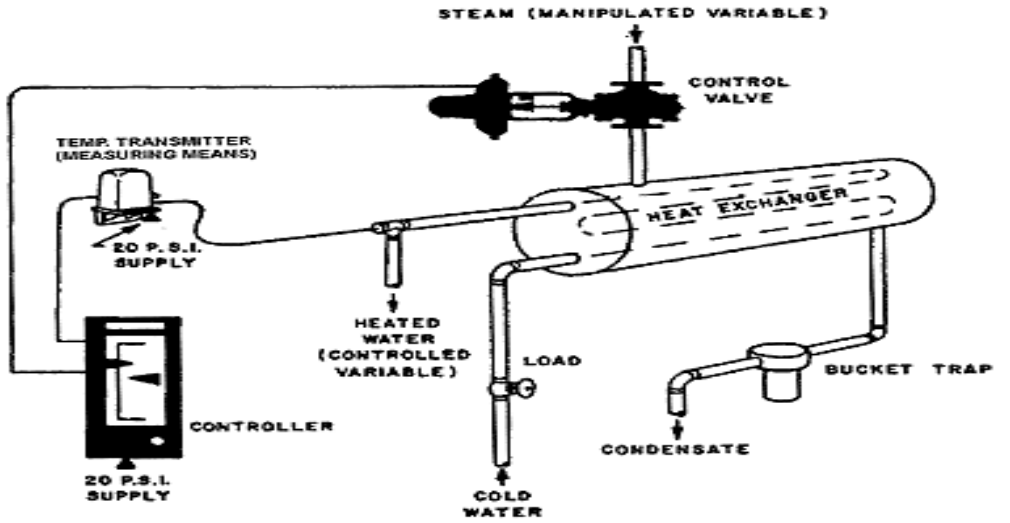
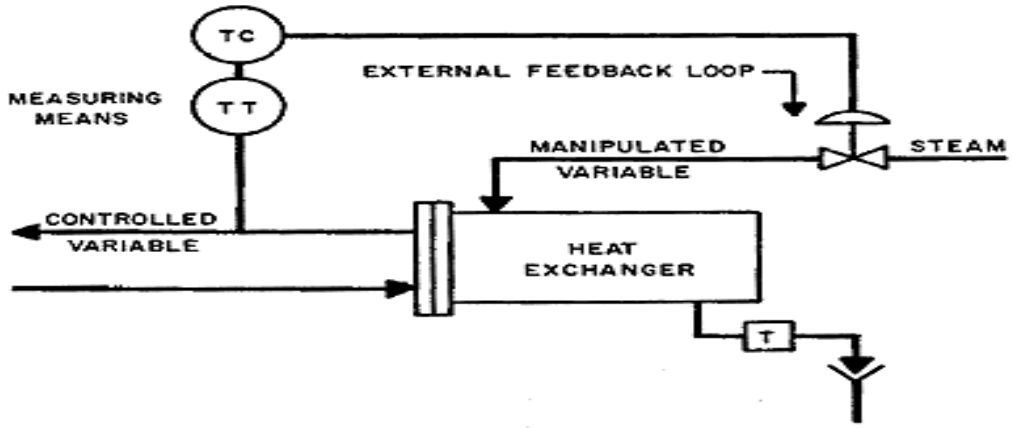
DCS Systems

Control Loop





Heat Exchanger Process

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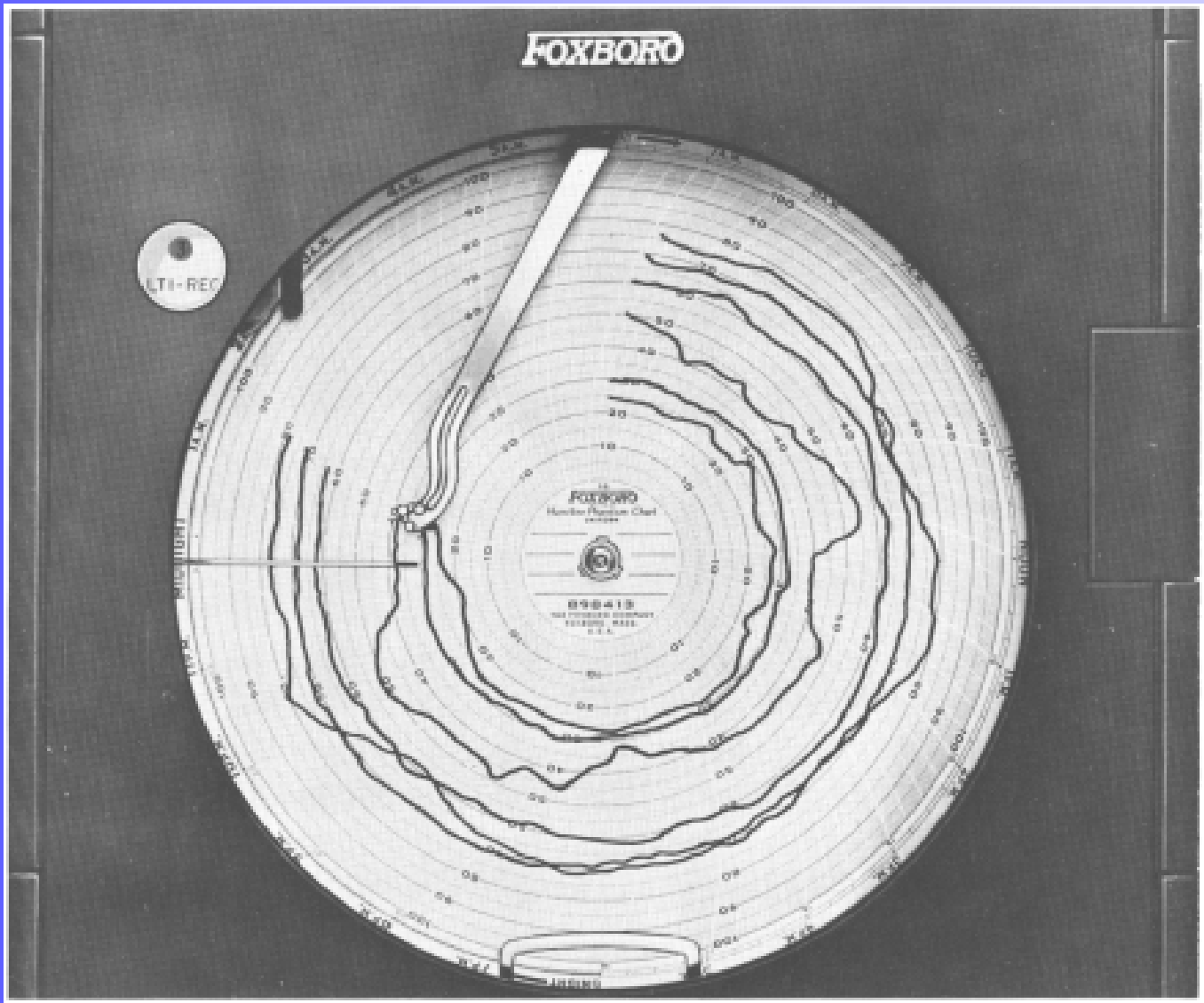
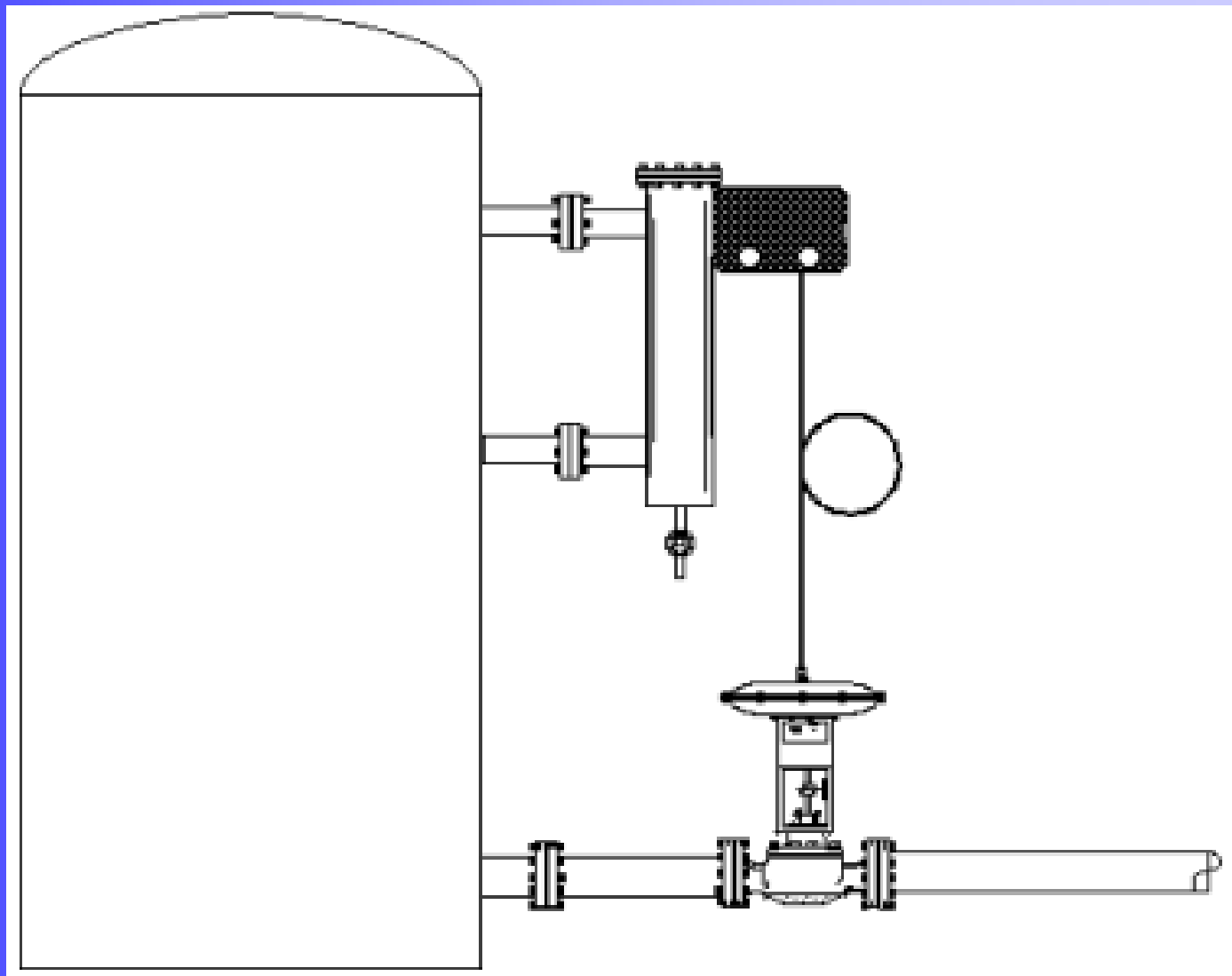
Recording Instrumentation

