**INDUSTRIAL AUTOMATION THROUGH INTERNET**

**ABSTRACT**

**on**

Industrial Automation

Through internet

**Introduction:-**Industrial automation is a latest technology for industrial control. There are several methods to automate the industrial process. But for automation through internet is a medium which is used to make connection between the remote server and the controlled machines (project equipment).

The medium can have two types:

1. Wired medium

2. Wireless medium

When we use the wired connection system then we need to connect wires from control panel to the controlled machines. This system can be used when the distance between the control panel and controlled devices are not too much. At the same time the cost of wires and the cost of maintaining the communication medium may be extent.

We can use wireless communication methods to avoid the use of physical wires. We can establish a communication system which can operate up to some kilometers distance. This type of system is costly and also has limitation of distance as the communication system has to be designed for a certain distance.

Automation through internet:

All These problems can be overcome if we use the internet as our media of communication. The distance between the control station and the controlled machines is not a problem as the internet is available everywhere. We just need to have internet connections at both sites. The cost of maintaining the communication system is just the internet bill of two connections with installation cost of hardware. We can use that internet connection for all other application.

In This project we are developing a controller card that will be attached to the serial port of the computer at the factory site. Our aim to control this controller card from any computer in the world connected to the internet. The connections of this control card are given to the machines through relays. An LCD display is also attached to this card to display the message received from the control station.

We are using Atmel’s AT89C51 microcontroller in it. An IC max 232 is used for serial communication.

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## 8051 Microcontroller

## MAX 232 IC

## Rectifier

## Transformer

## Relay

## LCD

1. **Automation tools:** ………………………………………………………………………

## ANN – Artificial neural network…………………………………………

## DCS – Distributed control system……………………………………….

## HME – Human machine interface

## SCADA – Supervisory control and data acquisition

## PLC – Programmable logic counter

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**Chapter 1**

* 1. **Automation: Definition**
  2. **Automation: Brief detail**
  3. **Current emphasis**
  4. **Application**
  5. **Advantages**

***1.1 DEFINATION: INDUSTRIAL AUTOMATION***

**Automation** is the use of control systems (such as numerical control programmable logic control, and other industrial control systems), in concert with other applications of information technology (such as computer-aided technologies [CAD, CAM, CAx]), to control industrial machinery and processes, reducing the need for human intervention.[[1]](http://en.wikipedia.org/wiki/Automated#cite_note-0#cite_note-0) In the scope of industrialization, automation is a step beyond mechanization. Whereas *mechanization* provided human operators with machinery to assist them with the *physical* requirements of work, *automation* greatly reduces the need for human *sensory* and *mental* requirements as well. Processes and systems can also be automated.

Automation is the use of control systems (such as numerical control, programmable logic control, and other industrial control systems), in concert with other applications of information technology (such as computer-aided technologies [CAD, CAM, CAx]), to control industrial machinery and processes, reducing the need for human intervention In the scope of industrialization, automation is a step beyond mechanization. Whereas mechanization provided human operators with machinery to assist them with the muscular requirements of work, automation greatly reduces the need for human sensory and mental requirements as well. Processes and systems can also be automated.

Automation plays an increasingly important role in the global economy and in daily experience. Engineers strive to combine automated devices with mathematical and organizational tools to create complex systems for a rapidly expanding range of applications and human activities.

Many roles for humans in industrial processes presently lie beyond the scope of automation. Human-level pattern recognition, language recognition, and language production ability are well beyond the capabilities of modern mechanical and computer systems. Tasks requiring subjective assessment or synthesis of complex sensory data, such as scents and sounds, as well as high-level tasks such as strategic planning, currently require human expertise. In many cases, the use of humans is more cost-effective than mechanical approaches even where automation of industrial tasks is possible.

Specialized hardened computers, referred to as programmable logic controllers (PLCs), are frequently used to synchronize the flow of inputs from (physical) sensors and events with the flow of outputs to actuators and events. This leads to precisely controlled actions that permit a tight control of almost any industrial process.

Human-machine interfaces (HMI) or computer human interfaces (CHI), formerly known as man-machine interfaces, are usually employed to communicate with PLCs and other computers, such as entering and monitoring temperatures or pressures for further automated control or emergency response. Service personnel who monitor and control these interfaces are often referred to as stationary engineers

***1.2 The brief detail***

Automation has a notable impact in a wide range of highly visible industries beyond manufacturing. Once-ubiquitous telephone operators have been replaced largely by automated telephone switchboards and answering machines. Medical processes such as primary screening in electrocardiography or radiography and laboratory analysis of human genes, sera, cells, and tissues are carried out at much greater speed and accuracy by automated systems. Automated teller machines have reduced the need for bank visits to obtain cash and carry out transactions. In general, automation has been responsible for the shift in the world economy from agrarian to industrial in the 19th century and from industrial to services in the 20th century.

. When automation was first introduced, it caused widespread fear. It was thought that the displacement of human operators by computerized systems would lead to severe unemployment.

Critics of automation contend that increased industrial automation causes increased unemployment; this was a pressing concern during the 1980s. One argument claims that this has happened invisibly in recent years, as the fact that many manufacturing jobs left the United States during the early 1990s was offset by a one-time massive increase in IT jobs at the same time. Some authors argue that the opposite has often been true, and that automation has led to higher employment. Under this point of view, the freeing up of the labor force has allowed more people to enter higher skilled managerial as well as specialized consultant/contractor jobs (like cryptographers), which are typically higher paying. One odd side effect of this shift is that "unskilled labor" is in higher demand in many first-world nations, because fewer people are available to fill such jobs.

