LabVIEW-based Software for the Test Stand of the CLAS Drift Chamber High Voltage System

Werth Teachey, Mary Ann Antonioli, Tanest Chinwanawich, Brian Eng, Michael Ferguson, Tony Madany, Marc McMullen, Armenak Stepanyan, Mark Taylor, and Amrit Yegneswaran
Physics Division, Thomas Jefferson National Accelerator Facility, Newport News, Va 23606
July 28, 2004

This paper presents the design and implementation of the LabVIEW-based software for the CAEN test stand (Cats), which checks the modules and the crates of the SY527 CAEN power supply (Sycaps).

Data acquisition, analysis, and presentation are based on an object-oriented, GUI-based LabVIEW program that allows Cats to rapidly test, calibrate, and debug crates and modules of Sycaps that provide high voltage for the CLAS drift chambers.

To communicate with the PC, the program has a set of functions which are: serial port initialize, total bytes at serial port (receives all data in the serial port buffer), write to serial port, and read from serial port, Fig. 1.

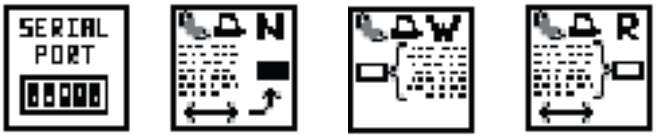


FIG. 1. LabVIEW serial port functions

At power-up, the introduction and menu screens, Fig. 2, are displayed. Once these pages are passed by pressing the "enter" and then the "d" keys, the voltage, current, channel status, and the current page number can be read, Fig. 3.

FIG. 2. Mainframe startup screens

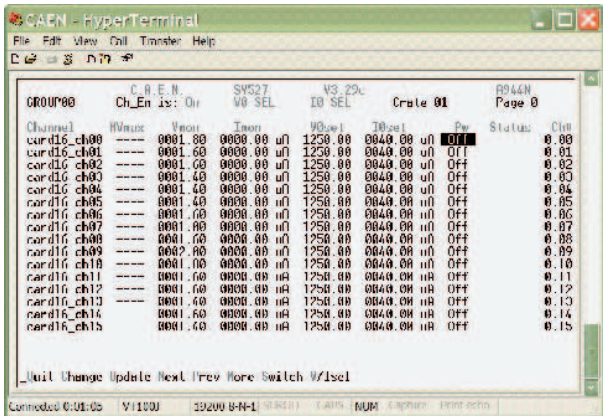
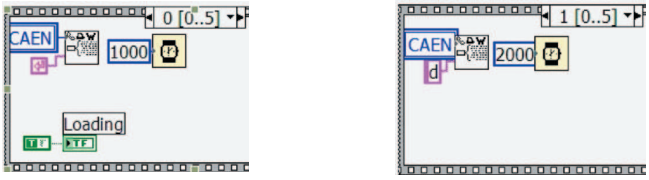


FIG. 3. Mainframe read-out

There are twenty-four channels per module of which only sixteen fit on a page. Cats reads the page number on which the current output is listed, top right corner of Fig 3, using LabVIEW's serial port interface controls, Fig. 4.



Sequence A Sequence B

FIG. 4.Serial port interface controls in Cats

The search string function searches the buffer for a match with the string "Page". Once a match is found, the function outputs an offset which gives the position of the last letter in the word "Page" in integer form. The program moves to this offset and acquires the page number. If the acquired page number is zero (first page), Cats is ready to start testing, if not, the search continues until page zero is found.

Then the cursor is placed in a known position – the first line at the channel on/off column. The cursor can be moved up, down, left, or right using the commands shown in Fig. 5.

CAEN Commands
\1B [A : Move Cursor Up
\1B [B : Move Cursor Down
\1B [C : Move Cursor Left
\1B [D : Move Cursor Right

FIG. 5. Mainframe cursor direction commands

The data parser removes unnecessary information in the buffer. First, data in the buffer are separated by line. Each line, Fig. 3, has all data for one channel, an address, e.g., line one's address is 5;1H, Fig. 6, and is eighty spaces long. The addresses for the lines are fed into a search function, which outputs an offset number that is input to a search-and-replace function that starts data extraction for eighty spaces at the offset number. These data are stored in an array. Next, the four data values voltage setting, voltage monitor, current setting, and current monitor are extracted.

Each value has a certain offset in the line. The program goes to the offset and extracts the value. This process, Fig. 7, runs sixteen times for page one, changes page, and runs eight more times.

