

Oscilloscope Control with PC

Roland Szabó, Aurel Gontean, Ioan Lie, Mircea Băbăiță

Abstract—In this paper two different oscilloscope control methods are presented. The first method is the classic method to send the SCPI commands via RS232 serial interface. The second method is to use the LabVIEW drivers. The first oscilloscope is the HAMEG HM407, which has its control program implemented in MATLAB. The second oscilloscope is the NI PXI-5412 with the control program in LabVIEW. The second control program is much faster and more simple, but with the classic method we can configure more and have a better control over the oscilloscope. The classic method is also general, because it can be controlled any oscilloscopes and equipment, even if they have no driver. In the first method the driver is made, in the second method a driver is used.

Keywords—Communication equipment, control equipment, driver, oscilloscope, protocol, remote handling, serial port.

I. INTRODUCTION

THIS paper presents the creation of an oscilloscope driver. To test the driver, the HAMEG HM 407, 40 MHz, 100MS/s cathode-ray tube oscilloscope (Fig. 1.) is connected with the PC to be controlled via the RS232 serial port. The oscilloscope is an analog/digital oscilloscope. It has an RS232 serial port and a microcontroller with implemented SCPI (Standard Commands for Programmable Instruments) commands. Its commands are presented in the product datasheet. Some commands are quite complicated and need a lot of binary calculation to make them work. Some of them are not complete or not well explained and need programming tricks to make them fully functional. Some commands are related to other commands. These dependencies are explained in another datasheet, so to command this equipment, a lot of prior study is needed.

The oscilloscope has a quite old microcontroller and this makes it a little more difficult to program, than other equipments.

Its commands are not standardized; the commands are closer to binary code.

This equipment was chosen, because it's not common equipment, like the Agilent equipments, which quite really simple to program and most of them have drivers for all common communication ports present on an equipment, like GPIB, RS232, USB or Ethernet.

II. PROBLEM FORMULATION

The most often used functions needed to be implemented in the computer interface of this HAMEG HM 407 oscilloscope.

Some functions that are not possible without a computer, like saving a graph from the oscilloscope, or sending a graph to the oscilloscope, were the main target.

On the computer interface the buttons needed to have similar name as those present on the oscilloscope.

III. PROBLEM SOLUTION

A. Programming Language Presentation

The goal was clear, to make a simple, but efficient computer interface for the oscilloscope via RS232 interface.

The software used for programming was MATLAB. This software is simple and powerful. MATLAB has also a graphical interface, which was very useful for our oscilloscope's user interface creation. The only inconvenience is that MATLAB has only Windows style controls, like sliders, buttons, check boxes and radio buttons. When, for example, a TIME/DIV. dial is needed, we had to use slider, not so suggestive, but functional.

Maybe for a better user interface some National Instrument's software can be more convenient, like LabVIEW, LabWindows/CVI or Measurement Studio for Visual Studio, because these software packages have dials, LEDs, graphs and other controls and indicators which look like the ones on electronic equipments.

MATLAB has its own advantages too. The thing that is very useful in MATLAB graphical interface is that any change on button makes change immediately a change in the MATLAB *.m code file. No need for generate callbacks like in other programming languages like Visual Studio or LabWindows/CVI. This can be very useful when a complicated code is made.

B. MATLAB Graphical Interface

MATLAB graphical interface can be accessed when the "guide" command is introduced at the command prompt.

This command will open a window like the one in Fig. 2. Here the user can drag-and-drop buttons, sliders and other Windows style controls and indicators needed.

In the oscilloscope interface sliders, Push buttons, pop-up menus controls and edit text, axe indicators were used.



Fig. 1. HAMEG HM 407 oscilloscope’s front with display and control buttons.

