



General overview of wireless based PLC and SCADA

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Programmable logic controllers

- ❖ **A PLC** is a solid state / industrial computer that performs discrete or sequential logic in a factory environment.
- ❖ It was originally developed to replace mechanical relays, timers, counters.
- ❖ A sequence of instructions is programmed by the user to the PLC memory. Its purpose is to monitor crucial process parameters and adjust process operations accordingly.

Various brands of PLCs

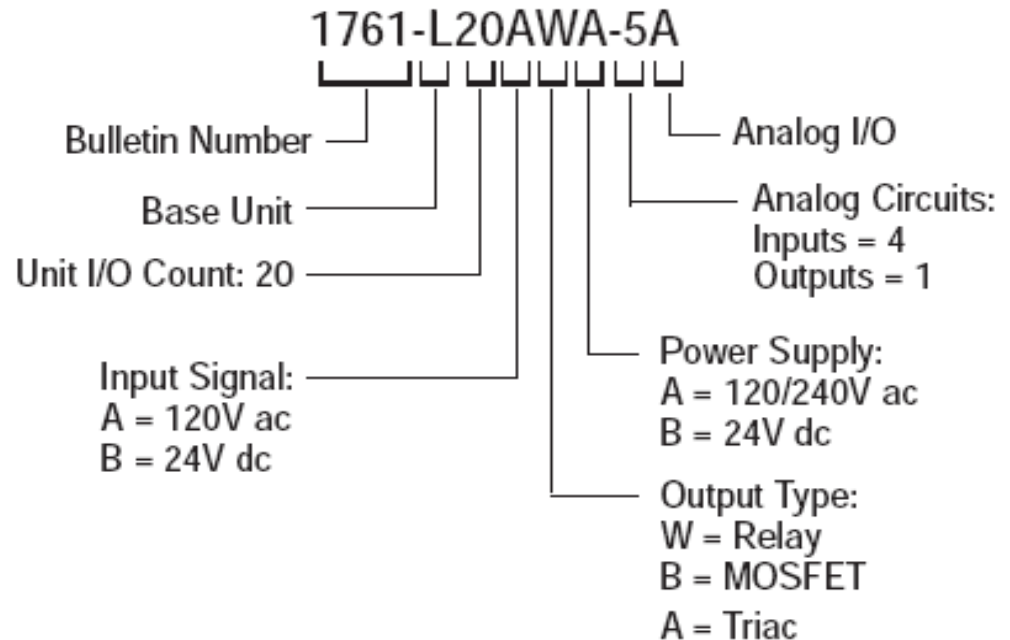
- **Allen Bradley** **USA**
- **Siemens** **Germany**
- **Modicon** **France**
- **Mitshubishi** **Japan**
- **GE Fanuc** **USA**
- **Omron** **Japan**

Programming languages of PLC

- Ladder Diagram (LD)
- Functional block Diagram (FBD)
- Structured Text (ST)
- Instruction List (IL)
- Sequential Functional Chart (SFC)

Hardware overview

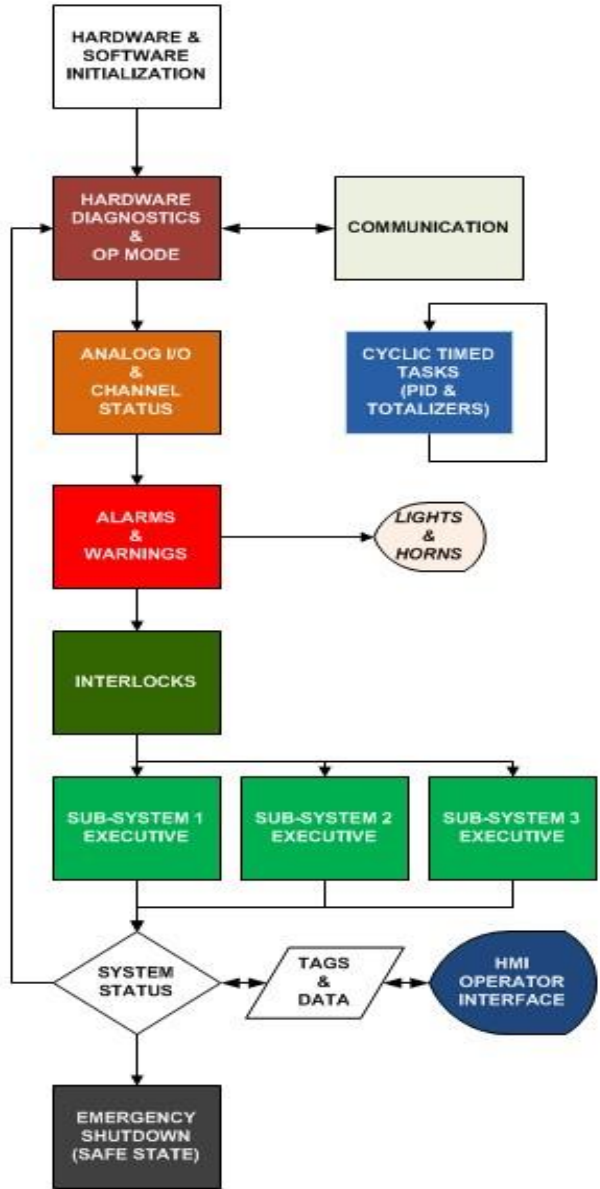
- **MicroLogix 1000** is a packaged controller containing a power supply, input circuits, output circuits, and a processor.



