. You will likely need to change the address to match that of your 34972A. Do this by selecting **Modify Instrument Address…** button. In the **Modify Address** window select **Modify** Icon, and in the **Connected Instruments** window press **Find**. When your 34972A is displayed, check the **Select** box and press the **Modify Address** button. If you want to avoid changing the 34972A IP address each time you use BLDL see appendix 6 on setting a static IP address inside the 34972A.

  NOTE: You may see a pop-up window stating that the configuration is "Read Only". This means a previous scan has been run and old data is present. In this case, the previous data is not critical and you can press the **Delete Data Log** button.
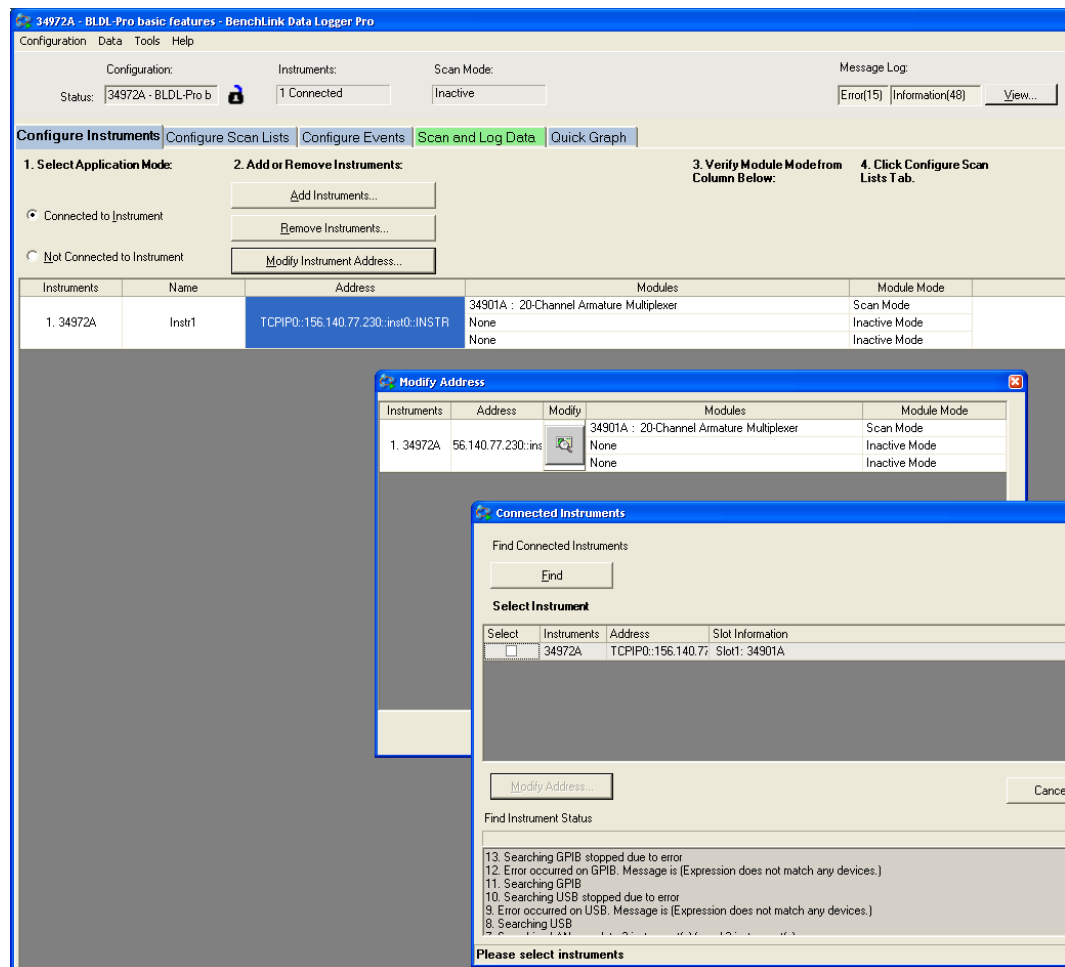

Figure 13 – Configure instruments – Modify Instrument address if needed

Step 3) Inspect and Configure channels

- Select the **Configure Scan Lists** tab. Notice the large number of 34972A channels that show up in the table. All of these channels are available to enter into a scan. For this configuration most of the channel information has been added for you. Inspect and make modifications if needed to match settings shown in figure 14:

    - **Scan:** select check-boxes to include channels
    - **Name:** assign names to channel, type in desired name
    - **Function:** select Temp 10K Therm, DCV or Frequency as shown in figure 9
    - **Range, Res and other columns:** can be left at defaults

Figure 14 – Select and configure the channels to include in scan

Step 4) Set up scan settings

- Select the **Scan and Log Data** tab. The first screen seen is a summary of the channels just configured. A quick inspection will verify the channels are correct. Notice the **Scan Control** section (as shown at right). Configure the scan settings by pressing the **Set…** button. In this case set the **Interval (Time between Scans)** to 2 seconds and press OK (figure 15).

Figure 15 – Setting up scan and data control

Step 5) Start the scan

- Now start the scan by pressing the green **Start/Stop** button (figure16).
- Depending on your specific installation, you may see different pop-up windows:
  - BLDL-Pro – if using 30 evaluation license a window will open reminding you how many days left you have on the license. Press **Continue** button to continue.
  - BLDL-Pro may display warning box about "scan list contains one or more Thermistors…". This is not an issue and can be ignored. Press **Yes** to continue.
- You should hear the relays clicking once every 2 seconds.

