Keysight Technologies
Using BenchVue to Create and Execute Scan Lists on 3497xA Data Acquisition Units

Application Note
Keysight’s BenchVue software’s DAQ app (BV0006B) can be used with Keysight’s 34970A and 34972A data acquisition (DAQ) units to create, chart and log data for extended periods of time. BenchVue allows you to utilize a special hardware feature of 34970/72A DAQ units to create up to five sets of instrument states and store them in the instrument. They can then be recalled and executed at any time, either manually or by using BenchVue’s sequencing feature, called Test Flow. This application note illustrates how to create two scan lists/states and execute them from Test Flow depending upon alarm conditions that the instrument detects.

Here are the two instrument states to be set up:

- State 1. Scan three multiplexer channels, all using DC volts. One channel is set up to generate an alarm if the measured value on one channel exceeds certain limits.
- State 2. Scan three different channels than State 1, 10 times. One of the three channels is set to measure AC volts.

A sequence is created using Test Flow to do the following:

1. Initialize the instrument and recall State 1.
2. Loop indefinitely, checking for the alarm.
3. If an alarm is detected, stop the scan, recall State 2, then restart a scan.
4. Export data to Excel when done.

Unlimited sequence and measurement combinations are possible with BenchVue. The sequence uses Keysight’s Command Expert software to get alarm data from the instrument, start and stop the scan and recall stored scan lists.
Setting Up the Instrument States

**Step 1.** First, on the Instrument Settings tab in BenchVue DAQ app, choose the relay multiplexer card. In this case, it’s in Slot 2. Choose the “Scan Module” radio button. If desired, this card can also be used as independent switches. See Figure 1.

![Instrument Settings](image)

**Step 2.** Next, set the desired states and save them:
Using the “Configure Channels” tab, enable a scan on channels 201, 202 and 203 by checking the boxes on the left. If desired, these channels can be named by entering up to 18 alphanumeric characters in the text entry box.

Step 2a. Select the DMM function (DCV), range (Auto) and resolution (5.5 digits). If any scaling of the reading is desired, a gain and offset can be entered and the resulting units changed if desired.

Step 2b. Choose the alarm condition (Low/High), enter the Low and High values (± 0.005 V) and choose Alarm 1 as the hardware alarm to use. See Figure 2.

NOTE: Do NOT use the additional features in the “More” field. These are not included in the state information that will be saved in the instrument.

Step 2c. Set up data logging. In the “Data Logging Settings” tab (see Figure 3), select the condition that will start and stop the scan. When executed from Test Flow, the “Start Button” and “Stop Button” will consist of SCPI commands to start and abort the scan. Also select minimum delay between readings:

Figure 2. Channel configuration for State 1.

Figure 3. Data log settings for State 1.
State 1. Scan Three Multiplexer Channels, All Using DC Volts (Continued)

**Step 2d.** Lastly, save State 1. Going back to the Instrument Settings tab, select “More Settings...” (see Figure 1), select the Instrument State tab. On this screen (see Figure 4) select STATE1 and click “Store Current State.”

![Figure 4. Saving instrument state.](image-url)
State 2. Scan Three Channels (Different Channels Than Used in State 1) and Loop 10 Times with No Alarms Enabled

**Step 2e.** Select three different channels, one of which measures ACV; no alarms are enabled:

![Channel setup for State 2](image)

**Figure 5.** Channel setup for State 2.

**Step 2f.** Again, set the data logging tab for the desired number of scans, in this case 10:

![Data logging for State 2](image)

**Figure 6.** Data logging for State 2.
State 2. Scan Three Channels (Different Channels Than Used in State 1) and Loop 10 Times with No Alarms Enabled (Continued)

**Step 2g.** Finally, save State 2:

![Figure 7. Save instrument State 2.](image)
State 2. Scan Three Channels (Different Channels Than Used in State 1) and Loop 10 Times with No Alarms Enabled (Continued)

Step 3. Create a Test Flow sequence.

At this point, the two states have been sent to the instrument and saved in its memory. We’ll now use Test Flow to create an automated test sequence to do the following:

1. Initialize the instrument and recall State 1.
2. Loop indefinitely, checking for the alarm.
3. If an alarm is detected, stop the scan, recall State 2, then restart a scan.
4. Export data to Excel when done.