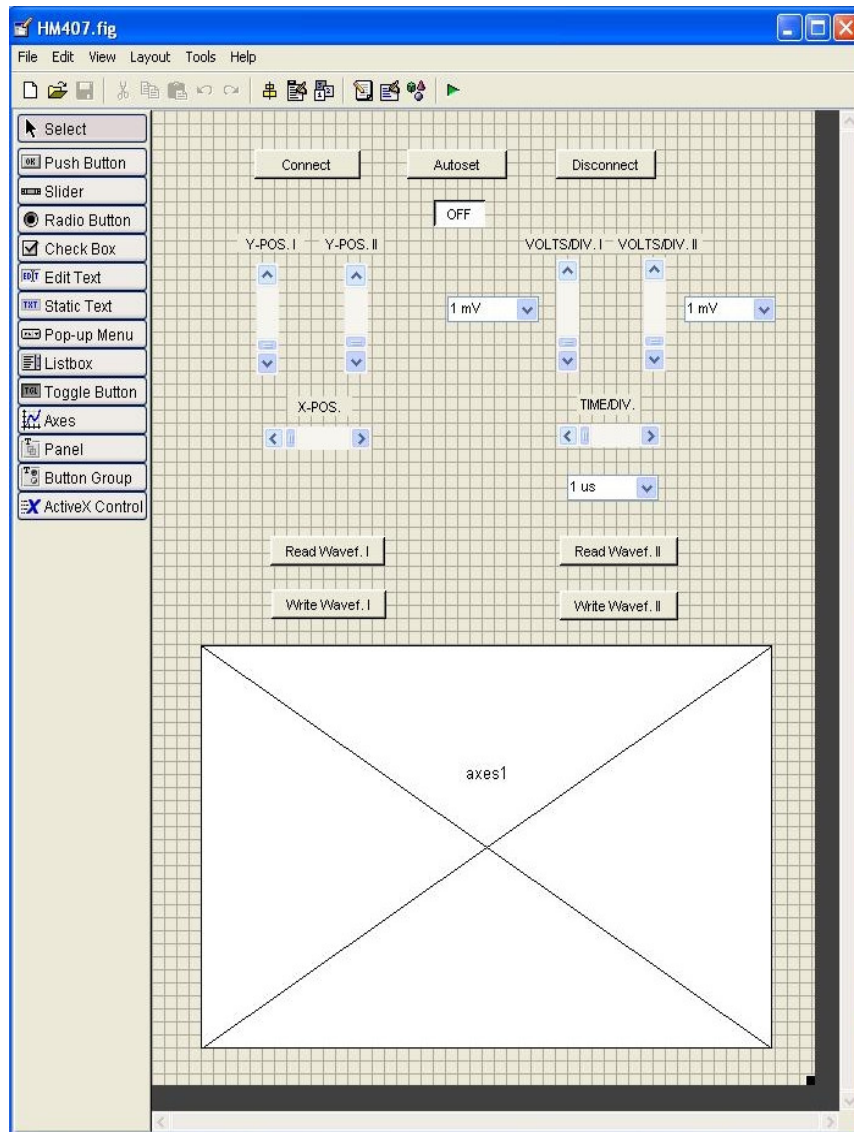


Fig. 2. Front panel creation of the oscilloscope in MATLAB. This window can be accessed when the “guide” command is introduced to the command prompter.

As we can see we have a Connect button for connecting the computer to the oscilloscope. This buttons sends the command, which puts the equipment in remote mode. During this time, the physical buttons from the oscilloscope are not functional, it pressed they make an error beep. An LED indicator on the oscilloscope indicates that the equipment is in remote mode and can be commanded just with a computer. On the graphical interface the status of the oscilloscope is shown with and edit text indicator, where the information ON or OFF is shown, depending on the state of the oscilloscope (remote or local).

To return to local mode, the Autoset button from the oscilloscope need to be pushed for a few seconds and the oscilloscope will return in local mode. The Autoset button's secondary function is returning the oscilloscope in local mode. After this operation the oscilloscope will not be commanded eth the PC, just with the buttons physically present on the equipment and the remote LED will be turned off. To return the oscilloscope in local mode, the disconnect button from the computer interface can be used too.

The Autoset button from the user interface has the same effect as the Autoset button physically present on the oscilloscope; it sets the Time/DIV and Volt/DIV parameters most optimal to the acquisitioned signal.

For setting the horizontal (X-POS.) and vertical (Y-POS. I and Y-POS. II) positions of the signal, sliders were used. Here a little trick need to be used, because for positive vertical position was one command and for negative vertical position was another command, but only one slider was used, so the two commands needed to be merged in one.

For setting the timebase (TIME/DIV.) and the amplitude (VOLTS/DIV. I and VOLTS/DIV.), also sliders were used. Because sliders, were fuzzy, a more accurate solution was needed, to set exactly the timebase and the amplitude, this way pop-up menus were used. For timebase between 1 μ s/DIV. and 0,5 s/DIV., for amplitude between 1 mV/DIV. and 20 V/DIV. The values can be set exactly. For the timebase and amplitude, both controls are functional, for exact and for fuzzy setting of the signal.

For saving the signal form the oscilloscope two buttons are used Read Wavef. I (for CH I) and Read. Wavef. II (for CH II). The signal will be shown on the axe. The acquisitioned signal has 256 samples (256 points), for larger signals more samples need to be combined. The serial interface has a buffer of 512 samples.

For writing a saved waveform from the computer to the oscilloscope, the Write Wavef. I and Write Wavef. II buttons were used. The oscilloscope has two memories and this way it can memorize to signals. The signals are saved in a text file (signal.txt) as points. This can be used for saving each signal from each channel to the computer, make some signal processing and after that send it back to the equipment. In the signal.txt file also is a signal with 256 samples (256 points). Here also a little trick is needed to make it work, the oscilloscope need to be put in STOR. MODE, so the REF bit has to be put on "1" logic by software, otherwise it will not work. This is very important to be done, because otherwise if

the REF bit is not activated manually on the oscilloscope, the saving of a signal will not work and an error beep will be received.

C. The Code behind the buttons

In this section the code behind the buttons is explained.

Every SCPI command needs to be ended with carriage return (CR, 0Dh or 13d). There are exceptions too, some of them needs only CR and other CR and LF, depends on the SCPI command.