At first glance, automation might appear to devalue labor through its replacement with less-expensive machines; however, the overall effect of this on the workforce as a whole remains unclear. Today automation of the workforce is quite advanced, and continues to advance increasingly more rapidly throughout the world and is encroaching on ever more skilled jobs, yet during the same period the general well-being and quality of life of most people in the world (where political factors have not muddied the picture) have improved dramatically.

## *1.3 Current emphasis*

Currently, for manufacturing companies, the purpose of automation has shifted from increasing productivity and reducing costs, to broader issues, such as increasing quality and flexibility in the manufacturing process.

The old focus on using automation simply to increase productivity and reduce costs was seen to be short-sighted, because it is also necessary to provide a skilled workforce who can make repairs and manage the machinery. Moreover, the initial costs of automation were high and often could not be recovered by the time entirely new manufacturing processes replaced the old.

Automation is now often applied primarily to increase quality in the manufacturing process, where automation can increase quality substantially. For example, automobile and truck pistons used to be installed into engines manually. This is rapidly being transitioned to automated machine installation, because the error rate for manual installment was around 1-1.5%, but has been reduced to 0.00001% with automation. Hazardous operations, such as oil refining the manufacturing of industrial chemicals, and all forms of metal working, were always early contenders for automation.

Another major shift in automation is the increased emphasis on flexibility and convertibility in the manufacturing process. Manufacturers are increasingly demanding the ability to easily switch from manufacturing Product A to manufacturing Product B without having to completely rebuild the production lines. Flexibility and distributed processes have led to the introduction of Automated Guided Vehicles with Natural Features Navigation.

## *1.4Advantages:*

The main advantage of the automated manufacturing are: higher consistency and quality, reduce the lead times, simplification of production, reduce handling, improve work flow and increase the moral of workers when a good implementation of the automation is made.

* Replacing human operators in tedious tasks.
* Replacing humans in tasks that should be done in dangerous environments (i.e. Fire, space, volcanoes, nuclear facilities, under the water, etc)
* Making task that are beyond the human capabilities such as handle too heavy loads, to large objects, too hot or too cold substances or the requirement to make things to fast or to slow.
* Economy improvement: Sometimes and some kinds of automation implies improves in economy of enterprises, society or most of the humankind. For example, when an enterprises that have invested in automation technology recover its investment; when a state or country increase its incomes due to automation like Germany or Japan in the 20th Century or when the humankind can use the internet which in turn use satellites and other automated engines.

## *1.5 Application:*

## The automation is used in following areas:

## Air traffic control: large building automation system: fire, security access, energy, lighting, air conditioning, communications, traffic control

## Motor control (exhaust regulations)

## Automatic train control: reduce operation costs, faster diagnostics, better energy management,

## Launching vehicle control

## Robot control

## Power plants

## Power flow in grid: Power transmission network

## Pharmaceutical Industry

## Manufacturing

## Printing machine

## Oil & Gas, petrochemicals

## Chemical industry

## Harbours

## Water treatment: Waste treatment, incinerators (waste-to-energy)

## Steel mills particularity: synchronization of the motors in the rolling mill

## Cement Works

## Mining

## Building Automation: basics: fire, intrusion, climate, energy managemt

**Chapter 2**

## 2.1 All about project

## 2.2 Project: Block diagram

## 2.3 Project: Circuit diagram

## 2.4 Project: Operation process

## 2.5 Project: Circuit element detail

## 

## 8051 Microcontroller

## MAX 232 IC

## Rectifier

## Transformer

## Relay

## LCD

* 1. ***All about project:***

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The medium can have two types:

1. Wired medium

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We are using Atmel’s AT89C51 microcontroller in it. An IC max 232 is used for serial communication.

Our project “Industrial automation through internet” basically a hardware circuit arrangement of electronic elements to control an industry remotely.

In the circuit design we arrange al l circuit components according to the circuit diagram by soldering . Join all ports of microcontroller and IC MAX 232 to relevant position. Connect a no of devices such as a crystal oscillator, timers, watchdog, serial and analog I/O etc. to microcontroller to control.

Connect an alarm and a seven segment display to check message and receive message.

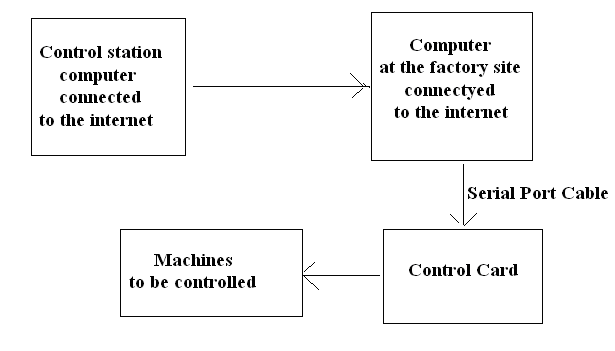
Process:

* Fix the COM port to connect the hardware with computer with internet connectivity
* Connect the pins of COM port to IC MAX232 and LCD according to the circuit.
* Connect all pins of IC MAX 232 to AT89c51 microcontroller and display unit
* Connect all pins of AT89C51 microcontroller to all devices which is to be controlled. All ports of microcontroller should be connected to relevant devices and circuit element according to the circuit.
* Connect the control switch of all devices with AT89C51 microcontroller.
* A crystal oscillator is used for microcontroller and works at 11.0592MHz frequency. We use crystal oscillator due to its high stability characteristics.
* Appropriate switches are connected to AT89C52 microcontroller to perform the function of control all devices.
* Resistors, capacitors and inductors are connected according to the circuit diagram.