Circular Chart Recorder

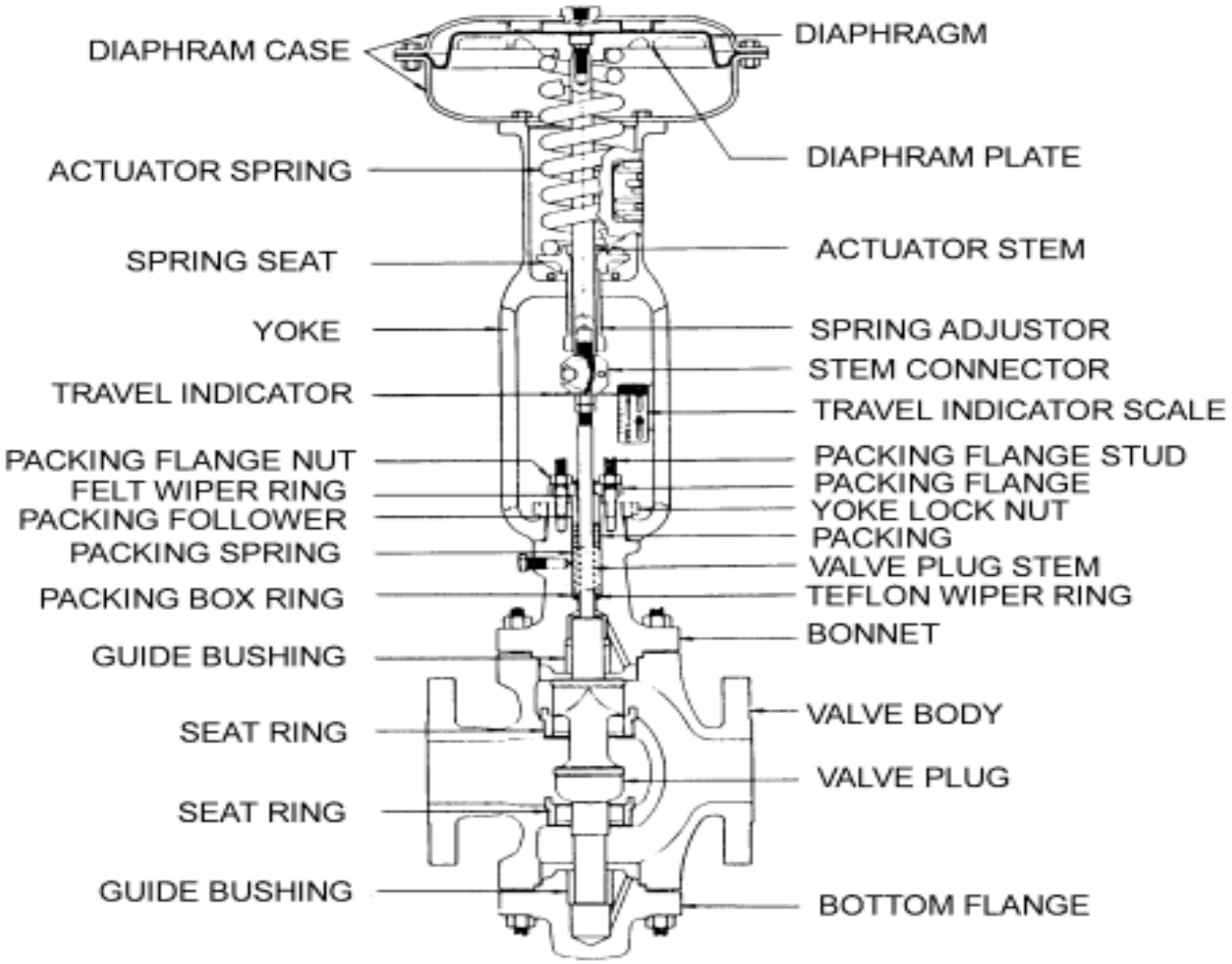


Controllers

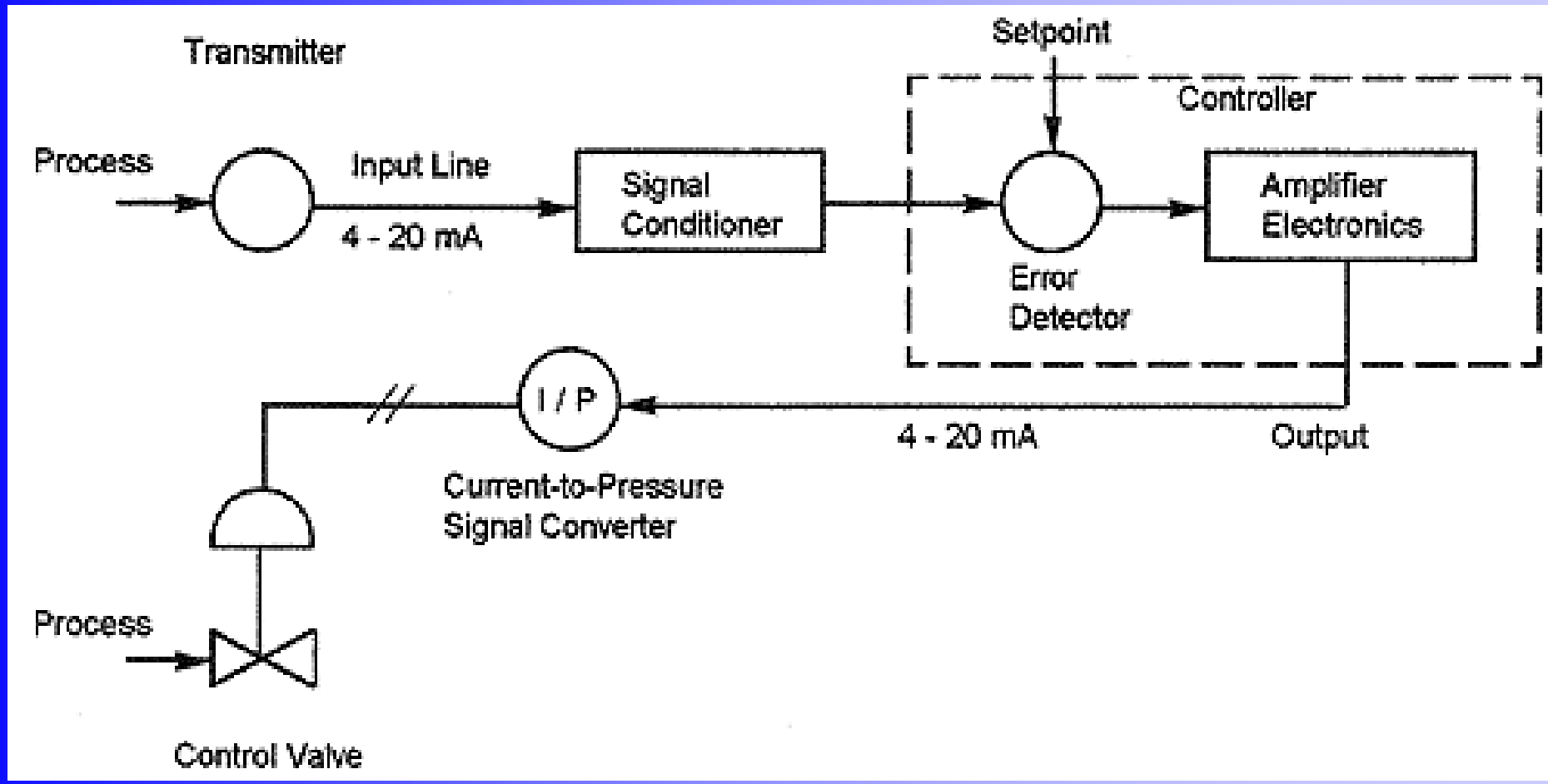
Displacer-Type Local Level Controller



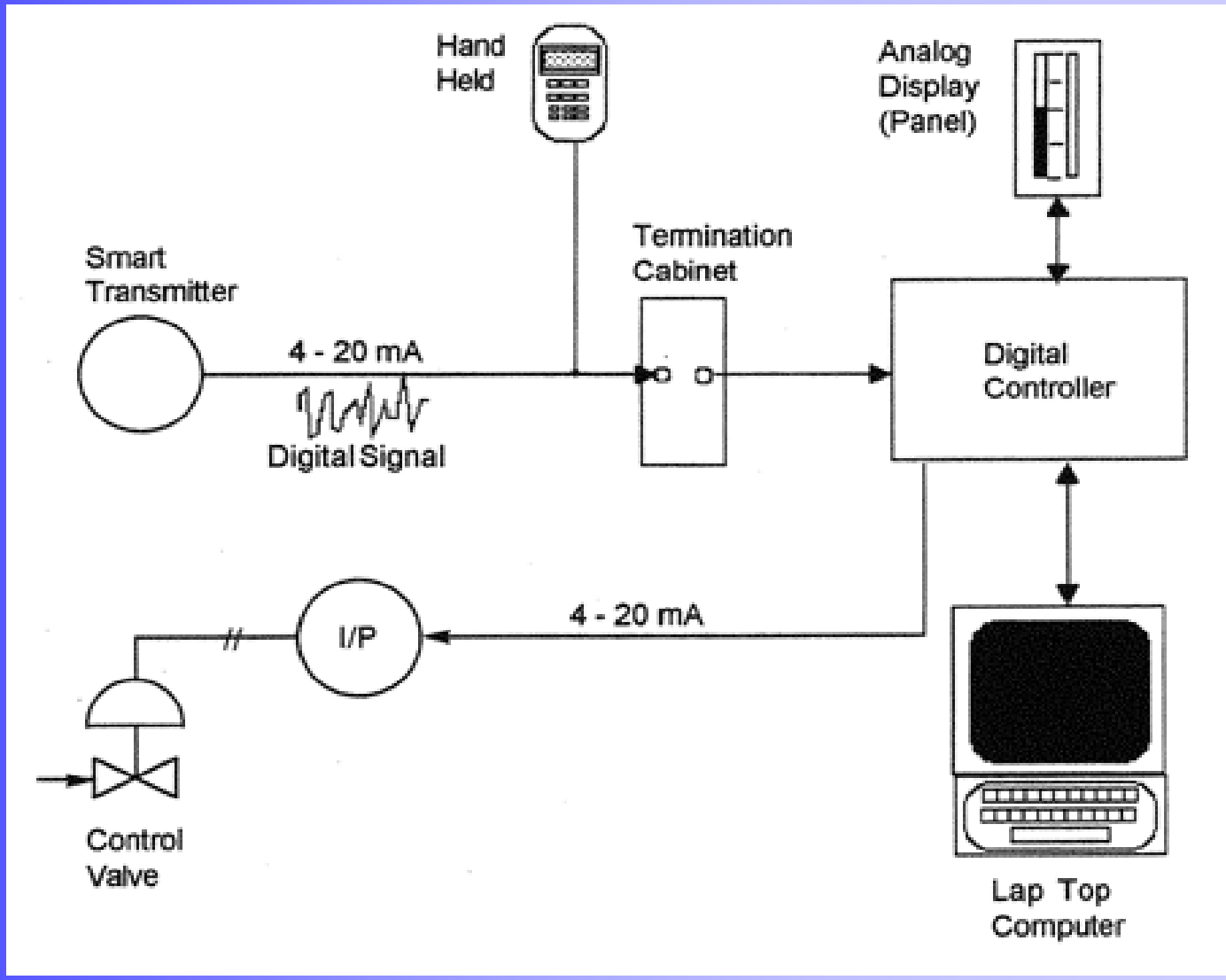
Control Valves



Analog Instrumentation Loop

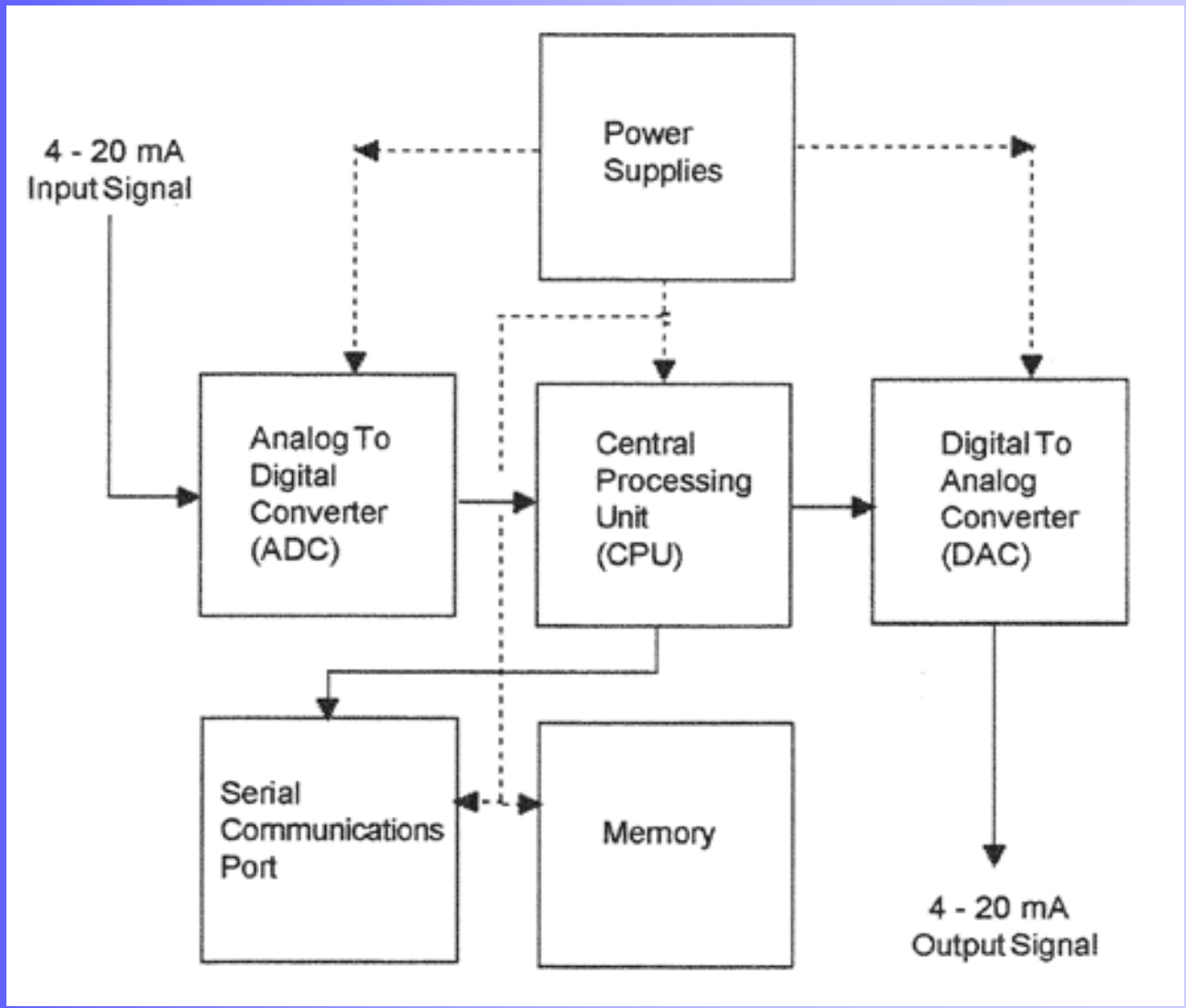


The Digital Instrument Loop

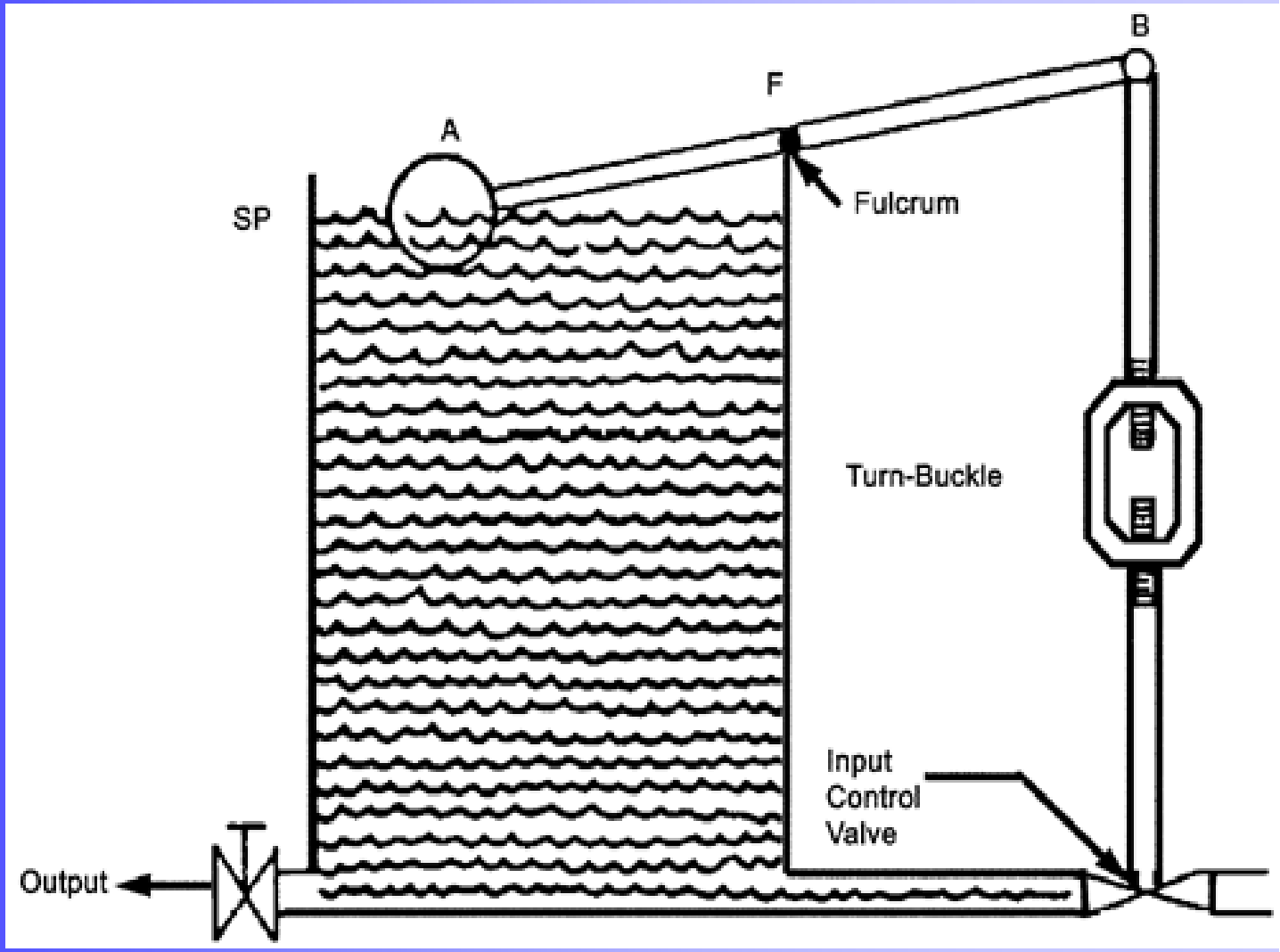


Smart Transmitters

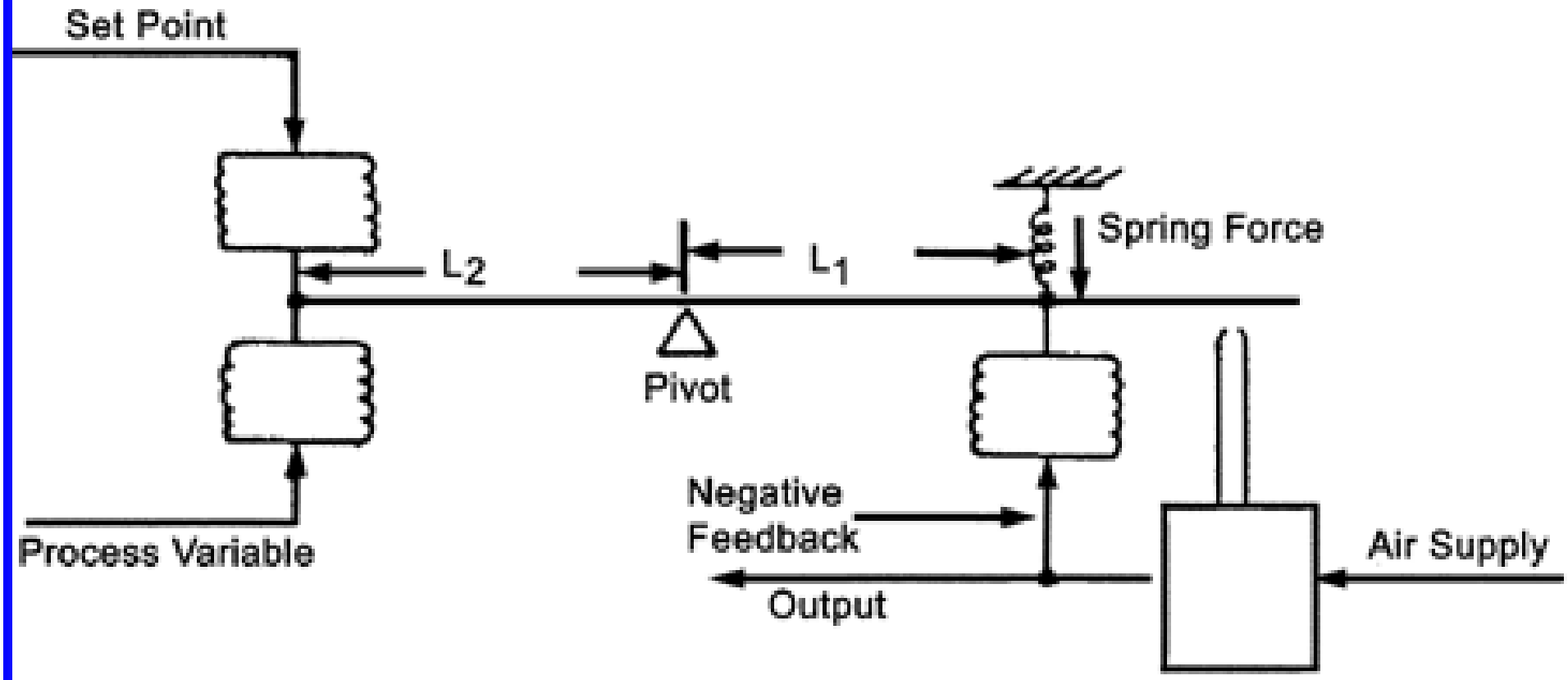
Functional Diagram of a Smart Transmitter