These SCPI commands can be obtained from the oscilloscopes user manual or from an existing program with the HHD Free Serial Monitor program (Fig. 3 and Fig. 4.). With this program we can obtain the SCPI commands that the existing program uses.

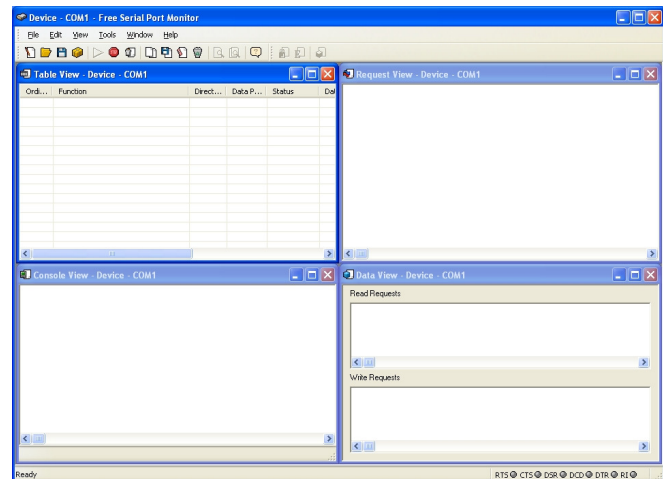


Fig. 3. The HHD Serial Monitor program configured.

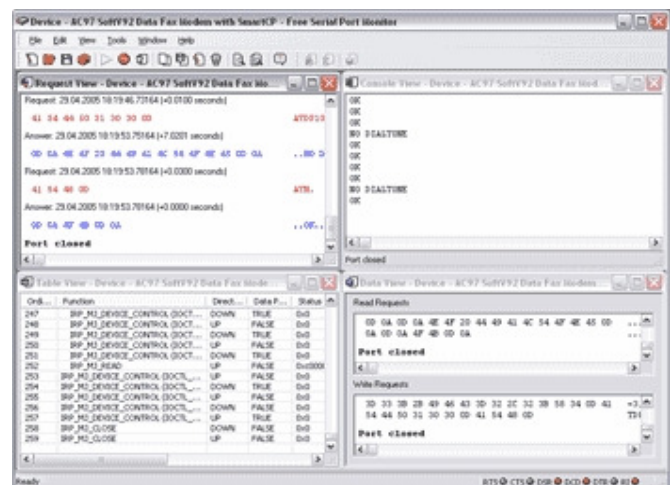


Fig. 4. The HHD Serial Monitor program obtaining SCPI commands from and existing program.

TABLE I shows the used SCPI commands.

These commands are obtained from the user guide or from an existing program using the Free Serial Monitor program.

We obtained them from the user manual, because we couldn't find an existing program for our oscilloscope.

TABLE I
USED SCPI COMMANDS

Command	Description
<i>AUTOSET</i>	<i>AUTO SET</i> function will be carried out
<i>YzPOS=w</i>	Sets <i>Y 1/2 POSITION</i> settings
<i>XPOS=w</i>	Sets <i>X-POSITION</i> settings
<i>CHz=b</i>	Sets <i>CH1/2</i> settings (like amplitude)
<i>TBA=b</i>	Sets <i>TIMEBASE A/B</i> settings
<i>STRMODE=b</i>	Delivers <i>STORE MODE</i>
<i>RDWFMz:ww</i>	<i>READ WAVE FORM 1/2</i>
<i>WRREFz:ww</i>	<i>WRITE REFERENZ 1/2</i>
<i>RM0</i>	Exit <i>REMOTE</i> mode

The functions used for write and read data from the serial port are *fwrite* and *fread*.

For example the Autoset button has the following code:

```
function autos_Callback(hObject,
 eventdata, handles)
    cmdb=double('AUTOSET');
    b=[13 10];
    fwrite(handles.obj1,[cmdb b]);
    bl=fread(handles.obj1,3);
```

Every button has similar code to this example, *obj1* is set to COM1, the first serial port installed on the computer, but it can be set to any COM port desired with the following command:

```
handles.obj1=serial('COM1');
```

The information is sent decimal. Comments are generated automatically by MATLAB, which can be cleared. Here the SCPI command is: *AUTOSET*. The command need to be ended with carriage return (CR, 0Dh or 13d) and line feed (LF 0Ah or 10d) too. The *AUTOSET* command is concatenated with the carriage return and line feed bits. The number 3 from the *fread* function is the number of bits read.

Modifying this function we can make the functions for all buttons, just by reading the specific SCPI command from datasheet and being attentive to some bits.

The Connect button has a similar function, but no SCPI commands are used, only sending the 20h (32d) and the CR termination character. The serial port is opened with the *fopen* and closed with *fclose* functions and set to its default values: baud rate: 9600, data bits: 8, parity: none, stop bits: 1, flow control: none:

```
fopen(handles.obj1);
...
fclose(handles.obj1);
```

The serial port is activated with the following command:

```
set(handles.obj1,'FlowControl','hardware');
```

The ON/OFF indicator is commanded, where needed, with the following commands:

```
set(handles.sts,'String','ON');
...
set(handles.sts,'String','OFF');
```

Where *sts* is the indicator's identifier and *String* is the parameter that is changed and after that is the value: *ON* or *OFF*. With this command almost every parameter can be changed, like size or position.