Figure 16 – Starting the scan

Step 6) View and customize the graph

- Select the **Quick Graph** tab. The Benchlink Datalogger has an easy to use graphical display that allows visual monitoring of the scan process.
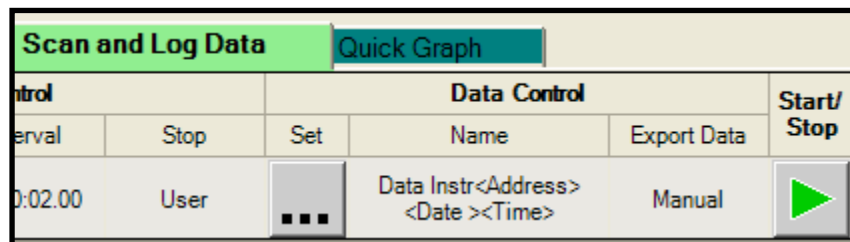- The **Quick Graph** tab provides an easy to use interface to visually follow the scan results. For easiest viewing, set the scales as shown below and figure 17.

Channels	Scale Y		Move Y Ref	
101	10	C	60	C
102	10	C	60	C
103	10	C	60	C
107	5	VDC	0	VDC
108	200	Hz	0	Hz
Scale X-Axis (Time):	1min			

Channels			Modify Y-Axis View			
ID	Color	Graph	Scale Y		Move Y Ref	
101 <T1-Heater>			10	C	60	C
102 <T2-Heatsink>			10	C	60	C
103 <T5-Ambient>			10	C	60	C
107 <V+ voltage>			5	VDC	0	VDC
108 <Fan speed>			200	HZ	0	HZ

Figure 17 – Optimize viewing by adjusting settings

- Turn on the heater and allow temperature to stabilize. It may take a while, so please be patient (at least 60 seconds).
- While waiting for the temperature to settle, explore the interface and see what features you can find. Some suggestions:
  - ➢ Select Markers and change trace colors.
  - ➢ Hover over trace. Value at that point will be displayed.
  - ➢ Explore the Preference tab to see display options available.
  - ➢ Double click anywhere in the graph black area to view graph full screen mode
- Turn on the fan and let temperature settle for at least 60 seconds and then turn off the heater
- End graph should begin to resemble Figure 18. Power supply DCV is shown on top, fan speed shown in middle and three thermistor temperatures shown on bottom. NOTE: your temperatures measured may vary slightly from that shown in figure 18 (due to various hardware versions of the demo cube).
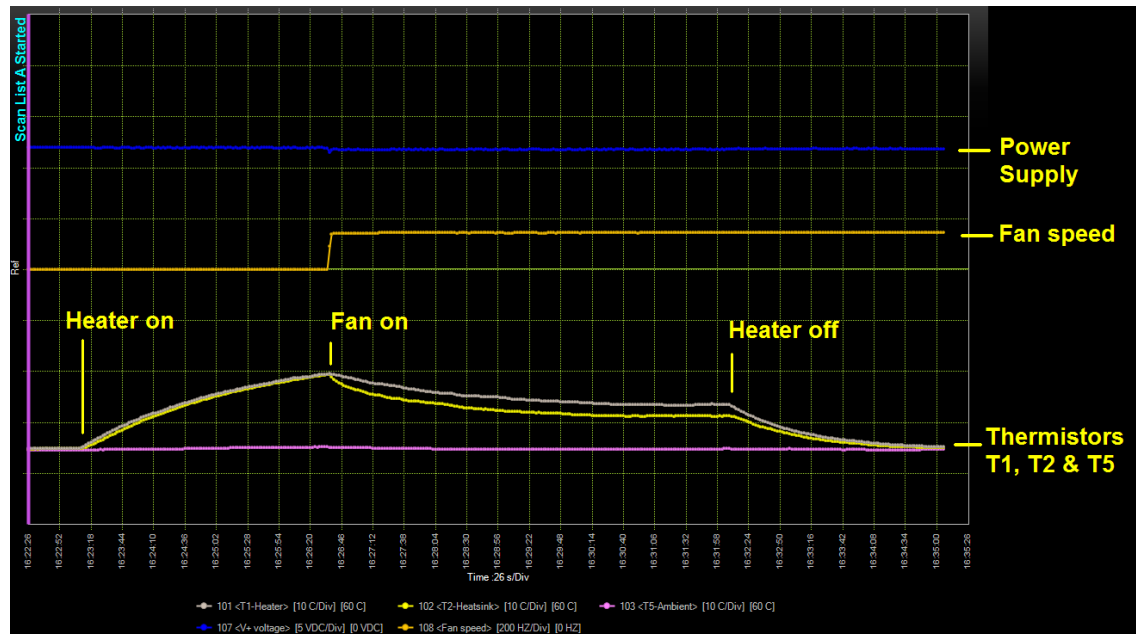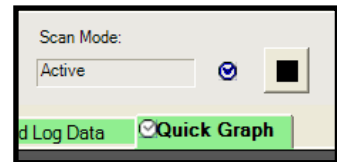
Figure 18 – BLDL display. Top trace is Power supply, second is fan speed and bottom three traces are temperature

Step 7) Stop the scan

- Stop the scan by pressing the large black button as shown to the right.
- A window titled **Scan and Log Data Summary** will appear. This window will allow you to add comments and export the data just collected by using the **Export Data** button (NOTE: on the DEMO version of Benchlink DataLogger Pro, the **Export Data** button is grayed out so you cannot save the data).