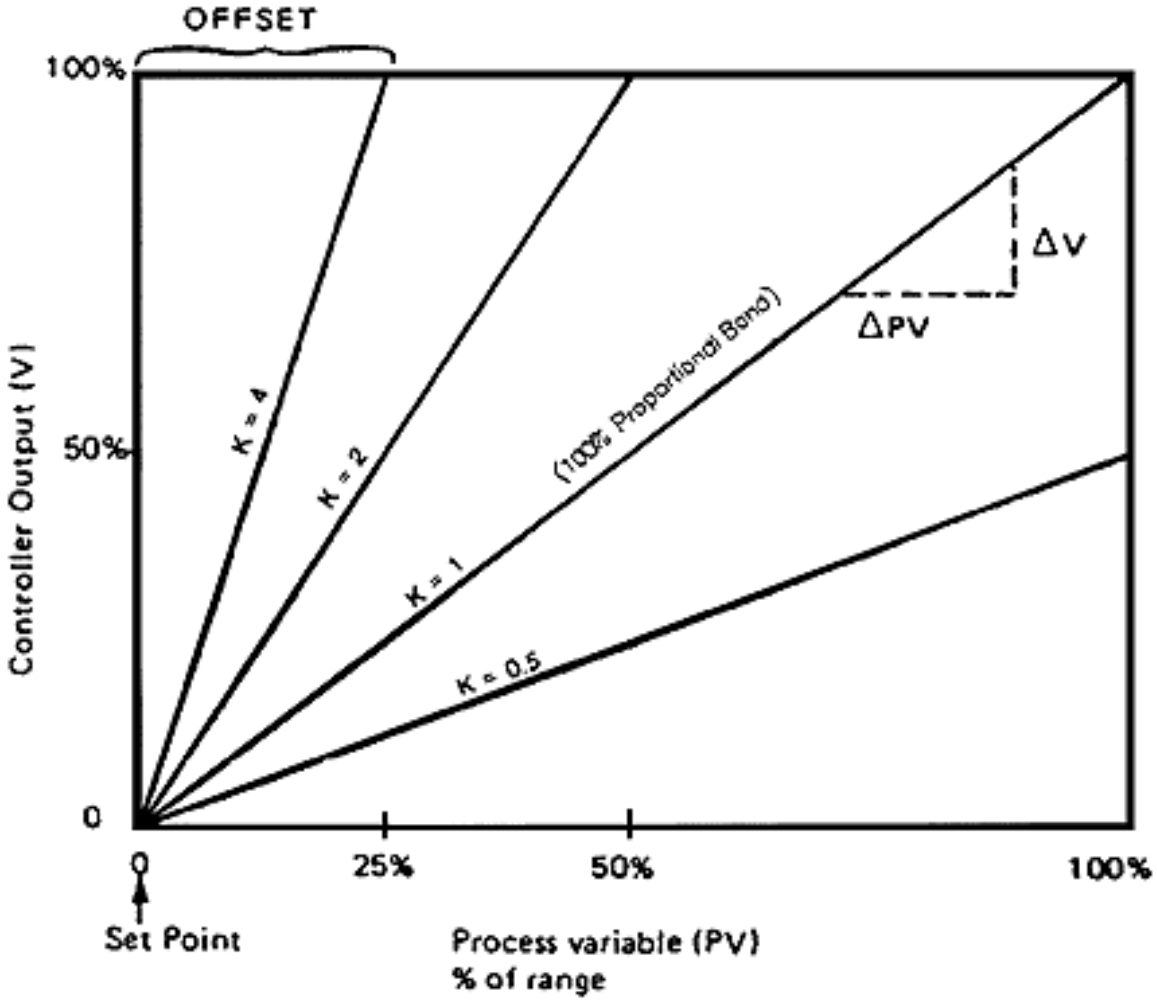
Simple Proportional Control



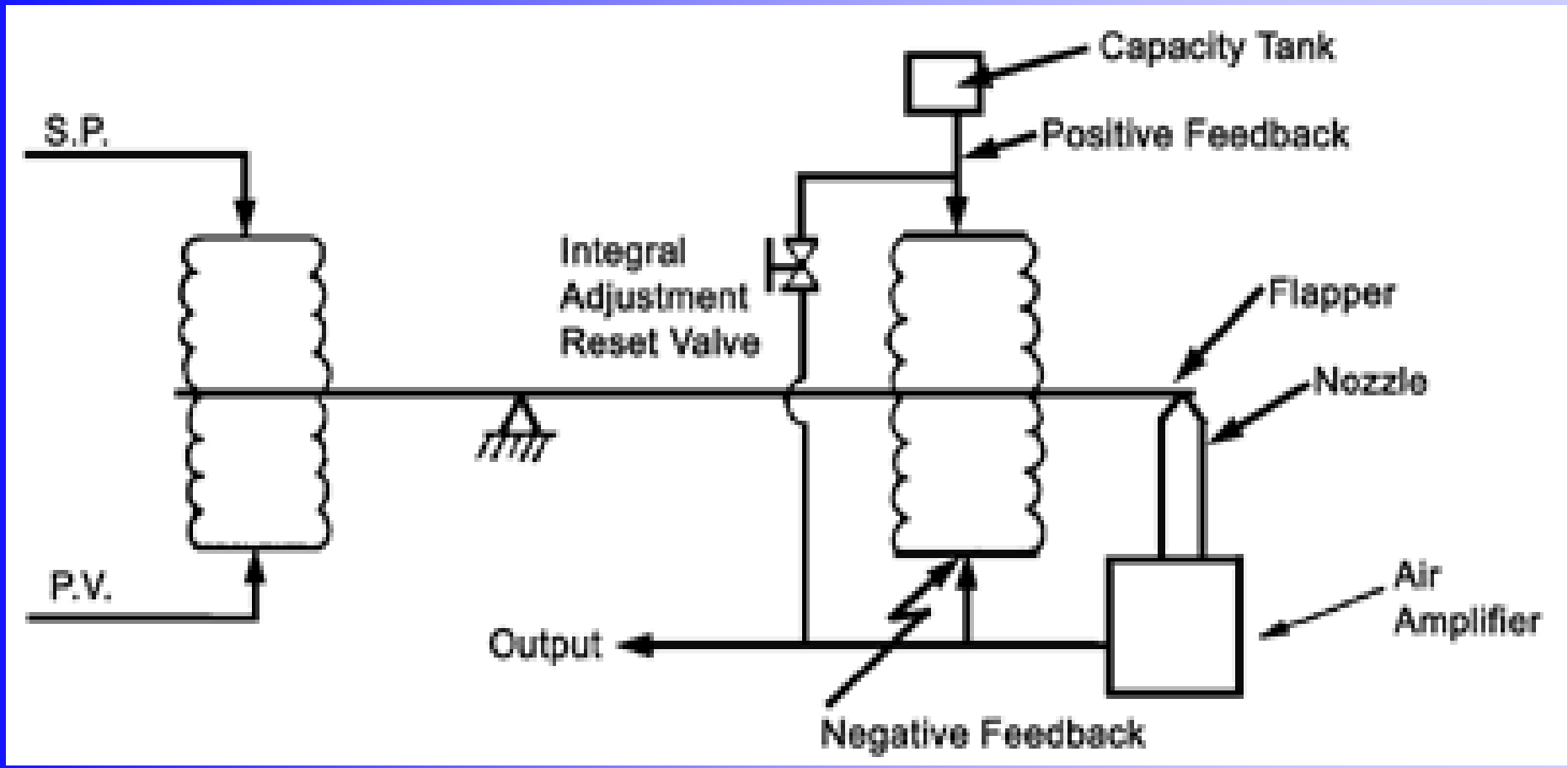
Moment Balance Pneumatic Proportional Controller



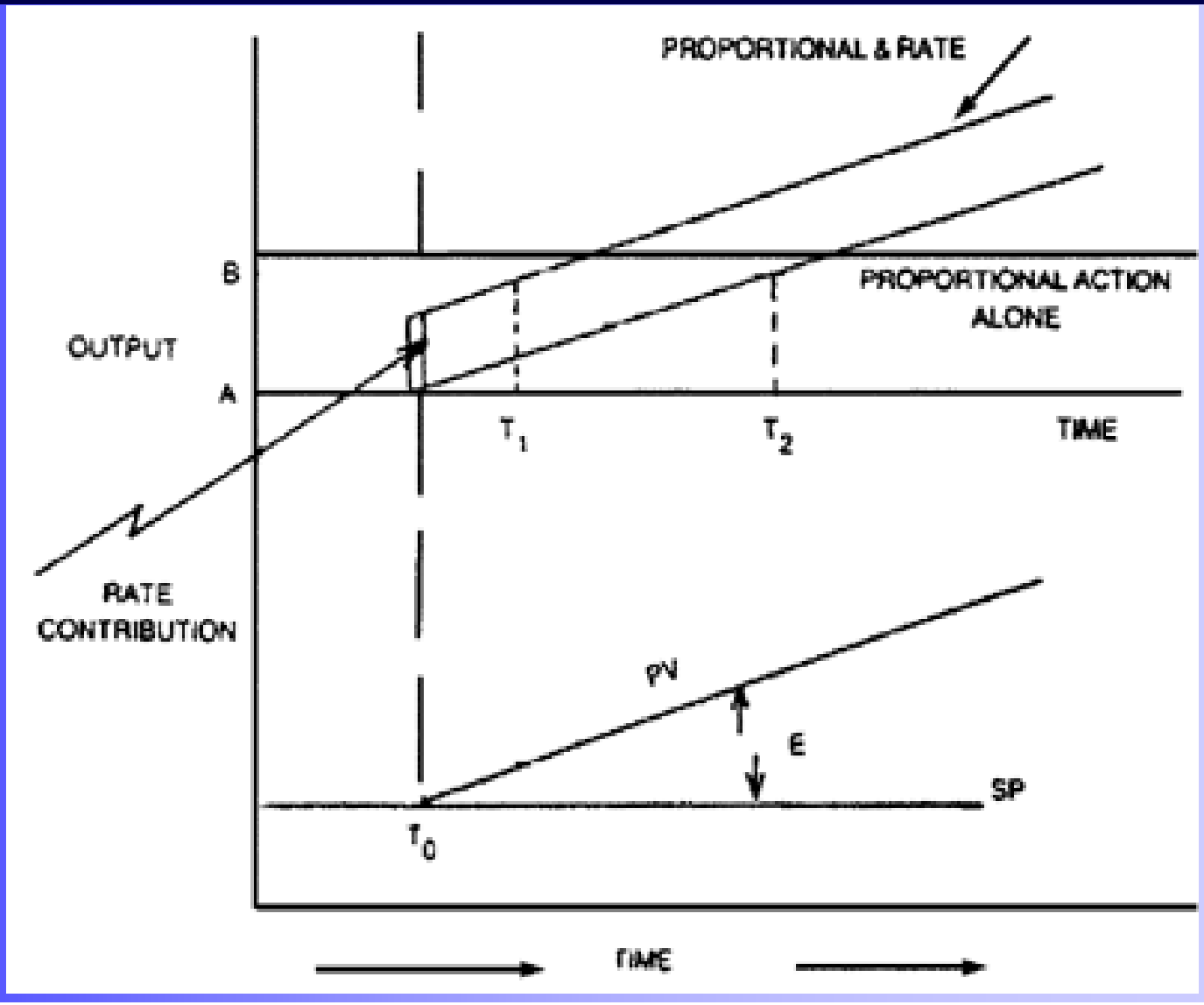
Controller Output vs. Process Variable



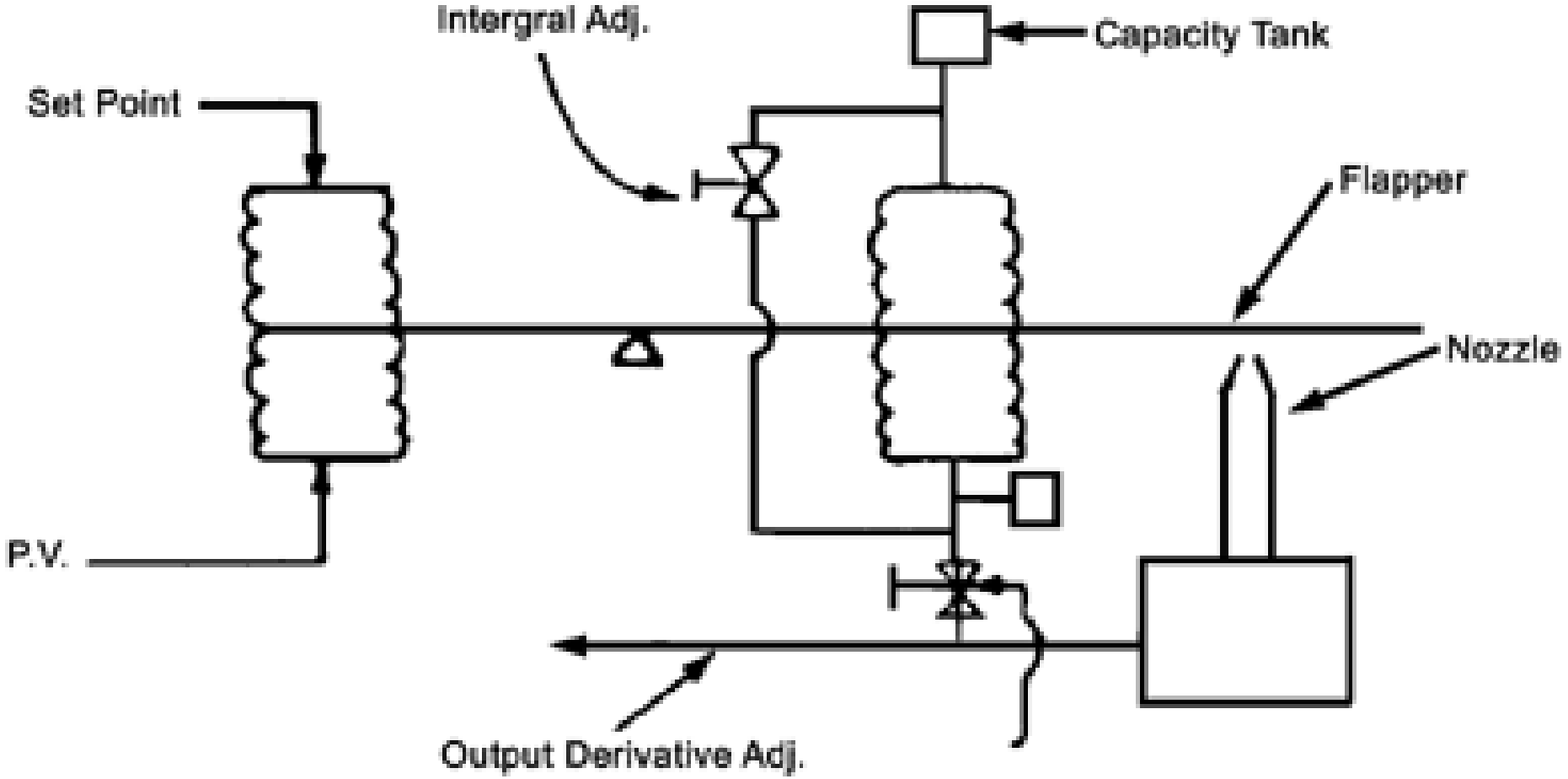
Proportional Plus Reset Controller



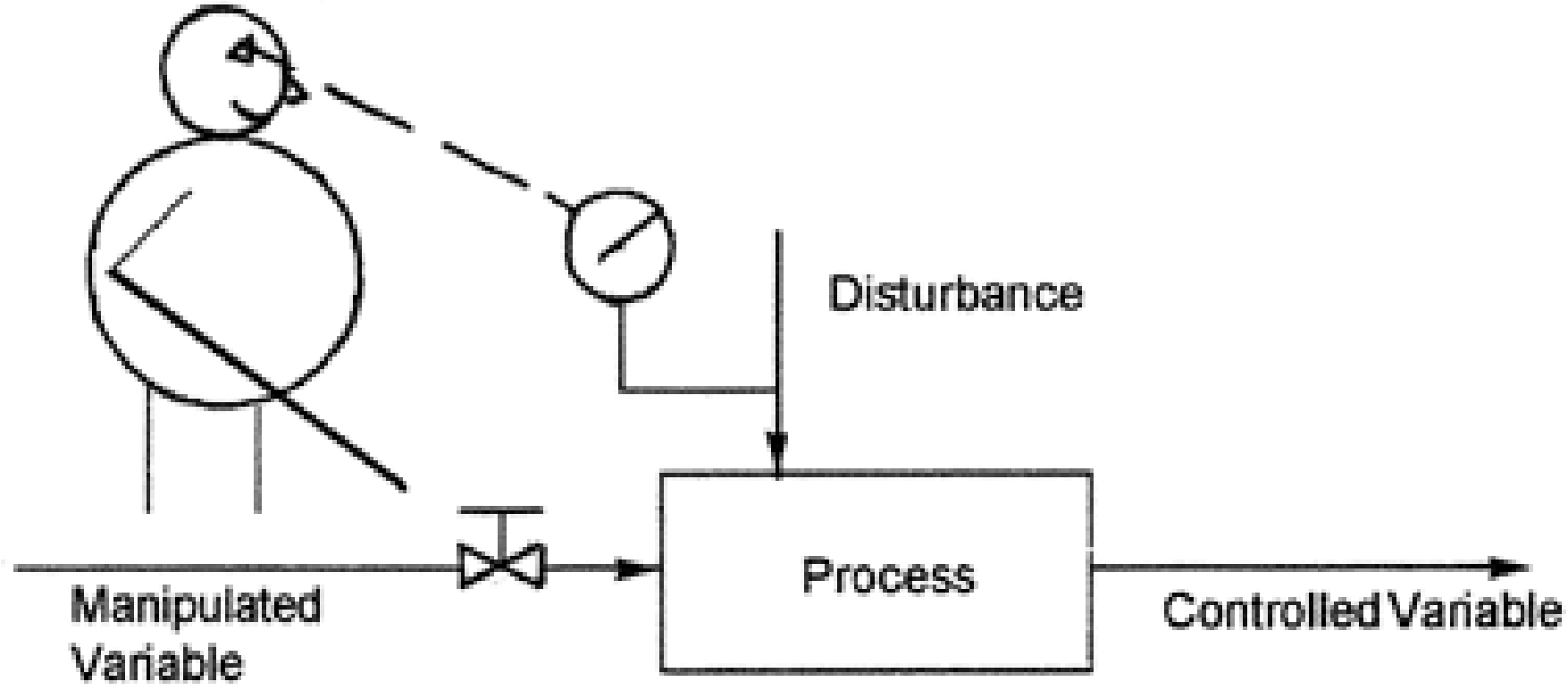
Rate Contribution to Controller Output



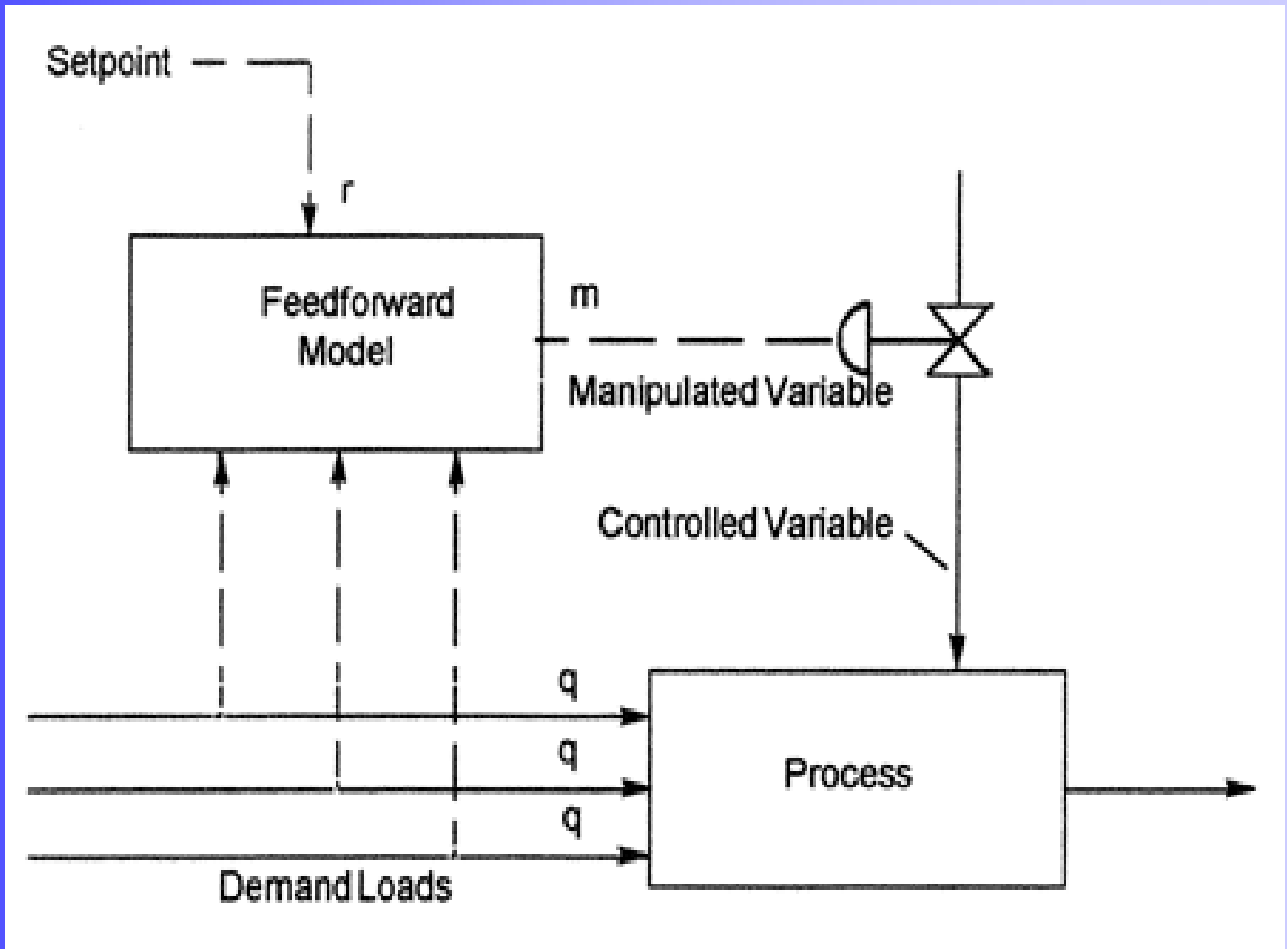
Proportional Plus Reset Plus Rate Controller