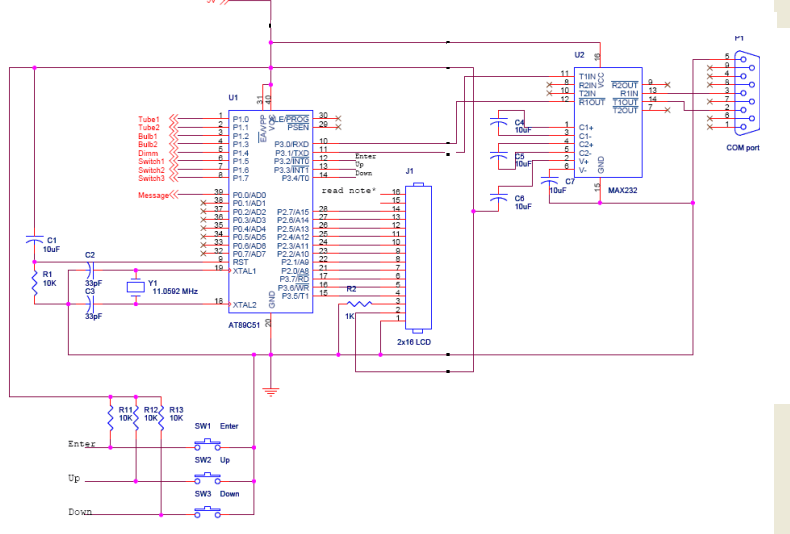
In this project our aim is to :

* Check the status of industry
* Switch on a device
* Switch off a device
* Change the state of operation for a device
* Send message & display on LCD
* Play alarm until someone not check the message (especially for emergency conditions)

**2.2 Block diagram**



* 1. **CIRCUIT DIAGRAM**



**2.4 Circuit element detail**

* ***MICRO CONTROLLER***

A **microcontroller** (also microcontroller unit, MCU or µC) is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers, watchdog, serial and analog I/O etc.

Microcontrollers are designed for small applications. Thus, in contrast to the microprocessors used in personal computers and other high-performance applications, simplicity is emphasized. Some microcontrollers may operate at clock frequencies as low as 32 KHz, as this is adequate for many typical applications, enabling low power consumption (miliwatts or microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just in nano watts, making many of them well suited for long lasting battery applications.

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes

Manual Instruction

This AT89c51 flash manual programmer can be used in four mode, AT89c51 identity reading, Loading program, Program verification and program deleting.

AT89c51 Identity Reading

Following steps are done to read the AT89c51 identity.

Switch off the power supply.

Put the AT89c51 in to ZIF socket.

Move the EA/VPP switch at 5 volt.

Move P2.6, P2.7, P3.6 and P3.7 switch at LOW.

Move the data switch at FFh (11111111b).

Switch on the power supply

Set the Address switch (switch A) with 30h (00110000b), the code will be seen at the data LED. (displaying LED then be verified to AT89c51 datasheet).

Set the Address switch (switch A) with 31h (00110001b), the code will be seen at the data LED. (displaying LED then be verified to AT89c51 datasheet).

Set the Address switch (switch A) with 32h (00110010b), the code will be seen at the data LED. (displaying LED then be verified to AT89c51 datasheet).

Before put off the microcontroller, the power supply must be switched off.

Program Deleting

Following steps are done to delete the program in AT89c51 flash memory.

Switch off the power supply.

Put the microcontroller in to ZIF socket.

Move the EA/VPP switch at 5 volt.

Move P2.6 switch at HIGH, P2.7, P3.6 and P3.7 switch at LOW.

Switch on the power supply.

Move EA/VPP switch at 12 volt.

Push the PROG button once.

Before put off the microcontroller, the power supply must be switched off.

Program Loading

Following steps are done to load the program in to AT89c51 flash memory.

Prepare the program in LST file, then write down the instruction code for each address.

Switch off the power supply.

Put the microcontroller in to ZIF socket.

Move EA/VPP switch at 5 volt.

move P2.6 switch at LOW, P2.7, P3.6 and P3.7 at HIGH.

Switch on the power supply.

Set the address switch (switch A) with 00h (00000000b), (can be seen from the light of address LED).

Set the Data switch with appropriate hex code (hex code that will be loaded). And then move EA/VPP switch at 12 volt.

Push the PROG button once.

Remove EA/VPP switch at 5 volt.

Repeat step 7 to 10, with the data address add by 1.

Repeat all of steps until all of hex code is finished.

Before put off the microcontroller, the power supply must be switched off.

Program Verifying

Following steps are done to verify the program that load in to AT89c51 flash memory.

Switch off the power supply.

Put the microcontroller in to ZIF socket.

Move EA/VPP switch at 5 volt.

Move P2.6, P2.7 switch at LOW, while P3.6 and P3.7 switch at HIGH.

Move the data switch at FFh (11111111b).

Switch on the power supply.

Set the address switch (switch A) with 00h (00000000b), (can be seen from the light of address LED).

Repeat the step 7, with the data address add by 1.

Repeat all steps above until the reading data is FFh for every next address.

Before put off the microcontroller, the power supply must be switched off.

If the hex code that is resulted same with the LST file, it can be concluded that the loading hex code is valid.