Summary - basic datalogging

The information shown in figure 18 is of great value to technicians, engineers and scientists. Temperature is a very significant factor that affects many material properties. Information on thermal rises, conductivity and time constants can easily be captured, archived and analyzed using the 34972A and Benchlink Datalogger 3 or Benchlink Datalogger Pro software, saving the user many hours of valuable time.

Advanced datalogging and control - Using BLDL-Pro

All of the features presented so far in this lab are available in either BLDL-3 (at no charge) or BLDL-Pro. This section will describe features only available on the BLDL-Pro software.

In some cases out-of-temperature or other conditions need to generate an alarm, jump to different scan lists or modify instrument settings. BLDL-Pro allows conditional branching and control capabilities not available in the BLDL-3 software. This section will show you examples of those advanced features.

In this example we will monitor the temperature of the demo cube's heater. If the heater temperature rises above preset limit level, the BLDL-Pro will modify the scan to increase scan rates. If the temperature rises above a second limit level, BLDL-Pro will set an alarm, turn on the fan, and send out an email to the engineer.

To run this portion of the lab:
   a) Set the heater and fan switch on the demo cube to the "off" state.
   b) From BLDL-Pro, select **Configuration -> Open** to select scan configuration "**BLDL-Pro Lab advanced features**"
   c) Inspect the **Configure Scan Lists** tab. Notice there are multiple scans shown (figure 19). BLDL-Pro supports multiple scans and conditional branching from scan to scan.
   d) Start the scan using the Green arrow and view the Quick Graph to see the results (remember to disregard the evaluation license reminder window by pressing the **Continue** button).
   e) Set the heater switch to the "on" state and allow the scan to run for a few minutes.
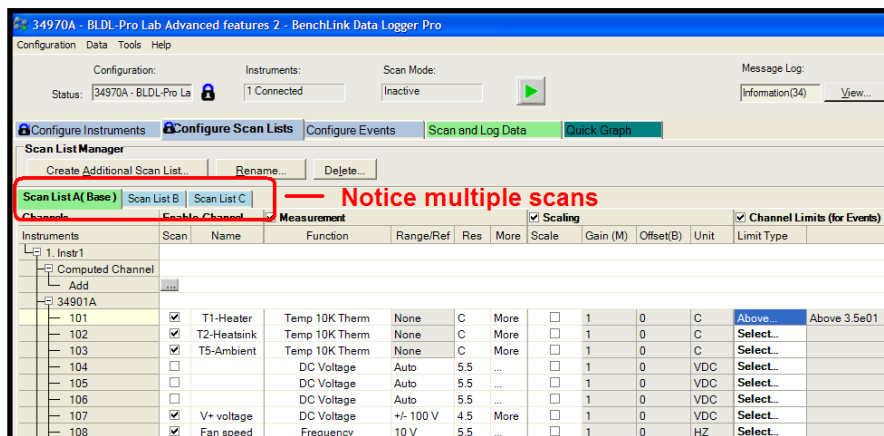

Figure 19 – BLDL-Pro supports multiple Scan Lists and conditional branching
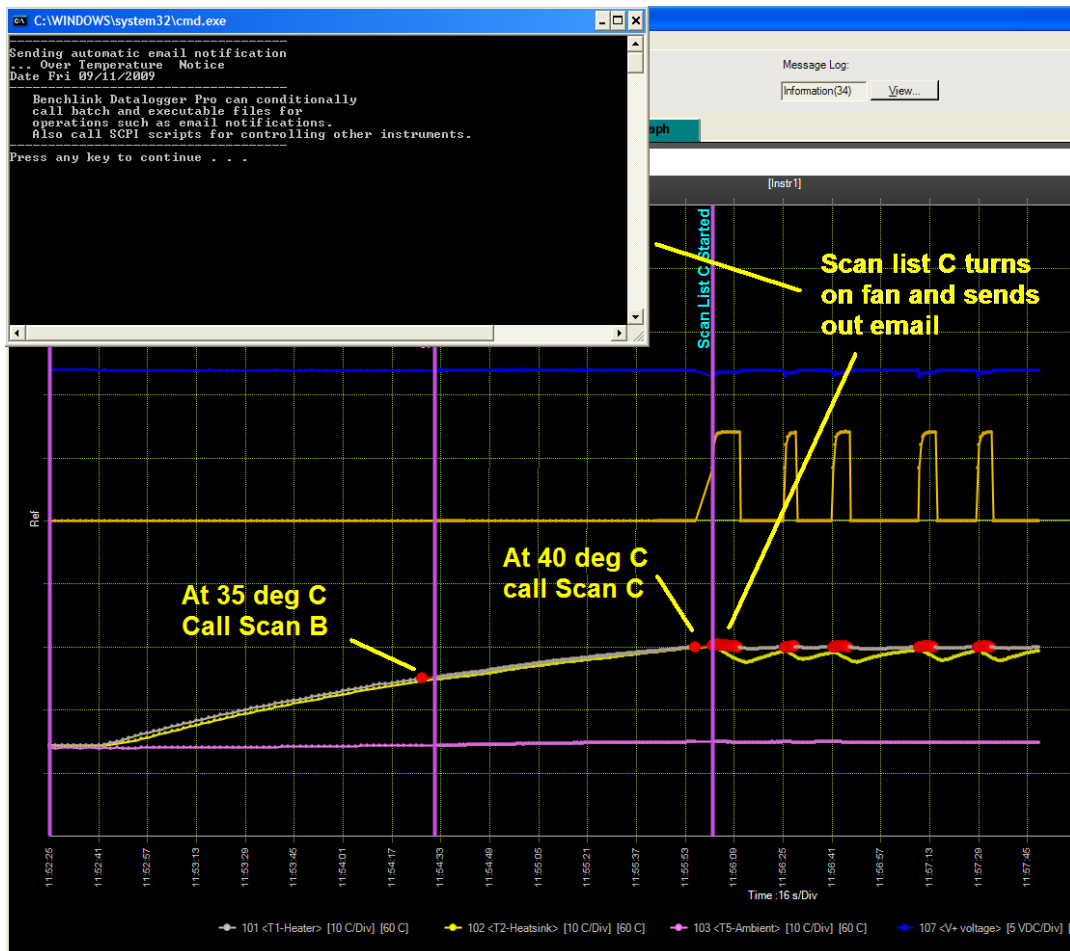
Figure 20 – BLDL-Pro conditional branching and batch file execution