Data Files in Micrologix 1000

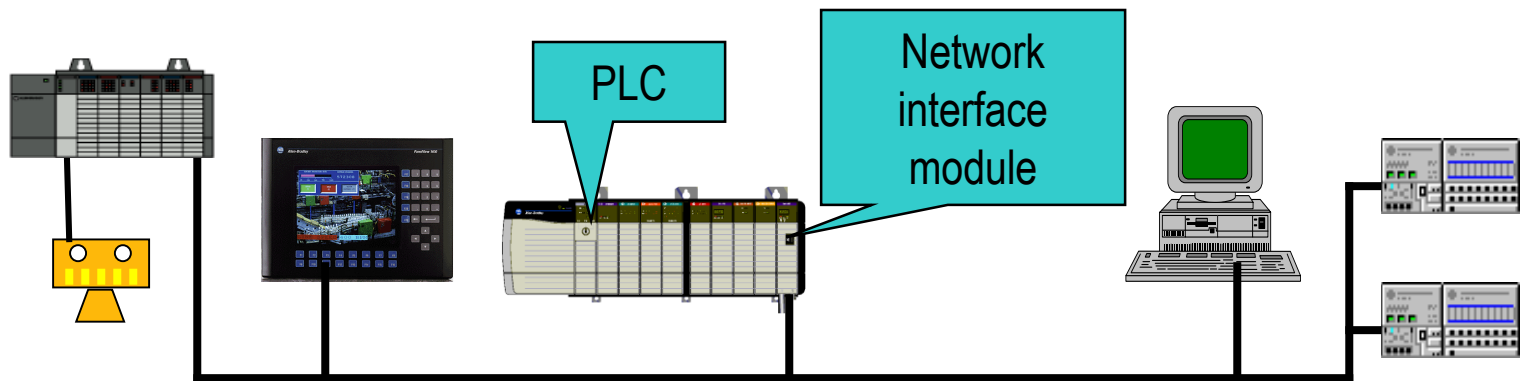
File Type	Identifier	File Number
Output	O	0
Input	I	1
Status	S	2
Bit	B	3
Timer	T	4
Counter	C	5
Control	R	6
Integer	N	7