*Features*

• Compatible with MCS-51® Products

• 4K Bytes of In-System Programmable (ISP) Flash Memory

– Endurance: 1000 Write/Erase Cycles

• 4.0V to 5.5V Operating Range

• Fully Static Operation: 0 Hz to 33 MHz

• 128 x 8-bit Internal RAM

• 32 Programmable I/O Lines

• Two 16-bit Timer/Counters

• Six Interrupt Sources

• Full Duplex UART Serial Channel

• Watchdog Timer

• Dual Data Pointer

• Power-off Flag

• Fast Programming Time

• Flexible ISP Programming (Byte and Page Mode)

*Description*

The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K

bytes of in-system programmable Flash memory. The device is manufactured using

the Atmel AT89S51 is a powerful microcontroller which provides a

highly - flexible and cost-effective solution to many embedded control applications.

The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of

RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a five vector

Two - level interrupt architecture, a full duplex serial port, on-chip oscillator, and

clock circuitry. In addition, the AT89S51 is designed with static logic for operation

down to zero frequency and supports two software selectable power saving modes.

The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and

interrupt system to continue functioning. The Power-down mode saves the RAM contents

but freezes the oscillator, disabling all other chip functions until the next external

interrupt or hardware reset.

* ***MAX 232 IC***

The MAX232 is an integrated circuit that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

The drivers provide RS-232 voltage level outputs (approx. ± 7.5 V) from a single + 5 V supply via on-chip charge pumps and external capacitors. This makes it useful for implementing RS-232 in devices that otherwise do not need any voltages outside the 0 V to + 5 V range, as power supply design does not need to be made more complicated just for driving the RS-232 in this case.

The receivers reduce RS-232 inputs (which may be as high as ± 25 V), to standard 5 V TTL levels. These receivers have a typical threshold of 1.3 V, and a typical hysteresis of 0.5 V.

The later MAX232A is backwards compatible with the original MAX232 but may operate at higher baud rates and can use smaller external capacitors – 0.1 μF in place of the 1.0 μF capacitors used with the original device.

The newer MAX3232 is also backwards compatible, but operates at a broader voltage range, from 3 to 5.5V.

It is helpful to understand what occurs to the voltage levels. When a MAX232 IC receives a TTL level to convert, it changes a TTL Logic 0 to between +3 and +15V, and changes TTL Logic 1 to between -3 to -15V, and vice versa for converting from RS232 to TTL. This can be confusing when you realize that the RS232 Data Transmission voltages at a certain logic state are opposite from the RS232 Control Line voltages at the same logic state. To clarify the matter, see the table below. For more information see RS-232 Voltage Levels.RS232 Line Type & Logic Level RS232 Voltage TTL Voltage to/from MAX232

Data Transmission (Rx/Tx) Logic 0 +3V to +15V 0V

Data Transmission (Rx/Tx) Logic 1 -3V to -15V 5V

Control Signals (RTS/CTS/DTR/DSR) Logic 0 -3V to -15V 5V

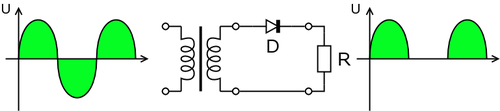
Control Signals (RTS/CTS/DTR/DSR) Logic 1 +3V to +15V 0V

* **Rectifier**

A **rectifier** is an electrical device, comprising one or more semiconductor devices (such as diodes) or vacuum tubes arranged for converting alternating current to direct current. When just one diode is used to rectify AC (by blocking the negative or positive portion of the waveform) the difference between the term *diode* and the term *rectifier* is merely one of usage, e.g. the term *rectifier* describes a *diode* that is being used to convert AC to DC. **Rectification** is a process whereby alternating current (with zero avg. value) is converted into direct current (DC). Almost all rectifiers comprise a number of diodes in a specific arrangement for more efficiently converting AC to DC than is possible with just a single diode. Rectification is commonly performed by semiconductor diodes. Before the development of solid state rectifiers, vacuum tube diodes were used.

## Half-wave rectification

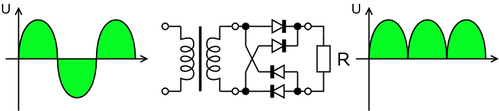
A half wave rectifier is a special case of a clipper. In half wave rectification, either the positive or negative half of the AC wave is passed easily while the other half is blocked, depending on the polarity of the rectifier. Because only one half of the input waveform reaches the output, it is very inefficient if used for power transfer. Half wave rectification can be achieved with a single diode in a one phase supply.

[](http://en.wikipedia.org/wiki/Image:Halfwave.rectifier.en.png)

## *Fig: Half wave rectifier*

## Full-wave rectification

Full-wave rectification converts both polarities of the input waveform to DC, and is more efficient. However, in a circuit with a non-center tapped transformer, four rectifiers are required instead of the one needed for half-wave rectification. This is due to each output polarity requiring 2 rectifiers each, for example, one for when AC terminal 'X' is positive and one for when AC terminal 'Y' is negative. The other DC output requires exactly the same, resulting in four individual junctions Four rectifiers arranged this way are called a bridge rectifier.

[](http://en.wikipedia.org/wiki/Image:Gratz.rectifier.en.png)

*Fig: Full wave rectifier*

A full wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output by reversing the negative (or positive) portions of the alternating current waveform. The positive (negative) portions thus combine with the reversed negative (positive) portions to produce an entirely positive (negative) voltage/current waveform.

For single phase AC, if the AC is center-tapped, then two diodes back-to-back (i.e. anodes-to-anode or cathode-to-cathode) form a full wave rectifier

### [Full wave rectifier](http://en.wikipedia.org/wiki/Image:Fullwave.rectifier.en.png)

### *Fig: Centre tap rectifier*

### Peak Loss

An important aspect of most full wave rectification is a loss from peak input voltage to the peak output voltage, caused by the threshold voltage of the diodes, often around 0.7 volts. In a diode bridge circuit the peak output will be lower than the peak input by an amount equal to twice this value. In addition, the diodes will not conduct below this voltage, so the circuit is only passing current through for a portion of each half-cycle, causing short segments of zero voltage to appear between each "hump".