When the temperature reaches the first limit point (35 deg C in this case), the scan jumps to Scan List b. Scan list b has a higher scan rate, and you can hear the difference. At the second limit point (40 deg C in this case), Scan List c is called, an alarm is set to turn on the fan, and an email batch file is called. Batch or executable files can be used to send out notifications such as emails. In this case this batch file indicates an email has been sent to the engineer so they can respond to the over temp condition.

NOTE: your temperatures measured and set-points may vary slightly from that shown in figure 19 (due to various hardware versions of the demo cube).

Summary Advanced datalogging and control with BLDL-Pro
In some applications, advanced Datalogging and control features are required. Common applications include control of thermal chambers, adjusting power supplies or changing scan lists depending on previous measured results. The Benchlink DataLogger Pro provides these advanced features.

End of lab

Solar Cell game

Here is a game that can be used either during tradeshows or at the end of the training labs. This lab demonstrates the ease of programming the 34972A using standard, commonly available software utilities. In this case, the software tool is Microsoft Excel which comes with built-in Visual Basic for Applications. To run this lab, first make sure the Agilent I/O libraries are installed (see appendix for details). Open the file **SolarCell game.xls**. If the message box "enable active content" is displayed, select ok to continue.

In cell E7 enter the **Visa address** string for your particular 3497xA (available from the I/O libraries – see appendix).

Run the game by pressing **Execute Command List** button on the spreadsheet. First participant attempts to hold a laser pointer on the demo cube solar cell as steady as possible for 10 seconds. Next the second participant does the same. At the end, the results of 100 readings, once every 100mS (10 seconds) are displayed as shown in figure 21. The winner is the one with the steady hand as indicated in the Volt*Sec result. See appendix F for additional game ideas.
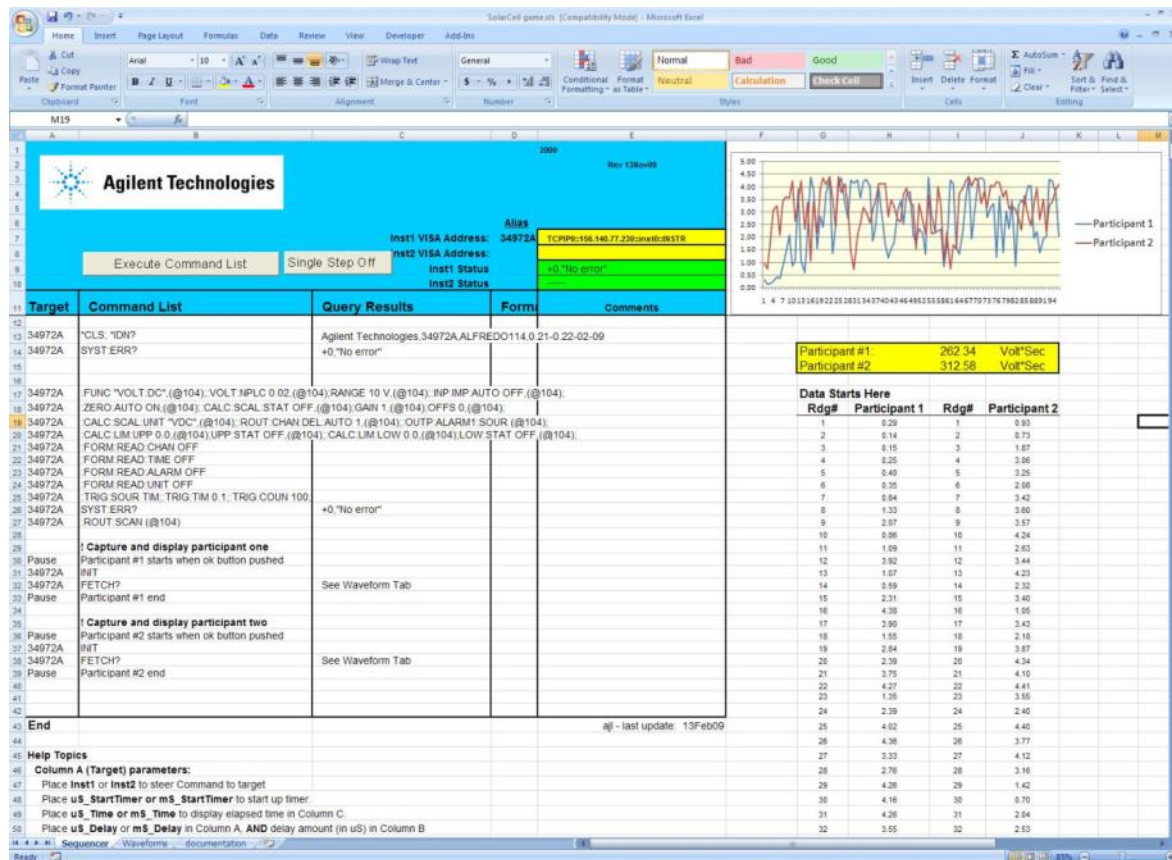