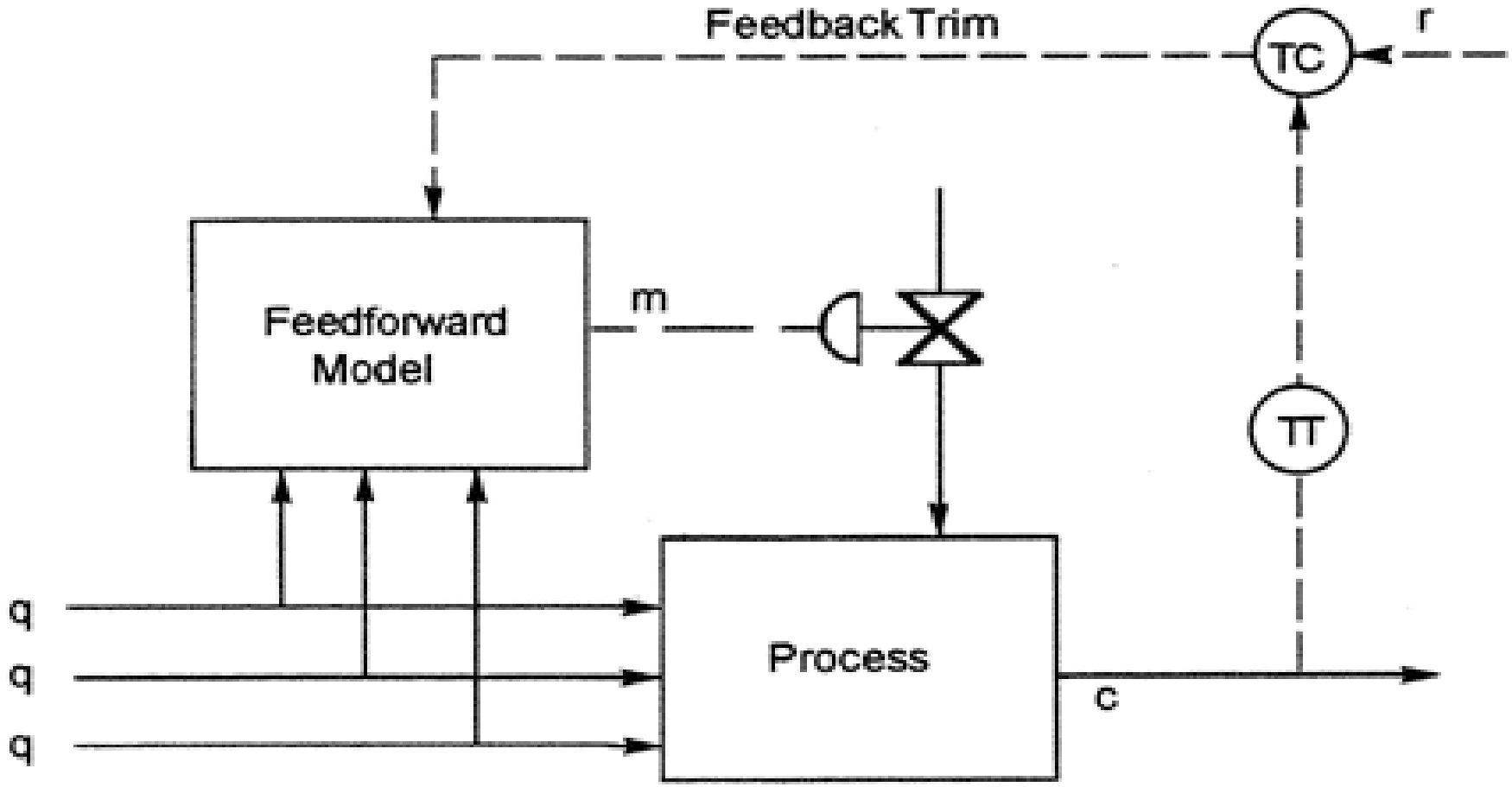
Manual Feedforward Control



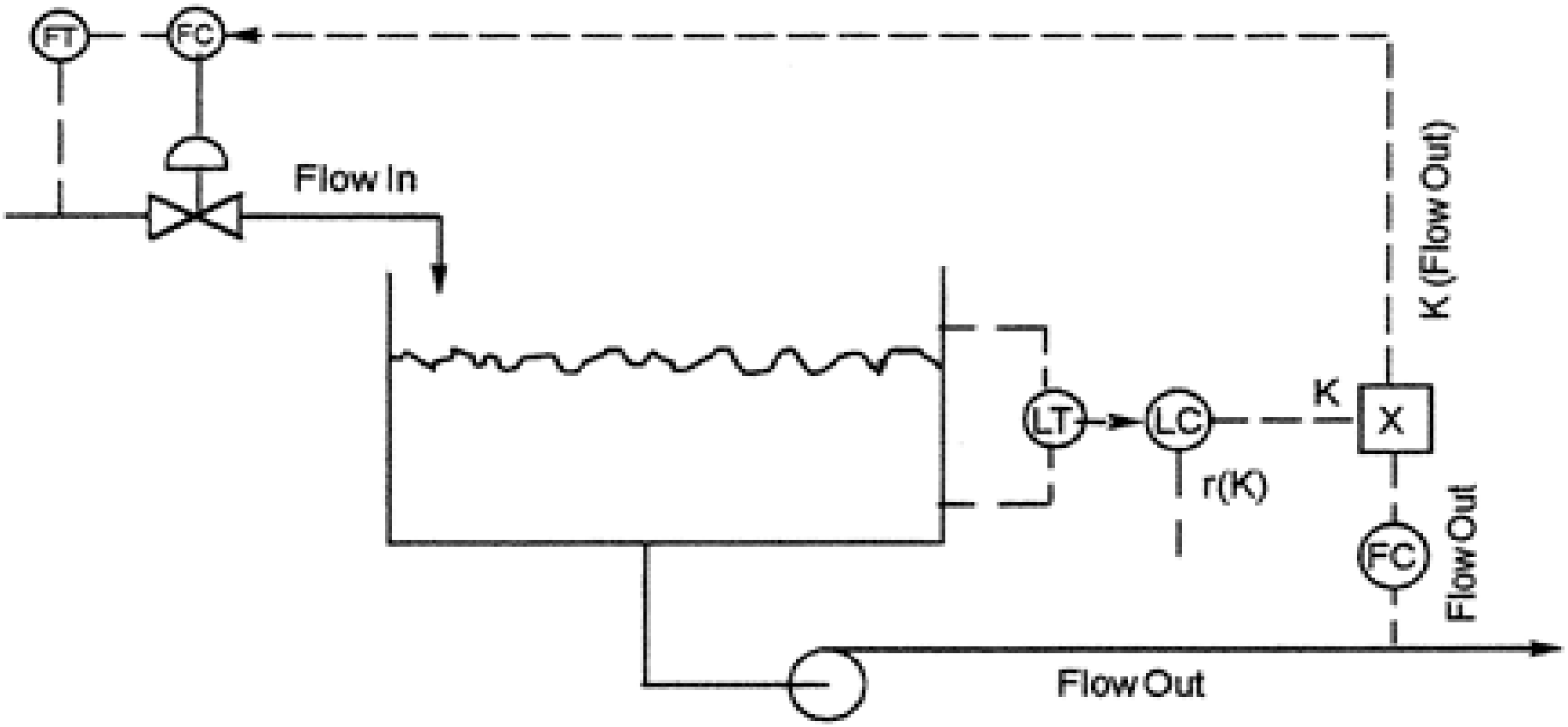
Feedforward Model



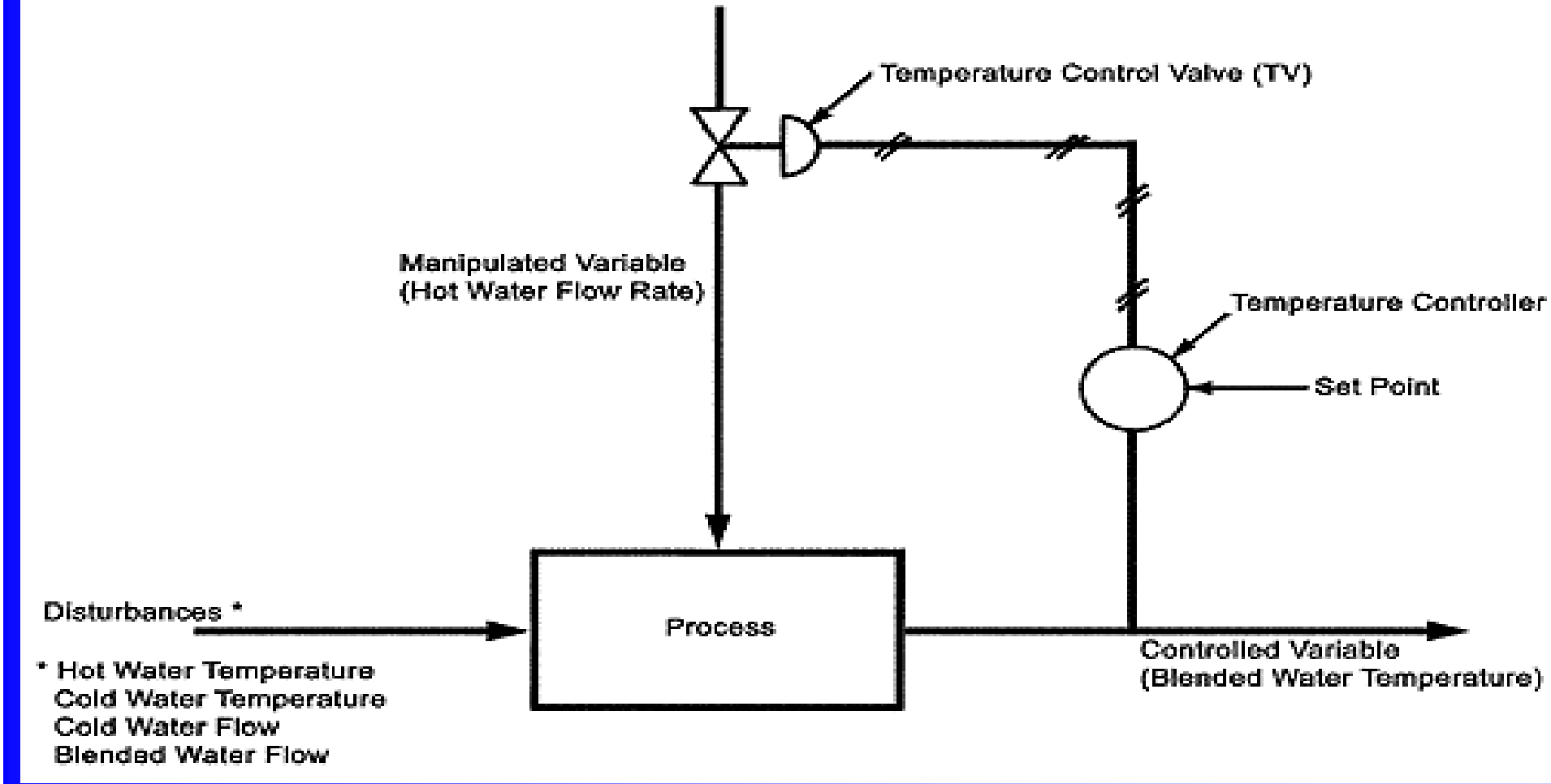
Feedforward Control with Feedback Trim



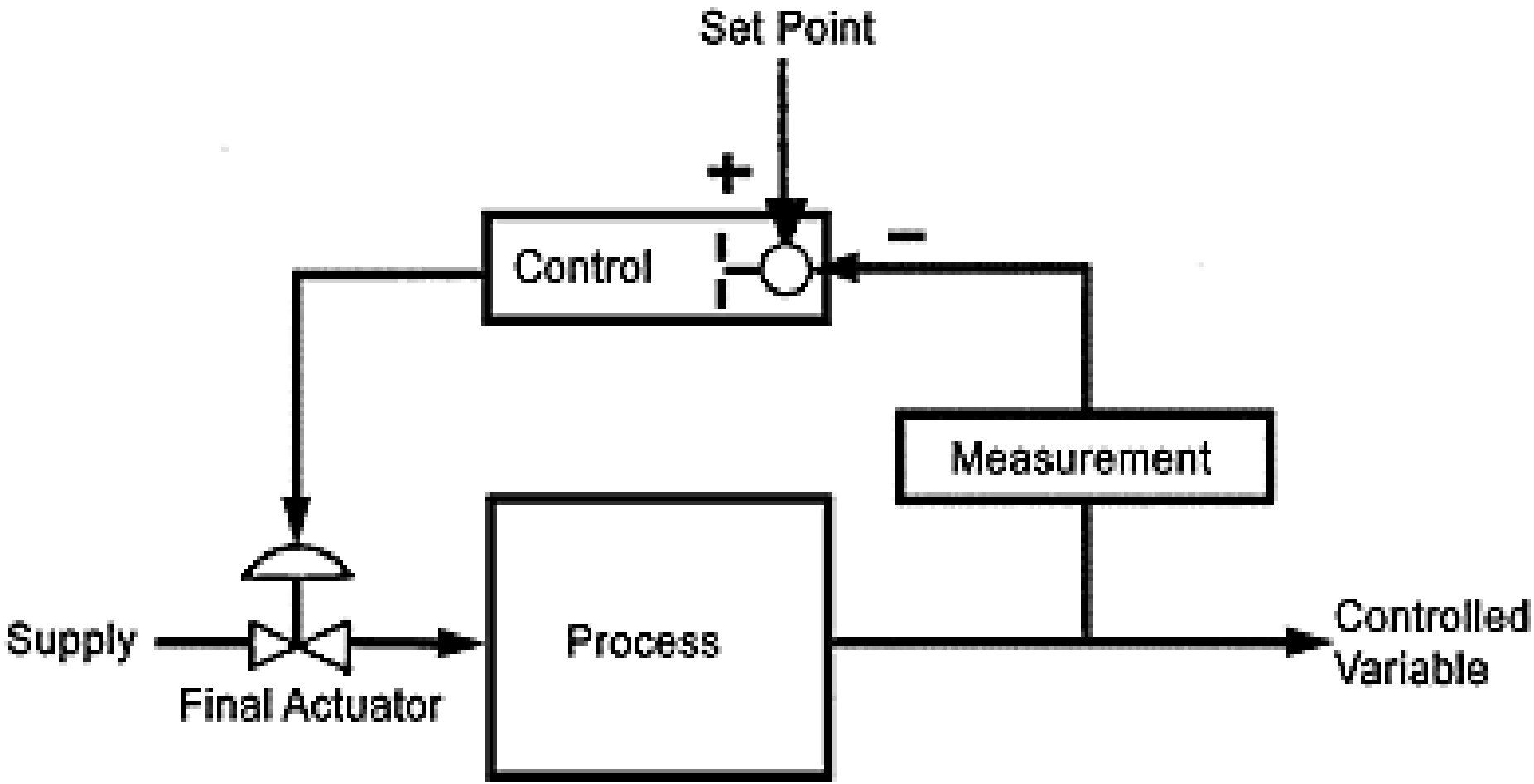
Feedforward of a Level Process



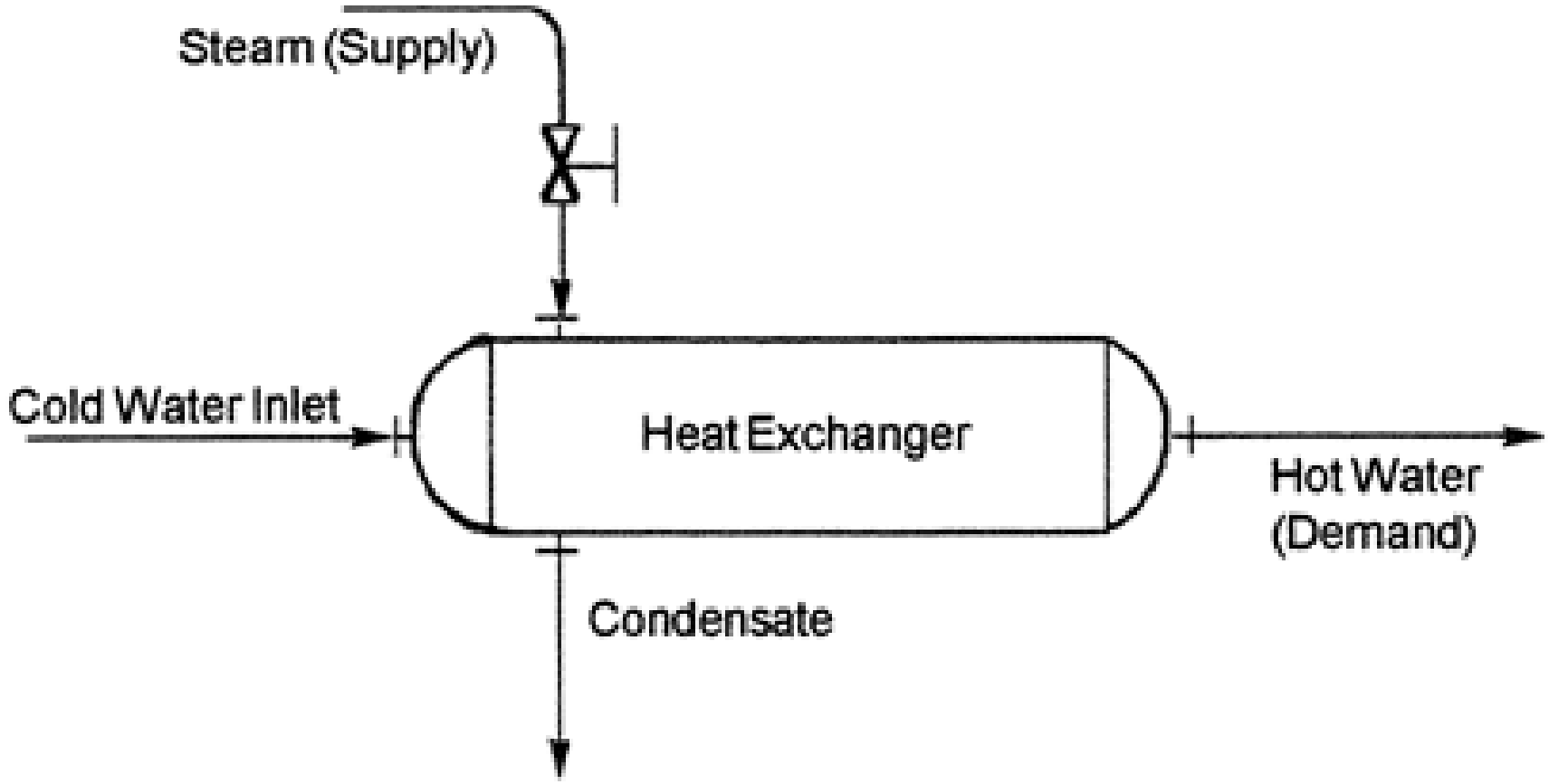
Temperature Control Loop



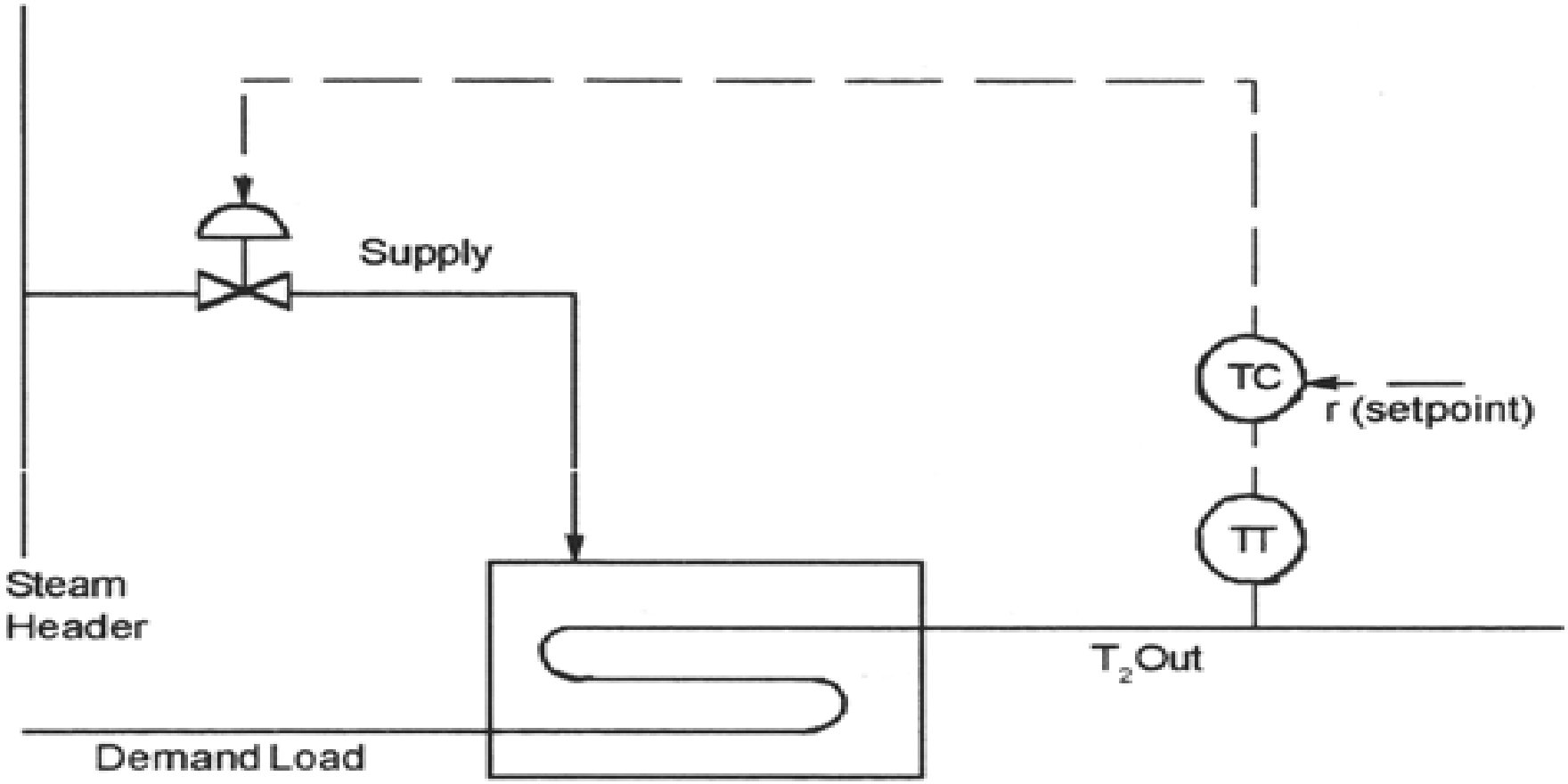
Feedback Control Loop



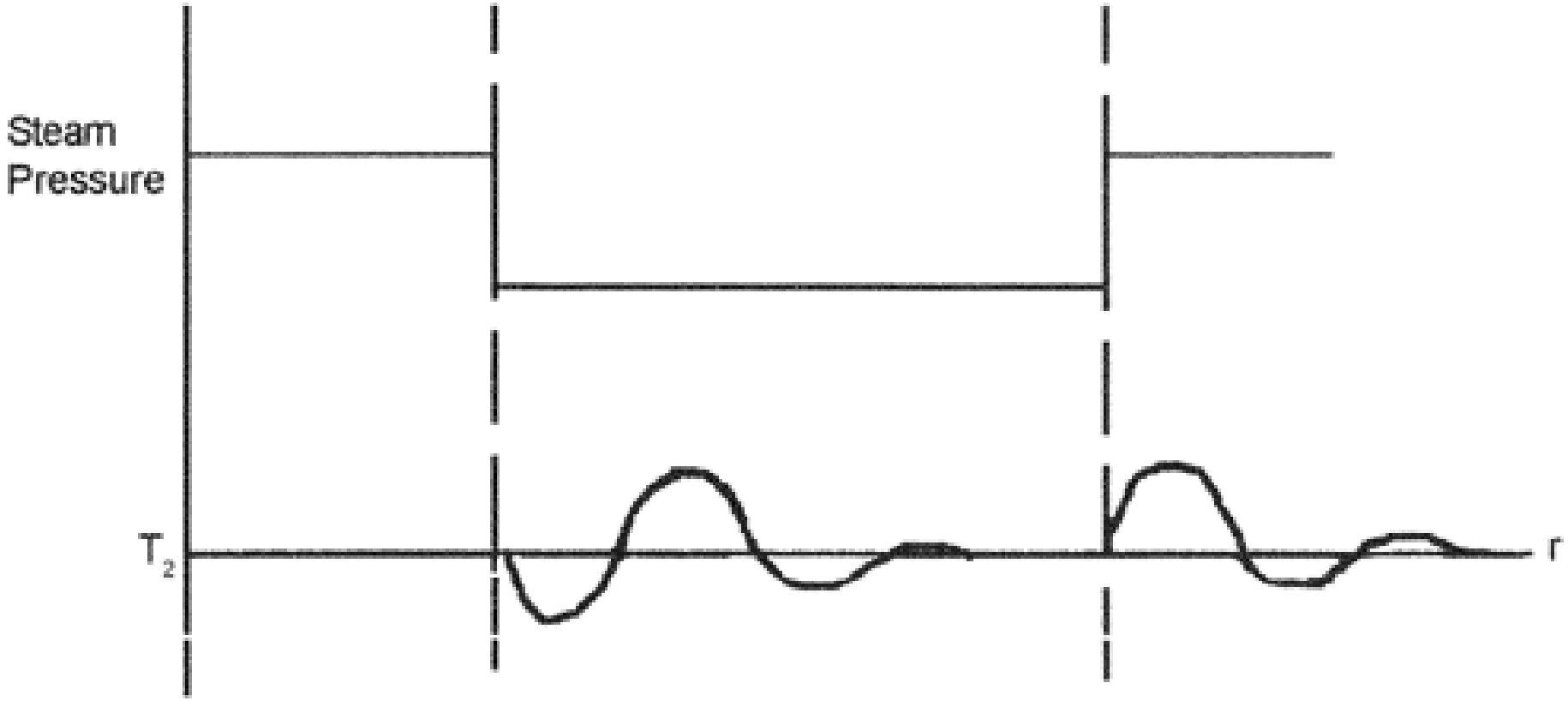
Typical Process Supply and Demand



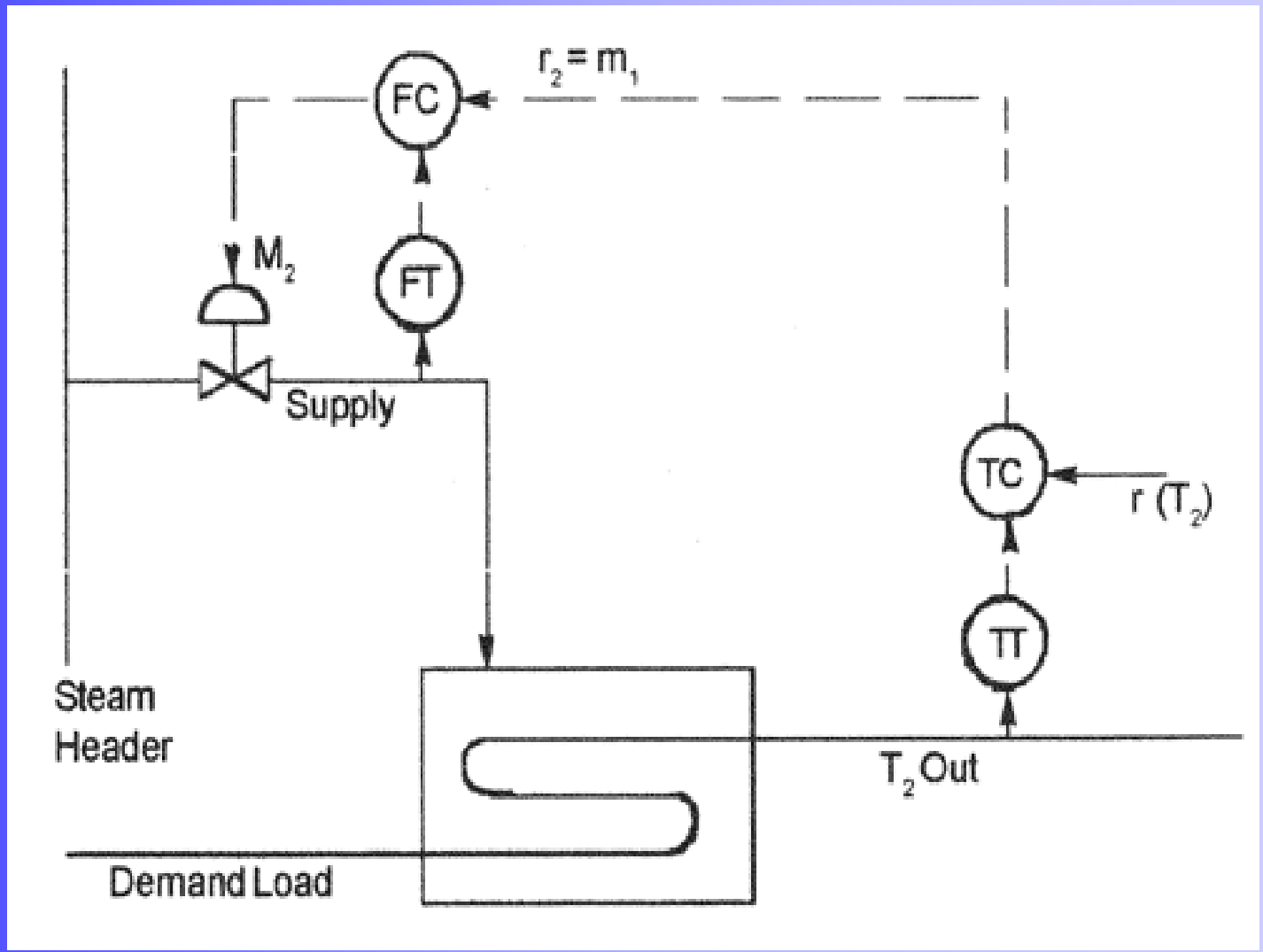
Simple Feedback Loop



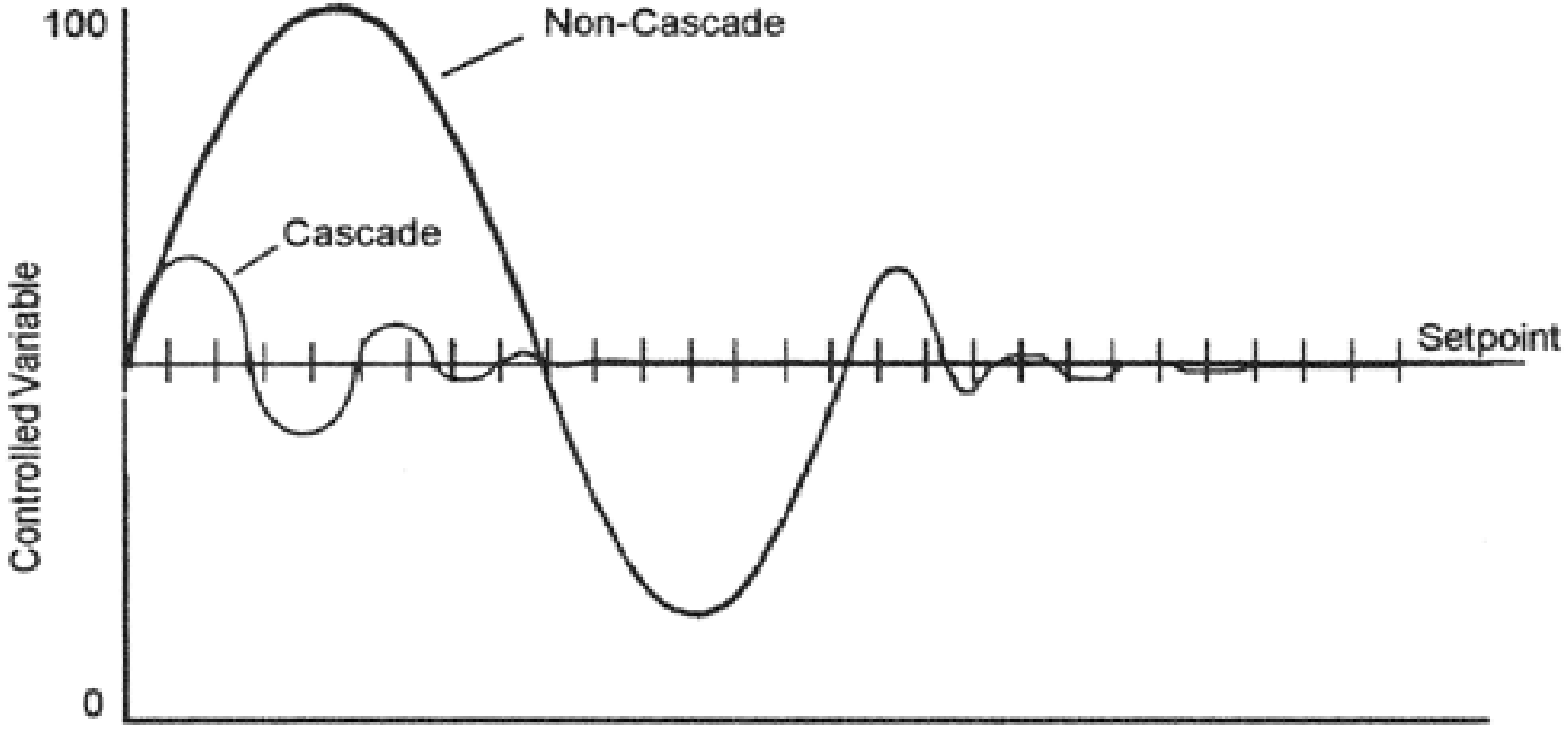
Response to Supply Upsets



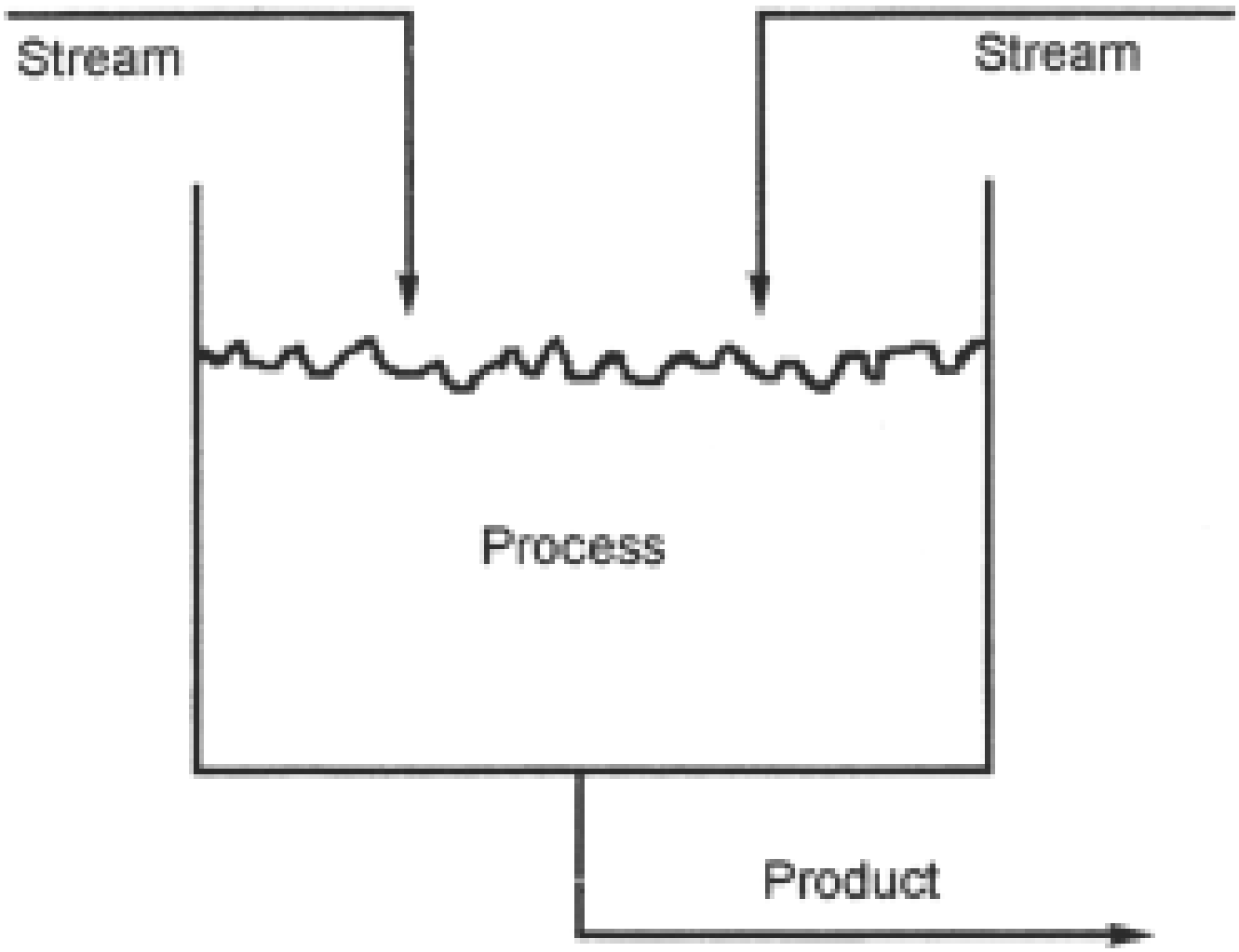
Simple Cascade Control Loop



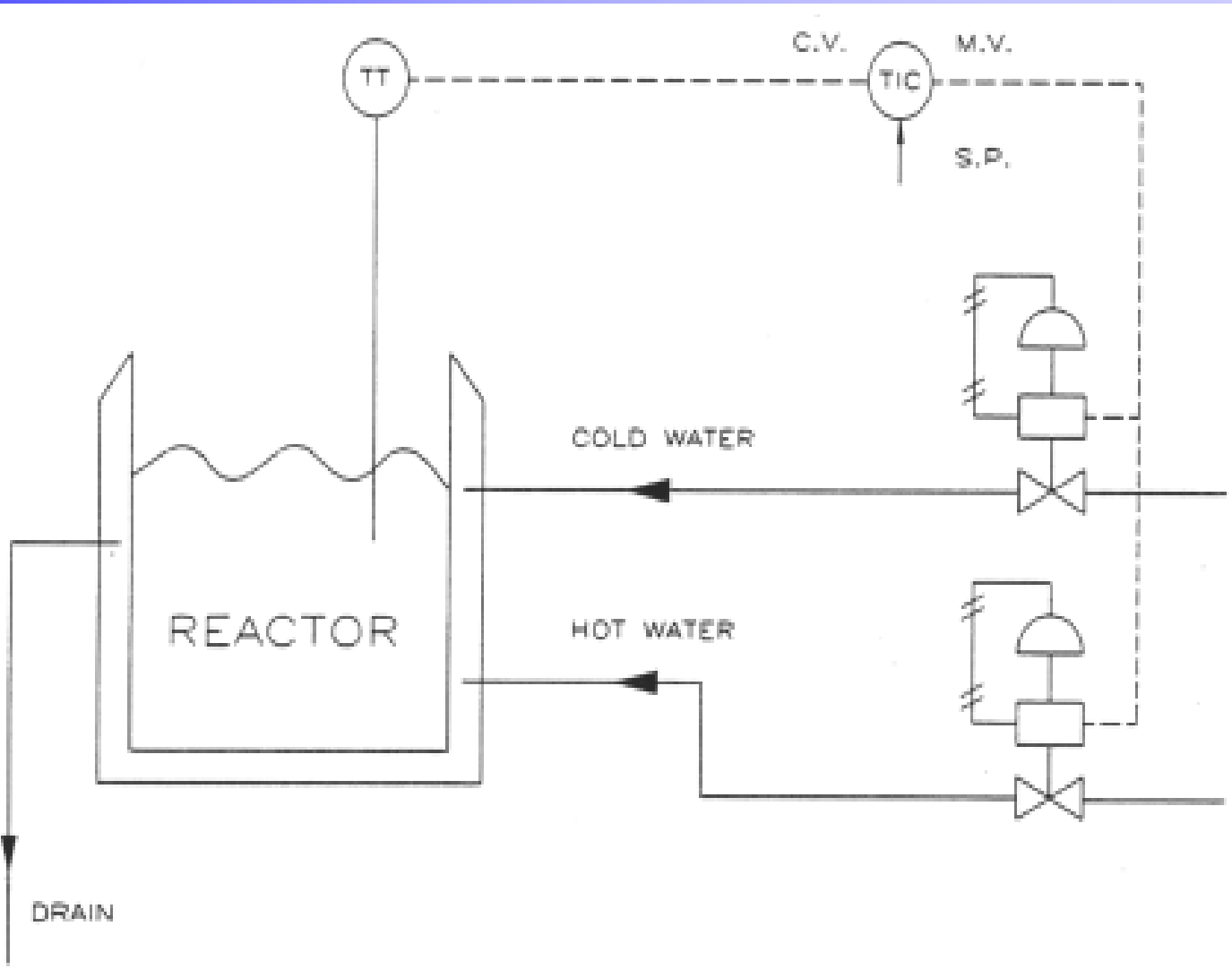
Relative Loop Performance to Supply Upsets