BASIC PLC PROGRAM MODULES



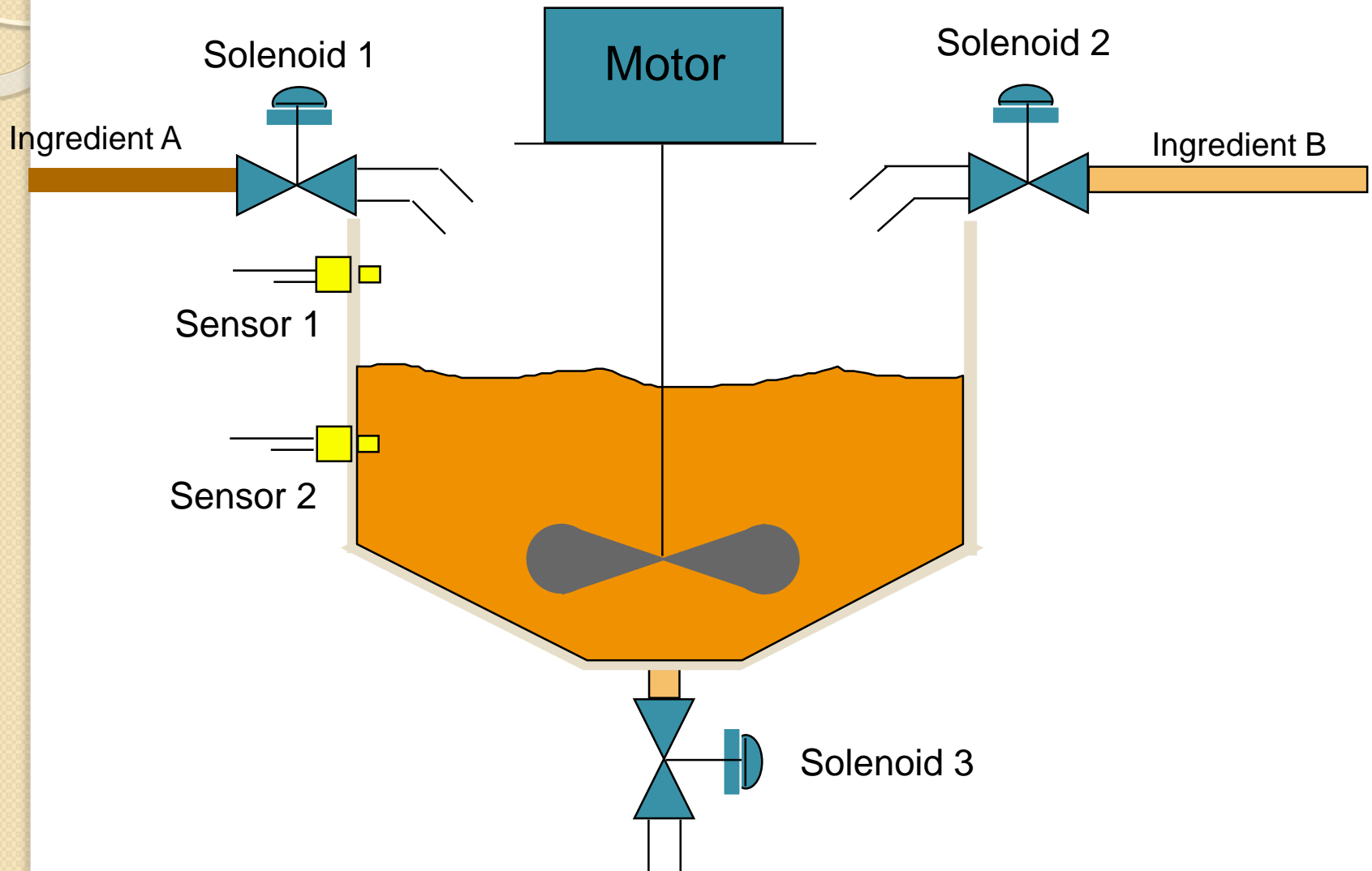
Basic Components of a PLC System

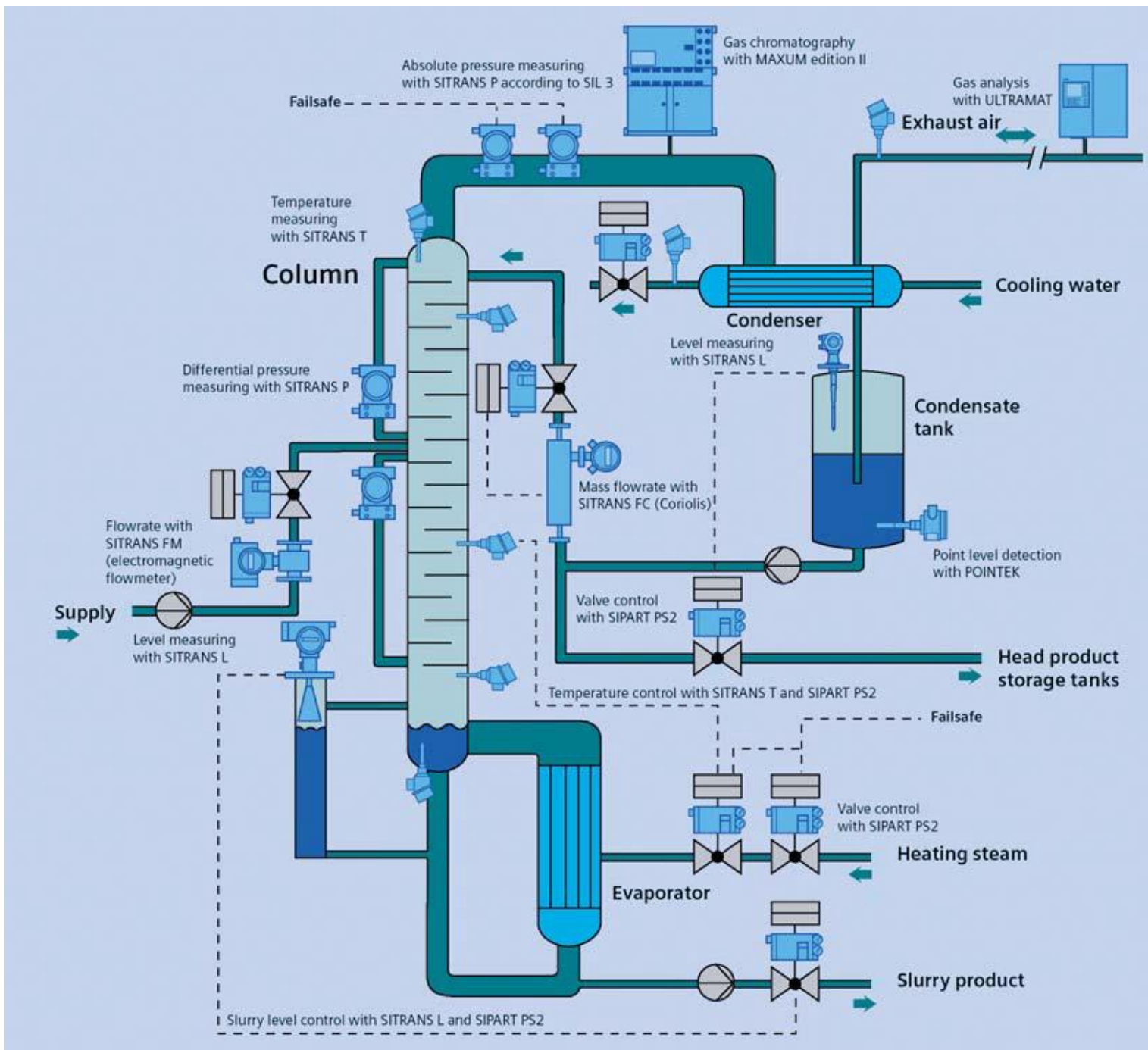
- Network Interface
- Most PLCs have the ability to communicate with other devices. The PLC will communicate to the other devices through a network interface.