The whole initialization program is the following:

```
function HM407_OpeningFcn(hObject,
 eventdata, handles, varargin)
    handles.obj1=serial('COM1');
    handles.output = hObject;
    guidata(hObject, handles);
```

```
function varargout =
HM407_OutputFcn(hObject, eventdata,
 handles)
    varargout{1} = handles.output;
```

```
function axes1_CreateFcn(hObject,
 eventdata, handles)
```

```
function con_Callback(hObject,
 eventdata, handles)
    fopen(handles.obj1);
    set(handles.obj1,'FlowControl','hardwa
re');
    a=[32 13];
    fwrite(handles.obj1,a);
    a1=fread(handles.obj1,3);
    set(handles.sts,'String','ON');
```

The Disconnect button is made similar, but it uses the *RM0* (remote 0) SCPI command and the serial port is closed with the *fclose* function:

```
function discon_Callback(hObject,
 eventdata, handles)
    cmdz=double('RM0');
    z=[13 10];
    fwrite(handles.obj1,[cmdz z]);
    z1=fread(handles.obj1,3);
    set(handles.sts,'String','OFF');
    fclose(handles.obj1);
```

For the horizontal position setting first we read the value of the slider with the following command:

```
yp1=get(hObject,'Value');
```

Then we use the *YzPOS=w* SCPI command, where *z* is the number of channel, 1 or 2 and *w* is the distance in word. The only problem is that the oscilloscope is like a coordinate system and it has positive and negative position. The goal was to change the position with only one button, so a little trick was needed.

The program that does the trick is the following:


```

function ypos1_Callback(hObject,
eventdata, handles)
    yp1=get(hObject,'Value');
    cmdc=double('Y1POS=');
    if (yp1>15)
        cyp1=yp1-15;
    end
    if (yp1<=15)
        cyp1=yp1+240;
    end
    c=[160 cyp1 13];
    fwrite(handles.obj1,[cmdc c]);
    cl=fread(handles.obj1,3);

```

As we can see the program is similar, but with *if* statement insertion. The whole idea is that the information that we have to send is 16 bits long, so we need two decimal numbers. The slider is set to the value of 15 and the minimum value to 0 and maximum to 30.

The whole screen height is FF0h (4080d), the inserted string is the LF (0Ah), so this way we have FF0Ah. We split the word in two bytes and get FFh and 0Ah, we reverse them and get FFh (255d) and A0h (160d), and these need to be sent in reversed orders.

With the implemented algorithm we will be able to change the vertical position in brute values (changing the MSB). In binary the positive values for the second byte are between 0000000b – 00001111b (00h – 0Fh, 0d – 15d) and the negative values between 11110000 – 11111111 (F0h – FFh, 240d – 255d), the negative values are in the complement of 2, so the lowest value is FFh (255d) and the highest is F0h (240d).

A same program can be made to the channel 2, but using *Y2POS=w* SCPI command and for horizontal position with the *XPOS=w* SCPI command.

For the amplitude the used SCPI command is *CHz=b*, where *z* in the number of channel, 1 or 2 and *b* is the value in byte. There are 4 bytes for other settings to the channel and 4 bytes for setting the amplitude. D7 = GND, D6 = AC, D5 = INV, D4 = ON, D4 ÷ D0 are the setting for amplitude between 0000b – 1101b (0d – 13d). All bits can be “0” logic, but the ON bit must be at “1” logic, so the number we need to send are between 10000b – 11101b (16d – 29d). This way the slider’s value is set to 22 and the minimum value to 16 and the maximum value to 28.

The same thing can be made for the channel 2, but with the *CH2=b* SCPI command and a similar function will work for the timebase, but with the *TBA=b* SCPI command, where *A* is the A timebase, because this model has no B timebase.

The program for the amplitude is the following:

```

function vdiv1_Callback(hObject,
eventdata, handles)
    vold1=get(hObject,'Value');
    cmdf=double('CH1=');
    f=[round(vold1) 13];
    fwrite(handles.obj1,[cmdf f]);
    fl=fread(handles.obj1,3);

```

The program for the timebase is the following:

```

function tdiv_Callback(hObject,
eventdata, handles)
    timed=get(hObject,'Value');
    cmdh=double('TBA=');
    h=[round(timed) 13];
    fwrite(handles.obj1,[cmdh h]);
    hl=fread(handles.obj1,3);

```

For pop-up menu the programming is a little more complicated, because we ne exact amplitude and timebase. For amplitude, we have 14 values between 1 mV/DIV. and 20 V/DIV, this way 1 mV/DIV. means 1, but we need to send 16, and 20 V/DIV. means 14, but we need to send 29, so we have to add 15 to every value. Same thing for TIME/DIV. but we have 26, values between 1 µs/DIV. and 0,5 s/DIV., so we need to add 3 to every value.