Figure 8. Example of complete Test Flow sequence of both instrument states using BenchVue’s DAQ app.

NOTE: You must CLOSE the DAQ App. It cannot be running while we are in direct control of the instrument via Test Flow and Command Expert.

Keysight BenchVue software now works in combination with Keysight’s Command Expert software enabling you to create more in depth automated tests and utilize more of your instruments functionality. Command Expert allows you to quickly find instrument commands and create command sequences to fully configure your instruments.

With BenchVue working in combination with Command Expert now you can use Test Flow to quickly setup automated tests as well as access the full programmatic functionality (SCPI or IVI commands) of your instruments.

For detailed information on Keysight’s no-cost Command Expert software, see www.keysight.com/find/commandexpert.
State 2. Scan Three Channels (Different Channels Than Used in State 1) and Loop 10 Times with No Alarms Enabled (Continued)

Now let’s examine each block in the sequence. In the following, the Test Flow block is shown; followed by the Command Expert sequence that it is being executed (text show below). To view the Command Expert sequence simply click the Command Expert icon. See details below for Command Expert setup.

Command Expert setup and adding new libraries

When Command Expert starts up, you must select the instrument you want to control, in this case the 34970A DAQ. If it is not in the list, you can click the “New Instrument” button and add the command libraries for that instrument as shown in Figure 9.

Once the instrument has shown up in “My Instruments”, click it, then “Identify Instrument” to have Command Expert recognize it. See figure 10.
State 2. Scan Three Channels (Different Channels Than Used in State 1) and Loop 10 Times with No Alarms Enabled (Continued)

After the instrument has been identified, you can then connect to it and start using the commands that are available for it (See Figure 11).

Now the commands can be chosen from the “Command Search” list. Some of the ones we will use here come from the “Transport” section because they are not SCPI commands but information for the sequencer. See Figure 12.
Examining Each Block in the Sequence

Below the Test Flow block is shown; followed by the Command Expert sequence that it is being executed.

**Step 1.** Tell CE not to issue SYST:ERR? queries, issue abort to make sure instrument is idle, clear the status and error registers, recall the first state, setup the status register to tell us when there’s an alarm, and do an init to start a scan:

```
34970A Dim v34970A As Ag3497x("GPIB0::14::INSTR")
34970A v34970A.Transport.ErrorQueryBehavior.Set("None")
34970A v34970A.SCPI.ABORT.Command
34970A v34970A.SCPI.CLS.Command
34970A v34970A.SCPI.RCL.Command(1)
34970A v34970A.SCPI.STATUS.ALARM.Enable.Command(64)
34970A v34970A.SCPI.INITiate.Command
```

**Step 2.** Loop until the status register tells us there was an alarm.

```
Set
alarm - 0

Repeat Until
alarm > 0

Command Expert
Get Scan status
Connections

Output Parameters
alarm alarm 0
```

```
34970A Dim v34970A As Ag3497x("GPIB0::14::INSTR")
34970A v34970A.SCPI.STATUS.ALARM.Condition.Query(alarm)
```
Examine Each Block in the Sequence (Continued)

**Step 3.** Send an ABOR to stop the scan.

**Step 3a.** Recall State 2, enable the status register to return "scanning" status, and do an init.

**Step 3b.** Loop until the status = stopped.
Examining Each Block in the Sequence (Continued)

**Step 3c.** Issue a FETC? command to read the data. Note that one must be careful not to gather more data than the instrument can store (50 K readings).

**Step 4.** Finally, call an “Export” function to programatically export the retrieved data.

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**Conclusion**

BenchVue software provides two ways to control Keysight’s 34970A or 34972A DAQs. BenchVue’s DAQ App (BV0006B) can be used to easily create state information that a Test Flow sequence can recall, using hardware alarms to control the flow of execution. The DAQ app can also be used by itself—if multiple decisions are not required—to create, chart and log data for extended periods.

This application note has explored a method of creating instrument states containing scan lists one of several helpful DAQ app features. Be sure to explore the other application notes and videos available on our web site showing how BenchVue allows you to easily control your instruments, quickly build automated tests and drive measurements to actionable insights faster.

For additional details and to download the no-cost BenchVue software platform and a 30-day free trial of the BenchVue DAQ app, visit: [www.keysight.com/find/benchvuedaq](http://www.keysight.com/find/benchvuedaq)
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