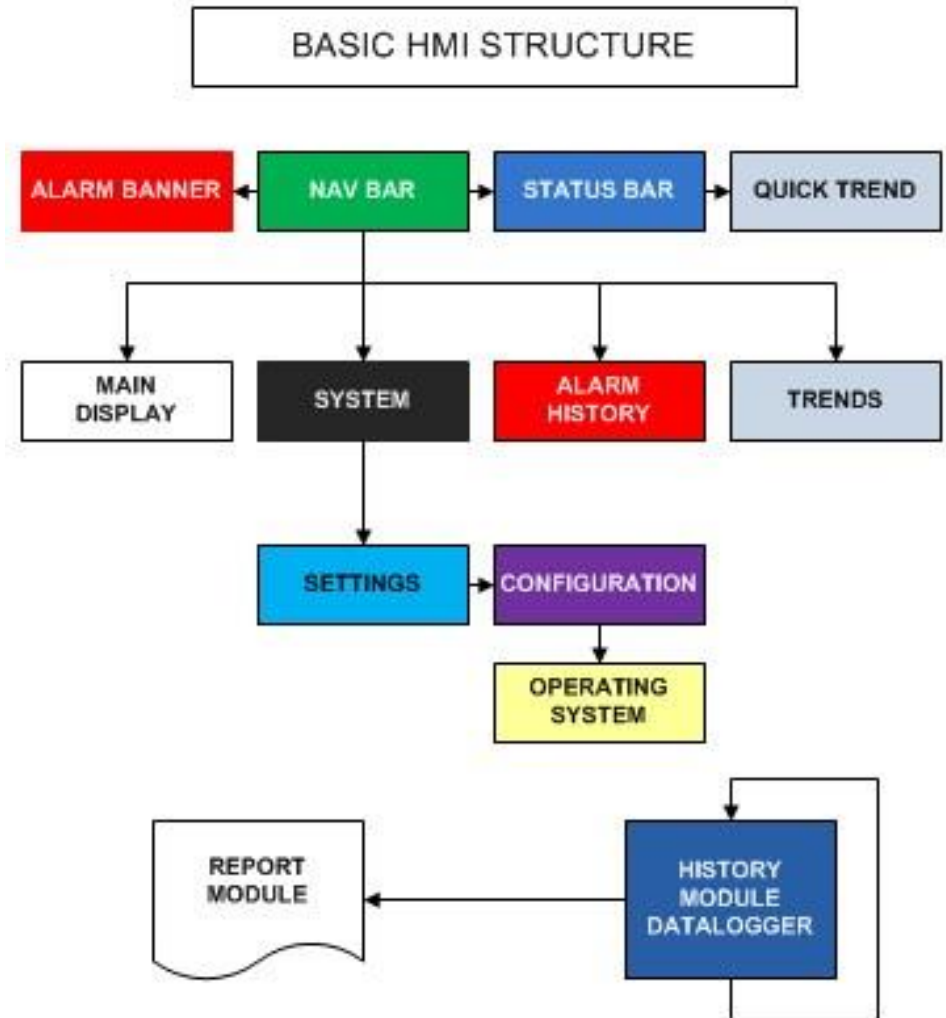
Network connecting other devices

Typical PLC Application





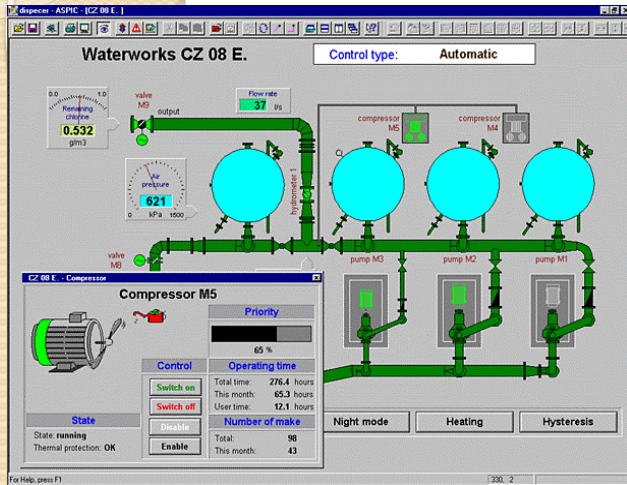
Human machine interface





- Sample

Automation : Typical installation



SCADA Software



Communication Cable

Control Hardware
Control Panel



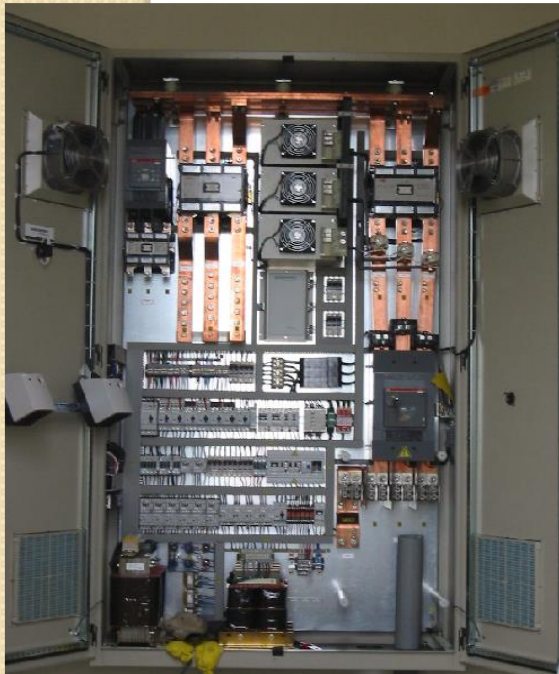
Field Cabling

Junction Box



Field Cabling

Sensors Placed in the field

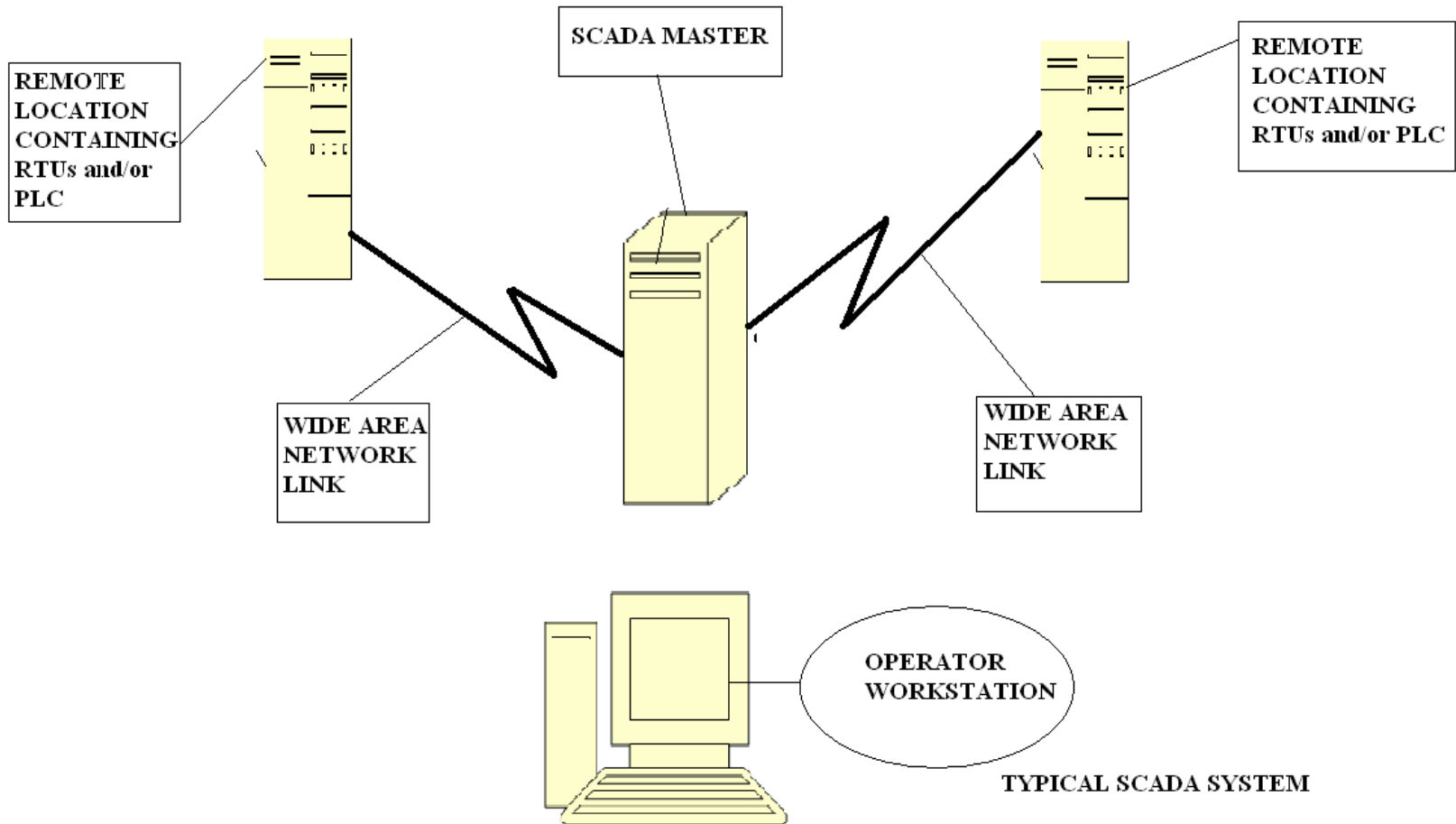


SUPERVISORY CONTROL AND DATA ACQUISITION(SCADA)



SCADA refers to a system that collects data from various sensors at a factory, plant or in other remote locations and then sends this data to a central computer which then manages and controls the data