Maybe a little more complicated is the reading of the waveforms, the used SCPI command is *RDWFMz:ww*, where *z* is the number of channels, 1 or 2 and the first *w* word is the offset and the second is the length. The offset we will set to 0, so the first two bytes are 00h and 00h. The length we will set to 256 samples (256 points), the serial has a 512 sample buffer. 256 = 0100h, we split the word in two bytes and we get 01h and 00h, after all we need to send it in reversed order, so 00h and 01h. All the numbers from the offset and length in reversed order, in decimal and with CR termination character is: 0 0 0 1 13.

Where we plot the information from the 12th sample, because these samples in the start are information about the waveform, but the waveform data starts from 12 and ends at 267.

For this signal acquisition to work we have to be careful with the STOR. MODE bits using the *STRMODE=b* SCPI command. D7 = REF2, D6 = REF1, D5 ÷ D3 = PRE TRIGGER (011 = 0%) and D2÷D1 STOR MODE (000 = REF). This way for signal acquisition we need no reference memory, so we have 11000b (24d), for sending signals to reference memory 1 we will have 1011000b (88d) and for reference memory 2 we will have 10011000b (152d). This way we don’t need to push the reference button manually all the time and stop the program.

After it we need to lot de received data to the axe, so the program section will be:

```

function rdwf1_Callback(hObject,
eventdata, handles)
    cmdi=double('STRMODE=');
    i=[16 13];
    fwrite(handles.obj1,[cmdi i]);
    i1=fread(handles.obj1,3);
    cmdj=double('RDWFM1:');
    j=[0 0 0 1 13];
    fwrite(handles.obj1,[cmdj j]);
    j1=fread(handles.obj1,267);
    l=1;
    for k=12:267

```

```

V(l)=j1(k);
l=l+1;
end
plot(V)

```

For writing a signal to the memory is quite similar to reading it. The used SCPI command is *WRREFz:ww*, where *z* is the number of channels, 1 or 2 and the first *w* word is the offset and the second is the length. The signal is written by some numbers in one colon in the signal.txt file.

The function should be the following:

```

function wtwf1_Callback(hObject,
eventdata, handles)
cmdm=double('STRMODE=');
m=[88 13];
fwrite(handles.obj1,[cmdm m]);
m1=fread(handles.obj1,3);
load signal.txt -ascii;
cmdn=double('WRREF1:');
n=[0 4 0 1 signal' 13];
fwrite(handles.obj1,[cmdn n]);
n1=fread(handles.obj1,3);

```

The signal it's transposed with *signal'*, it is more simple to write values in a colon in a *.txt file than in a row. The file must contain exactly 256 values (Fig. 5.).

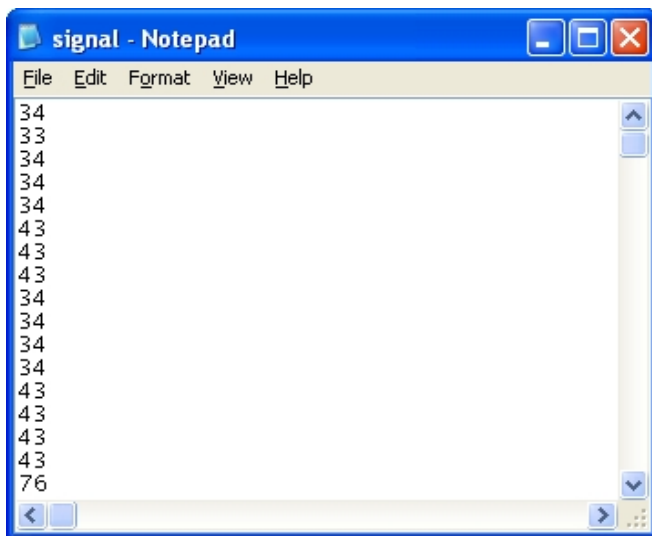


Fig. 5. The signal.txt file with some random numbers forming a random signal.

In Fig. 6. we can see the graphical user interface running and acquisitioning a square waveform.

The plotted signal is generated with the oscilloscope internal generator with plugging the oscilloscope probe in the calibrate input.

The measured signal has more samples, but we acquisitioned only 256 samples + signal information, because the RS-232 interface has a buffer of 512 samples. For more samples we have to make multiple acquisitioning.

