Section 8

Mixed function multi-channel scanning

In this section:

Introduction

This example application demonstrates how to use the DAQ6510 to perform complex multi-channel, mixed function scanning in a production-test environment.

The DAQ6510 can perform more than one function in a multichannel scan, providing a range of data-acquisition options in a single test.

In this production environment the DAQ6510 is:

- Integrated into a test stand.
- Wired to a fixture that is connected to an active device under test (DUT).
- Quickly capturing DC volts and current, temperature, and AC volts and current.

Prior to the start of the scan, you can step through each of the configured channels on the DAQ6510, which allows you to troubleshoot the test configuration. This allows you to view the readings of individually closed channels to ensure that connections to the DUT are secure.

Equipment required

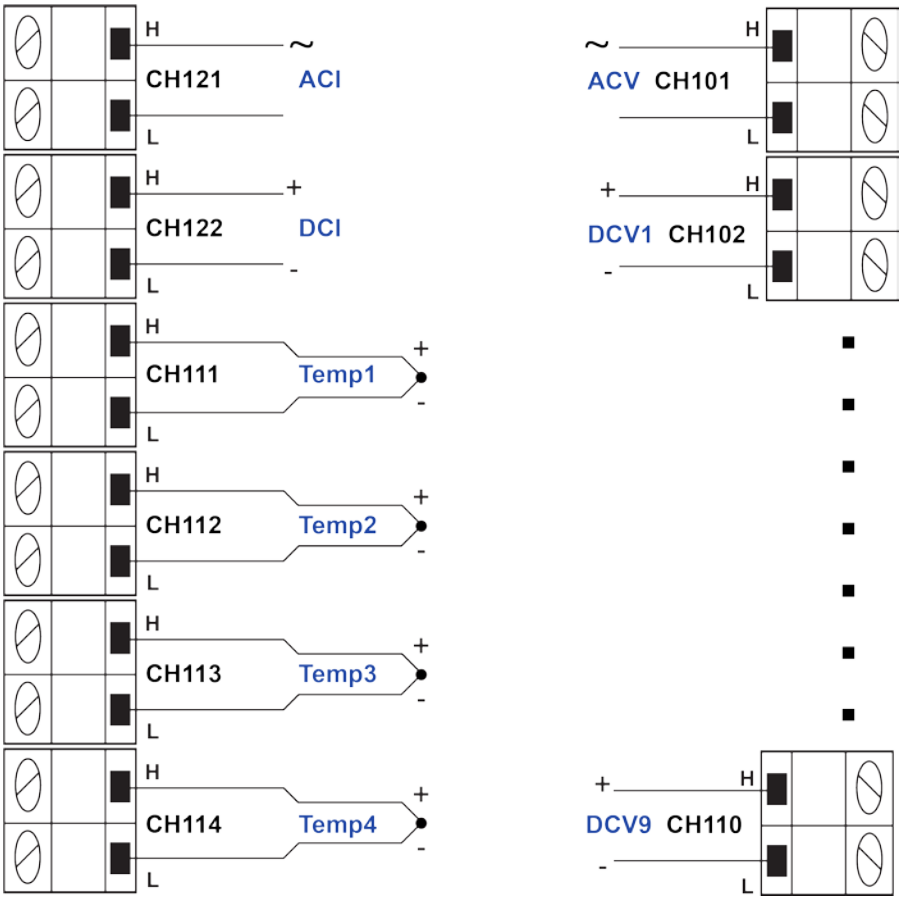
- One DAQ6510
- One Model 7700 20-channel differential multiplexer module
- One computer setup for communication with the instrument
- One device or component to be tested

Device connections

This application example uses a DAQ6510 with a 7700, 20-channel differential multiplexer configured to monitor the following signals:

- Channel 101: AC voltage being supplied to the DUT.
- Channels 102 to 110: DC voltages at several points located on the DUT.
- Channels 111 to 112: Temperature (using Type-K thermocouples) of two voltage regulators within the DUT.
- Channels 113 to 114: Temperature (using Type-K thermocouples) of two loads to which the DUT is supplying power.
- Channel 121: AC current being drawn by the DUT.
- Channel 122: DC current being drawn by the load.