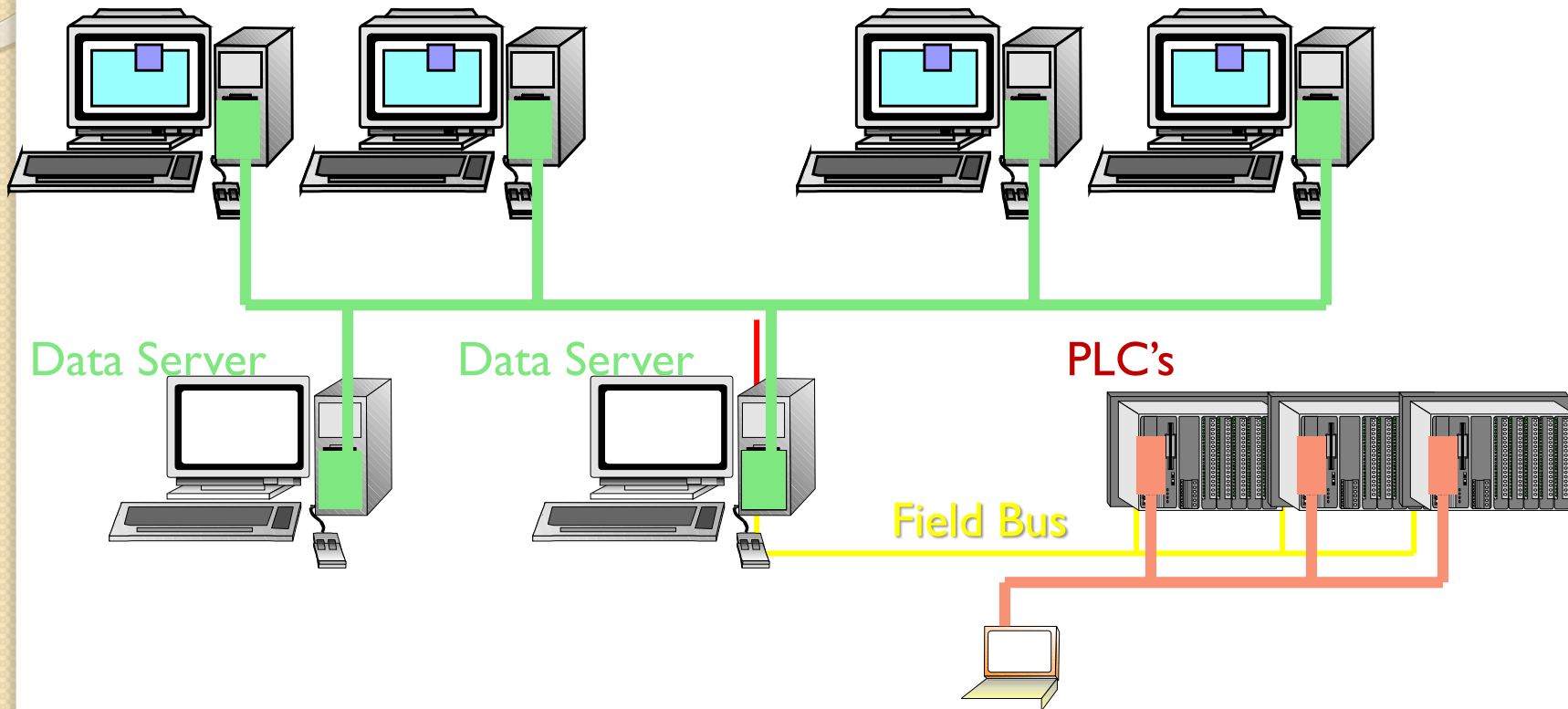
Typical SCADA



SUBSYSTEMS OF SCADA SYSTEM

- **Human-Machine Interface** is the apparatus which presents process data to a human operator, and through this, the human operator monitors and controls the process.
- **Remote Terminal Units** connecting to sensors in the process, converting sensor signals to digital data and sending digital data to the supervisory system.
- **Programmable Logic Controller** 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