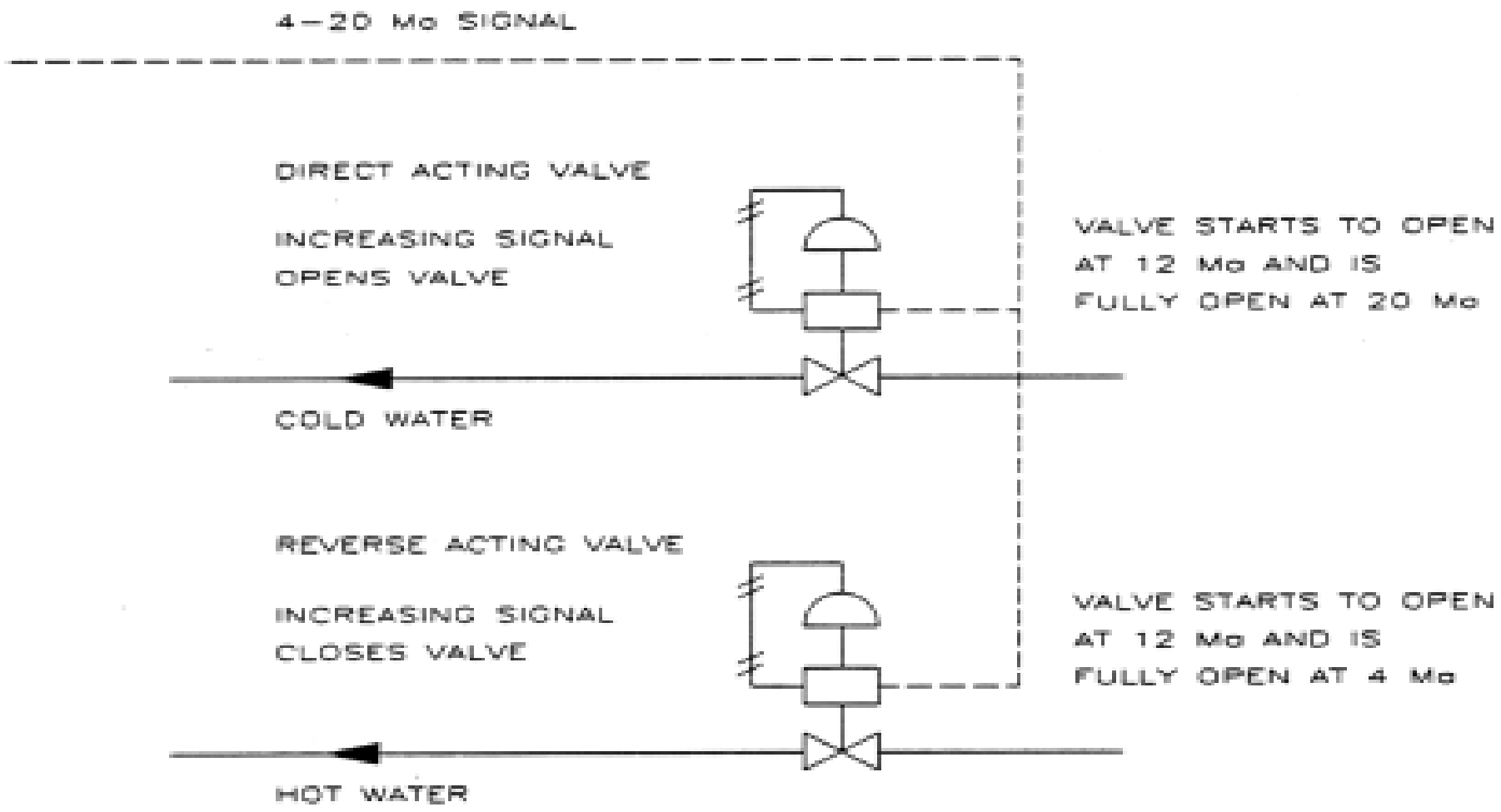
Basic Ratio Process



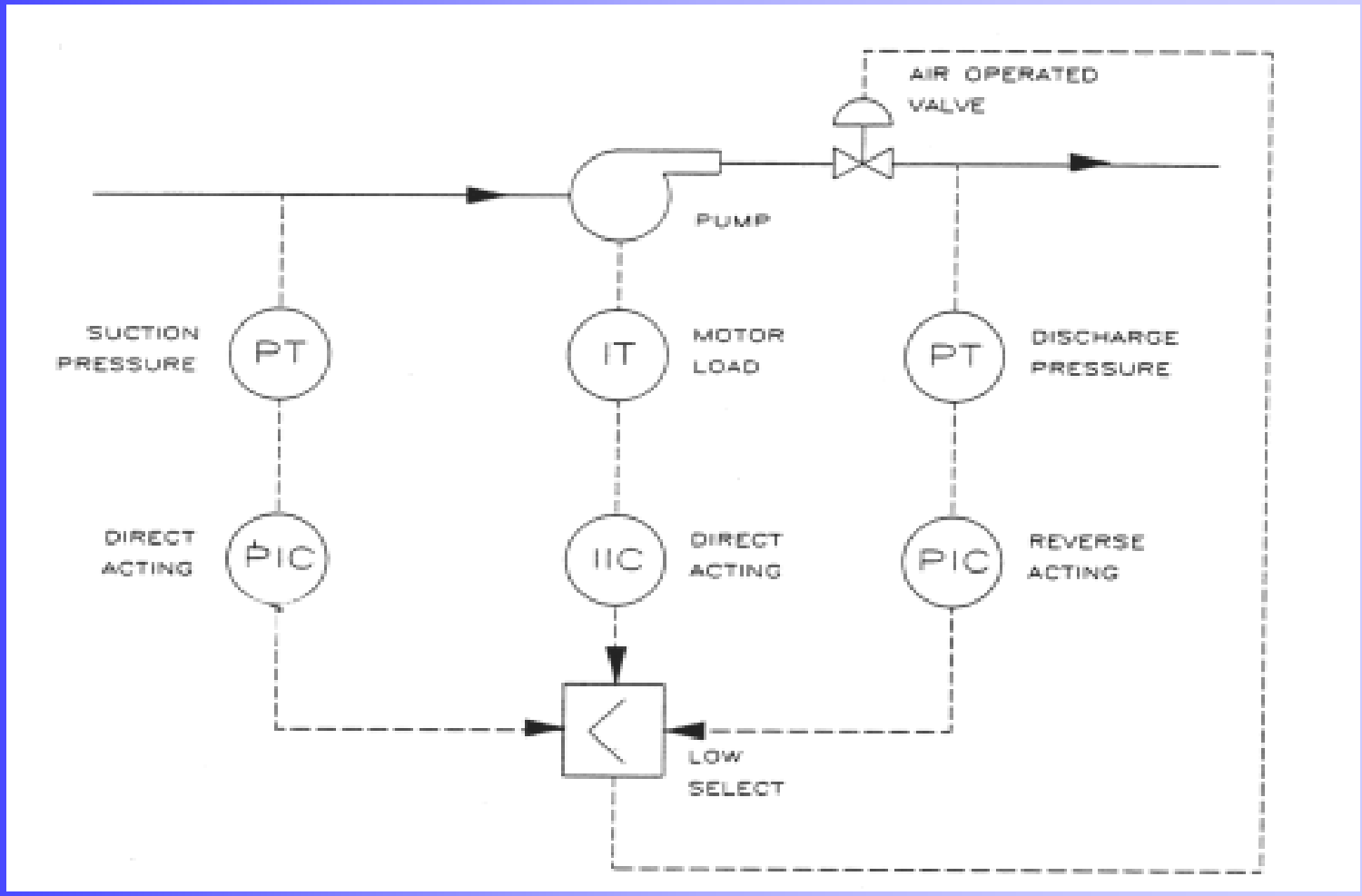
Typical Split-Range Control Loop



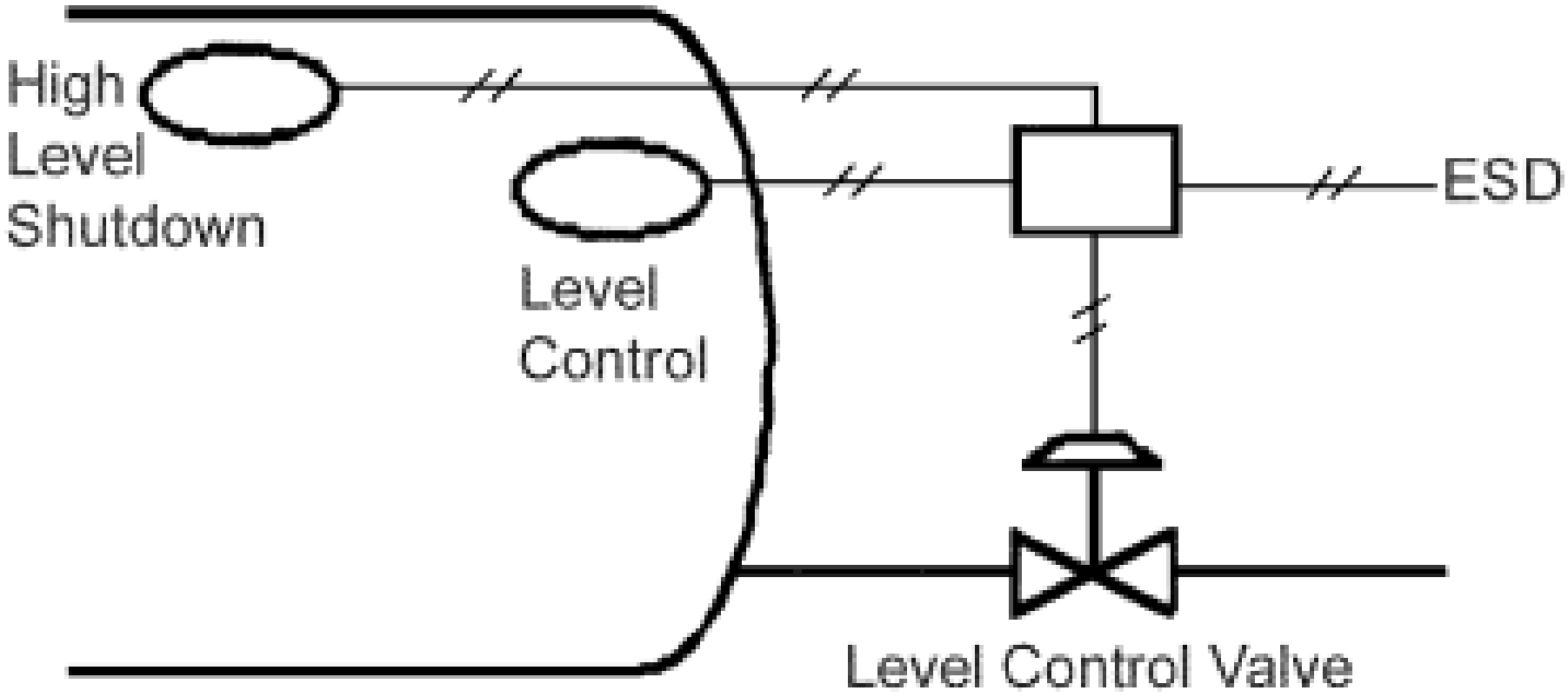
Direct and Reverse Acting Valves



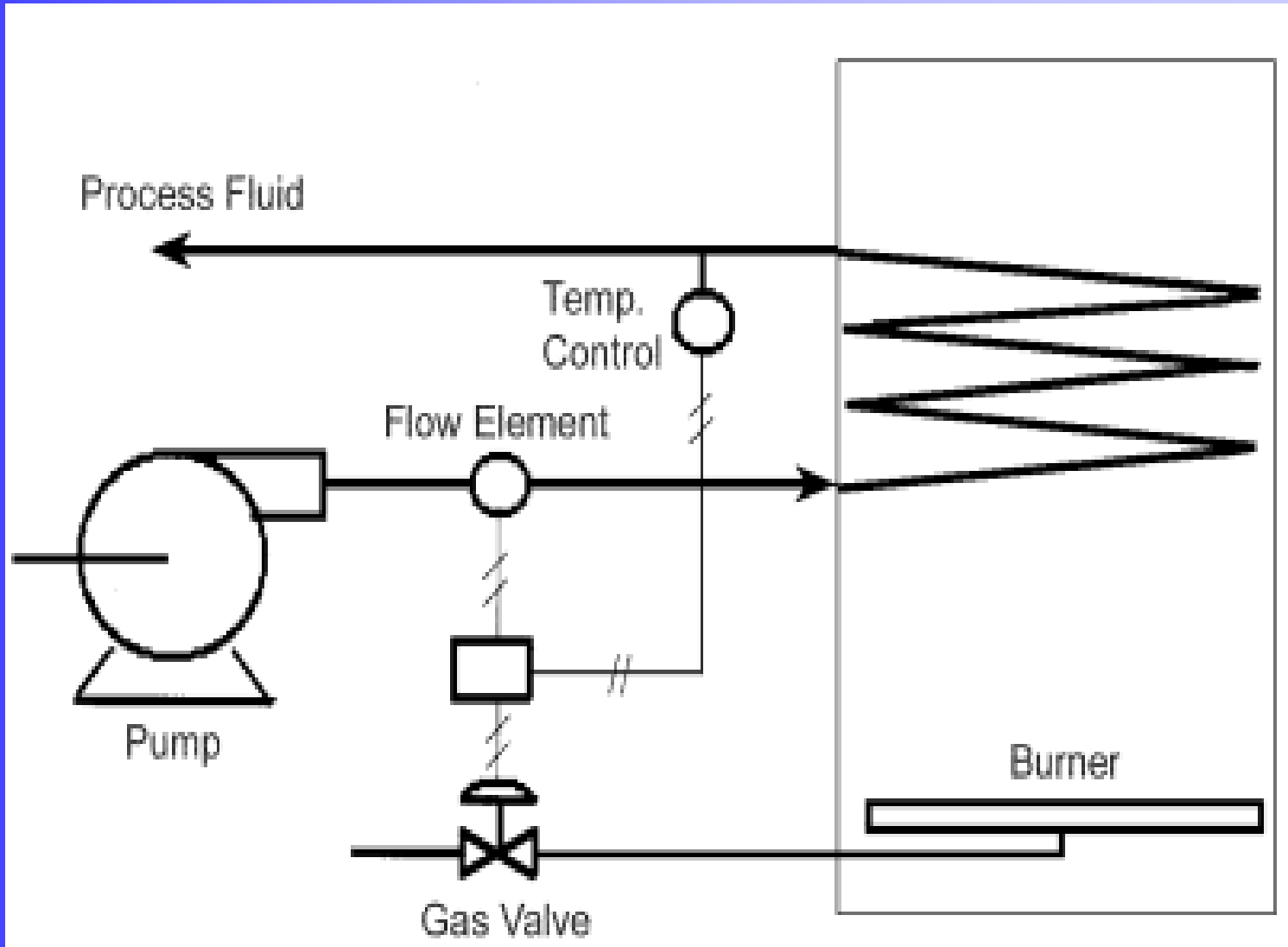
Auto-Select Cut Back Control



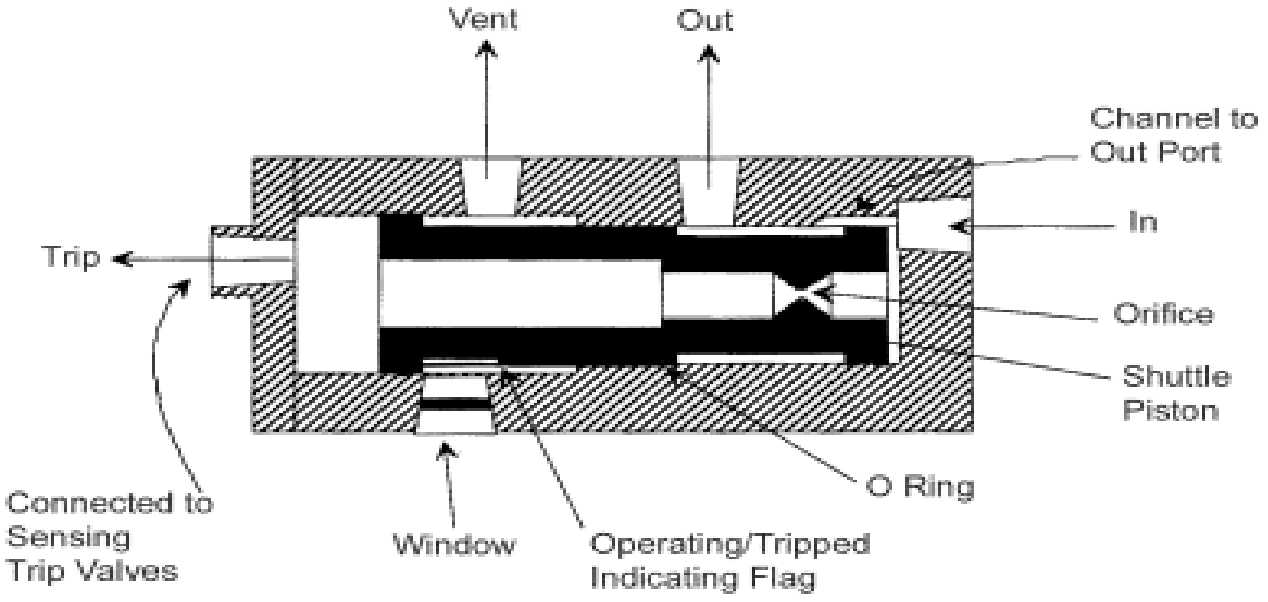
Multiple use of an End Device



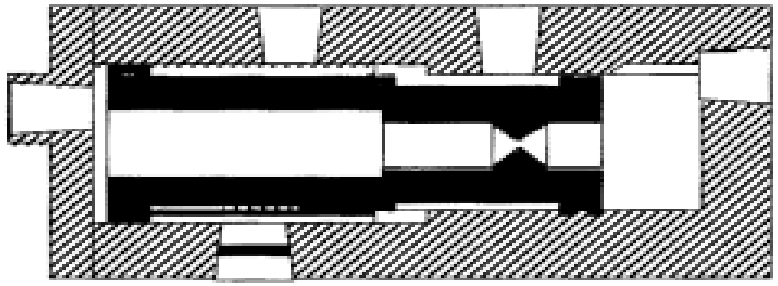
Interlocks


Process Fluid
Temp.
Control
Flow Element
Pump
Burner
Gas Valve

Pneumatic Shutdown

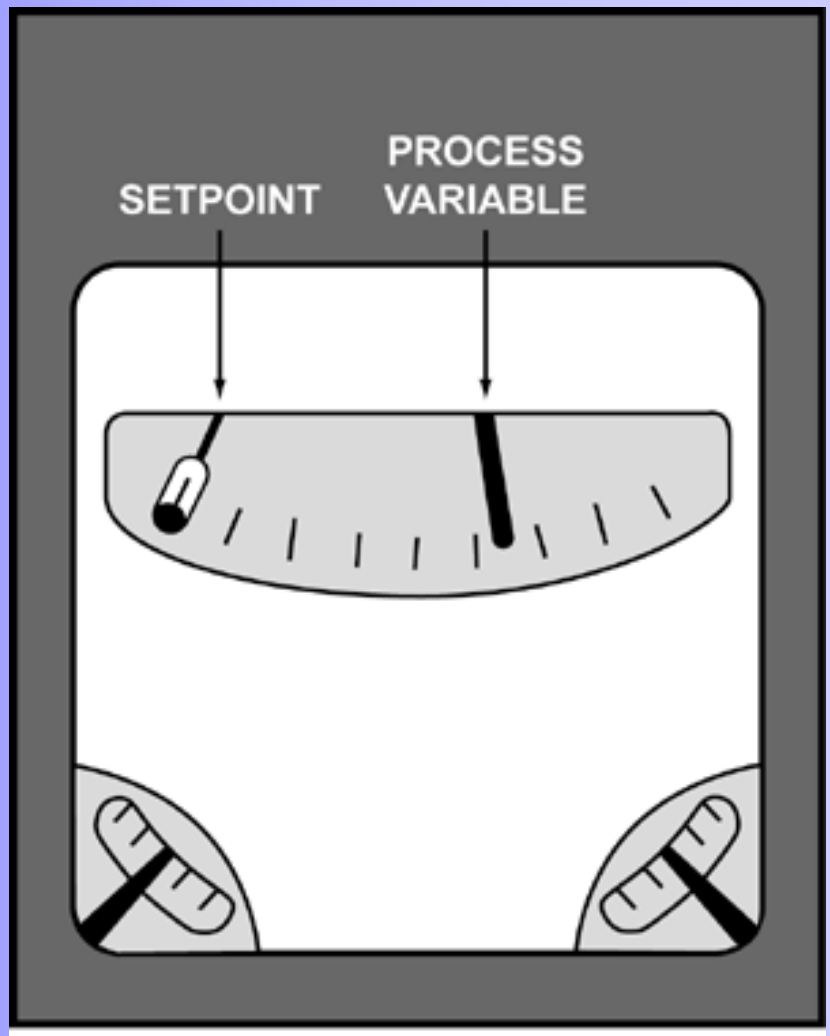


(a) Relay in Operating Position



(b) Relay in Tripped Position

Local Control Loop



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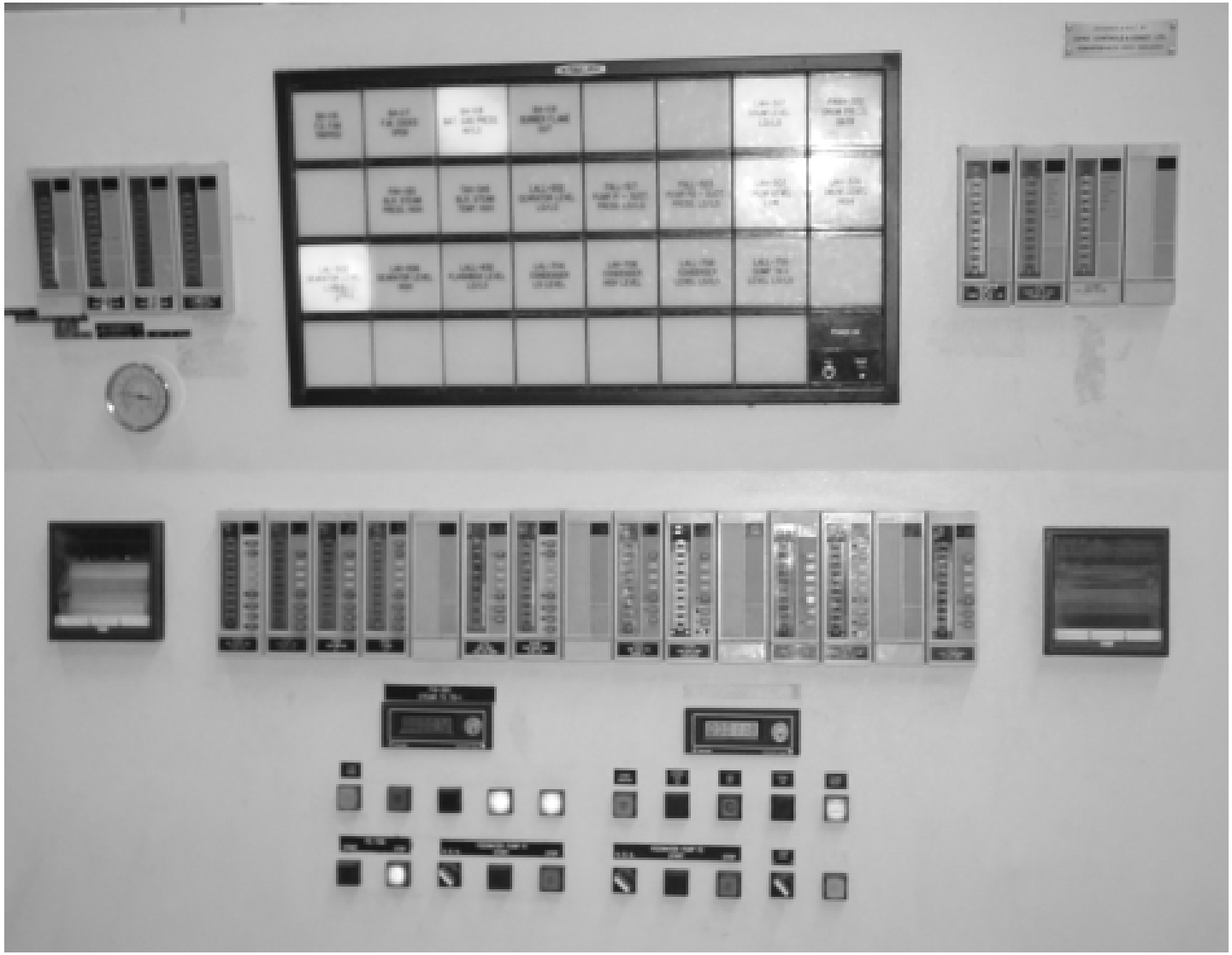
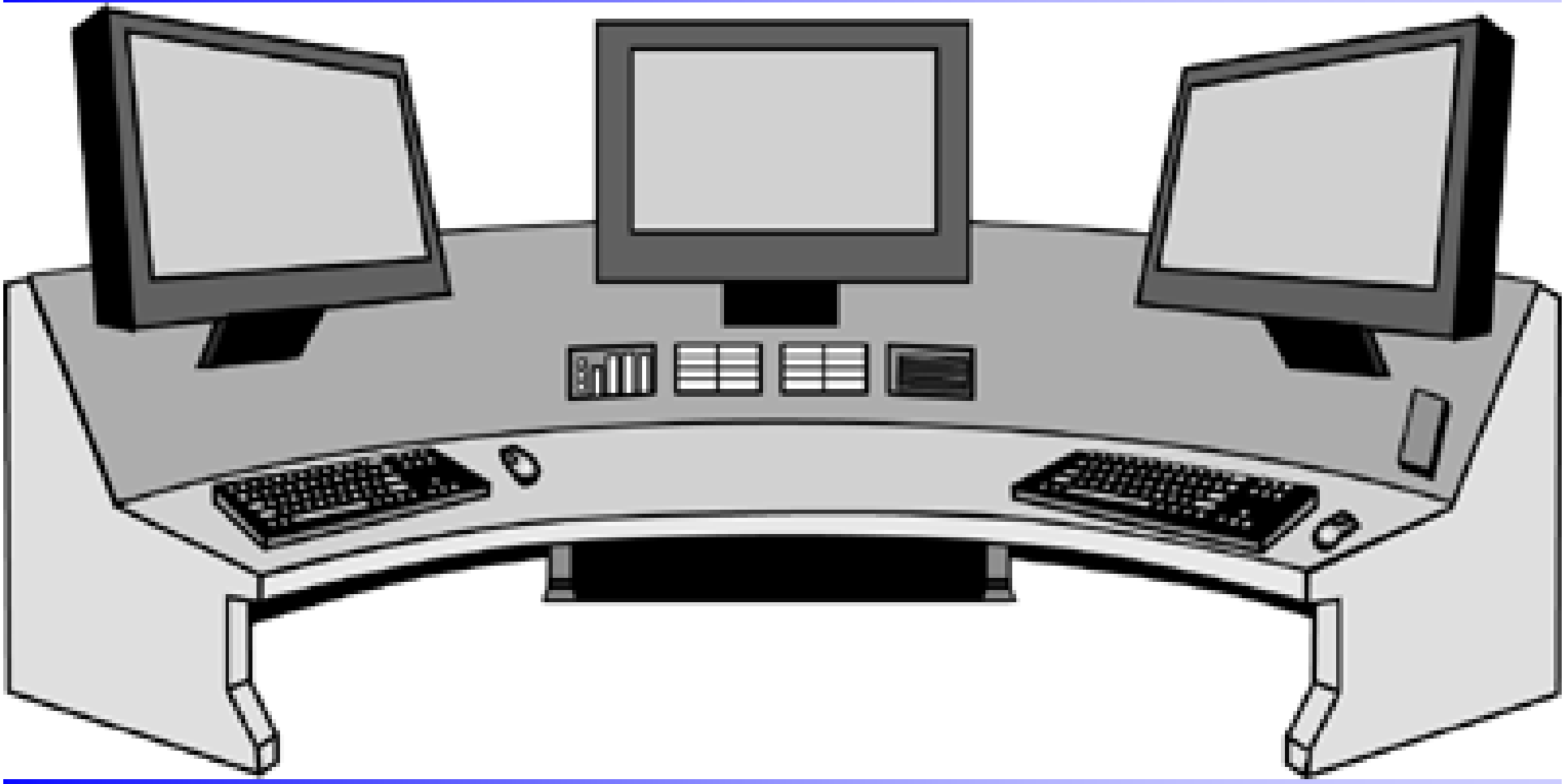
Analog Field Panel



DCS System Consoles



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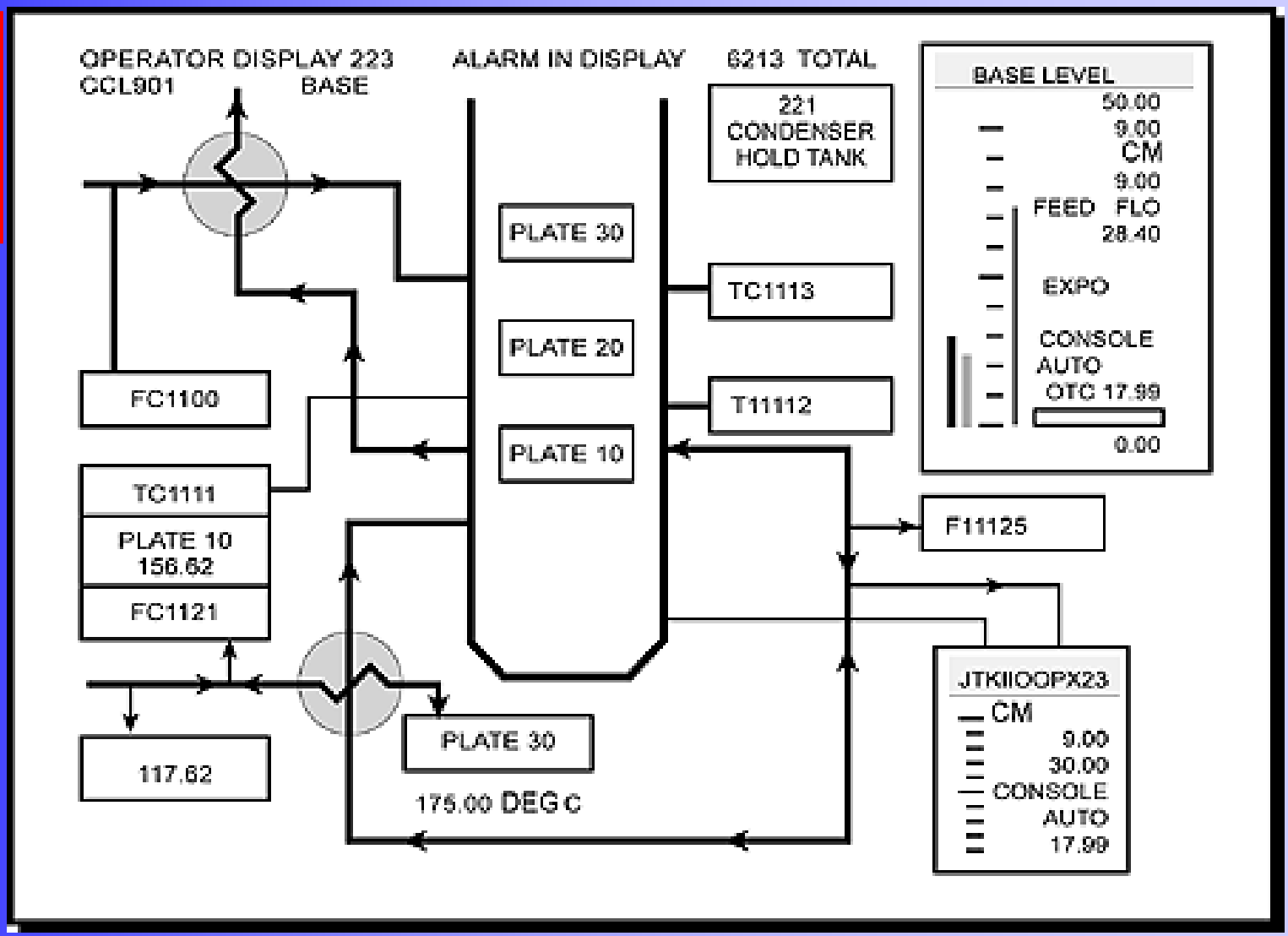
Digital Control Screen