Figure 21 Solar cell game using Microsoft Excel
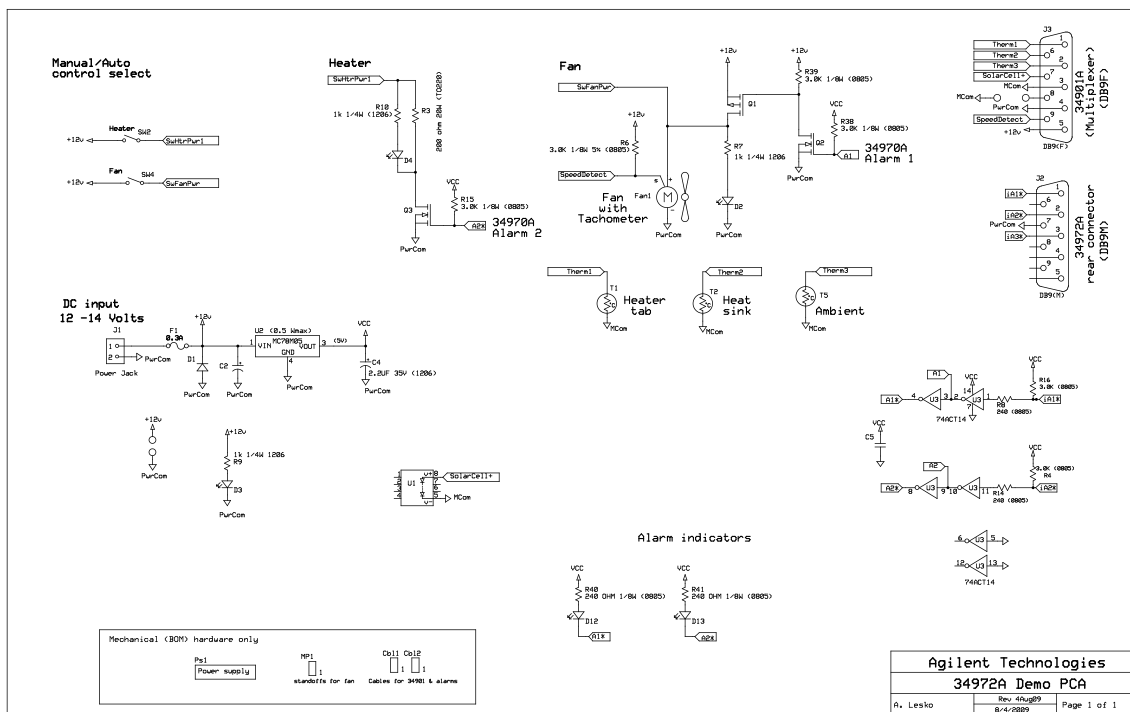
Appendix A – demo cube details

Figure A1 –schematic of demo cube

Channel	Demo Cube measurement point	Measurement configuration
101	Thermistor T1 (heater tab)	TEMPERATURE -> THERMISTOR -> TYPE 10 KOHM
102	Thermistor T2 (opposite side of heater)	TEMPERATURE -> THERMISTOR -> TYPE 10 KOHM
103	Thermistor T5 (ambient temperature)	TEMPERATURE -> THERMISTOR -> TYPE 10 KOHM
104	Solar cell connection	DC VOLTS -> 10 V RANGE -> 5 ½ DIGITS
105	No connection	--
106	No connection	--
107	+12V supply	DC VOLTS -> AUTORANGE -> 5 1/2 DIGITS
108	Fan tachometer	FREQUENCY -> 10 V RANGE -> 5 1/2 DIGITS

Table A1 – measurement map to 34972A channels

What's included in the demo kit:
1) Demo assembly as show in figure 2
2) Flash memory drive located on demo assembly containing the following:
    a. README.TXT for overview information
    b. A copy of this document
    c. Benchlink Datalogger Pro DEMO version (to be installed on your PC)
    d. Benchlink Datalogger Pro example configurations
    e. Agilent I/O Libraries (to be installed on your PC)
    f. Sales tools located in directory "Sales tools"
    g. Application notes located in directory "Application notes"
3) Two DB9 cables:
    a. One connects to 34901A (included)
    b. One connects to 34970A Alarm connector (DB9F on rear of 34970A)
4) 12Volt power supply
5) One USB extension cable
6) Agilent 34901A module pre-wired to one of the two DB9 cables

What's not included in the demo kit:
1) The 34972A may need to be procured from demo stock.
2) LAN and localized instrument power cables