Configuration of SCADA Systems



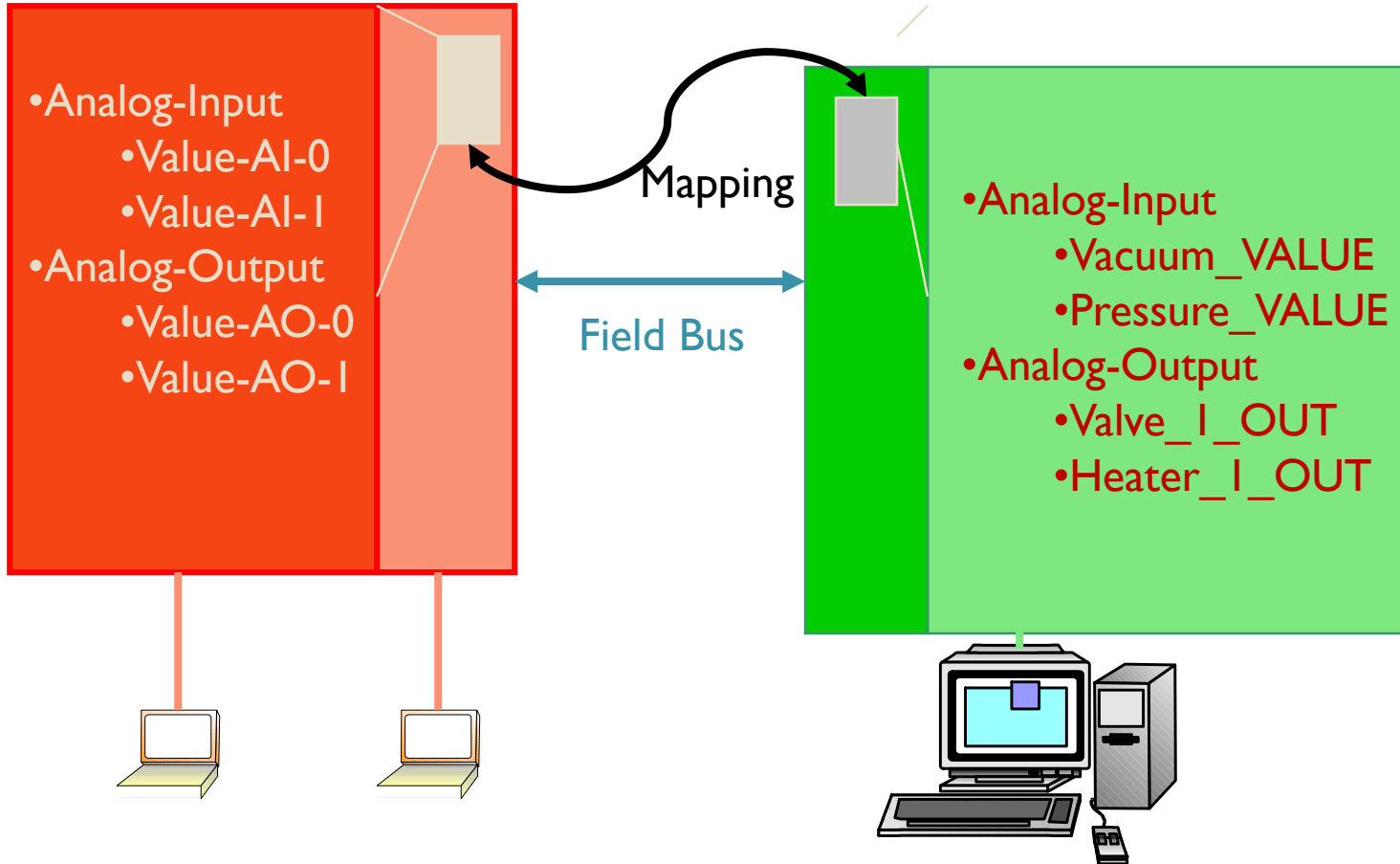
Configuration of SCADA Systems

PLC

Programs

Communication
Processor

SCADA



Configuration of SCADA Systems

SCADA

Data Server

- Analog-Input
 - Vacuum_VALUE
 - Pressure_VALUE**
- Analog-Output
 - Valve_I_OUT
 - Heater_I_OUT

Alarm Generation

(generic) Alarm scripts:

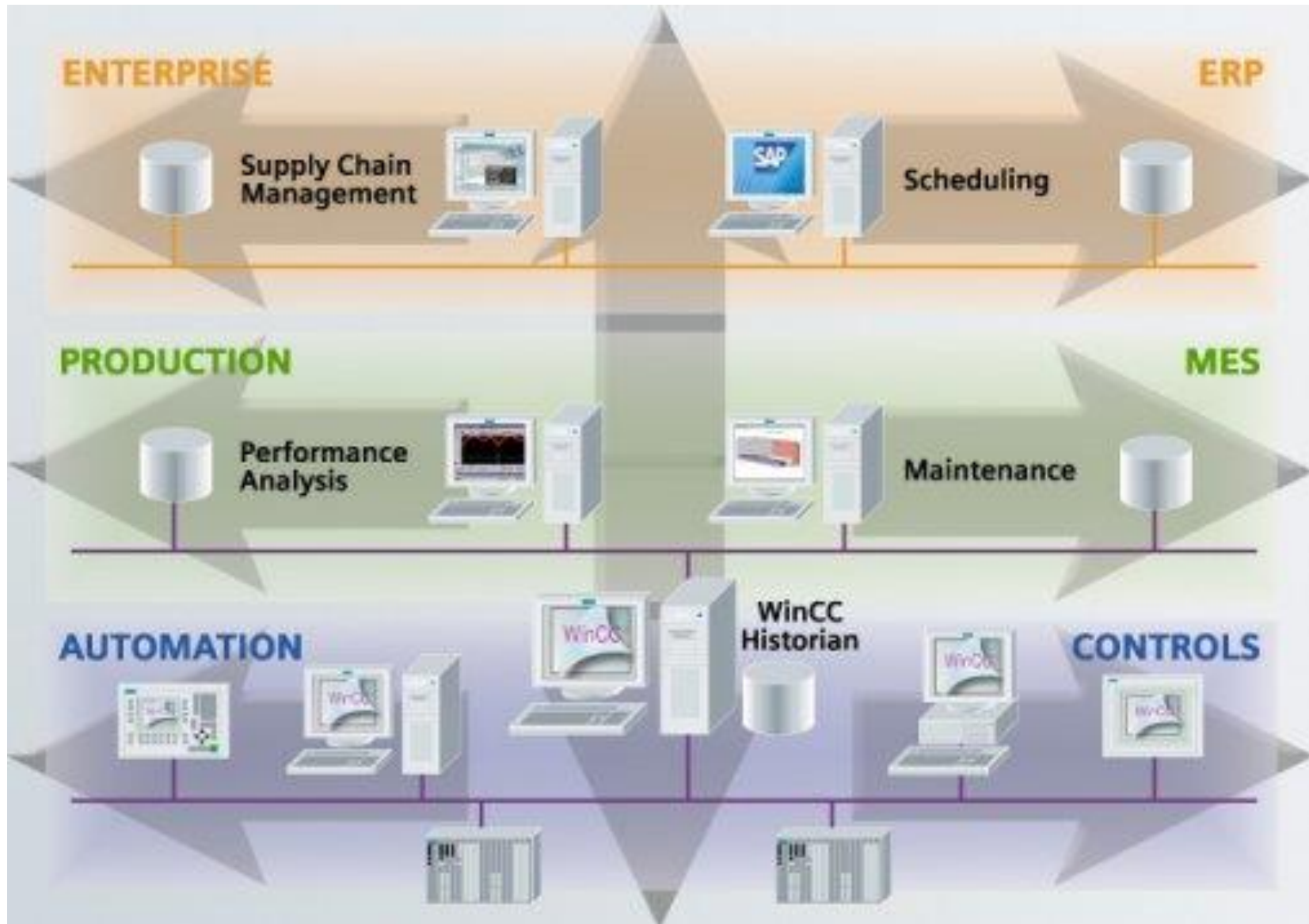
```
IF (Pressure_VALUE > Pressure_HIHI_ALARMVAL)
  {Pressure_ALARM_HIHI=TRUE
  Pressure_ALARM_STATE=CRITICAL
  Pressure_ALARM_COLOR=RED }
IF (Pressure_VALUE < Pressure_LOLO_ALARMVAL)
  {Pressure_ALARM_LOLO=TRUE
  Pressure_ALARM_STATE=ATTENTION
  Pressure_ALARM_COLOR=BLUE }
```