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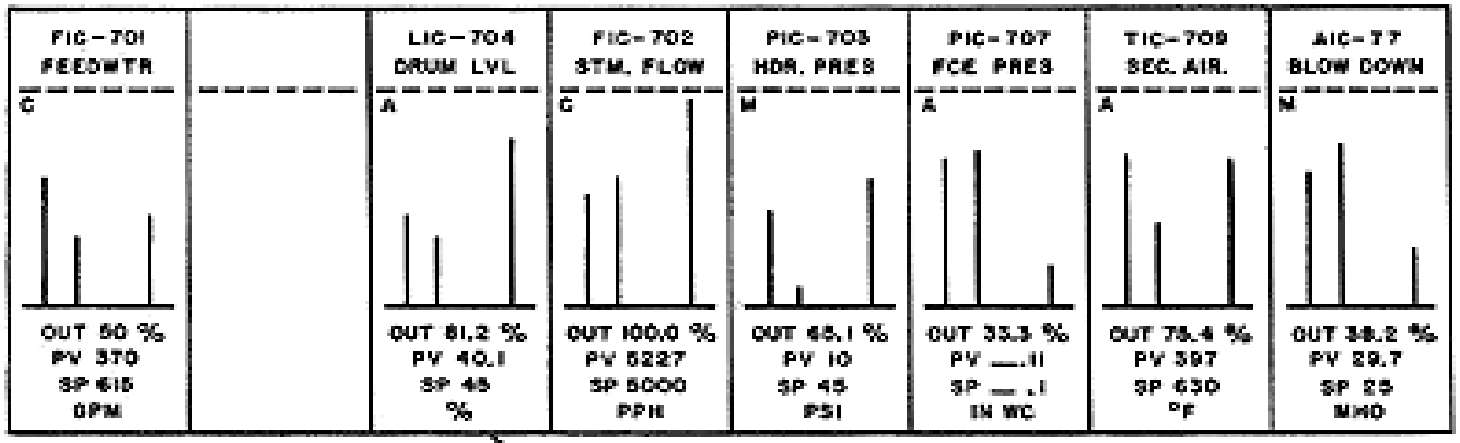
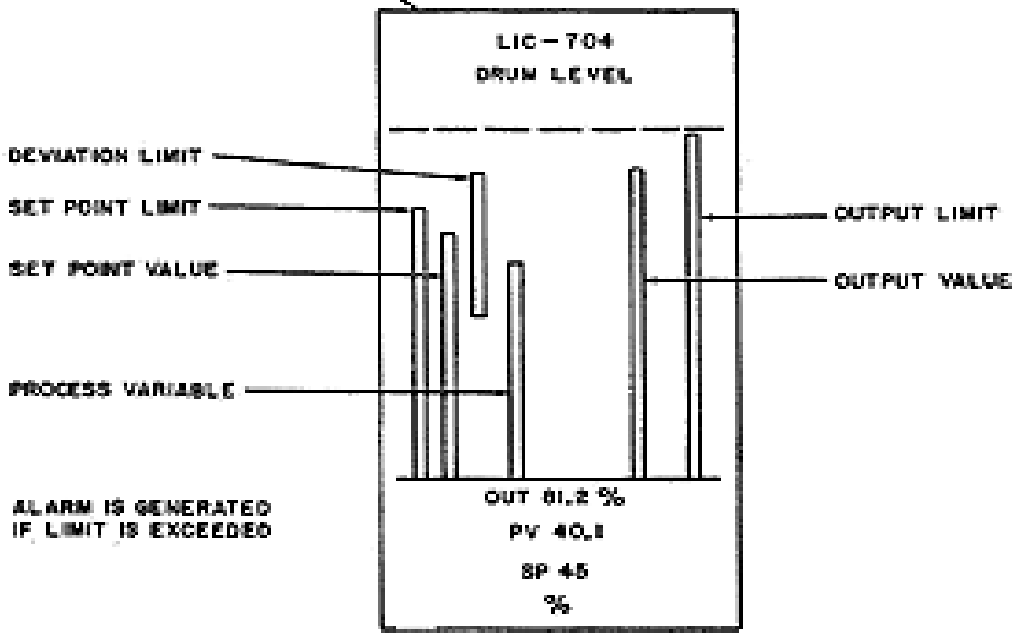
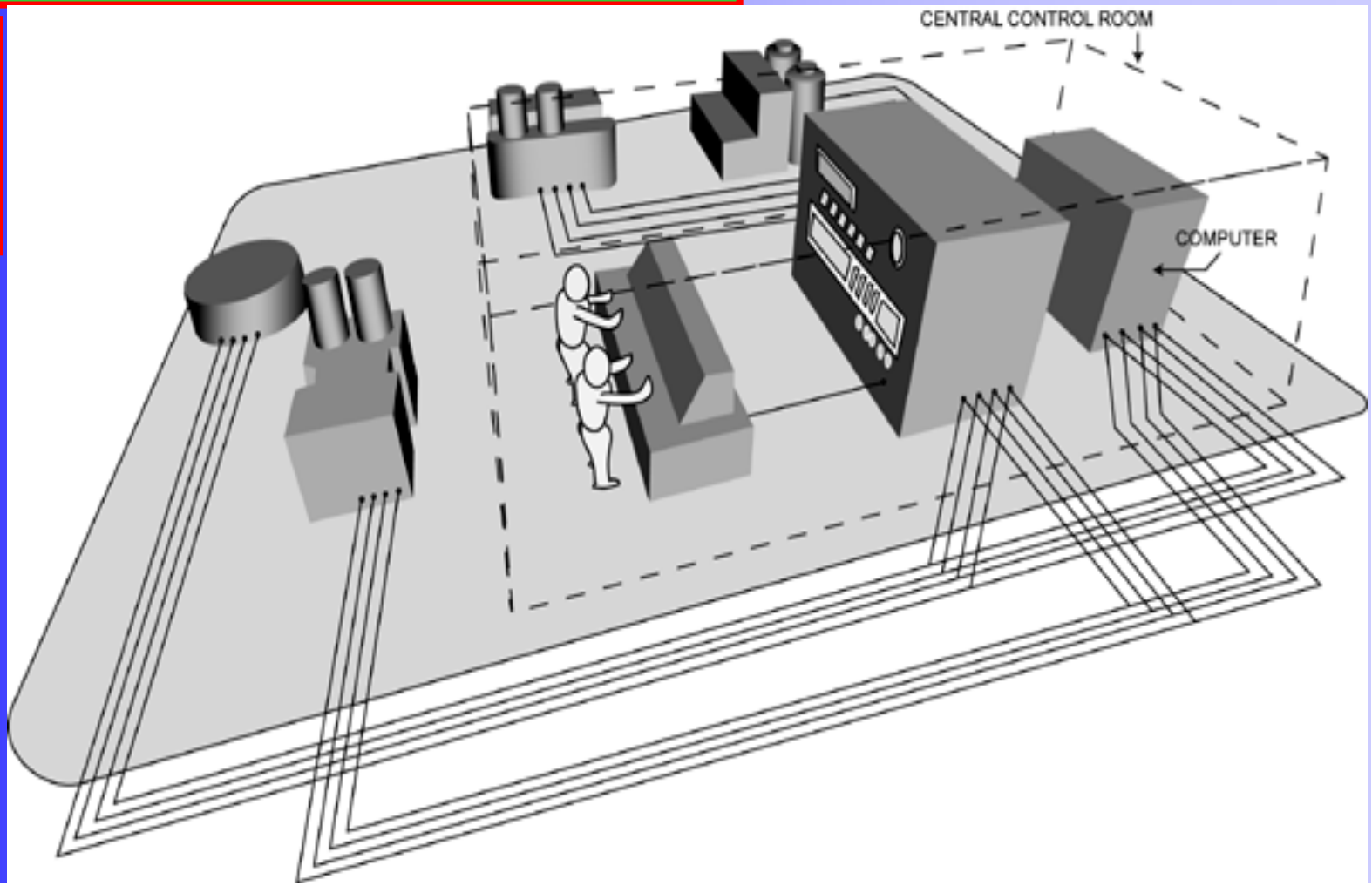
Digital Controller Display



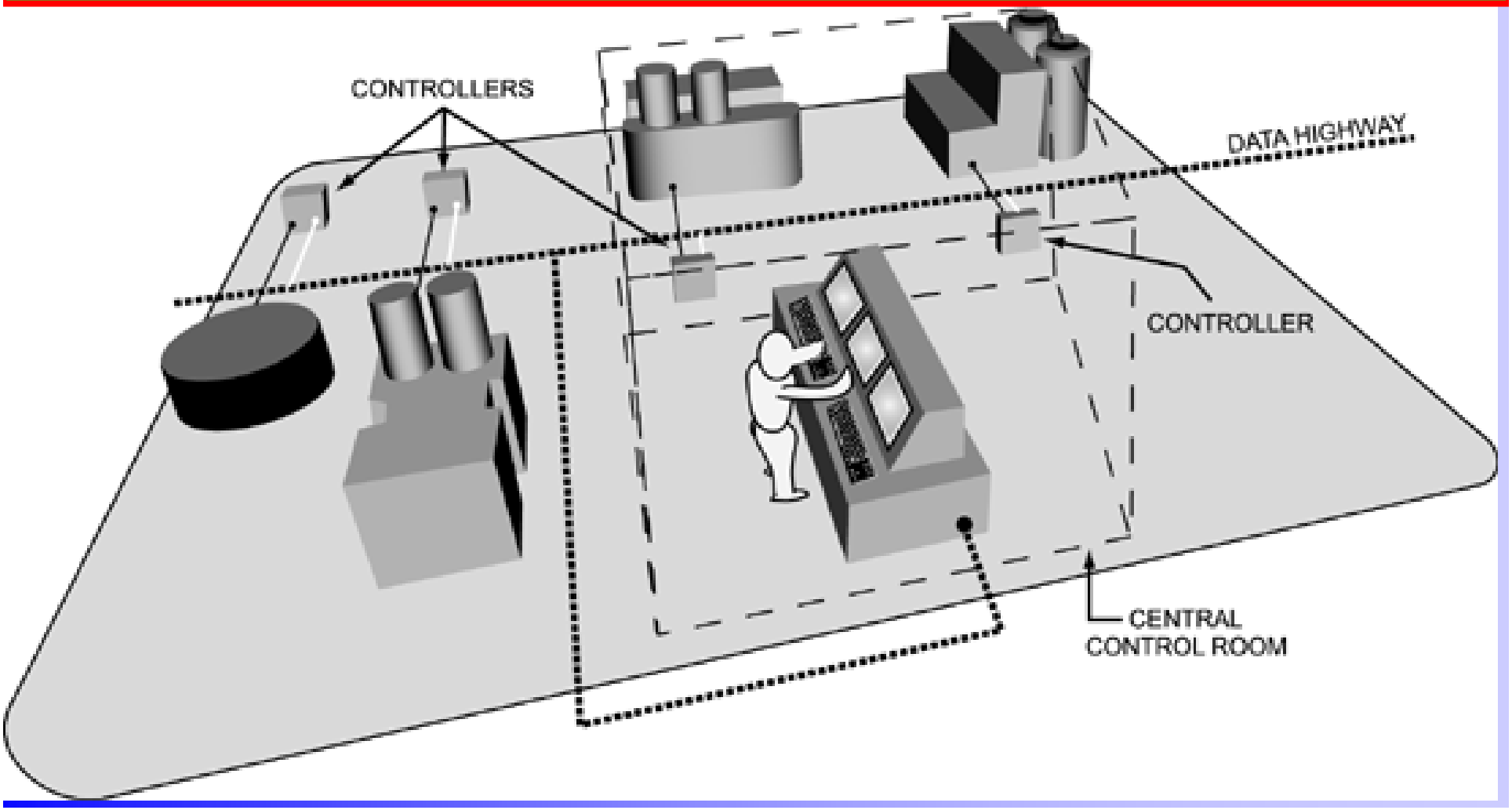


Distributed and Logic Control

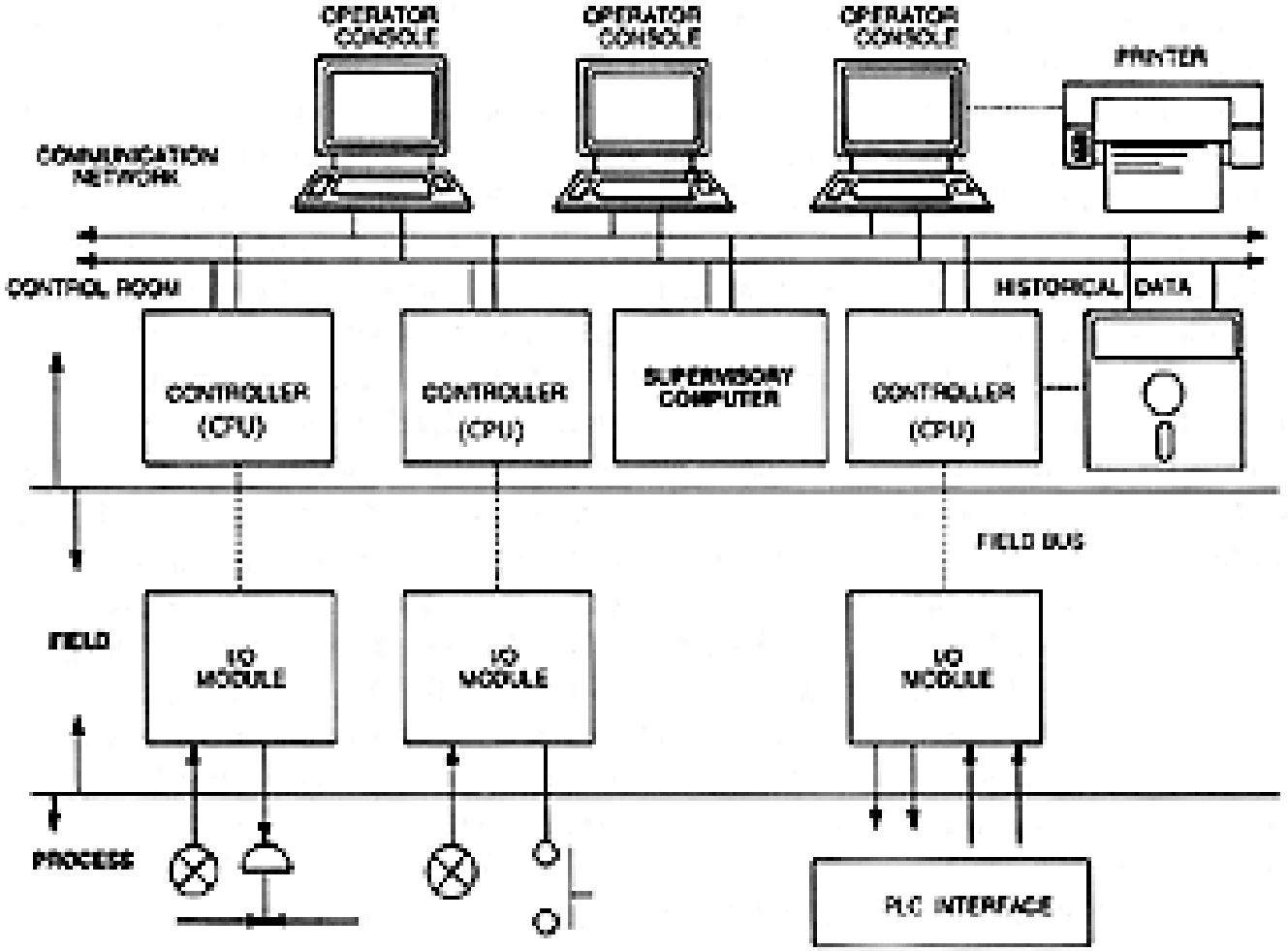
Analog Control System



Distributed Control System with Data Highway



DCS System


OPERATOR CONSOLE
OPERATOR CONSOLE
OPERATOR CONSOLE
PRINTER
COMMUNICATION NETWORK
CONTROL ROOM
HISTORICAL DATA
CONTROLLER (CPU)
CONTROLLER (CPU)
SUPERVISORY COMPUTER
CONTROLLER (CPU)
FIELD BUS
FIELD
I/O MODULE
I/O MODULE
I/O MODULE
PROCESS
PLC INTERFACE

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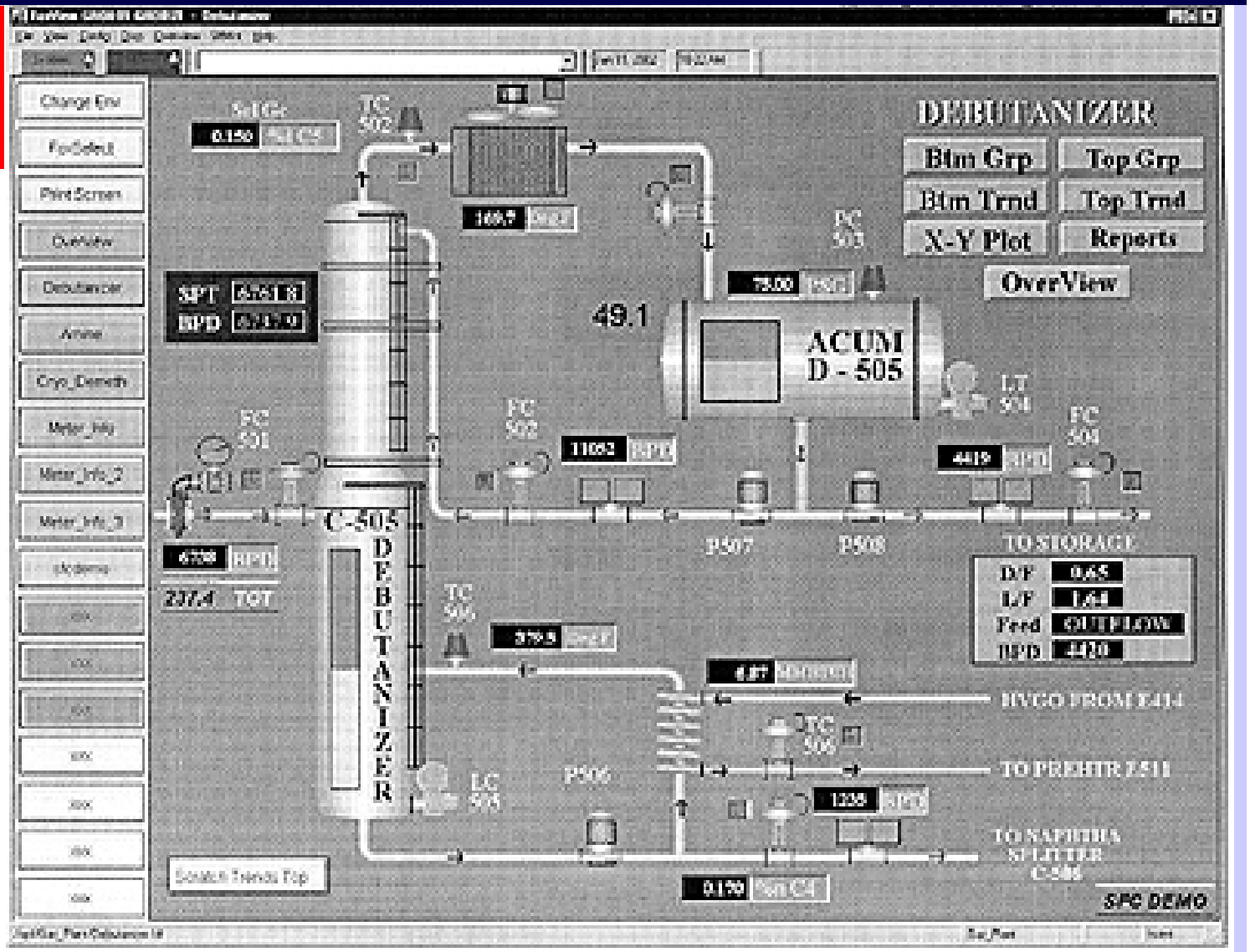
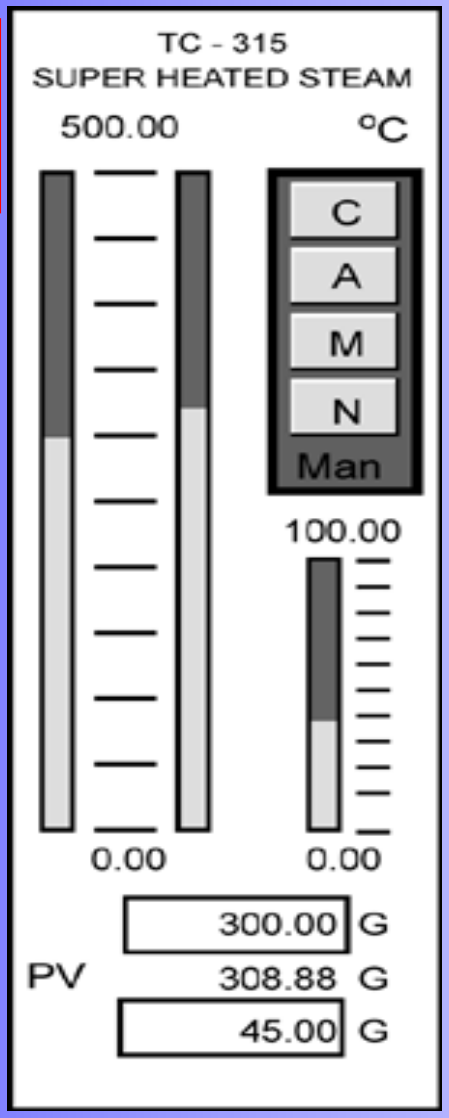
Graphic Display