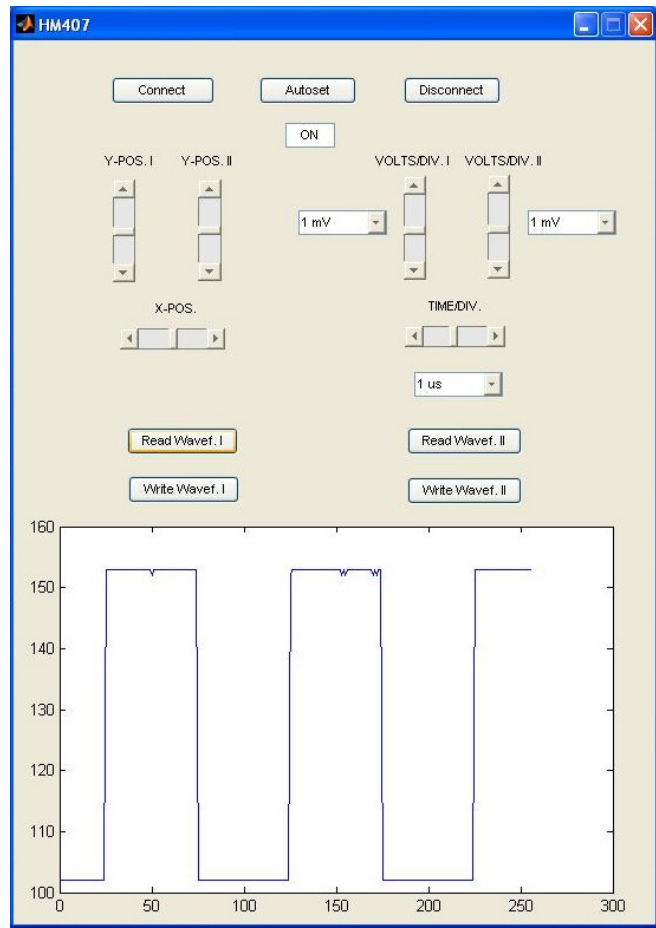


Fig. 6. The graphical user interface for the HAMEG HM 407 oscilloscope running when acquisitioning a square signal.

IV. THE NI OSCILLOSCOPE COMMAND

The NI oscilloscope differs more from the HAMEG oscilloscope. It's not a stand-alone oscilloscope, it only a card that can be used just connected to a PC, this way the drivers are compulsory, so National Instruments provided them. The drivers were used and worked very well.

The oscilloscope card is in a PXI chassis (Fig. 7.). This chassis is connected to the PC via the MXI interface, which has speed up to 132 MB/s. Our chassis is the NI PXI-1044 with 14 slots.



Fig. 7. NI PXI-1044 chassis for acquisition cards.

The chosen oscilloscope is the NI PXI-5412 (Fig. 8.). This oscilloscope is traditional National Instruments equipment. It uses the NI-SCOPE driver.



Fig. 8. NI PXI-5412 oscilloscope from National Instruments.

The Front Panel of the NI PXI-5412 oscilloscope command made in LabVIEW is shown in Fig. 9. As we can see we have the resource name, which shows the card number in the PXI chassis. Two vertical adjust dials for each channel and a horizontal adjust dial. We have two Waveform Graphs which shows the signals at each channel.

The Block Diagram is shown in Fig. 10. As we can see we have a While loop. Its timing is set to 100 ms. Outside of the loop is the initialize and close VIs, ending everything with simple error handler. We have one horizontal adjust VI and to vertical adjust VIs with two read VIs for the two channels from the oscilloscope (channel 0 and 1). At the second channel we have a Bessel filter. We used a Build Array VI and Shift

Registers to make the static Waveform Graph dynamic; otherwise we would see a graph just after the While loop ends.

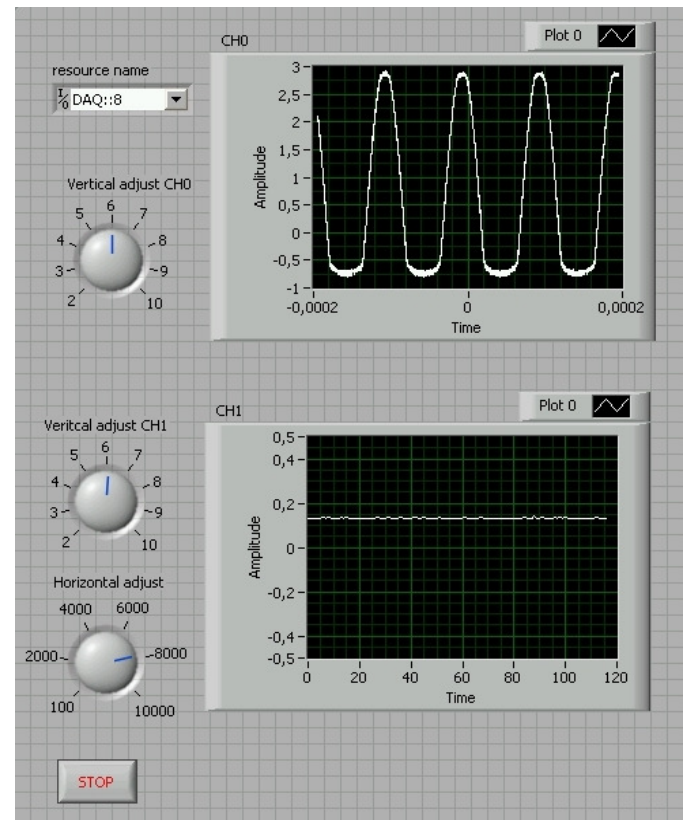


Fig. 9. The Front Panel of the NI PXI-5412 oscilloscope program made in LabVIEW.

