STUDY OF FIELD INSTRUMENTS IN CNC

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BHEL HYDERABAD

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COMPANY DETAILS

- BHEL as it is known today, as come a long way from being a mere heavy
- electrical generation equipment company to the position of leadership that it enjoys
- today with major presence not only in the field of power, but in the other co sectors
- of industry. Transportation, Transmission, Oil & Gas, Telecommunication,
- Defense & Civil Aviation.
- The wide network of BHEL consists of 14 manufacturing divisions , 4
- power sector regional centers, and 18 regional offices, enables the
- company to promptly serve its customers and provide them with
- suitable products ,systems and services-efficiently and it competitive prices.
- Today , BHEL has a major presence in the domestic power market and
- accounts for 65% of the nations installed power generating capacity. Thus
- making a significant contribution to the growth and development of the country's economy over several years.

PLC

Programmable Logic Controllers (PLCs), also referred to as programmable controllers, are in the computer family. They are used in commercial and industrial applications. A PLC monitors inputs, makes decisions based on its program, and controls outputs to automate a process or machine. This course is meant to supply you with basic information on the functions and configurations of PLCs.

PLCs consist of input modules or points, a Central Processing Unit (CPU), and output module or points. An input accepts a variety of digital or analog signals from various field devices (sensors) and converts them into a logic signal that can be used by the CPU. The CPU makes decisions and executes control instructions based on program instructions in memory. Output modules convert control instructions from the CPU into a digital or analog signal that can be used to control various field devices (actuators). A programming device is used to input the desired instructions. These instructions determine what the PLC will do for a specific input. An operator interface device allows process information to be displayed and new control parameters to be entered.

A device-level network system connects devices, while eliminating the hassles of traditional I/O wiring.

Figure 4: Traditionally hardwired control cabinet

Figure 5: Networked control cabinet using Eaton's SmartWire-DT

COMPONENTS:

- Programmable controllers have grown throughout industrial control applications because of the ease they bring to creating a controller: ease of programming, ease of wiring, ease of installation and ease of changing. PLCs span a wide range of sizes, but all contain these basic components:
- 1. Processor
- 2. Memory Unit
- 3. Power Supply
- 4. I/O Modules
- 5. Programming Device

- **Processor (CPU):**
- CPU will determine things like: the programming functions available, size of the application
- logic available, amount of memory available, and processing speed.
- **Memory Unit:**
- It is connected to the cpu which contains the programs of logic, sequencing and i/o operations.
- **Power Supply:**
- The power supply provides power for the PLC system. The power supply provides internal DC
- current to operate the processor logic circuitry and input/output assemblies. Common power
- levels used are 24V DC or 120 VAC.
- **I/O Modules:**
- Inputs carry signals from the process into the controller, they can be input switches, pressure
- sensors, operator inputs, etc. These are like the senses and sensors of the PLC.
- Outputs are the devices that the PLC uses to send changes out to the world. These are the
- actuator the PLC can change to adjust or control the process motors, lights, relays, pumps, etc.
- **Programming Device:**
- The PLC is programmed using a specialty programmer or software on a computer that can load
- and change the logic inside. Most modern PLCs are programmed using software on a PC or
- laptop computer. Older systems used a custom programming device.

OPERATION SEQUENCE

- PLC OPERATION SEQUENCE
- 1. SELF TEST- Testing of its own hardware and software for faults.
- 2. INPUT SCAN- If there are no problems PLC will copy the inputs and copy there values
- into memory.
- 3. LOGIC SOLVE /SCAN- Using inputs the ladder logic program is solved once and
- outputs are updated.
- 4. OUTPUT SCAN- While solving logic the output values are updated only in memory
- when ladder scan is done, the outputs will be updated using temporary values in memory

ADVANTAGES ANS DISADVANTAGES

- Smaller physical size than hard wired solutions.
- Easier and faster to make changes.
- Applications can be immediately documented.
- There's too much work required in connecting wires.
- It is difficult to find errors.
- Skillful workers are required.

PLC APPLICATIONS

- **PLC APPLICATIONS**
- Proper application of a PLC begins with an economical justification analysis. The batch
- process in chemical, cement, food and paper industries are sequential in nature, requiring
- time or event based decisions. PLCs are being used more and more as total solutions to a
- batch problem in these industries rather than just a tool.

CNC

- Controlling a machine tool by means of prepared program, which consists of blocks, or
- series of commands/numbers, is known as numerical control. Numerical Control [NC] for
- machine tools was introduced in 1950 by Prof. John T Parsons. The first CNC machine was built
- at the Massachusetts institute of technology [MIT] in 1953 by joint efforts of US Air force, MIT
- and the Parsons Corporation.
- NC is nothing but position control of machine tools by recorded information called part program,
- which is a set of coded instructions given as numbers for automatic control of machine tool in a
- predetermined sequence. Numerical control can be defined as a technique of controlling the
- position of a machine tool by the direct insertion of numerical data at some point (command
- point) of the control system. The functions that are controlled on the machine tool are position of
- slide members, spindle speed, tool selection etc. At first the numerical control was used to
- produce geometrically complex parts, but later used for added efficiency in medium batch
- production. Presently numerical controls are employed in all sections of production.

ELEMENTS OF CNC MACHINE

- The CNC system consist of the following elements:
- 1. Input Device
- 2. Machine Control Unit
- 3. Machine Tool
- 4. Driving System
- 5. Feedback Devices
- 6. Display unit

WORKING OF CNC

- First the part program is inserted into the MCU of the CNC.
- In MCU all the data process takes place and according to the program prepared, it
- prepares all the motion commands and sends it to the driving system.
- The drive system works as the motion commands are send by MCU. Drive system
- controls the motion and velocity of the machine tool.
- Feedback system, records the position and velocity measurement of the machine tool and
- sends a feedback signal to the MCU.
- In MCU, the feedback signals are compared with the reference signals and if there are
- errors, it corrects it and sends new signals to the machine tool for the right operation to
- happen.
- A display unit is used to see all the commands, programs and other important data. It acts
- as the eye of the machine.

ADVANTAGES

- **ADVANTAGES OF CNC**
- 1. It can produce jobs with highest accuracy and precision than any other manual
- machine.
- 2. It can be run for 24 hours of a day.
- 3. The parts produced by it have same accuracy. There is no variation in the parts
- manufactured by a CNC machine.

APPLICATIONS OF CNC

- Almost every manufacturing industry uses CNC machines. With increase in the
- competitive environment and demands, the demand of CNC usage has increased to a
- greater extent. The machine tools that comes with the CNC are late, mills, shaper,
- welding etc. The industries that are using CNC machines are automotive industry, metal
- removing industries, industries of fabricating metals, electrical discharge machining
- industries, wood industries etc.