GRAPHICAL USER INTERFACE (GUI) FOR TESTING CAMAC MODULES

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Abstract

A new program (GUI) for testing CAMAC modules (CAMAC ADC, DAC, Input Gate, Output Register) is developed using LabVIEW and dynamic link libraries (DLLs). On start-up, the program initializes the CAMAC Controller via PCI bus interface, thus enabling communication with CAMAC modules. It can test CAMAC modules through different controls like slider bars, buttons etc. and display status of individual channels with soft panel meters and LEDs. The GUI is extremely useful in troubleshooting hardware problems of CAMAC modules and also in developing new modules.

CAMAC TEST SET-UP DESCRIPTION

The CAMAC modules test program (GUI) is written in LabVIEW and has one page for testing CAMAC ADC/DAC modules and other page for testing CAMAC Input/output Gates. Figure 1 shows the basic block diagram of CAMAC Test set-up. The GUI communicates with the dynamic link libraries (DLL) which in turn call the PCI driver (associated with PCI Interface card). Separate DLLs are used to implement CAMAC read command and CAMAC write command. The DLL initiates the PCI Interface card to communicate with CAMAC controller via parallel bus interface. The CAMAC controller accepts command from PCI Interface card and passes that command to CAMAC modules via CAMAC bus. If it is a "CAMAC WRITE" command then the module receives data from PC in appropriate register (channel number called sub address). If it is a "CAMAC READ" command then the module sends data (from appropriate channel number) to PC via CAMAC Controller.

The CAMAC ADC/DAC page has user interface to enter station number N (where the module to be tested is present). The DAC has 8 channels and hence 8 slider bars are used to control each channel's voltage output from 0 to 10 V. If it a 12-bit CAMAC DAC module located in slot number 12 and we want to set 5V at channel number 6, then station number entered into GUI is 12 and sixth slider is used to set 5V. 0 to 10 V is converted into 0 to 4095 (as DAC is 12 bit). 5 V is converted into 2047 by the slider control. This data is passed to CAMAC Controller which passes this to station number 12 (it also sets sub-address as 5 for channel number 6). The ADC has 16 channels and hence 16 meters are used to display individual channels voltage. The range of each meter is from 0 to 10 V. Each channel converts analog input (range 0 to 10 V) into digital number (0 to 4095) and this number is read by the CAMAC controller from ADC module's appropriate channel register and send to PC via PCI Interface card. The LabVIEW program will convert

this digital number into analog voltage (0 to 10V) and display it on respective channel meter. The page for CAMAC ADC/DAC module testing can test one ADC and one DAC module simultaneously.

The CAMAC Input/output gate page has user interface to enter station number (N). The Output Gate has 24 channels with each channel controlling an isolated relay contact. Whenever the channel receives logic '1' i.e 5 V input the relay operates and connects the output contact. Hence if we want to turn on the contact at 8th channel number, we have to press the eighth button (which when pressed turns green). Internally the GUI program converts this information into binary 24 bit word in which the eighth bit will be '1' and all other bits will be '0'.

Figure 2 shows us the snapshot of GUI program in LabVIEW which controls Output register and displays status of Input Gate. It also displays the internal logic value of Output Register which the user has changed. This internal register is first written by CAMAC Controller and then read by the LabVIEW program and displayed as 24 LEDs (instead of 24 bits).
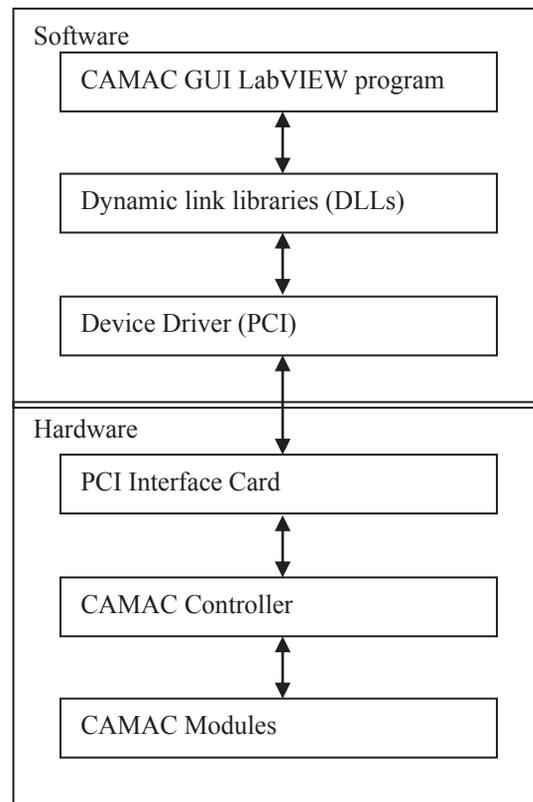
Figure 1: CAMAC Testing Set-up Block Diagram

Figure 2: Snapshot of LabVIEW program testing CAMAC Output Register's 8th channel (turning 8th channels relay ON/OFF) and also watching the status of all channels.

LabVIEW GUI PROGRAM

The reason for choosing LabVIEW was ease of programming, easy interface to DLLs (active X controls), having many instrument palettes etc. [1]. The graphical way of programming is easier to understand and implement. The call library node is used to call DLL files. Separate DLL files are used for read and write operation. The ADC status is displayed continuously by using a Timer in the LabVIEW program which executes CAMAC read function every one second.

The program takes the input (station number) N and then makes a CAMAC NAF (station **N**umber, Sub-**A**ddress, **F**unction) command internally for each channel. This command is then passed on to appropriate call library node which executes the CAMAC command and writes/reads CAMAC data to/from DAC/ADC respectively. For DAC module plugged in station number 20, there are eight channels and hence eight sub-addresses (`0000` to `0111`) whereas the function is write (CAMAC function code = `10000`). Hence the CAMAC NAF (station number, Sub-address, Function) command for channel 1 is "`10100000010000`". For ADC module situated at

station number 20, there are sixteen channels and hence sixteen sub-addresses (`0000` to `1111`) from where the ADC data is read (CAMAC function code = `00000`). NAF command for reading from channel 1 is "`10100000000000`". While reading data from CAMAC Controller even parity is checked and data is considered valid if parity of all data bits is even. This parity checking logic is also implemented in LabVIEW program. Timer control is used to trigger measurements every one second for ADC and Input gate modules.

ADVANTAGES

The LabVIEW program is useful for troubleshooting different CAMAC modules and tested modules are used for control of Pelletron Accelerator Facility, TIFR. This program has helped in preventive as well as breakdown maintenance of CAMAC electronics. Development of new modules is also possible due to this test program.

REFERENCES

[1] Jeffrey Travis, Jim Kring, "LabVIEW for Everyone", Pentice Hall.