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Design of an automated system to measure and test the electrical parameters of CT/Inductor using Labview

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Abstract
Automated systems are increasing day by day. Nowadays, Large Industries prefer automated systems for higher production rates and increased productivity, more efficient use of materials, better product quality, improved safety, shorter workweeks for labour, and reduced factory lead times, etc. This paper presents the design of an automated system, which is used to measure and test the electrical parameters such as inductance, resistance, voltage in an Inductor using NI-Elvis and to measure voltage in a CT using data logger and Labview.

Keywords: NI-Elvis II+, Labview, Data logger, CT, USB.

Introduction

Nowadays, in many industries where large number of electrical/electronic products is manufactured, the need of automated system to test these products is increasing. Manual testing of large number of products being manufactured is less efficient, increases time for testing, report generation is harder. Hence automated systems are needed to test these products in an efficient manner, thereby reduce time for testing, makes report generation faster and easier, etc. Data loggers address a wide range of applications, both for general- and special-purpose situations. Special-purpose data loggers are available for temperature and humidity, voltage, thermocouple. These are usually single-channel devices that feature low cost. Other multi-channel product solutions can measure a variety of measurements at the same time, like voltage, ac rms, 4-20 mA process current, etc.

NI ELVIS II/II+

The NI ELVIS is a modular engineering educational platform that enables students to easily connect to measurements for their various laboratory experiments. These measurement instruments, called NI ELVIS mx soft front panels can be launched both from the native NI ELVIS Instrument Launcher as well as from NI Multisim. The 12 instruments integrated into the NI ELVIS hardware are accessed through measurement instruments that are accessed, viewed and controlled from your PC. The instruments connect to the NI ELVIS hardware via the USB DAQ connection. Ensure the power switch on the back of the NI ELVIS workstation is in the OFF position (as in Fig. 1 (a)). Connect the USB cable to the back of the NI ELVIS workstation (grey cord in Fig. 1 (b)). Connect the AC power supply to the NI ELVIS II Series Workstation. Connect the power supply into a wall outlet (Fig. 1(c)). Install the prototyping board by positioning the PCI connector at the receptacle on the top of the workstation (Fig. 1 (d)). Slide the PCI connector into the workstation and ensure it is tightly connected. Turn the power switch on the back of the NI ELVIS workstation (Fig. 1) to the ON position. Turn the prototyping board power switch to the ON position as in Fig. 1(e).

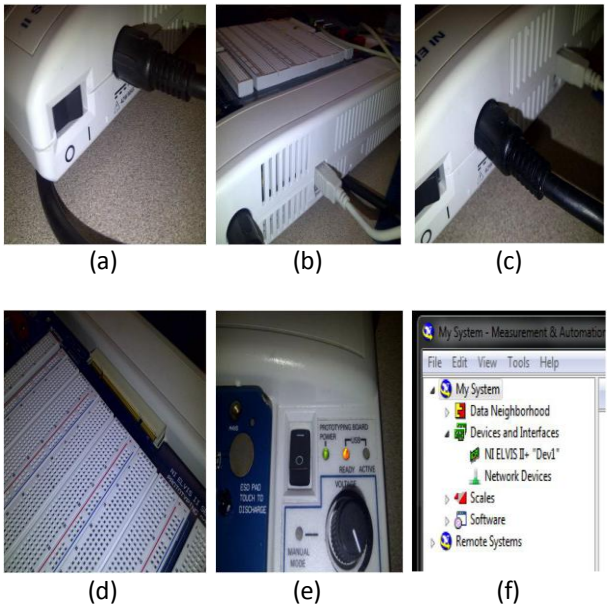


Fig. 1. (a) NI ELVIS off switch, (b) USB Cable, (c) AC Power Supply, (d) Plug-in the prototyping board, (e) Prototyping Board in the ON position, (f) Measurement and Automation interface.

Select Start > All Programs > National Instruments > Measurement & Automation Explorer to open the interface to configure and access your hardware devices. Under My System expand Devices and Interfaces. Confirm your device is detected by searching for the NI ELVISII hardware (Fig. 1 (f)). Right-click the NI ELVISII device and select Self-Test. When the self-test finishes, a message indicates either successful verification or an error occurred.

