HIGHER TECHNICAL INSTITUTE
ELECTRICAL ENGINEERING DEPARTMENT

DIPLOMA PROJECT

DEVELOPMENT OF A PC BASED DATA AQUISITION SYSTEM

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ABSTRACT

The Project involves the design, construction and testing of a Data Acquisition System to be used for troubleshooting of circuit transient or 'through' faults and Sequence of Events Conditioning.

Objectives and Requirements:

1. To monitor analogue DC signals 0-20mA, 0-1V, 0-10V, 0-100mV and logic signals of 0/24V DC.

2. To be fast enough to help trace the failing signal before the rest of the signals fail as a consequence i.e. high discrimination time.

3. To provide a computer interface to an IBM compatible PC which through a suitable software will be able to store input data for analysis.

4. To be able to monitor 8 measuring channels.

5. To avoid interference with the circuit under examination.

6. To develop a software program in C language for storing the input values.

7. To develop software for presenting the stored data through a Spreadsheet.

A major objective of the design and construction of this Data Acquisition System is that it may be used as a Sequence of Events Conditioning System. That is a system which will accept data from various signals from a device or equipment so that if one part of the device fails to work then through an analysis of these data anyone can detect at which part of the device the failure or malfunction took place.

Obviously in the case where the fault remains permanent, identification of the cause can easily and much more economically be achieved by simple troubleshooting procedures. However in the case where the fault is transient or happens momentarily, normal troubleshooting procedures will prove inadequate to trace the fault, as this will have already cleared itself.

The objective of this PC based Data Acquisition System is that it can be used to locate faults in devices where the malfunction occurs momentarily and then disappears having most probably caused a problem to the system it was connected to.

INTRODUCTION

PC BASED DATA ACQUISITION SYSTEM OVERVIEW

In the last few years, industrial PC I/O products have become increasingly reliable, accurate and affordable. Because of this, PC-based data acquisition and control systems are widely used in areas such as industrial monitoring and control, laboratory applications and automatic test and measuring systems.

To be able to select and build a DA&A (Data Acquisition and Control) system the following areas must be taken into consideration:

-Real world Phenomena
-Transducers and Actuators
-Signal Conditioning
-Data Acquisition and Control Hardware
-Computer Systems Software

Real-world Phenomena

1. Data Acquisition and process control systems measure real-world phenomena, such as temperature, pressure, level and flow rate. These phenomena are sensed by transducers and are then converted into analogue signals which are eventually sent to the compute as digital signals.

2. Some real-world phenomena, such as contact monitoring and event counting, can be detected and transmitted as digital signals directly. The computer then records and analyses the digital data to interpret the real-world phenomenon.

3. In the same way, a computer can control outside events by producing digital or analogue outputs.

Transducers and Actuators

A transducer converts temperature, pressure, level, length, position, etc. into voltage, current, frequency, pulses or other signals.

Thermocouples, thermistors and resistance temperature detectors (RTDs) are common transducers for temperature measurement. Other types of transducers include flow sensors, pressure sensors, strain gauges, load cells and LVDTs which measure flow rate, pressure variances, force or displacement.

An Actuator is a device that activates process control equipment by using pneumatic, hydraulic or electrical power.

Signal conditioning

A signal conditioner is a circuit module specifically designed to provide signal scaling. Amplification, linearization, cold-junction compensation, filtering, attenuation, excitation, common-mode rejection, etc. Signal conditioning improves the quality of signals that are generated by transducers and are eventually converted into digital signals by the PC`s data-acquisition hardware.

One of the most common signal conditioning functions is amplification. Amplifying transducers signals, are thereby increasing resolution, provides an A/D converter with a much stronger signal. To aquire the highest resolution during A/D conversion the strength of the amplified signals should approximately be equal to the maximum input range of the selected A/D converter.

Data Acquisition and Control hardware

In general, DA&C hardware performs one or several of the following functions: analogue input, analogue output, digital input, digital output and counter/timer. In this project only the case of analogue input and digital output will only be considered.

Analogue inputs A/D:

Analogue to Digital (A/D) conversion is a function that converts analogue voltage or current levels into digital information. The conversion is necessary to enable the computer to process or store signals.

Computer systems-Software

The driving force behind any data acquisition and control system is software control. Programming of the DA&C system can be accomplished in the following three ways: hardware-level programming, driver-level programming and package-level programming. This project was programmed on a combination of driver-level programming and package-level programming.

Driver-level programming is done with the function call libraries for popular programming languages, such as C/C++, PASCAL, and BASIC, avoiding data register programming.

Package-level programming integrates data analysis, presentation and instrument control capabilities into a single software package. These programs offer a multitude of features, such as pull down menus and icons, data logging and analysis and real-time graphic displays.