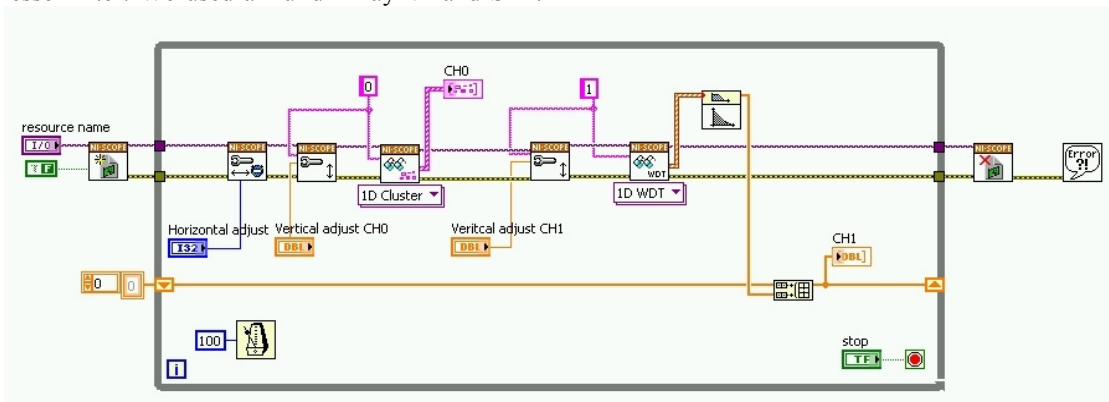


Fig. 10. The Block Diagram of the NI PXI-5412 oscilloscope program made in LabVIEW.

V. CONCLUSION

These days the instruments have simple SCPI commands, where no need for binary calculation is. Some instrument's vendors provide even drivers, where some functions gather the SCPI commands with the binary values and the user just calls the functions and enter decimal values.

As we saw almost any instrument can be programmed as the user wants and in any programming language. The

datasheet needs to be analyzed well and with a little binary calculation and some programming trick almost everything can be done.

The goal was achieved. We wanted to program an instrument and we needed some functions that are not possible without a computer, like signal sending to the oscilloscope or saving from it.

Further enhancements would be to make a button for every setting on the oscilloscope, maybe try program it in other

programming language, like C, and make an official driver with all function of the oscilloscope, so this way programmers will not have to do so many binary calculations and read all the datasheets.

The whole idea of this oscilloscope programming is that we wanted to see if we are capable of programming an oscilloscope with complicated SCPI commands with binary calculations.

With this knowledge now we are capable communicating with almost any equipment. It's an old equipment, but it still needs to be connected to the computer and it still needed to be programmed. As mentioned in the introduction these older equipments are still needed. On the other hand, somebody needs to make drivers for the instruments for simpler programming. This paper's goal is to show how to interpret the SCPI commands and this way to make an instrument driver. This paper is just an example how to program more complicated instruments. With this knowledge we hope that the communication with instruments will not be a problem.