Today's control room

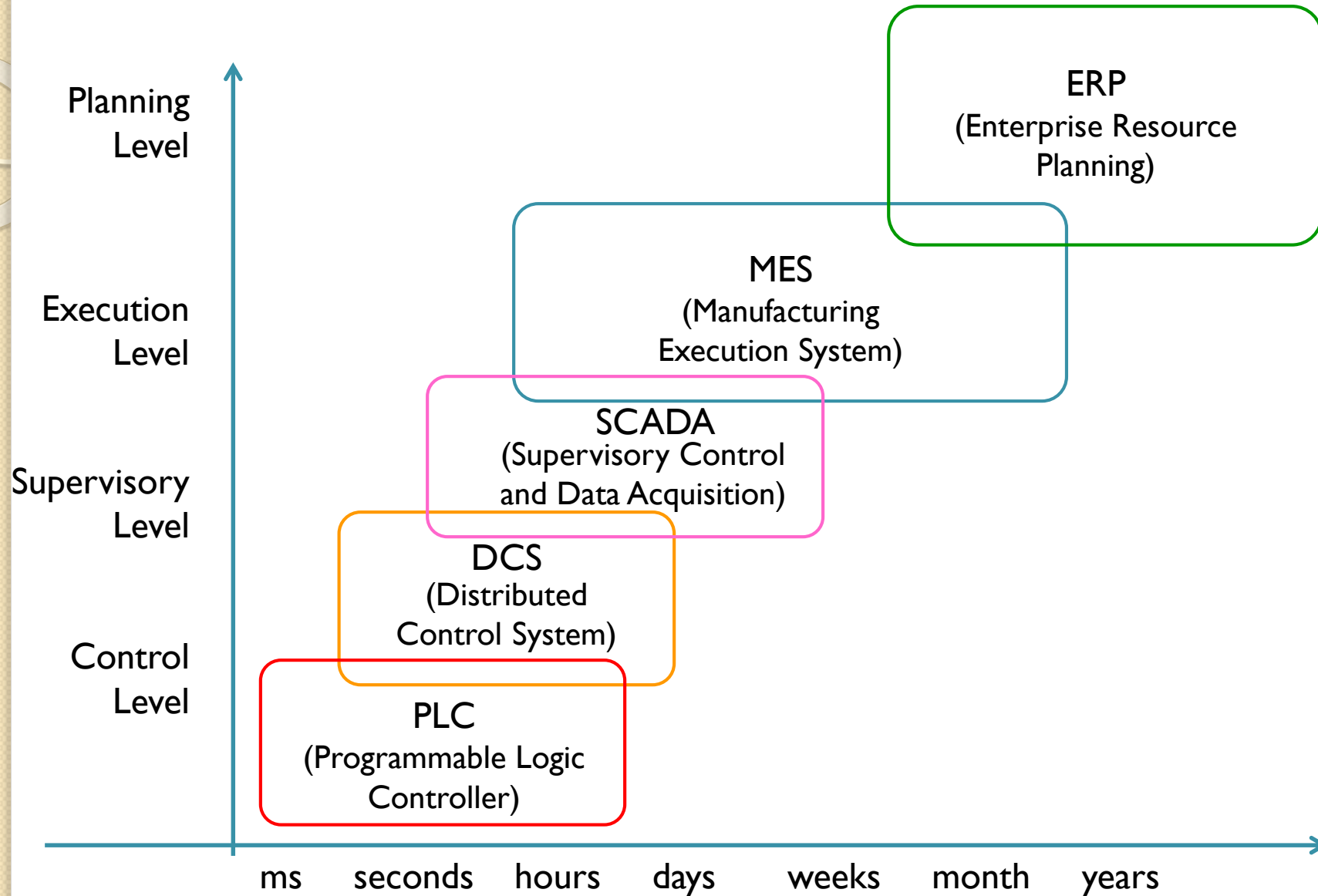


there is no more direct wiring to the plant. ...

Example of generic control



Response time and hierarchical level



Data Quantity & Quality and Hierarchical Level

Higher Levels

When ascending the control hierarchy, data are reduced:
higher level data are created (e.g. summary information)
Processing and decisions becomes more complicated (requires using models).
Timing requirements are slackened. Historical data are stored