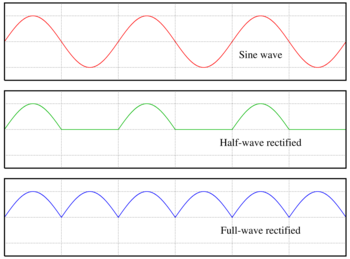
[](http://en.wikipedia.org/wiki/Image:Rectified_waves.png)

Fig: AC, half-wave and full wave rectified signals

### Applications

One of the first applications of rectifiers was detection of amplitude modulated radio signals by a diod

# Transformer

A **transformer** is an electrical device that transfers energy from one circuit to another by magnetic coupling with no moving parts. A transformer comprises two or more coupled windings, or a single tapped winding and, in most cases, a magnetic core to concentrate magnetic flux. An alternating current in one winding creates a time-varying magnetic flux in the core, which induces a voltage in the other windings. Transformers are used to convert between high and low voltages, to change impedance, and to provide electrical isolation between circuits.

## *Overview*

The transformer is one of the simplest of electrical devices. Its basic design, materials, and principles have changed little over the last one hundred years, yet transformer designs and materials continue to be improved. Transformers are essential for high voltage power transmission, providing an economical means of transmitting power over large distances. The simplicity, reliability, and economy of conversion of voltages by transformer was the principal factor in the selection of alternating current power transmission in the "War of Currents" in the late 1880s.

Transformers alone cannot do the following:

* Convert DC to AC or vice versa
* Change the voltage or current of DC
* Change the AC supply frequency.

However, transformers are components of the systems that perform all these functions.

### An analogy

The transformer may be considered as a simple two-wheel 'gearbox' for electrical voltage and current. The primary winding is analogous to the input shaft and the secondary winding to the output shaft. In this analogy, current is equivalent to shaft speed, voltage to shaft torque. In a gearbox, mechanical power (speed multiplied by torque) is constant (neglecting losses) and is equivalent to electrical power (voltage multiplied by current) which is also constant.

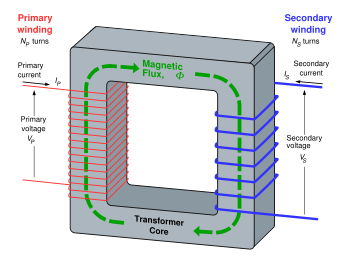
The gear ratio is equivalent to the transformer step-up or step-down ratio. A step-up transformer acts analogously to a reduction gear (in which mechanical power is transferred from a small, rapidly rotating gear to a large, slowly rotating gear): it trades current (speed) for voltage (torque), by transferring power from a primary coil to a secondary coil having more turns. A step-down transformer acts analogously to a multiplier gear (in which mechanical power is transferred from a large gear to a small gear): it trades voltage (torque) for current (speed), by transferring power from a primary coil to a secondary coil having fewer turns.

## *Basic principles*

### Coupling by mutual induction

A simple transformer consists of two electrical conductors called the **primary winding** and the **secondary winding**. These two windings can be considered as a pair of mutually coupled coils. Energy is coupled between the windings by the time-varying magnetic flux that passes through (links) both primary and secondary windings.

### Elementary analysis

[](http://en.wikipedia.org/wiki/Image:Transformer3d_col3.svg)

[Enlarge](http://en.wikipedia.org/wiki/Image:Transformer3d_col3.svg)

*Fig: A step-down transformer showing magnetizing flux in the* core

If a time-varying voltage {v_P}\,is applied to the primary winding of N_P\,turns, a current will flow in it producing a magneto motive force (MMF). Just as an electromotive force (EMF) drives current around an electric circuit, so MMF tries to drive magnetic flux through a magnetic circuit. The primary MMF produces a varying magnetic flux \Phi_P\,in the core, and, with an open circuit secondary winding, induces a back electromotive force (EMF) in opposition to {v_P}\,. In accordance with Faraday's law of induction, the voltage induced across the primary winding is proportional to the rate of change of flux:

{v_P} = {N_P} \frac {d \Phi_P}{dt}     and     {v_S} = {N_S} \frac {d \Phi_S}{dt}

Where:

* *Vp* and *VS* are the voltages across the primary winding and secondary winding,
* *NP* and *NS* are the numbers of turns in the primary winding and secondary winding,
* *d*Φ*P* / *dt* and *d*Φ*S* / *dt* are the derivatives of the flux with respect to time of the primary and secondary windings.

Saying that the primary and secondary windings are perfectly coupled is equivalent to \Phi_P = \Phi_S\,t.

By Substituting and solving for the voltages shows that:

\frac{v_P}{v_S}=\frac{N_P}{N_S}

where

* *vp* and *vs* are voltages across primary and secondary,
* *Np* and *Ns* are the numbers of turns in the primary and secondary, respectively.

Hence in an ideal transformer, the ratio of the primary and secondary voltages is equal to the ratio of the number of turns in their windings, or alternatively, the voltage per turn is the same for both windings. The ratio of the currents in the primary and secondary circuits is inversely proportional to the turn ratio. This leads to the most common use of the transformer: to convert electrical energy at one voltage to energy at a different voltage by means of windings with different numbers of turns. In a practical transformer, the higher-voltage winding will have more turns, of smaller conductor cross-section, than the lower-voltage windings.