Digital Controller Display



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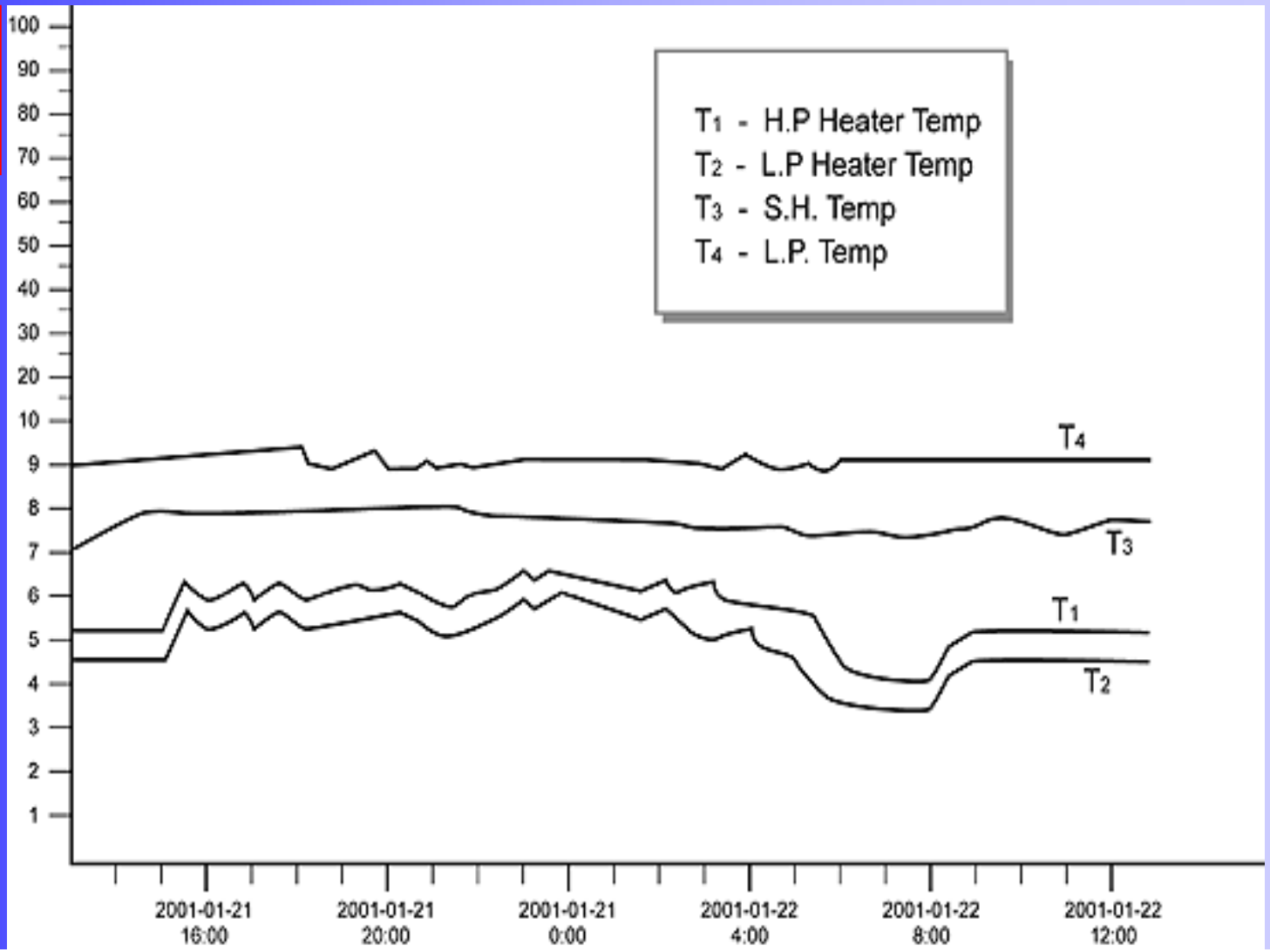
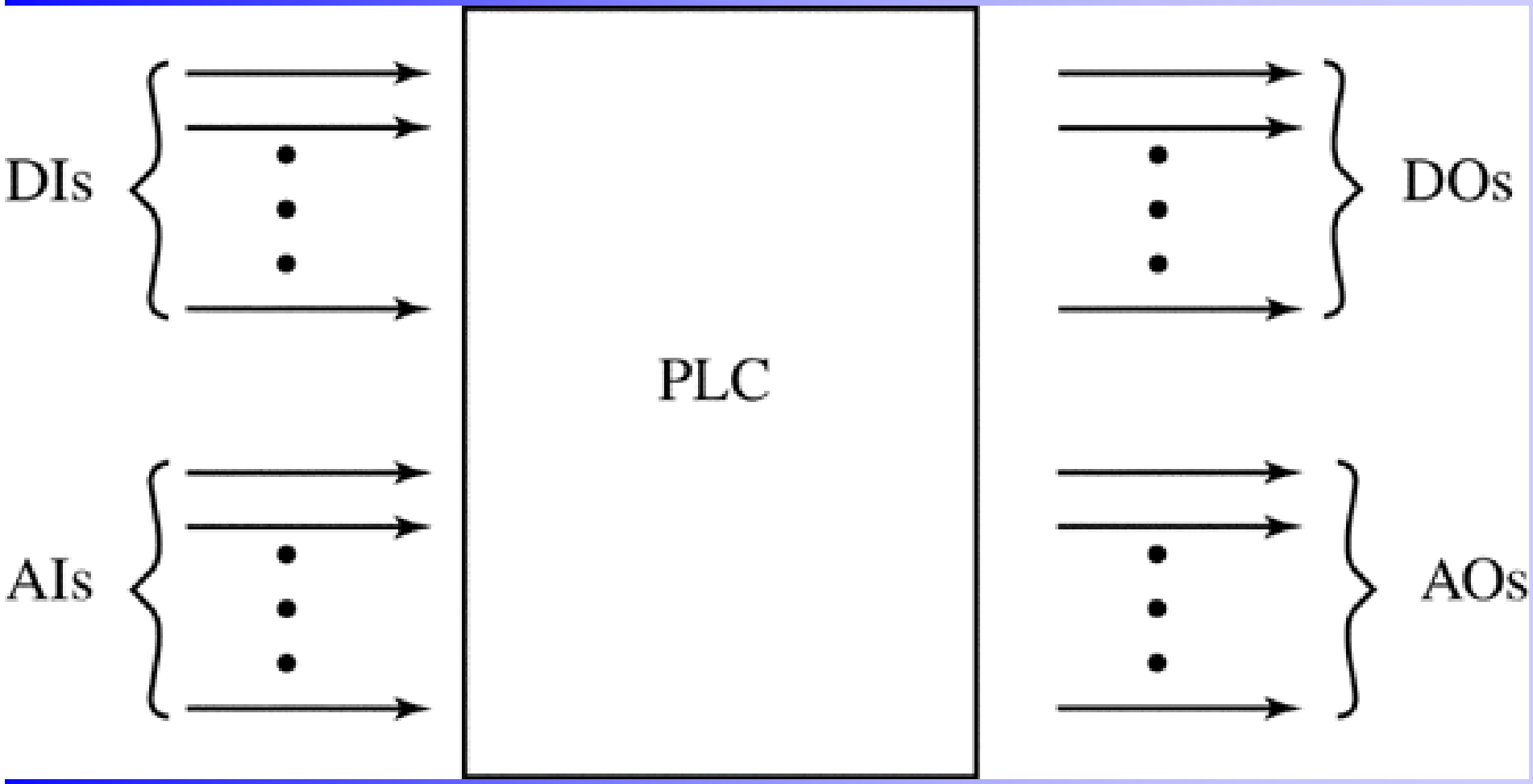
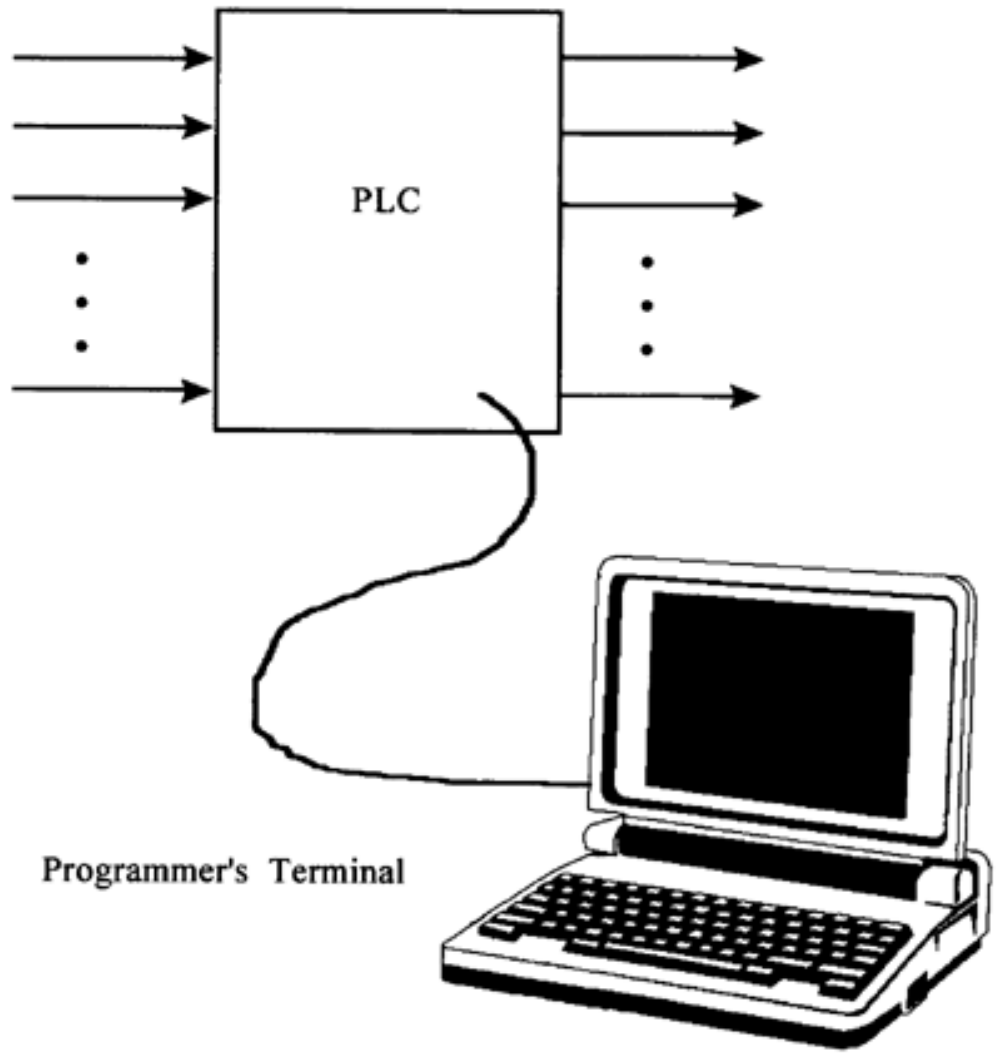
Trend Display



Inputs / Outputs of a Typical PLC



Connection of a PLC Programmer to a PLC

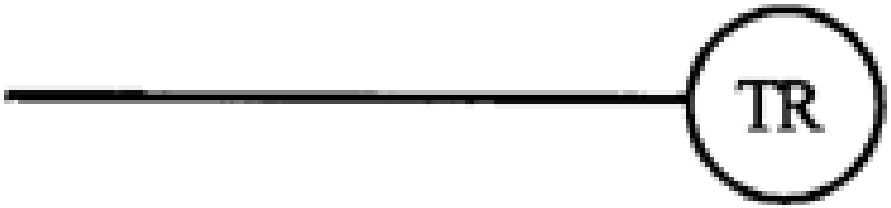


Electrical Schematic Symbols.

DI or Relay Contacts
Normally Open

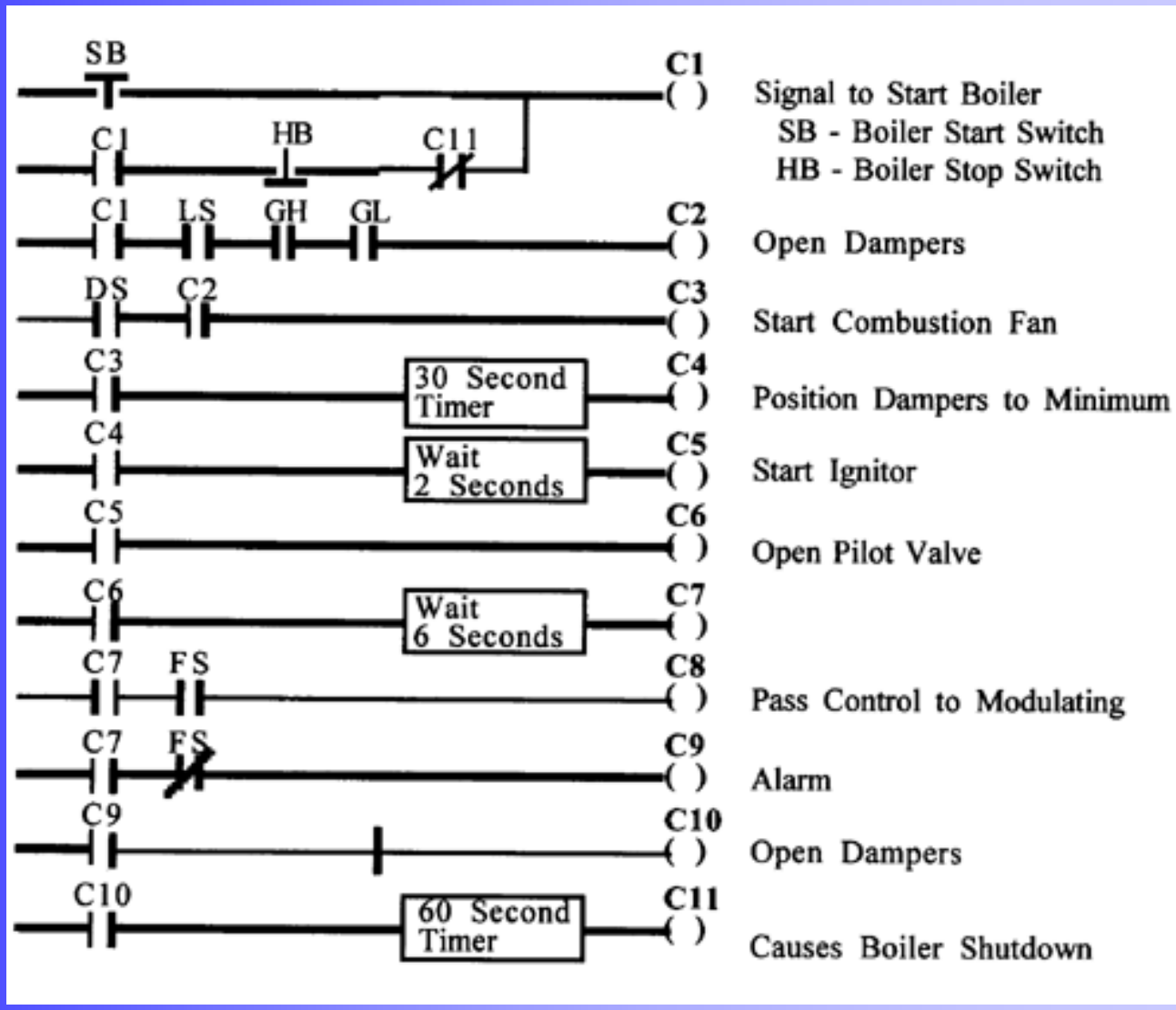
DI or Relay Contacts
Normally Closed

DO or Control Relay



Timer

Ladder Logic Diagram



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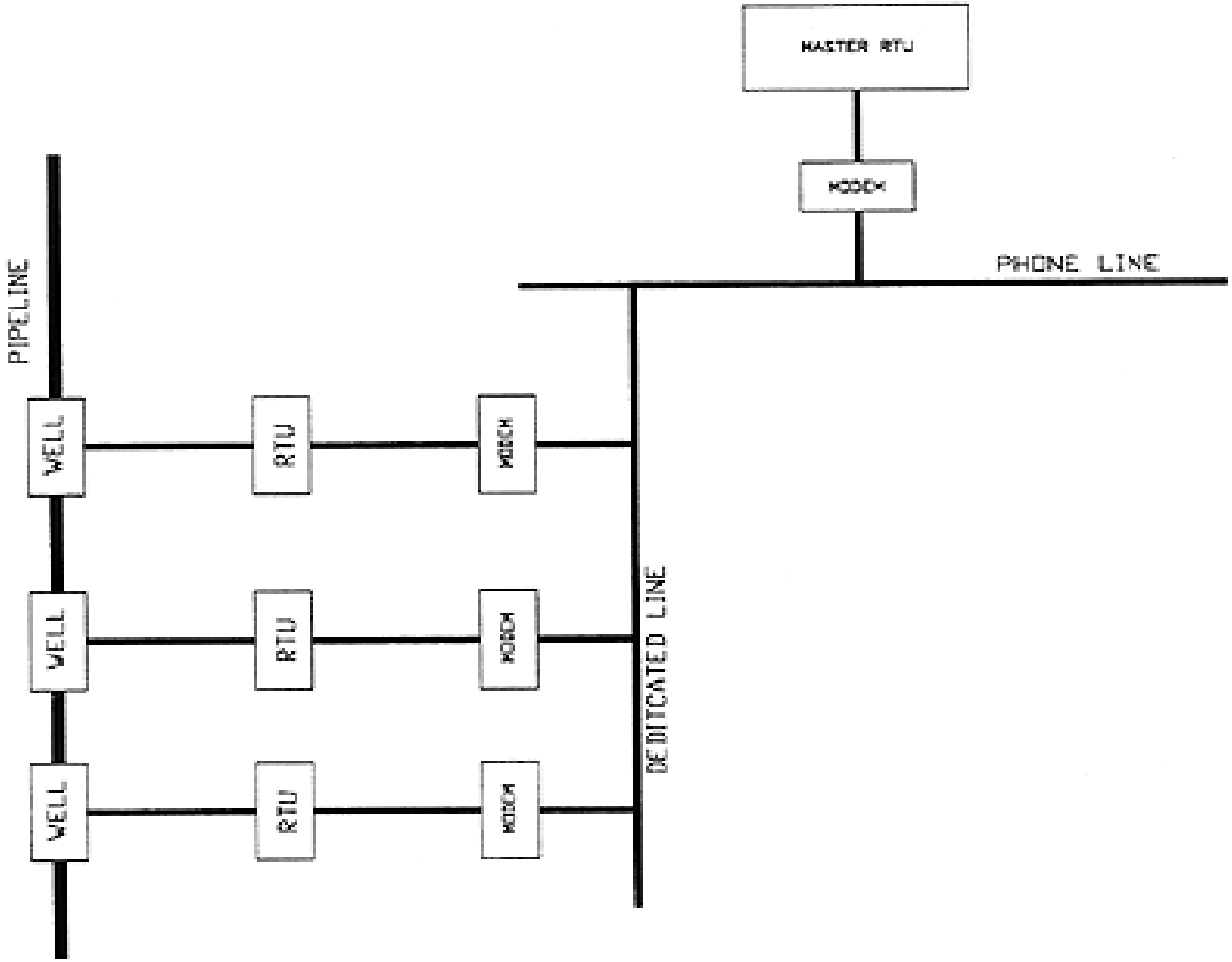
Simplified SCADA System



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Integrated Production Control System

CENTUM CS3000

~ A new system of CENTUM CS family ~

Our Solutions

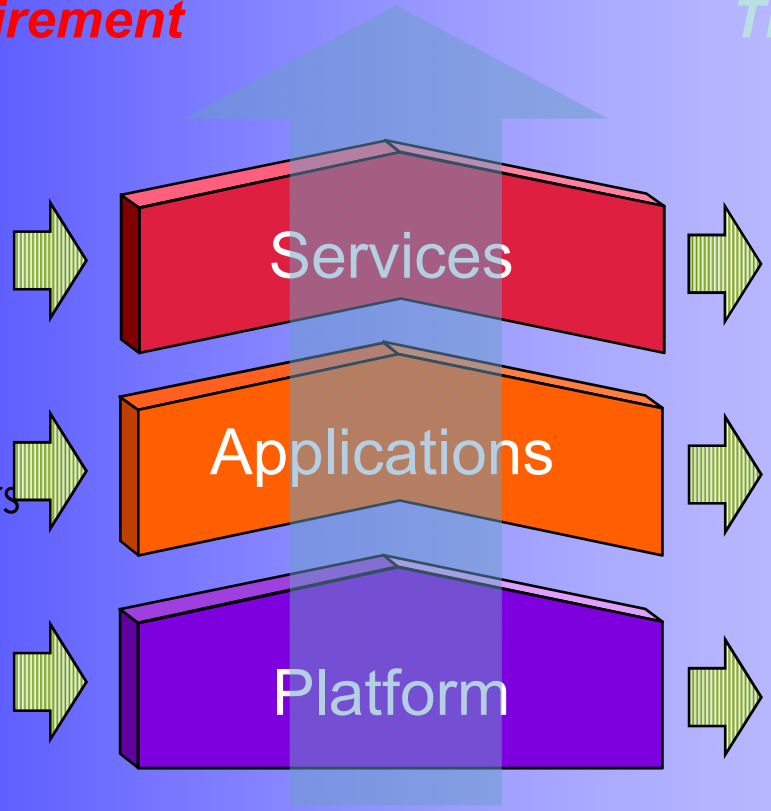
Customer Satisfaction

Customer Requirement

Life cycle support service

The best suited package for users

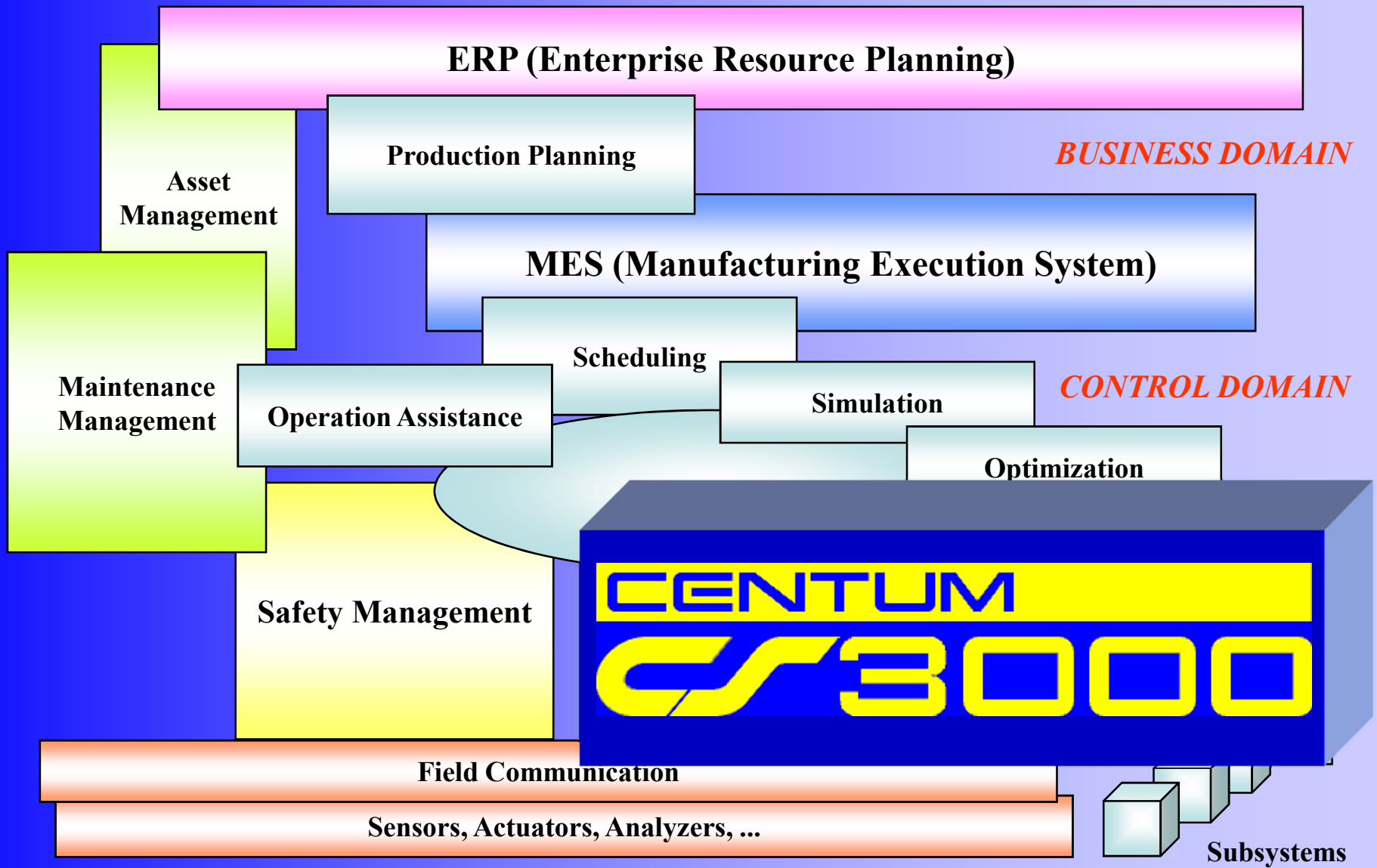
Industry-oriented open system



The Solutions

- **Project Management**
- **MIV Capability**
- **Installation**
- **Commissioning**
- **Maintenance Service**
- **Application Software**
- **Engineering Tools**
- **Industrial Solutions**
- **Hardware**
- **OS**
- **Network**

Control Execution



What is CS 3000?

Supports Large Systems

- Integrates with existing systems
- Greater application capacity
- Large-scale engineering support

Coexist with, or Upgrade, Existing System

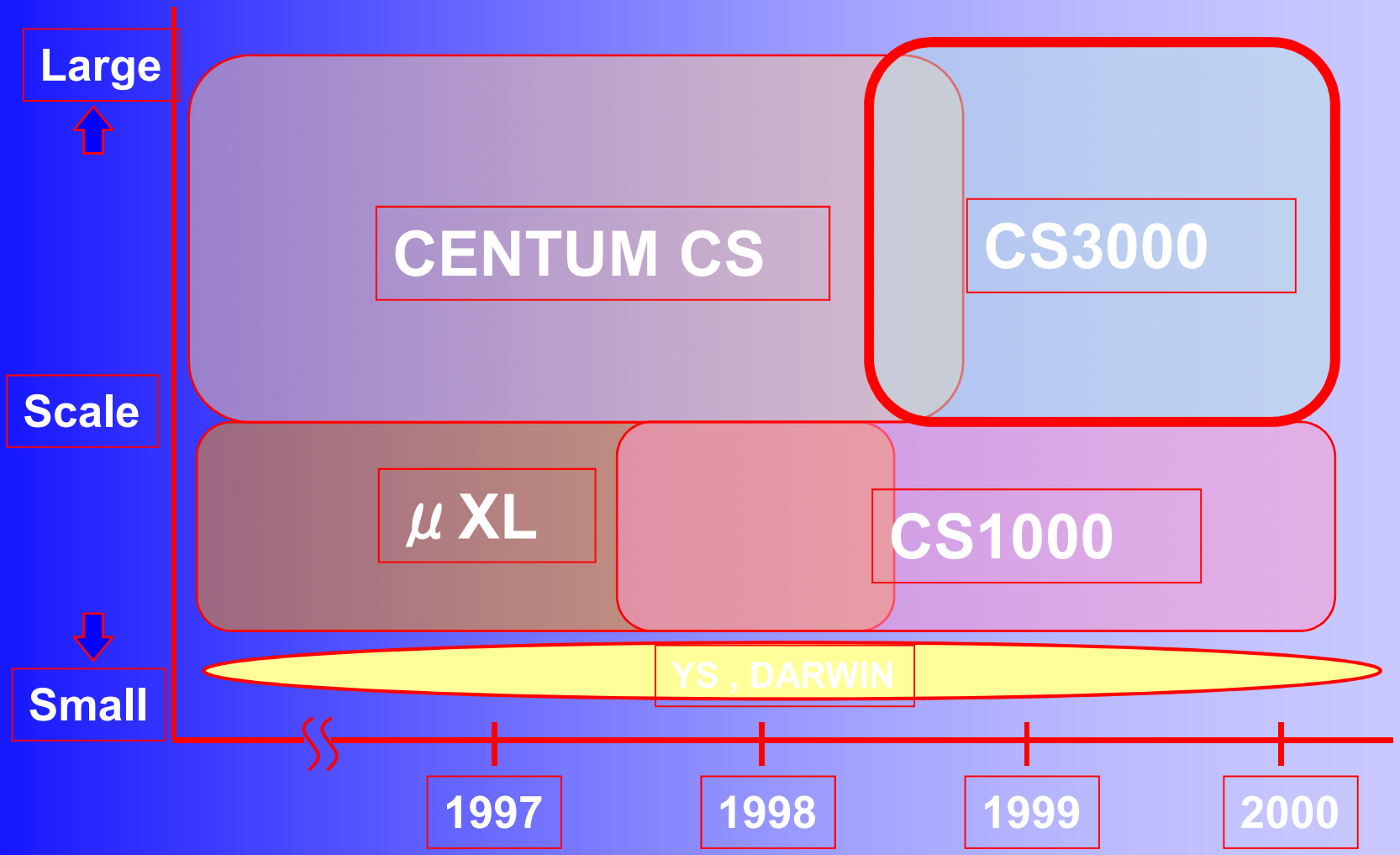
- CENTUM-V/XL upgrade to CS3000
- Coexist with - upgrade CENTUM CS

Merge MES and Production management

- High-reliability ETS platform
- Single-window CS3000 HMI
- Client-Server System Configuration