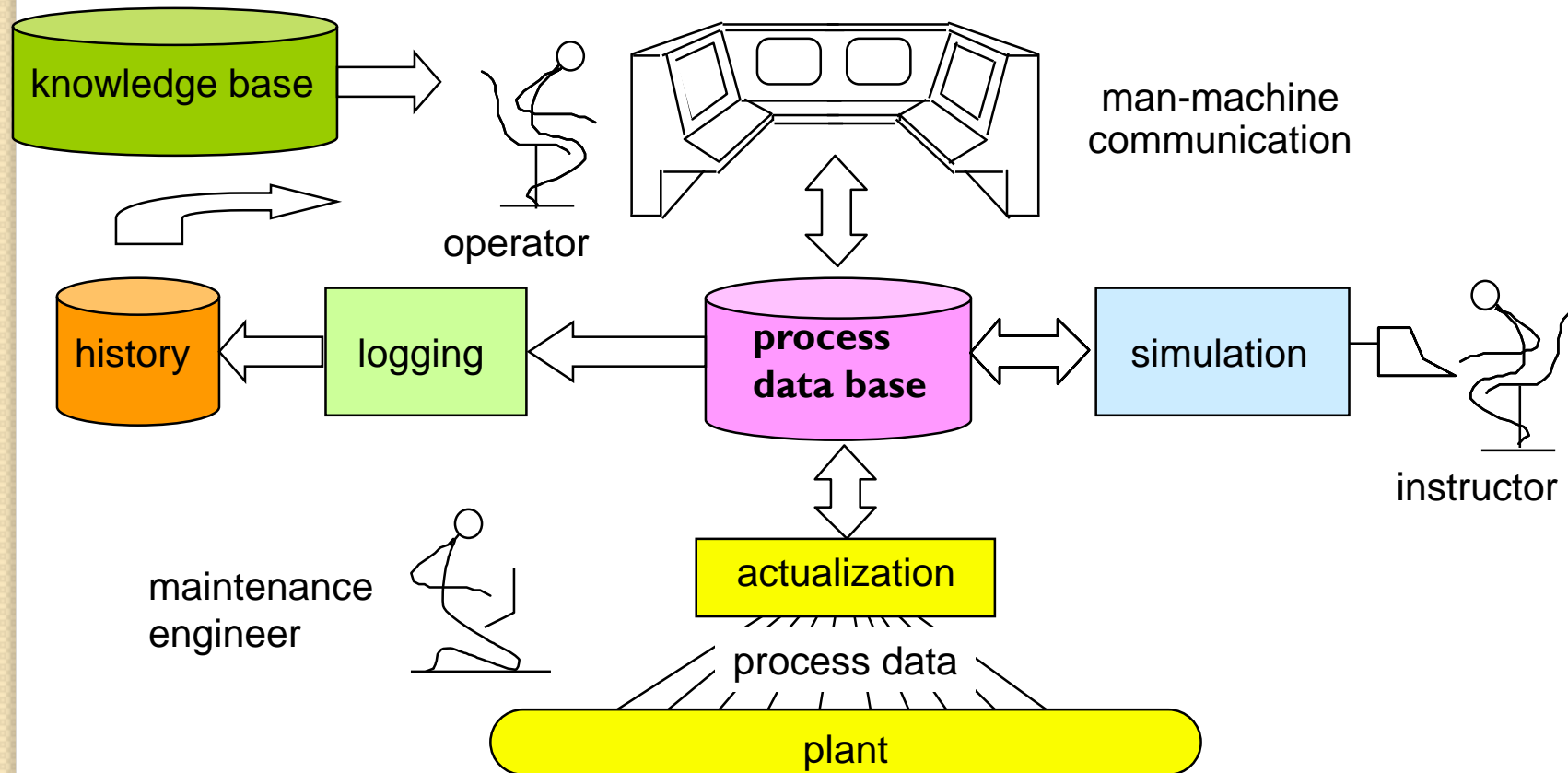
SCADA level

Presentation of complex data to the human operator,
aid to decisions (expert system) and maintenance.
Requires a knowledge database in addition to the plant's database

Lower Levels

Lowest levels (closest to the plant) are most demanding in response time.
Quantity of raw data is very large.
Processing is trivial (was formerly realized in hardware).
These levels are today under computer control,
except in emergency situations, for maintenance or commissioning.

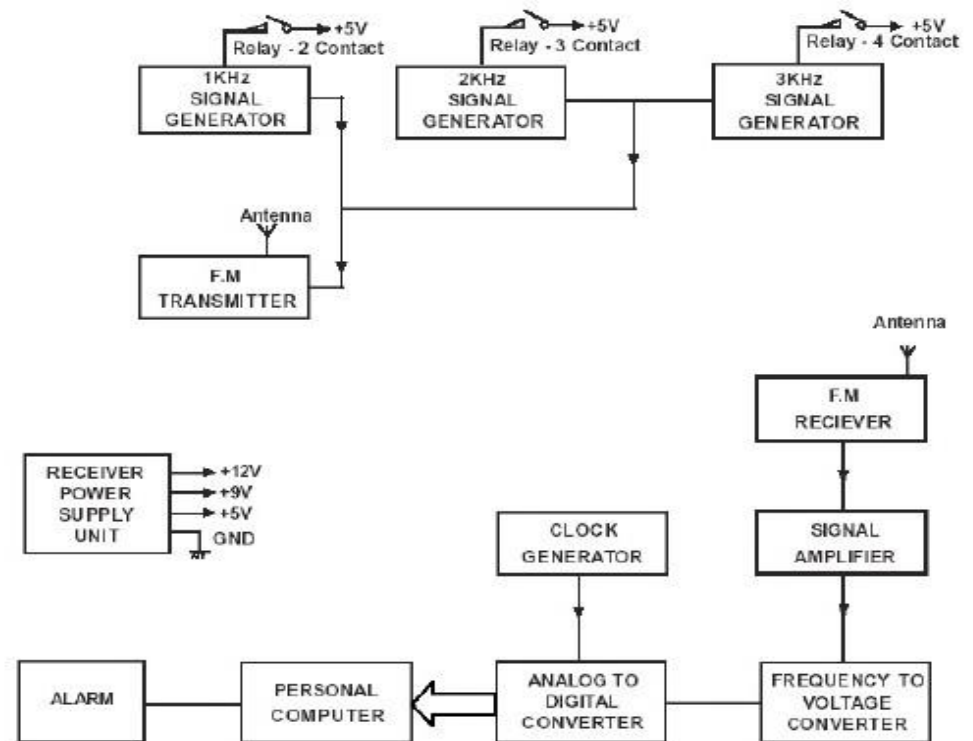
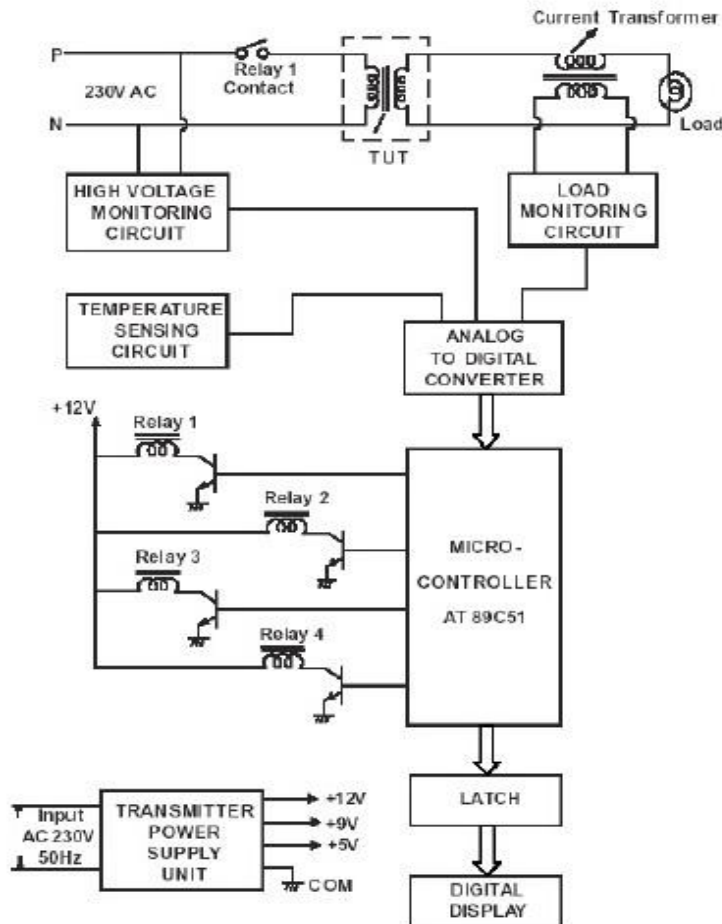
- Consideration of human intervention breaches this hierarchy.
- Normally, the operator is only concerned by the supervisory level, but exceptionally, operators (and engineers) want to access data of the lowest levels.
- The operator sees the plant through a fast data base, refreshed in background. This database is the pivot for logging and simulation.



Sample project

IMPLEMENTATION OF WIRELESS COMMUNICATION IN SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM OF A DISTRIBUTION TRANSFORMER USING MICROCONTROLLER & COMPUTER

BLOCK DIAGRAM



- 
- sample

Is SCADA the only Future ? ...

New Technology: Jet Web

Each node is an individual Web Server All nodes and all I/O hooked up to the Ethernet