The EMF in the secondary winding, if connected to an electrical circuit, will cause current to flow in the secondary circuit. The MMF produced by current in the secondary opposes the MMF of the primary and so tends to cancel the flux in the core. Since the reduced flux reduces the EMF induced in the primary winding, increased current flows in the primary circuit. The resulting increase in MMF due to the primary current offsets the effect of the opposing secondary MMF. In this way, the electrical energy fed into the primary winding is delivered to the secondary winding.

For example, suppose a power of 50 watts is supplied to a resistive load from a transformer with a turns ratio of 25:2.

* *P* = *EI* (power = electromotive force × current)

50 W = 2 V × 25 A in the primary circuit

* Now with transformer change:

50 W = 25 V × 2 A in the secondary circuit.

### *Classifications*

* **Step-up**

The secondary has more turns than the primary.

* **Step-down**

The secondary has fewer turns than the primary.

* **Isolating**

It is intend to transform from one voltage to another voltage. The two coils have approximately equal numbers of turns, although often there is a slight difference in the number of turns, in order to compensate for losses (otherwise the output voltage would be a little less than, rather than the same as, the input voltage).

* **Variable**

The primary and secondary have an adjustable number of turns which can be selected without reconnecting the transformer.

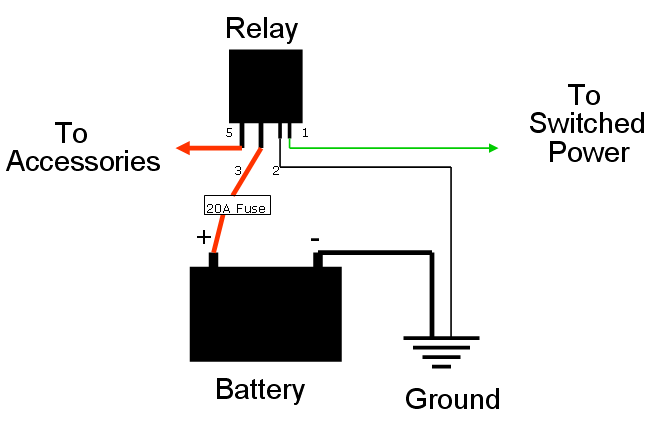
* Distribution transformers are generally used in power distribution and transmission systems.

Distribution transformers contain the highest voltage so as to minimize power loss during transmission. The high voltage is later lowered using home supply transformers

* ***RELALY***

A **relay** is an electrical switch that opens and closes under the control of another electrical circuit. In the original form, the switch is operated by an electromagnet to open or close one or many sets of contacts. It was invented by Joseph Henry in 1835. Because a relay is able to control an output circuit of higher power than the input circuit, it can be considered to be, in a broad sense, a form of an electrical amplifier.

*Circuit*



*Fig: Relay switch*

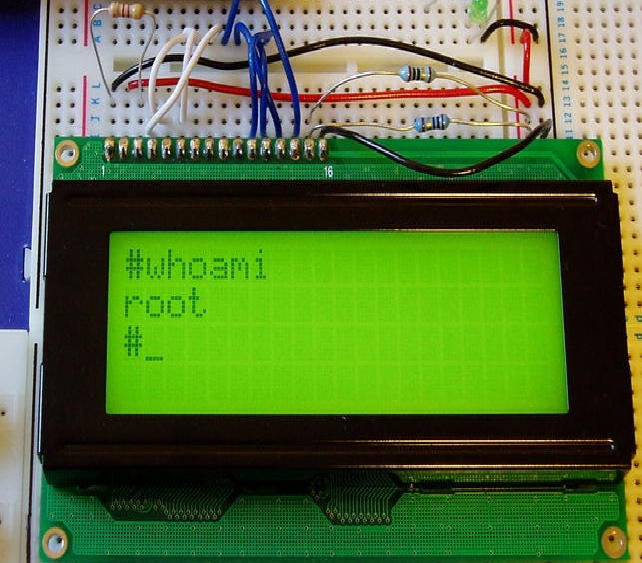
## Applications

Relays are used to and for:

* Control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers,
* Control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile,
* Detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers (protection relays),
* Isolate the controlling circuit from the controlled circuit when the two are at different potentials, for example when controlling a mains-powered device from a low-voltage switch. The latter is often applied to control office lighting as the low voltage wires are easily installed in partitions, which may be often moved as needs change. They may also be controlled by room occupancy detectors in an effort to conserve energy,
* Logic functions. For example, the boolean AND function is realized by connecting normally open relay contacts in series, the OR function by connecting normally open contacts in parallel. The change-over or Form C contacts perform the XOR (exclusive or) function. Similar functions for NAND and NOR are accomplished using normally closed contacts. The Ladder programming language is often used for designing relay logic networks.
* **LCD**

A liquid crystal display (LCD) is a thin, flat panel used for electronically to display information such as text, images, and moving pictures. Its uses include monitors for computers, televisions, instrument panels, and other devices ranging from aircraft cockpit displays, to every-day consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. Among its major features are its lightweight construction, its portability, and its ability to be produced in much larger screen sizes than are practical for the construction of cathode ray tube (CRT) display technology. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. It is an electronically-modulated optical device made up of any number of pixels filled with liquid crystals and arrayed in front of a light source (backlight) or reflector to produce images in color or monochrome.

LCDs with a small number of segments, such as those used in digital watches and pocket calculators, have individual electrical contacts for each segment. An external dedicated circuit supplies an electric charge to control each segment. This display structure is unwieldy for more than a few display elements.