Figure 39: DAQ6510 Model 7700



WARNING

To prevent electric shock, test connections must be configured such that the user cannot come in contact with test leads or any device under test (DUT) that is in contact with the conductors. It is good practice to disconnect DUTs from the instrument before powering the instrument. Safe installation requires proper shields, barriers, and grounding to prevent contact with test leads.

There is no internal connection between protective earth (safety ground) and the LO terminals of the DAQ6510. Therefore, hazardous voltages (more than 30 V_{rms}) can appear on LO terminals. This can occur when the instrument is operating in any mode. To prevent hazardous voltage from appearing on the LO terminals, connect the LO terminal to protective earth (safety ground) if your application allows it. You can connect the LO terminal to the chassis ground terminal on the front panel or the chassis ground screw terminal on the rear panel. Note that the front-panel terminals are isolated from the rear-panel terminals. Therefore, if you are using the front-panel terminals, ground to the front-panel LO terminal. If using the rear-panel terminals, ground to the rear panel LO terminal. Failure to follow these guidelines can result in injury, death, or instrument damage.

Mixed function multi-channel scanning

This application example uses the DAQ6510 to execute complex multi-channel, mixed function scanning in a production-test environment.

For this application, you will:

- Configure the instrument for:
  - One channel each of ACV, ACI, and DCI.
  - Nine channels of DCV.
  - Four channels of temperature using Type K thermocouples using a simulated reference junction.
- Set labels on certain channels to help better identify what the measurement is monitoring at the DUT.
- Step through the scan to check each individual channel reading prior to scanning.
- Execute 10 scans for each selected channels.
- Use the reading table to view (or print) the scanned measurements.

You can operate the instrument through the front panel or using SCPI or TSP code. For information about setting up remote communications, see Remote communications interfaces (on page 3-1).

Using the front panel

To set up the application from the front panel:

1. Press the **POWER** switch on the front panel to turn on the instrument.
2. Set the TERMINALS switch to **REAR**.
3. Select **Build Scan** from the Scan swipe screen.
4. Select the **+** button to add channel **101,** select **OK**.
5. Select **AC Voltage** on the Measure Functions screen.
6. Select the Detector Bandwidth option, and set the bandwidth to 30 Hz.
7. Select channel 101, scroll to Label, enter **ACMains**, and select **OK** to continue.
8. Select the **+** button, add channels 102 to 110, select **OK**.
9. Select **DC Voltage.**
10. Select the **+** button, add channels 111 to 114, select **OK**.
11. Select **Temperature**.
12. Scroll to the **Temperature** setting, enter a Simulated junction temperature of **23 °C,** select **OK**.
13. Select **Simulated** for the Reference Junction.
14. In the top left corner of the screen, select **Menu,** select **Expand Groups**.
15. Select channel 111 and enter **Reg12VTemp** for the label. Select **OK**.
16. Select channel 112 and enter **Reg5VTemp** for the label. Select **OK**.
17. Select channel 113 and enter **LoadTemp1** for the label. Select **OK**.
18. Select channel 114 and enter **LoadTemp2** for the label. Select **OK**.
19. Select **Menu** and **Collapse Groups**. The AC Volt, DC Volt, and Temp groups are separated into individual groups.
20. Select the highlighted **+** button to add another group of channels and add channel 121. Select **OK**.
21. Select **AC Current**.
22. Select the **+** button and add channel 122, select **OK**.
23. Select **DC Current.**
24. On the Scan tab, set Scan Count to 10, select **OK**.
25. Press the **HOME** key.
26. Select **Step Scan**. This closes the first channel in the scan and displays the results. Use the left/right arrows adjacent to Watch Channel to scroll through the selected channels, selecting **Step Scan** on each, until all the channels have been validated.
27. Select **Abort Scan**.
28. Press the **TRIGGER** key to the right of the display to initiate the scan.