REFERENCES

- [1] N. Sulaiman, N. A. Mahmud, "Designing the PC-Based 4-Channel Digital Storage Oscilloscope by using DSP Techniques," *Research and Development*, 2007. SCOReD 2007. 5th Student Conference, 2007, pp. 1-7.
 - [2] Tew Yiqi, Goi Bok-Min, "Oscilloscope: A PC-based Real Time Oscilloscope," *Innovative Technologies in Intelligent Systems and Industrial Applications*, 2008. CITISIA 2008. IEEE Conference, 2008, pp. 92-97.
 - [3] R. Lincke, I. Bull, A. Trutia, B. Logofatu, "PC-based oscilloscope," *Semiconductor Conference*, 1995. CAS'95 Proceedings, 1995 International, 1995, pp. 229-232.
 - [4] M. O. Hagler, D. Mehrl, "A PC with sound card as an audio waveform generator, a two-channel digital oscilloscope and a spectrum analyzer," *Education, IEEE Transactions*, vol. 44. 2001.
 - [5] C. Bhunia, S. Giri, S. Kar, S. Haldar, P. Purkait, "A low-cost PC-based virtual oscilloscope," *Education, IEEE Transactions*, vol. 47, 2004, pp. 295-299.
 - [6] S. A. Chickamenahalli, A. Hall, "Interfacing a digital oscilloscope to a personal computer using GPIB," *Frontiers in Education Conference*, 1997. 27th Annual Conference. 'Teaching and Learning in an Era of Change'. Proceedings, vol. 2, 1997.
 - [7] *MATLAB - Creating Graphical User Interfaces*
 - [8] *MATLAB - Instrument Control Toolbox 2 User's Guide*
 - [9] *HAMEG Instruments - Description of Interface Commands*
 - [10] Muhammad Sharfi Najib, Mohd Shawal Jadin, Mohd Razali Dau, "Development of Real-Time Signal Generator Graphical User Interface Using Matlab 6.5," *Software Engineering, Parallel and Distributed Systems*. SEPADS '08. 7th WSEAS International Conference, 2008, pp. 103-106.
 - [11] Vladislav Slavov, Tasho Tashev, "Data Acquisition Units Using For Student Labs," *System Science and Simulation in Engineering*, 5th WSEAS International Conference, 2006, pp. 228-231.
 - [12] S.M. Potirakis, M. Rangoussi, G.E. Alexakis, "Exploiting Multimedia for the instruction of Analog Electronics, Applied Acoustics and Electro-Acoustics undergraduate courses," WSEAS International Conference.
 - [13] A. Etxebarria, R. Bărcena, "Real Experiments Remotely Controlled Through The World Wide Web," *Engineering Education*. EE'08. 5th WSEAS / IASME International Conference, 2008, pp. 259-264.
 - [14] A. Ascia, B. Ando, S. Baglio, N. Pitrone, "Teaching Advanced Technologies to Undergraduates," *Engineering Education*. EE'08. 5th WSEAS / IASME International Conference, 2008, pp. 360-365.
- Roland Szabó** is a Master student in the Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România. He was born in Timișoara, România, in April 14, 1986. He is an electrical engineer since 2009, with LabVIEW Basics I & II Certificate from National Instruments Hungary – 2009, with Software Quality Engineer certificate from Continental Automotive România – 2009.
- He is a Hardware Engineer at Continental Automotive România located in Timișoara. He is research laboratory responsible in the Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România. He had summer job also in Alcatel-Lucent located in Timișoara, Romania. He has 5 papers. Areas of interest: robots, creating computer interfaces for electronic equipments, servers, web programming.
- Eng. Roland Szabó is a Hardware Engineer at Continental Automotive România.
- Aurel Gontean** is professor and vicedean in the Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România. He was born in June 26, 1961. He had 3 months scholarship at Central Lancashire University, Preston, England, VLSI Design oriented – 1996, a 3 months scholarship at Fachhochschule Wiesbaden, Germany, Programmable Logic Design oriented – 1995, a 3 days FPGA Workshop, Texas Instruments, Germany – 1993. He is an IEEE member since 1999.
- Activities: Invited Professor, DH Loerrach, Germany, EU Expert – appointed grant reviewer in Bulgaria, Initiates the Remote Access Electronic Lab in Electronics Faculty Timișoara, România, International Program Committee member, Programmable Devices and Systems conferences, IFAC, National reviewer for Romanian grants, Workshops and trainings dedicated to Digital Electronics Fundamentals and Microcontrollers at Soletron, Timișoara, Workshops and trainings dedicated to Digital Electronics Fundamentals and Microcontrollers at Siemens VDO, Timișoara, IEEE Member, 1994 - Member in the π - TEAM (research team), Texas Instruments, Europe, 1993 Appointed lecturer for Texas Instruments FPGA Workshops and Seminars in Romania. He has over 70 papers, 5 books and over 20 grants. Interests: VHDL, FPGA, C.NET programming.
- Prof. Aurel Gontean, PhD is a PhD advisor in the Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România.
- Ioan Lie** is associate professor in the Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România. He was born in Recea, Brașov, România in October 28, 1961. Other jobs: Engineer at "Electrotimis" Ltd. Timișoara, Timteh Electronics Ltd. Company (Timișoara, România), The direct customers of Timteh Ltd. was Rada Electronic Industries, Tel Aviv, Israel and Elbit Systems Ltd. Haifa, Israel.
- Activities: development and implementation of software for testing Boeing 737, Boeing 777, DC-10 and Concorde airplane electronics units on the specific Automatic Test Equipment (ATE), development and implementation of hardware for digital video recorder, collaboration with Metrys GmbH, Germany, regarding Hardware and Software solutions for: Water Meters, Heat Costs Allocators, Transit-Time Ultrasonic Liquid Flow Meters, AMR (Automatic Meter Reading) and RFID. He has over 30 papers, 2 books and 8 grants. Interests: Electronic Design Automation, Methods and Implementations for Ultrasonic Measurement and Testing, Programmable Logic, Microcontrollers and Microprocessors, Automatic Test Equipments, Software for applications
- Assoc. Prof. Ioan Lie, PhD is at Applied Electronics Department, Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România.
- Mircea Băbăiță** is lecturer in the Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România. He was born in Orăștie, Hunedoara, România in July 18, 1964. He had 6 weeks scholarship at University of Strathclyde, Glasgow, Scotland – 2000, 2 weeks scholarship at University of Mannheim, Germany – 2002.
- Activities: development and implementation of hardware and software for regarding DSP Utilization for MCC Motor Drives, development and implementation of hardware and software for E-learning Distance Interactive Practical Education in Power Electronics. He has over 50, 6 books and over 20 grants. Interests: Digital Logic, Microcontrollers and Microprocessors, Power Electronics, Motor Drives, Fuzzy Logic.
- Lect. Mircea Băbăiță is at Applied Electronics Department, Faculty of Electronics and Telecommunications, "Politehnica" University of Timișoara, România.