*Fig: Liquid Crystal Display*

High-resolution color displays such as modern LCD computer monitors and televisions use an active matrix structure. A matrix of thin-film transistors (TFTs) is added to the polarizing and color filters. Each pixel has its own dedicated transistor, allowing each column line to access one pixel. When a row line is activated, all of the column lines are connected to a row of pixels and the correct voltage is driven onto all of the column lines. The row line is then deactivated and the next row line is activated. All of the row lines are activated in sequence during a refresh operation. Active-matrix addressed displays look "brighter" and "sharper" than passive-matrix addressed displays of the same size, and generally have quicker response times, producing much better images.

CHAPTER 3

AUTOMATION TOOLS

Different types of automation tools exist:

**3.1 ANN - Artificial neural network**

* 1. **DCS – Distributed control system**
  2. **HMI – Human machine interface**

**3.4 SCADA – Supervisory control and data acquisition**

**3.5 PLC – Programmable logic controller**

* **ANN - Artificial neural network**

An artificial neural network (ANN), usually called "neural network" (NN), is a mathematical model or computational model that tries to simulate the structure and/or functional aspects of biological neural networks. It consists of an interconnected group of artificial neurons and processes information using a connectionist approach to computation. In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase. Neural networks are non-linear statistical data modeling tools. They can be used to model complex relationships between inputs and outputs or to find patterns in data.

* **DCS - Distributed Control System**

distributed control system (DCS) refers to a control system usually of a manufacturing system, process or any kind of dynamic system, in which the controller elements are not central in location (like the brain) but are distributed throughout the system with each component sub-system controlled by one or more controllers. The entire system of controllers is connected by networks for communication and monitoring.

DCS is a very broad term used in a variety of industries, to monitor and control distributed equipment.

* Electrical power grids and electrical generation plants
* Environmental control systems
* Traffic signals
* radio signals
* Water management systems
* Oil refining plants
* Chemical plants
* Pharmaceutical manufacturing
* Sensor networks
* Dry cargo and bulk oil carrier ships
* **HMI - Human Machine Interface**

The user interface (also known as human computer interface or man-machine interface (MMI)) is the aggregate of means by which people—the users—interact with the systea particular machine, device, computer program or other complex tool. The user interface provides means of:

* Input, allowing the users to manipulate a system
* Output, allowing the system to indicate the effects of the users' manipulation.
* **SCADA - Supervisory Control and Data Acquisition**

SCADA stands for supervisory control and data acquisition. It generally refers to an industrial control system: a computer system monitoring and controlling a process. The process can be industrial, infrastructure or facility based as described below:

Industrial processes include those of manufacturing, production, power generation, fabrication, and refining, and may run in continuous, batch, repetitive, or discrete modes.

Infrastructure processes may be public or private, and include water treatment and distribution, wastewater collection and treatment, oil and gas pipelines, electrical power transmission and distribution, civil defense siren systems, and large communication systems.

Facility processes occur both in public facilities and private ones, including buildings, airports, ships, and space stations. They monitor and control HVAC, access, and energy consumption.

A SCADA System usually consists of the following subsystems:

A Human-Machine Interface or HMI is the apparatus which presents process data to a human operator, and through this, the human operator monitors and controls the process.

A supervisory (computer) system, gathering (acquiring) data on the process and sending commands (control) to the process.

Remote Terminal Units (RTUs) connecting to sensors in the process, converting sensor signals to digital data and sending digital data to the supervisory system.

Programmable Logic Controller (PLCs) used as field devices because they are more economical, versatile, flexible, and configurable than special-purpose RTUs.

Communication infrastructure connecting the supervisory system to the Remote Terminal Units

* **PLC - Programmable Logic Controller**

A programmable logic controller (PLC) or programmable controller is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or lighting fixtures. PLCs are used in many industries and machines. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed or non-volatile memory. A PLC is an example of a real time system since output results must be produced in response to input conditions within a bounded time, otherwise unintended operation will result.

Early PLCs were designed to replace relay logic systems. These PLCs were programmed in "ladder logic", which strongly resembles a schematic diagram of relay logic. This program notation was chosen to reduce training demands for the existing technicians. Other early PLCs used a form of instruction list programming, based on a stack-based logic solver.

Modern PLCs can be programmed in a variety of ways, from ladder logic to more traditional programming languages such as BASIC and C. Another method is State Logic, a very high-level programming language designed to program PLCs based on state transition diagrams.

**Functionality:**

The functionality of the PLC has evolved over the years to include sequential relay control, motion control, process control, distributed control systems and networking. The data handling, storage, processing power and communication capabilities of some modern PLCs are approximately equivalent to desktop computers. PLC-like programming combined with remote I/O hardware, allow a general-purpose desktop computer to overlap some PLCs in certain applications

**Programming:**

PLC programs are typically written in a special application on a personal computer, then downloaded by a direct-connection cable or over a network to the PLC. The program is stored in the PLC either in battery-backed-up RAM or some other non-volatile flash memory. Often, a single PLC can be programmed to replace thousands of relays.