Appendix B – Software installs
1) Copy the directory **34972A Demo Install** located on the demo cube flash drive onto your PC desktop
2) Install Agilent I/O libraries. The I/O libraries proved a simple method to interconnect software applications to the instruments. A copy of the libraries is located on the flash drive on the demo cube assembly. Install the libraries by:
    a. Navigate to **34972A Demo Install\34972A Demo install\ Agilent IO Libraries**
    b. Execute the file **IOLibSuite_15_5_13009_1.exe**
3) Install Agilent Benchlink DataLogger Pro DEMO version. This software application is one of the easiest methods for customers to begin data acquisition measurements with the 34972A. Install the software by:
    a. Navigate to **34972A Demo Install\34972A Demo install\BLDL installation files**
    b. Execute the file **BenchLinkDataLoggerPro_3_0_DEMO.exe**
4) Open Benchlink DataLogger and unpack the configuration files. The configuration files are in an archived form. Before you use them, you must import them into BLDL using a process called unpacking. Unpack the configurations using this process:
    a. Open Benchlink Datalogger
    b. On the top menu bar select **Data->Data Manager...**
    c. When the Data Manager opens, select **Package->Read...**
    d. Navigate to **34972A Demo Install\34972A Demo install\BLDL configuration files**
    e. Select the checkboxes for the two BLDL-Pro Configurations and press **Unpackage**

Appendix C – Setting a static IP address

When using the 34972A directly connected to a computer using LAN it is important to know that it changes its IP address whenever it is reset or turnoff. This can be a disadvantage when showing it to customers with a tight schedule since you have to waste time looking for an IP address every time you power it up to use the LXI web interface or BLDL. Setting up a static IP address in your 34972A demo unit that you can memorize or write down allows you to save time and avoid tedious setup that is not relevant to the demo from a marketing perspective. Keep in mind the static IP will only work when you are using the 34972A on a private network or directly connected to your PC. When the 34972A is connected to the internet or a company's network the DHCP server for that network will assign a different IP address to the 34972A. The following is a list of instructions that detail how to set a static IP address for the 34972A:

1. Go to the section "Steps for LXI interface Lab" on page ten. Complete Roman numeral "I" entitled "Connect LXI interface and open 34972A Web-server homepage". At the end instead of choosing Remote Interface choose Network Configuration as shown in figure 1C.
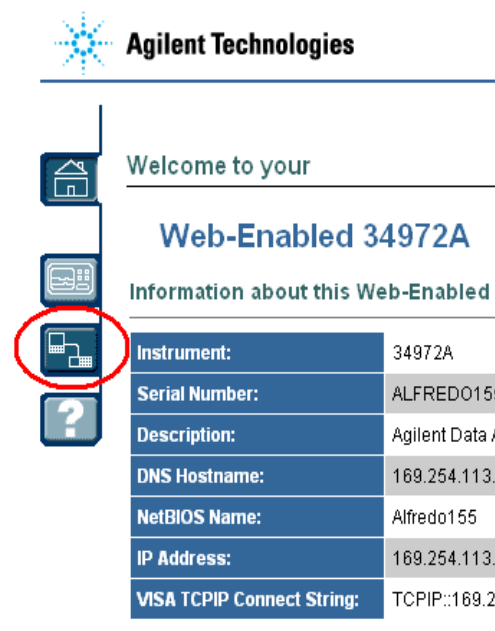

Figure 1C. Web Interface Menu

2. Select the "Modify Configuration" button to change the network settings.
3. Change the network settings to the following: Select → Manual; IP Address → 3.4.9.72; Subnet Mask → 0.0.0.0; Default Gateway → 3.4.9.72 as shown in figure C2.

Figure C2. Network configuration change

4. Of course you can change the IP address to whatever you want. I just chose 3.4.9.72 because it is easy to remember. Remember the "Default Gateway" has to match the IP address.
5. Select "Apply" when the pop-up window comes up select "Ok" to apply the changes. Wait about 15 seconds and cycle the power for the new IP address to take effect.
6. After the 34972A is done powering up and initializing wait about a minute and enter the new IP address into the web browser. The web interface should come up.
7. Now the 34972A's IP address will be the same every time you power it up, except if it is connected to a DHCP server.

Appendix D – LAN will not work, what do I do?

This appendix provides suggestions on what to do if you cannot get the 34972A LAN connection to work for a demonstration. If the LAN will not work it makes it hard to show the valuable remote features of the 34972A like the LXI web interface and the BLDL software.

LXI Web Interface

There are three main ways to supplement demonstrating the web interface of the 34972A. The three supplemental approaches are:

1. Use the "34972A Web Interface Simulator" program to show the web interface. This software tool allows you to simulate the exact web interface that is on the 34972A. This software tool is an executable jar file and can be found on the USB memory stick on the Demo Cube or you can get it off the Agilent external web page at: www.agilent.com/find/34972Ademo