Data Logger

A data logger (also data recorder) is an electronic device that records data over time or in relation to location either with a built in instrument or sensor or via external instruments and sensors. Data loggers vary between general purpose types for a range of measurement applications to very specific devices for measuring in one environment or application type only. One of the primary benefits of using data loggers is the ability to automatically collect data on a 24-hour basis. Data loggers from DATAQ Instruments address a wide range of applications, both for general-and special-purpose situations. Special-purpose data loggers are available for temperature and humidity, voltage, thermocouple, and event applications to name just a few. These are usually single-channel devices that feature low cost [1]. Other multi-channel product solutions can measure a variety of measurements at the same time, like voltage, ac rms, 4-20 mA process current, and many more. Our full range of data logger solutions means a product to fit any application or budget. View all our Data Loggers. DI-730 Series Instruments offer 8 fixed isolated high voltage range (±1000V Full Scale) differential inputs and 16 general-purpose (±10V Full Scale) non-isolated inputs (available through the EXPANSION (USB and PP models) or Channel Expansion (EN models) connector on the rear of the instrument). General purpose inputs are connected directly to a multiplexer. Each channel can be configured for single-ended or differential operation on a channel-by-channel basis. General-purpose inputs can have gain factors of 1, 2, 4 or 8 applied on a channel-by-channel basis. DI-730 Series Instruments feature software programmable input measurement ranges of ±10mV, ±100mV, ±1V, ±10V, ±100V and ±1000V full scale with gain ranges of 1, 10, 100, 1000, 10000, and 100000 for the 8 fixed isolated high voltage range differential inputs. General-purpose inputs feature software-programmable input measurement ranges of ±10V, ±5V, ±2. 5V, and ±1. 25V full scale with gain ranges of 1, 2, 4, and 8. DI-730 instruments have one 12-bit D/A converter.

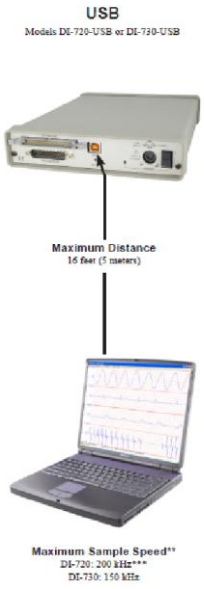


Fig. 2. Interfacing Data logger with a PC

Our Windaq (WINDAQ/Pro+) Recording Software is a no-programming, ready-to-run solution that supports all DATAQ Instruments products. The WINDAQ software package contains both recording and playback software.