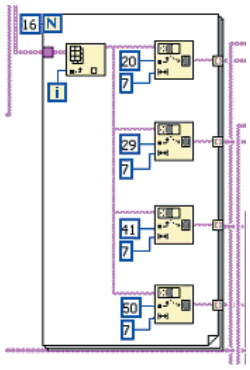


FIG. 7. Parsin

Figure 8 shows Cats' software diagram, which handles the setup of the mainframe and runs once.

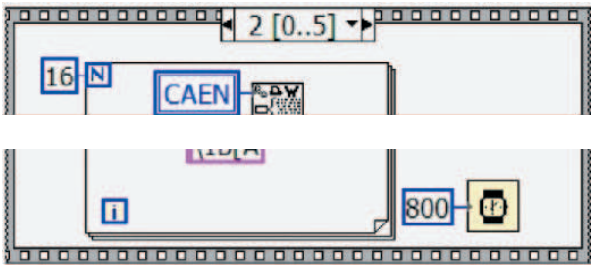


FIG. 8. Cats main control program

Figure 9 shows the two LabVIEW functions that must execute before communication can take place between the PC and mainframe or the High Voltage Controller Module (HVCM). The port numbers for the functions labeled "CAEN" and "Test Box" (HVCM) have to be initialized. The functions need a pre-determined buffer size for input of serial data – 16 KBytes ensures no buffer overflow. The CAEN mainframe operates at a baud rate of 19,200 and the HVCM at 9,600.

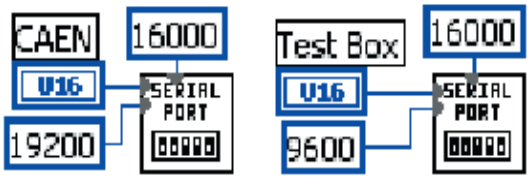


FIG. 9. Serial port initialization functions

The while loop, Fig. 10, handles the main operations of the program and runs continuously, awaiting user input. The top box, inside the loop, is where the test is selected, the bottom handles requests to view selected test.

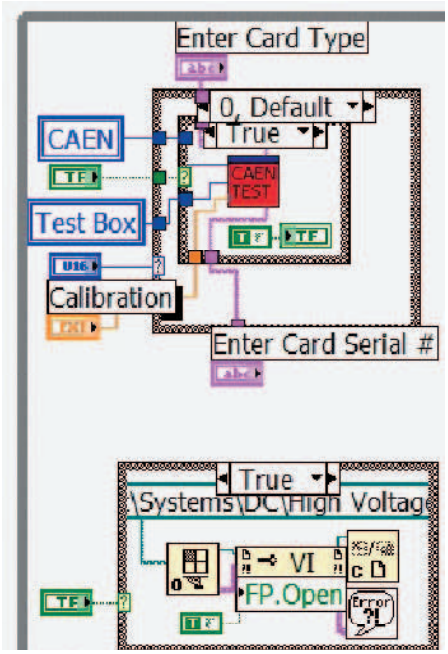


FIG. 10. Cats main test selection

Once the "O.K." button that starts the selected program is in the "true" state (green TF box in upper left corner), user inputs to "Test Box", "Card Type", "Card Serial #", and "CAEN" and HVCM "Test Box" port numbers are transferred to the test, center of the diagram, Fig. 10. The blue box labeled "U16" represents the selected test and the orange box requires the calibration value for the HVCM to read out voltages.

On the Cats' front panel (FP), the "Loading" LED, Fig. 11, indicates initialization, red LED indicates Cats is preparing for testing; green indicates ready. Test card information is transmitted to each individual test.

Test selection is done by using the up and down arrows. Step three "View Test " is optional. Selecting the "View Test" button displays the specifics of the test. The "O.K." button, step four, initiates test execution. At test completion, the LED to the left of the "View Test" button turns green.

When "View Test" is selected for a specific test on the Cats' FP, the specific test's FP, example shown in Fig. 12, is opened next to the Cats' FP. The test FP shows demand values, read-back values, results, a string of LED's indicating progress and status of the test, and a card information box that shows the identification of the card being tested.

FIG. 12. Voltage setting, resolution, and accuracy FP

Current trip and voltage levels are set at test start. During the test, a filename for the test data that is to be stored is requested. End of test is indicated by the "Test Complete" LED.

The LabVIEW-based programs allow a user of Sycaps to test and debug modules. Data are formatted so that they can be managed by and tested with LabVIEW.

[1] B. Woodhouse and R. Cash. "Automated Test Stand for the High Voltage System of the CLAS Drift Chambers". CLAS note: 02-014

[2] National Instruments. LabVIEW v6 User Manual. Austin, Texas: National Instruments Corporation, 2000.