Using SCPI commands

This sequence of SCPI commands configures the instrument for measuring DC Voltage, Temperature, AC Voltage, DC Current, and AC Current on different channels and then labels some of those channels. Each channel is then scanned 10 times and the readings are returned.

You may need to make changes so that this code will run in your programming environment. In the table, the SCPI commands have a light gray background.

Send the following commands for this example application:

Commands	Descriptions
`*RST`	• Put the instrument in a known state
`SENS:FUNC 'VOLT:AC',(@101)`	• Set channel 101 for ACV
`SENS:VOLT:AC:DET:BAND 30, (@101)`	• Set channel 101, low-end bandwidth to 30Hz
`SENS:FUNC 'VOLT:DC', (@102:110)`	• Set channels 102-110 for DCV

`SENS:FUNCtion 'TEMPerature', (@111:114)`
`SENS:TEMP:TRAN TC, (@111:114)`
`SENS:TEMP:TC:TYPE K, (@111:114)`
`SENS:TEMP:TC:RJUN:RSEL SIM, (@111:114)`
`SENS:TEMP:TC:RJUN:SIM 23, (@111:114)`
	• Set channels 111-114 for Temperature measurement using Type K thermocouples with a simulated reference junction set to 23°C

`SENS:FUNC 'CURR:AC', (@121)`	• Set channel 121 to measure ACI
`SENS:FUNC 'CURR:DC', (@122)`	• Set channel 122 to measure DCI
`ROUT:CHAN:LAB "ACSource", (@101)`	• Apply a label to channel 101
`ROUT:CHAN:LAB "Reg12VTemp", (@111)`	• Apply a label to channel 111
`ROUT:CHAN:LAB "Reg5VTemp", (@112)`	• Apply a label to channel 112
`ROUT:CHAN:LAB "LoadTemp1", (@113)`	• Apply a label to channel 113
`ROUT:CHAN:LAB "LoadTemp2", (@114)`	• Apply a label to channel 114
`ROUTe:SCAN:COUNt:SCAN 10`	• Set the number scans
`ROUTe:SCAN:CREate (@101:114,121,122)`	• Set the channels included in the scan
`INIT`	• Initiate the scan
`*WAI`	• Wait for scan completion
`TRAC:DATA? 1, 160, "defbuffer1", READ, CHAN`	• Query the readings from the instrument

Using TSP commands

NOTE

The following TSP code is designed to be run from Keithley Instruments Test Script Builder (TSB). TSB is a software tool that is available from the Keithley webpage on the Tektronix website (tek.com/keithley). You can install and use TSB to write code and develop scripts for TSP-enabled instruments. Information about how to use TSB is in the online help for TSB and in the "Introduction to TSP operation" section of the *DAQ6510 Reference Manual*.

To use other programming environments, you may need to make changes to the example TSP code.

By default, the DAQ6510 uses the SCPI command set. You must select the TSP command set before sending TSP commands to the instrument.

To enable TSP commands:

1. Press the **MENU** key.
2. Under System, select **Settings**.
3. For Command Set, select **TSP**.
4. At the prompt to reboot, select **Yes**.

This sequence of TSP commands makes a series of temperature measurements. After the code executes, the data is displayed in the Instrument Console of Test Script Builder.

Send the following commands for this example application:

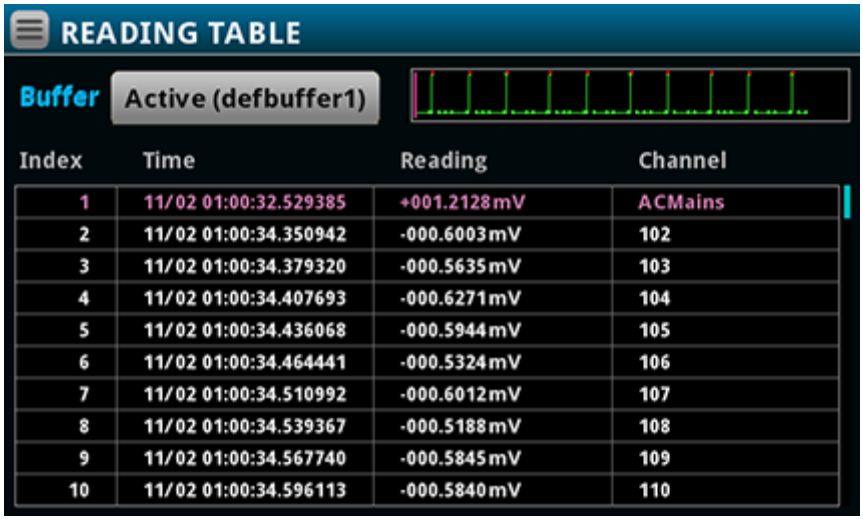
```
-- Reset the instrument to the default settings
reset()
-- Establish channel settings for the scan card configuration...
channel.setdmm("101", dmm.ATTR_MEAS_FUNCTION, dmm.FUNC_AC_VOLTAGE)
channel.setdmm("101", dmm.ATTR_MEAS_DETECTBW, dmm.DETECTBW_30HZ)
channel.setdmm("102:110", dmm.ATTR_MEAS_FUNCTION, dmm.FUNC_DC_VOLTAGE)
channel.setdmm("111:114", dmm.ATTR_MEAS_FUNCTION, dmm.FUNC_TEMPERATURE)
channel.setdmm("111:114", dmm.ATTR_MEAS_TRANSDUCER, dmm.TRANS_THERMOCOUPLE)
channel.setdmm("111:114", dmm.ATTR_MEAS_THERMOCOUPLE, dmm.THERMOCOUPLE_K)
channel.setdmm("111:114", dmm.ATTR_MEAS_REF_JUNCTION, dmm.REFJUNCT_SIMULATED)
channel.setdmm("111:114", dmm.ATTR_MEAS_FUNCTION, dmm.FUNC_TEMPERATURE,
   dmm.ATTR_MEAS_SIM_REF_TEMP, 23)
channel.setlabel("101", "ACSource")
channel.setlabel("111", "Reg12VTemp")
channel.setlabel("112", "Reg5VTemp")
channel.setlabel("113", "LoadTemp1")
channel.setlabel("114", "LoadTemp2")
channel.setdmm("121", dmm.ATTR_MEAS_FUNCTION, dmm.FUNC_AC_CURRENT)
channel.setdmm("122", dmm.ATTR_MEAS_FUNCTION, dmm.FUNC_DC_CURRENT)
-- Generate the scan...
scan.create("101:114,121,122")
scan.scancount = 10
-- Clear and size the buffer...
defbuffer1.clear()
defbuffer1.capacity = 10 * 16
-- Start the scan and wait...
trigger.model.initiate()
waitcomplete()
-- Extract the data...
printbuffer(1, defbuffer1.n, defbuffer1, defbuffer1.readings, defbuffer1.channels)
```

Test results

The following procedure shows the results for this application.

1. Press the **Menu** key.
2. Under Views, select **Reading Table**.
3. Scroll the reading table noting both the measurements and labels in the Channel column of the table.

Figure 40: DAQ6510 reading table mixed function multichannel scanning



Index	Time	Reading	Channel
1	11/02 01:00:32.529385	+001.2128mV	ACMains
2	11/02 01:00:34.350942	-000.6003mV	102
3	11/02 01:00:34.379320	-000.5635mV	103
4	11/02 01:00:34.407693	-000.6271mV	104
5	11/02 01:00:34.436068	-000.5944mV	105
6	11/02 01:00:34.464441	-000.5324mV	106
7	11/02 01:00:34.510992	-000.6012mV	107
8	11/02 01:00:34.539367	-000.5188mV	108
9	11/02 01:00:34.567740	-000.5845mV	109
10	11/02 01:00:34.596113	-000.5840mV	110

To save the scanned measurements to a USB flash drive:

1. Select the **MENU** key.
2. Under the **Measure** column, choose **Reading Buffers**.
3. Insert a USB flash drive into the DAQ6510, select **Save to USB.**
4. Select the **Change** button adjacent to the Filename label, enter **MixedScan** using the dialog provided.
5. Select **OK**.