CHAPTER 4

***SOFTWARE DETAIL***

* 1. ***Coding for start***
  2. ***Coding for check status***
  3. ***Coding for bulb & tube control***
  4. ***Coding for message***
  5. ***Coding for LCD***

4.1 Coding for start

#ifndef \_\_STRFUNC\_H\_\_

#define \_\_STRFUNC\_H\_\_

void str\_cpy(bit\_8\*, bit\_8\*);

#endif

4.2 Coding for connection

#ifndef \_\_SERIAL\_H\_\_

#define \_\_SERIAL\_H\_\_

#include "HAreg.h"

void serial\_init(void);

void transmit(bit\_8\*);

void delay(void);

bit\_8 recieve\_key(void);

#endif

*4.3 Coding for STATUS CHECK*

#ifndef \_\_CMD\_H\_\_

#define \_\_CMD\_H\_\_

void send\_status(void);

void tube(void);

void bulb(void);

void switches(void);

void trans\_val(bit\_8);

void msg();

void show\_msg();

void dimmness();

#endif

*4.4 Coding for Bulb and Tube control*

#ifndef \_\_HAREG\_H\_\_

#define \_\_HAREG\_H\_\_

#define DISABLE\_INT IE=0x0;

#define ENABLE\_INT IE=0x83;

sbit enter= 0xB2;

sbit up= 0xB3;

sbit down= 0xB4;

sbit tube1 = 0x90;

sbit tube2 = 0x91;

sbit bulb1 = 0x92;

sbit bulb2 = 0x93;

sbit dimm = 0x94;

sbit switch1 = 0x95;

sbit switch2 = 0x96;

sbit switch3 = 0x97;

sbit P3\_5 = 0xB5;

sbit P3\_6 = 0xB6;

sbit P3\_7 = 0xB7;

sbit P2\_7 = 0xA7;

sbit mesg = 0x80;

sfr tmod=0x89;

sfr tl1 =0x8B;

sfr th1 =0x8D;

sfr IE = 0xA8;

sbit EX0 = 0xA8;

sbit ri = 0x98;

sbit ti = 0x99;

sbit tr1 = 0x8E;

sbit tr0 = 0x8C;

sbit tf0 = 0x8D;

sfr th0 = 0x8C;

typedef unsigned char bit\_8;

#endif

*4.5 Coding for Message Display control*

#ifndef \_\_LCD\_H

#define \_\_LCD\_H

#include "HAreg.h"

#define lcd\_port p2

#define rs P3\_5

#define rw P3\_6

#define en P3\_7

#define D7 P2\_7

/\*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

LCD Command MACROS

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~\*/

#define LCD\_CLEAR 0x1

#define RETURN\_HOME 0x80

#define DEC\_CURSOR 0x4

#define INC\_CURSOR 0x6

#define DISP\_OFF\_CUR\_OFF 0x8

#define DISP\_OFF\_CUR\_ON 0xA

#define DISP\_ON\_CUR\_OFF 0xC

#define DISP\_ON\_CUR\_BLINK 0xE

/\*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Function Prototypes

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* 1. For LCD

void lcd\_init(void); // Initialize LCD

void busy(void); // Check Busy

void lcd\_sendcommand(bit\_8);// Sending Command

void lcd\_sendcommand\_int(bit\_8);

void lcd\_sendchar(bit\_8); // Sending single character

void lcd\_sendstr(bit\_8\*); // Sending String

void lcd\_sendstr\_int(bit\_8\*); // Sending String

#endif

CHAPTER 5

**5.1 Industrial automation inflection points**

For industrial automation, several new inflection points will arrive in the next few years. This is where the growth and success will occur, from which new instrumentation and automation leaders will emerge.

Some possibilities as:

· MEMS-based Sensors & Actuators: Micro-electromechanical systems that utilize semiconductor fabrication techniques to produce miniature turbines, motors, gears, moving mirrors and sensors.

· Nanotechnology: Atomic-scale systems, the next step beyond MEMS. Production with old-style metal bending, grinding and cutting will become obsolete as nanotechnology enables the building of products at the atomic level.

· Wireless Links: Tiny, low cost, low power sensors and actuators will be connected with wireless links that are fast, economical and yield big advantages. Tiny is important because they can be scattered around to measure just about everything that you can imagine. Low power, because they won't need to have batteries replaced, and may be solar-powered. Low-cost because the numbers required will be enormous.

· The Pervasive Internet: Soon bandwidth will be plentiful enough to connect everything to everything. The old “islands of automation” will disappear.

· Complex Adaptive Systems (CAS): The central control hierarchies of the past will give way to new self-organizing peer-to-peer networks, where intelligence resides directly in the sensors and actuators, eliminating large, complex and ineffective centralized control systems. By these standards, today’s PLC and PC-based controls and software will seem ineffective, expensive and even archaic. CAS provides a level of effectives and robustness that is unprecedented, and old deterministic control architectures will disappear.

# 5.2 Controversial factors

The industrial automation is certainly a awesome technology but it also some limitations such as:

* Unemployment.

It is in the common people sense that automation imply unemployment due to the fact that the work of a human been is replaces in part or completely by the machine. Nevertheless, the unemployment is caused by the economical politics of the work centre like dismiss the workers instead of changing their tasks. Since the general economical politic of most of the industrial plants are to dismiss people, nowadays automation implies unemployment. In different scenarios without workers, automation implies more free time instead of unemployment like the case with the automatic wash machine at home. Automation does not imply unemployment when it makes tasks unimaginable without automation such as exploring or when the economy is fully adapted to an automated technology such as occurs with the Telephone switchboard.

* Environment.

The cost of automatic environment is different according to the specific technology, product or engine automated. There are many automated engines that consume more energy resources from the Earth in comparison with previous engines and there are the opposite too.

* Human been replacement.

Exist the possibility in the future that the Artificial intelligence can replace and improve a human brain and the robots becomes not only fully automated but fully autonomous from the human been (Technological singularity).

CONCLUSION

There is no doubt that the industrial automation is very essential for modern industry. To optimize the utilization of automation it should be revolution time to time and improvement must be there. The limitation also should consider in the advancement of automation.

There are so much chance to extend the scope of automation such as video control. For this we just need to install camera at industrial site and then we can not only check the status but see the current position of industry.

Thus we should utilize this technique optimally by taking care of its limitations

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