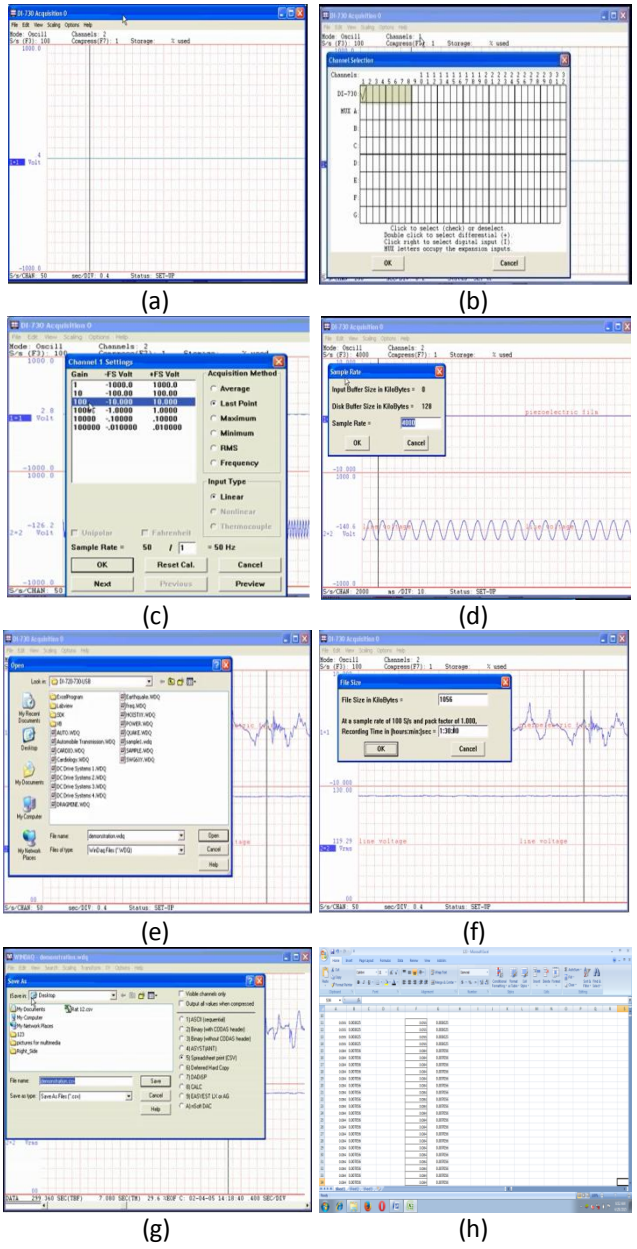


Fig. 3 Windaq pro+ operation, (a)Formatting the Windaq display, (b)Enabling channels, (c) Adjusting the gain in Windaq, (d)Changing the sampling rate, (e)Recording the data, (f) Enabling recording time, (g)Export data to excel (h) Output

The recording software allows you to record waveforms directly and continuously to disk while monitoring a real time display of the waveforms on your computer screen. WINDAQ pro+ software has three operating modes: Setup, Record, and Standby. In SET UP mode you can configure data acquisition parameters—such as the number of acquired channels, channel gain, and channel offset—and customize the real time

display. The SET UP mode displays data in real time but does not store data to disk. The RECORD operating mode stores, or streams, data to disk. Activate the RECORD mode by selecting Record from the File menu. Use the STANDBY operating mode to temporarily suspend (pause) waveform recording to disk.

Results and Discussion

The initial test to measure and test the electrical specifications of an inductor/CT is programmed using Labview and NI ElvisII+. Using Labview the NI ElvisII+ digital instrument launcher is used to measure resistance, inductance, and high voltage of an inductor. Initially the value of resistance is measured by using banana jack connectors (Fig. 3). If the measured resistance value is between 40Ω-90Ω, then that particular value is indicated as pass.

Fig. 4. Current Transformer 160A

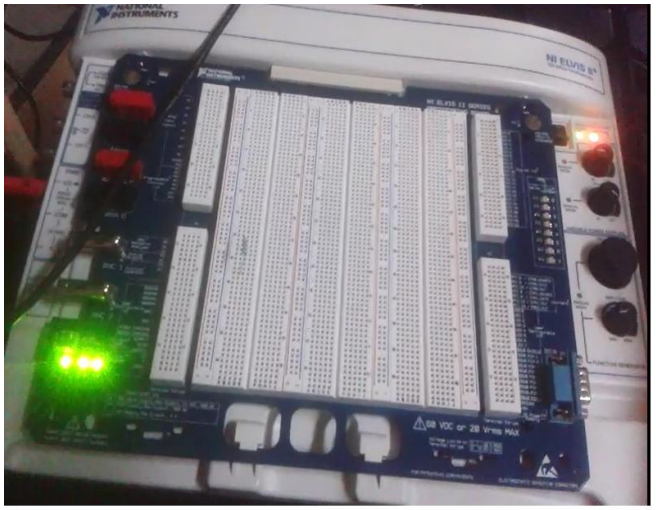


Fig. 5. Prototyping with NI-ElvisII+

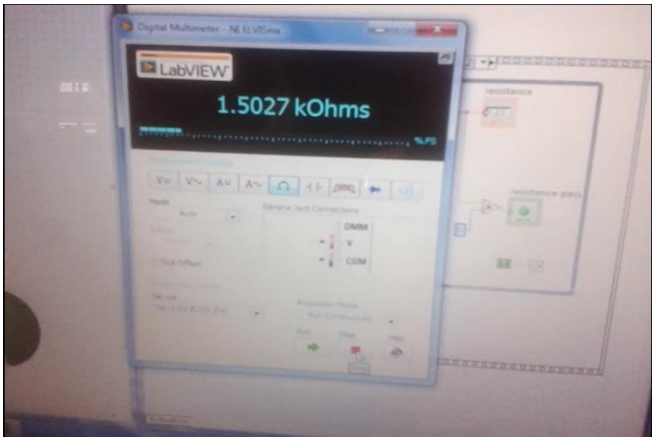
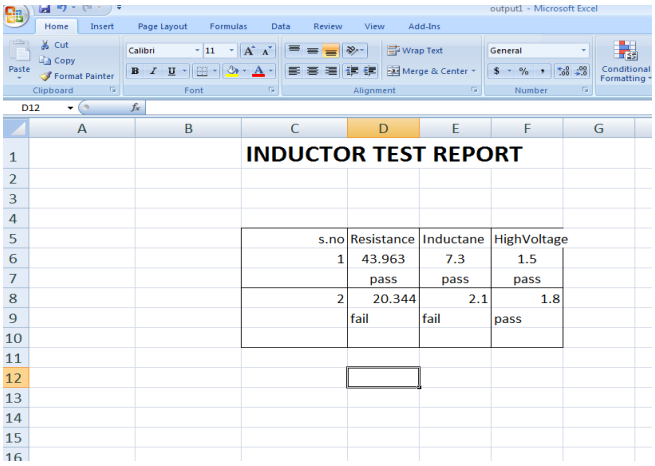