2. The 2 min 34972A product demonstration video could also be used since it covers the benefits of using LAN and the value of the web interface.
3. As a last resort you can use the web interface screen shots found in the 34972A VIP slides and/or the ones found in this training guide on pages 11-14.
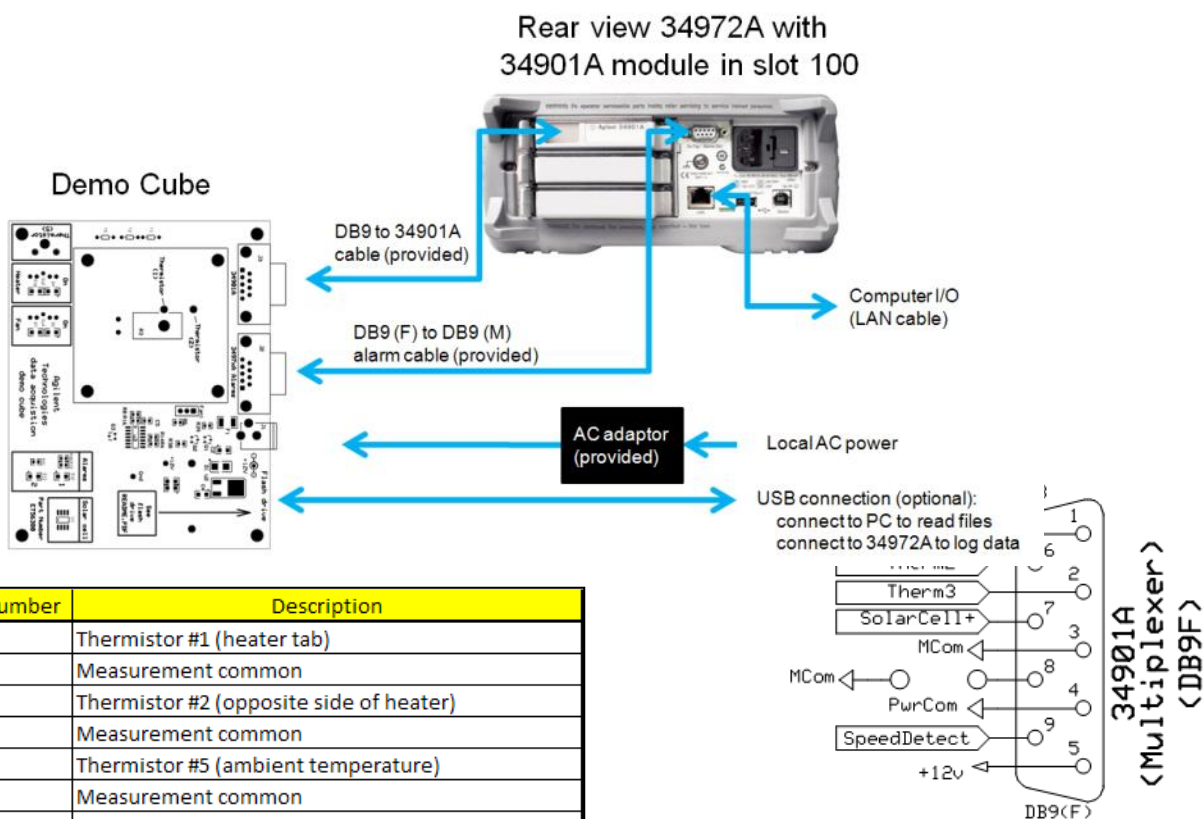
BLDL Software

The BLDL 3 or Pro can connect to the 34972A either through LAN or USB so if LAN is not working and you have a USB cable simply use the USB IO connection to do the demonstration. Since BLDL works the same with either type of connection you can still use the directions on configuring BLDL that start on page 16. The USB address of the instrument can be obtain through the front panel or using Agilent Connection Expert
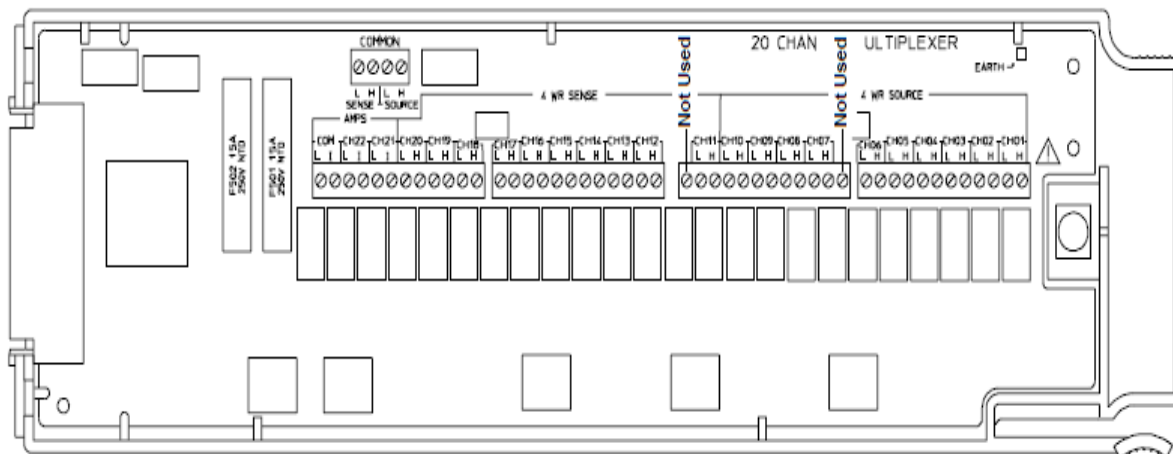
If you cannot access either IO type, check if the results of a previously run scan are still in BLDL. Do this by open BLDL and going to the "Quick Graph" tab to see if there is graph from last time the software was used, if so use this tab and the "Configure Scan List" tab to show the configuration and data analysis features of BLDL. As a last resort you can use the BLDL screen shots in this training guide found on pages 4, 19-22 to demonstrate BLDL.

Appendix E – Hardware configuration

Connect cables as shown below. Note: DB9 cable that connects to 34901A may need to be assembled. If so, use the interconnect table and figures below for guidance.