Fig. 6. Result for resistance in an current transformer measured using NI-ElvisII+

Next inductance value is measured at various frequencies (1 KHz, 5 KHz, 10 KHz) using DUT pins. It is connected between the DUT+ and DUT– terminals on the NI ELVIS II Series Prototyping Board. The FGEN connects to DUT+ internally and provides the voltage source. The value of inductance should be between (100µH-100mH), then that particular value is indicated as pass. Next is to measure high voltage using DMM, this value should be between (2mA-5mA), then that particular value is indicated as pass. Finally the test report is exported to excel sheet.



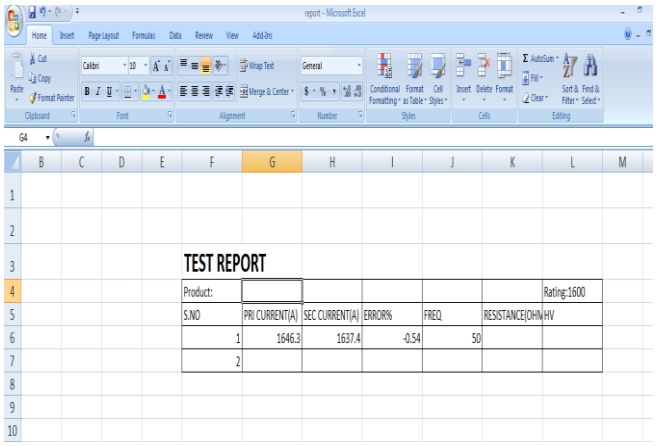
INDUCTOR TEST REPORT

s.no	Resistance	Inductane	HighVoltage
1	43.963	7.3	1.5
	pass	pass	pass
2	20.344	2.1	1.8
	fail	fail	pass

Fig. 7. Inductor test report

Final testing of voltage [2] in an inductor/CT is programmed using Labview and DI-730 hardware using activeX control. The manual operation carried out in Windaq pro+ to enable channels, set the gain, Sampling rate, Record the data, save it in excel file is automated using Labview and activeX control. Labview as an ActiveX server or ActiveX client can interface with other programs from the Labview programming interface. ActiveX is the general name for a set of Microsoft Technologies that allows you to reuse code and link individual programs together to suit your computing needs. Based on COM (Component Object Model) technologies, ActiveX is an extension of a previous technology called OLE (Object

Linking and Embedding). Each program does not need to regenerate components, but rather, reuse components to give you the power to combine applications together. Labview offers support for ActiveX automation as a server as well as support for ActiveX Containers, and ActiveX Events. After interfacing Windaq pro+ software in Labview. The three modes of operation in Windaq pro+ is been automated using Labview. Once the program is been executed all the operation is carried out in Labview using Windaq pro+. The final output will be obtained in an excel file.



TEST REPORT

Product:						Rating:1600
S.NO	PRI CURRENT(A)	SEC CURRENT(A)	ERROR%	FREQ	RESISTANCE(OHM)	HV
1	1646.3	1637.4	-0.54	50		
2						

Fig. 8. Test Report for Current Transformer

TABLE. 1. Comparison of Execution Time for 5reading

S. NO	Results For Execution time	
	Labview	Windaq PRO+
1	20 seconds	27 seconds
2	16 seconds	30 seconds
3	15 seconds	35 seconds
4	18 seconds	28 seconds
5	17 seconds	27 seconds
Total time for 5readings	86seconds	147 seconds

Conclusion

In this paper an automated system is designed to measure and test the electrical parameters in an Inductor/CT. The experimental results shows that the time required to generate test report is lesser using Labview compared with Windaq Pro+ software and also Manual operation are reduced.

Acknowledgment

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