Channel	DB9 pin number	Description
CH01H	1	Thermistor #1 (heater tab)
CH01L	3	Measurement common
CH01H	6	Thermistor #2 (opposite side of heater)
CH01L	3	Measurement common
CH03H	2	Thermistor #5 (ambient temperature)
CH03L	3	Measurement common
CH04H	7	Solar Cell
CH04L	3	Measurement common
CH05H	--	No connection
CH05L	--	No connection
CH06H	--	No connection
CH06L	--	No connection
CH07H	5	+12Vdc power supply
CH07L	4	Power common
CH08H	9	Fan speed tachometer
CH08L	4	Power common

Appendix F – Installation configuration and verification

1) Using an Ethernet cable, direct connect the 34972A LAN to the PC LAN (no need for cross-over cable).
2) Power up both the PC and the 34972A.
3) Click on the Agilent I/O icon in lower right of computer screen (figure D1)
4) Double click on Agilent Connection Expert (ACE) to open
5) Once ACE opens (figure D2) highlight the **LAN (TCPIP0)** icon (just below the **Refresh all** button).
6) Select **Add Instrument** icon on the toolbar (figure D2 – 1)
7) Select **Auto Find** (figure D2-2)
8) In several seconds, the connected 34972A should be discovered and displayed. Check the **Select** (figure D2-3) box to add to the configuration and **Ok** (figure D2-4) to close.
9) Instrument should appear with green checkbox as shown in figure D3. If the green checkbox is not present and instead a red box , there is a communications problem. You must stop and determine the cause of the problem before you continue. Consider manually typing in the IP address as shown in figure D4.
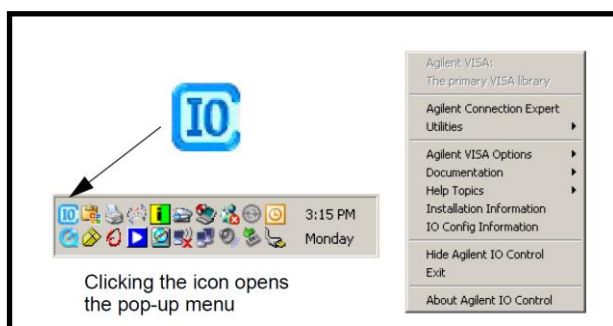

Figure D1– Open the I/O library software Agilent Connection Expert (ACE)

Figure D2– Add instrument to ACE.

Figure D3– ACE correctly displaying a instrument (USB/GPIB in this case)
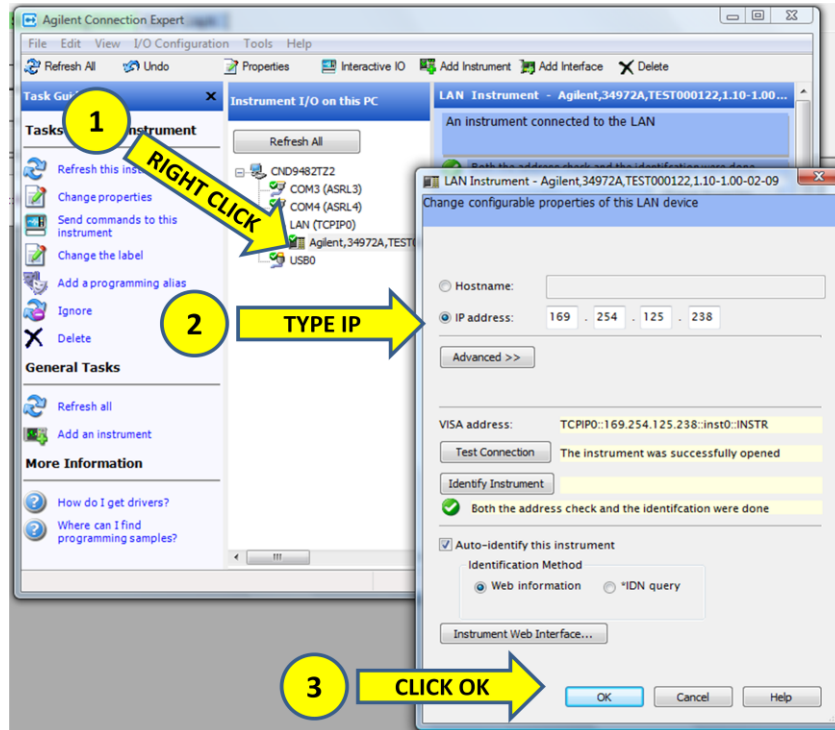
Figure D4– In some cases it may be necessary to directly type in the IP address

Appendix G – Simple game ideas

Page 25 "Solar Cell game" covers using an Excel based VB program along with the demo cube and a laser pointer to create a fun game. This appendix presents some other simple ideas to create games using the 34972A.

Who is the hottest or the brightest

Create a simple contest "who is the hottest" by seeing who can get thermistor 5 on the demo cube the hottest by touching it. Set some time limit for how long the participant can touch it. At the end award the participant who was able to reach the highest temperature value with a prize at the end. Refer to page 6 figure 1 to see the location of the thermistor 5 on the demo cube. Thermistor 5 is connected to channel 103 on the 34901A MUX module in the 34972A. You can use the 34972A in "Monitor" to show a continuous view of the temperature either using the front panel or the web interface. Refer to page three to configure the 34972A to make a basic measurement.

You can also make a "who is brightest" game using the same concept just covered above, but with the solar cell located on the demo cube. Refer to page 6 figure 1 shows the location of the solar cell on the demo cube. Use channel 104 on the 34901A MUX card and configure for DC volts to monitor the solar cell output.

Curve fitting

Another slightly more complicated game is the "curve fitting game" or "graphing game". This game uses BLDL and the demo cube. First you use either thermistor 5 (channel 103) or the solar cell (channel 104) or both to create a 15 to 30 second graph using BLDL, using BLDL is covered on page 4 and 17. Be sure to make the graph as dynamic and varying as possible. Capture a screen shot of the graph you created. Then you challenge participants to try and create a graph that resembles your graph as much as possible. At the end give the participant with the closet match a prize.