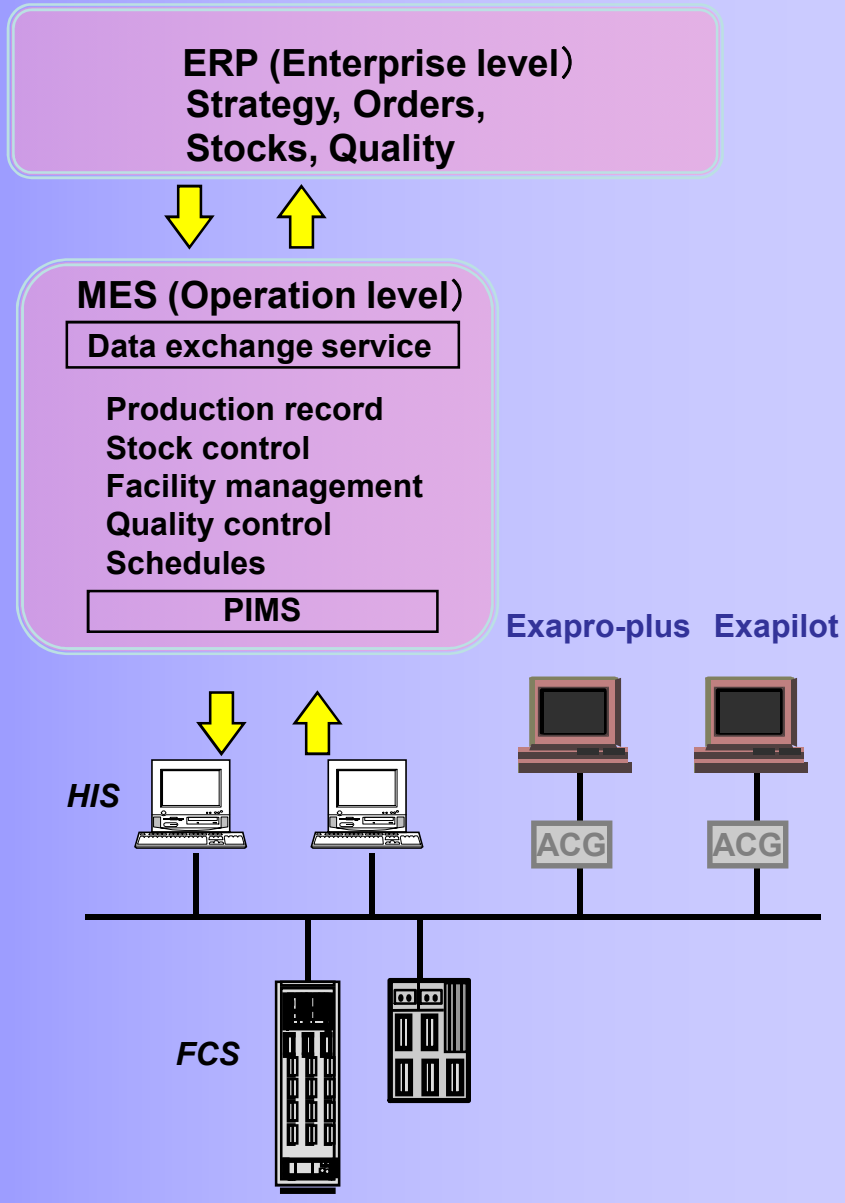
Product Positioning

- Product Line-up of DCS

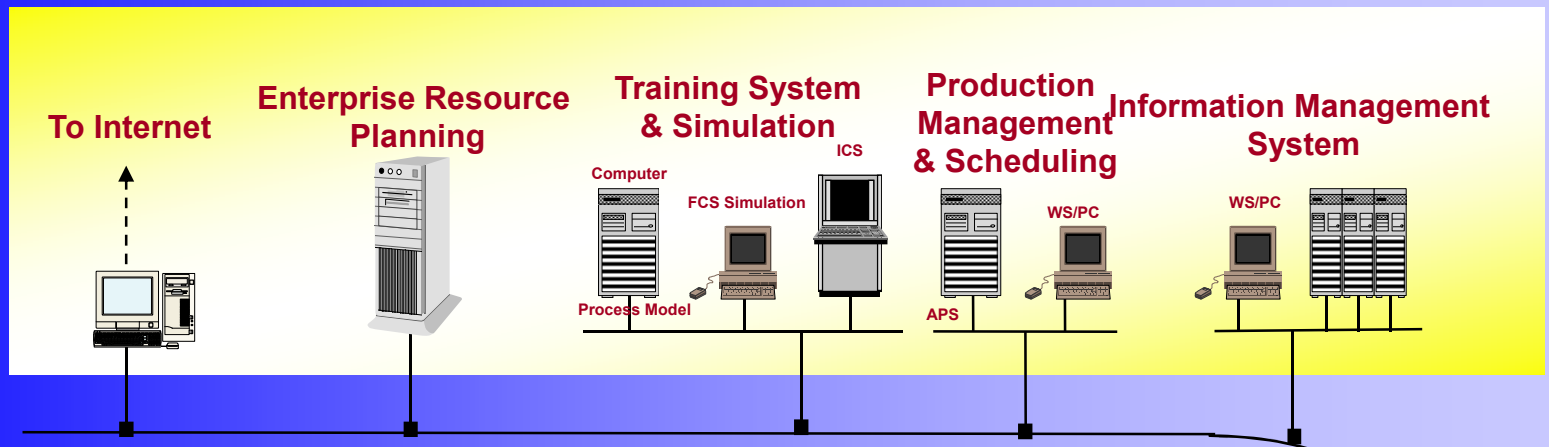


ETS Platform

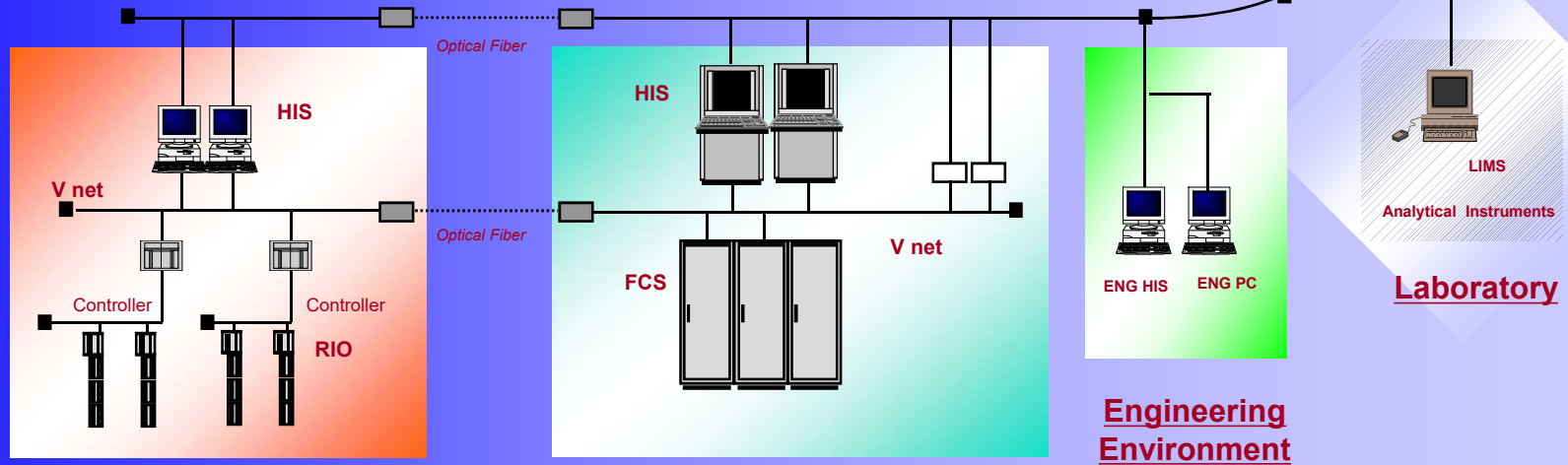
- *Open System*
  - Ethernet Connection with MES, PIMS
  - OPC/DDE support
  - General Windows Application/ Peripherals can co-exist
  - General PC can be used for monitoring and operation



Open System Architecture



Ethernet Local Area Network and Wide Area Network



Plant A

Plant B

Engineering Environment

Laboratory

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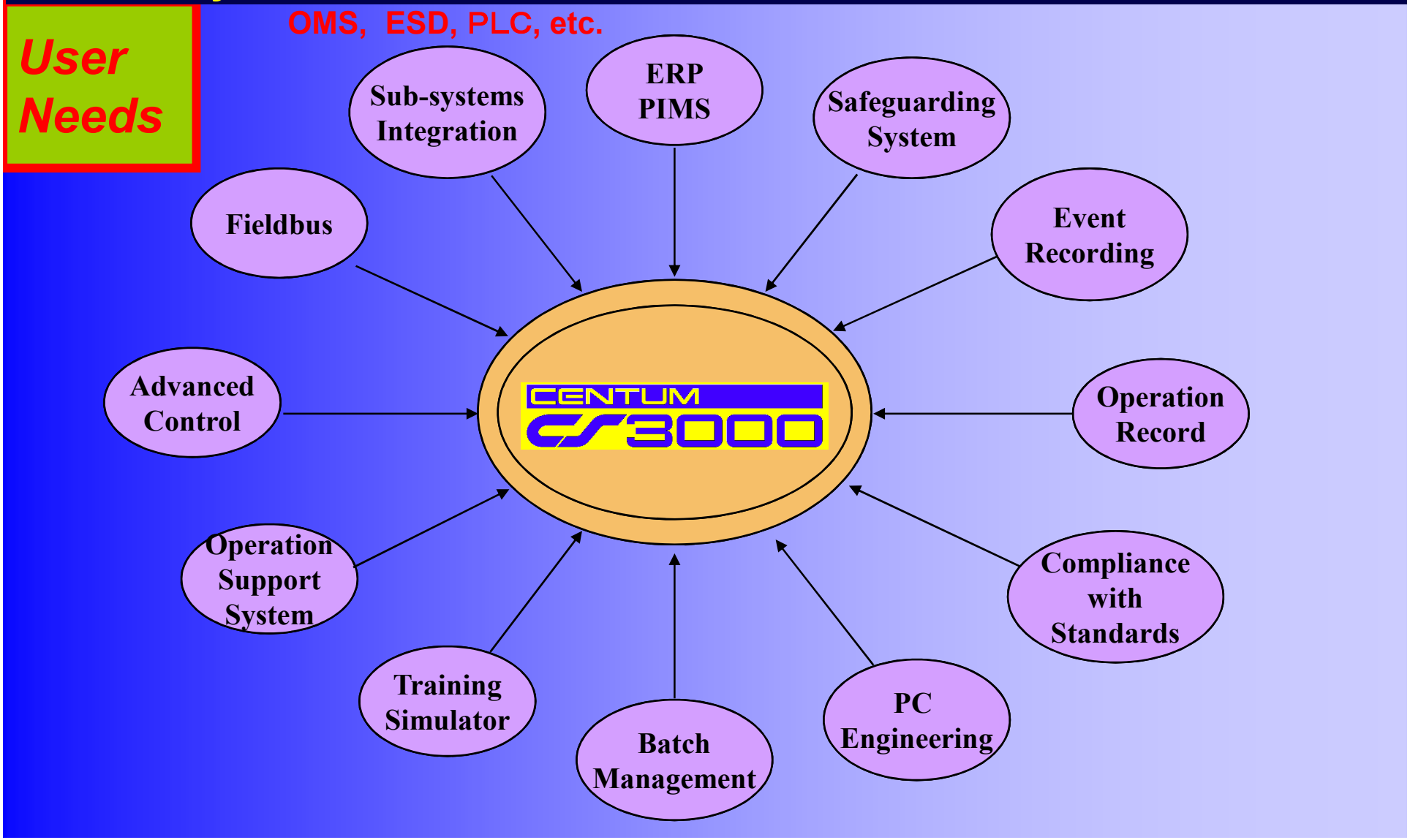
User Needs



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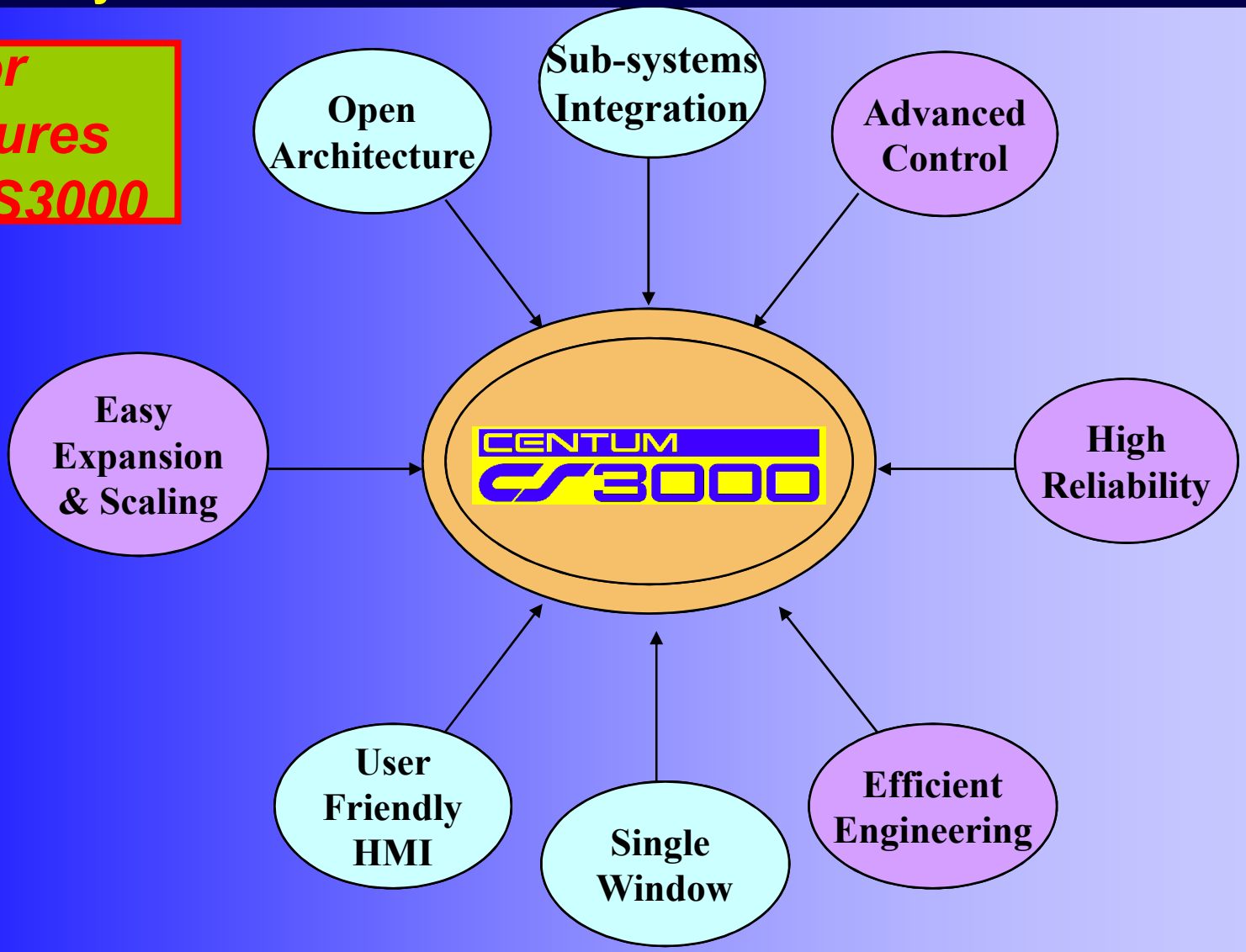
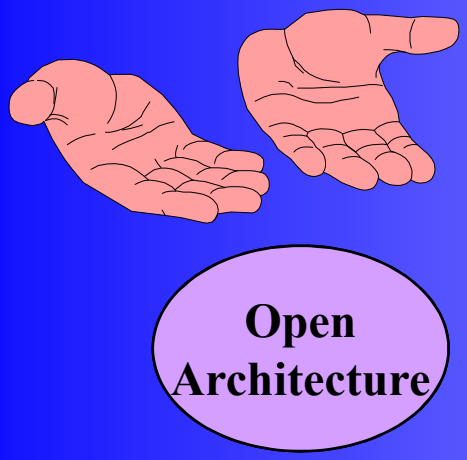
Major Features of CS3000



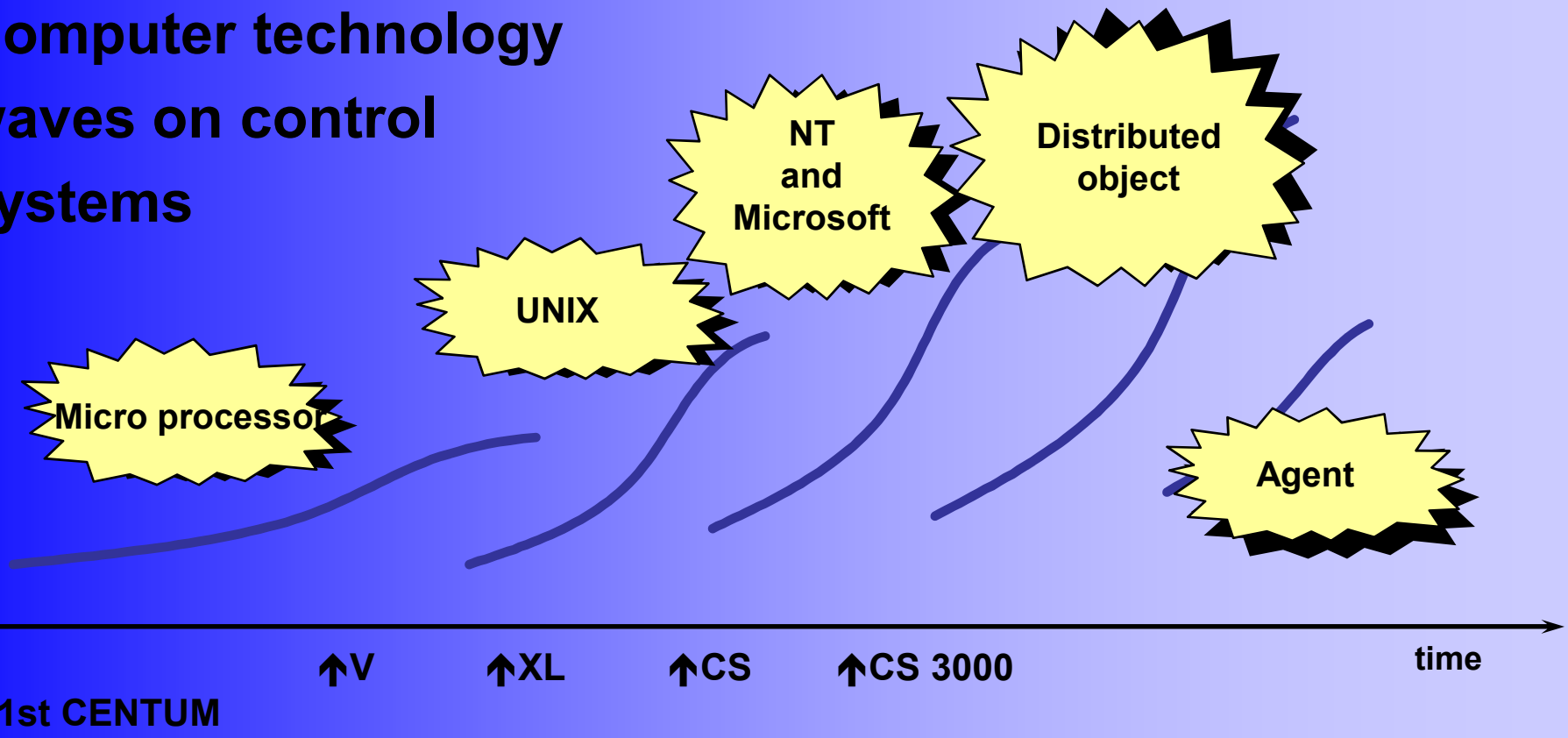


Openness

- ***Windows NT Platform for Operator Station***
- ***Network Interface***
  - ***Client/Server System***
  - ***Windows DDE/OPC Support***
- ***Configuration on Multiple Platforms:***
  - ***Operator's station***
  - ***Engineer's station***

Why NT ? (1) -Time requires NT

Computer technology waves on control systems



Why NT ? (2) - Is NT All Right ? -

- Overcomes weakness of DOS and previous NT
  - **Performance**
  - **Network operation**
  - **Durable file system**
  - **Sufficient real-time operation**

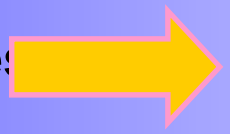
→ **No inferiority to UNIX**

- Effects on application-quality

→ **No effects with Yokogawa quality**

Functional superiority to UNIX

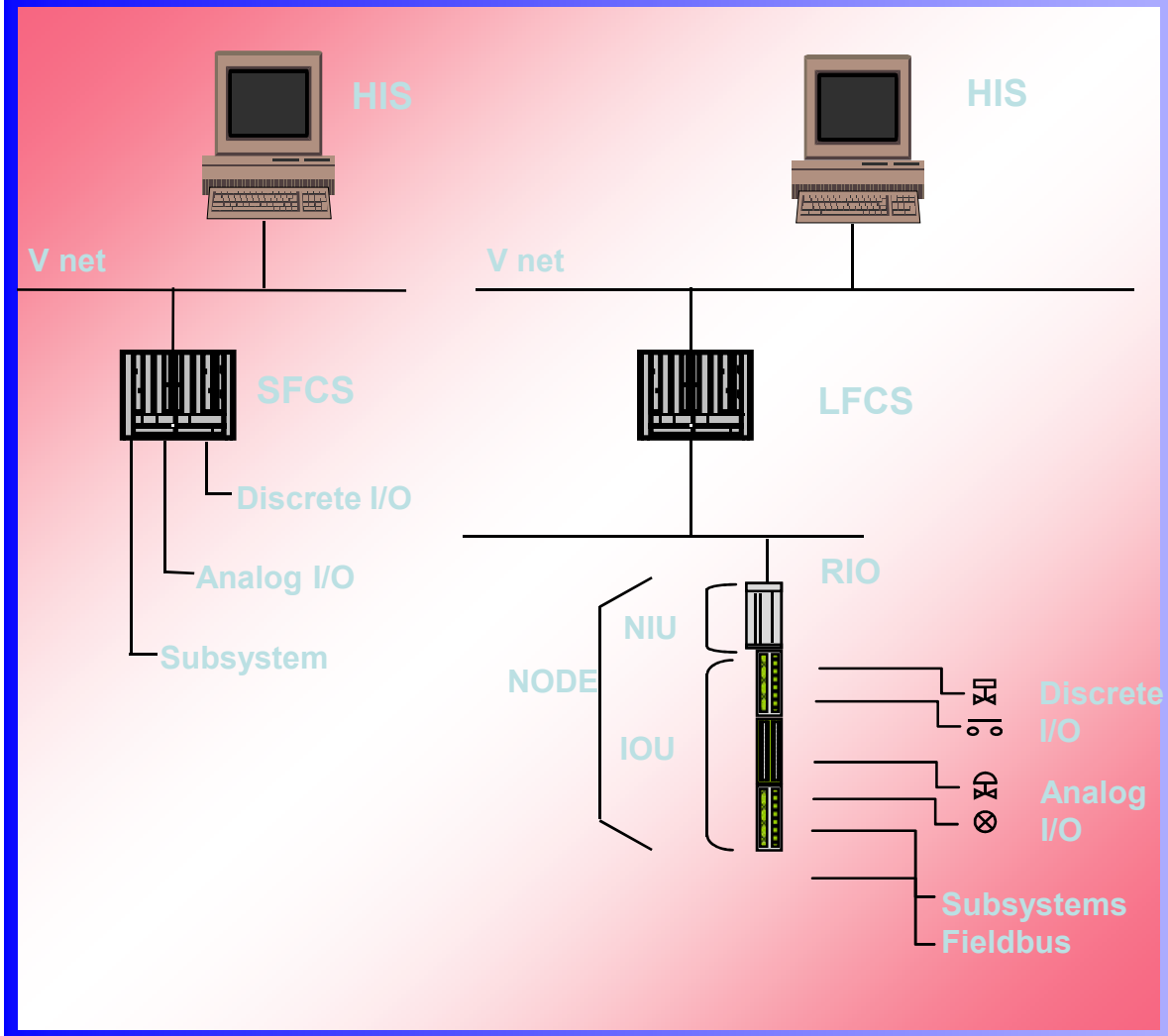
- NT is only one (diverse types of UNIX are present)
- Low-price platform
- Open technology
- Diverse peripheral devices
- De fact standard



NT is demanded by times

System Configuration

Basic System Configuration

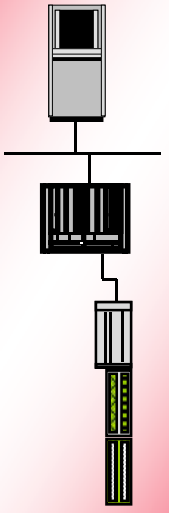


- Straight Forward Architecture
- Masterless V-Net Communication
- Limited no. of Spare Parts
- **LFCS = Standard Field Control Station**
- **SFCS = Compact Field Control Station**
- **HIS = Human Interface Station**
- **RIO = Remote I/O bus**
- **NIU = Node Interface Unit**
- **IOU = I/O Unit**

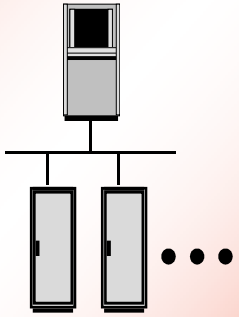
System Scale Details

Tag Number : 16-character

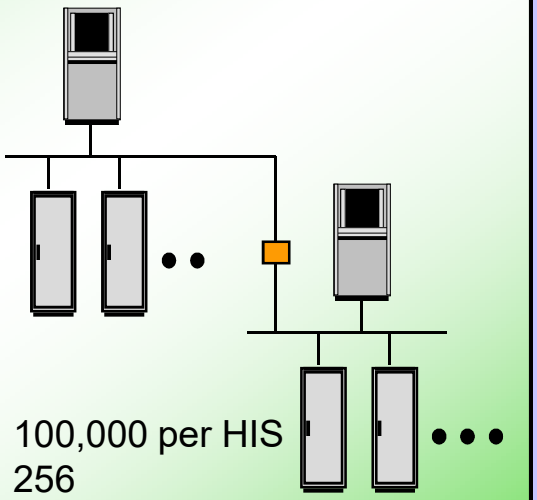
Min. Configuration



Max. Domain Configuration

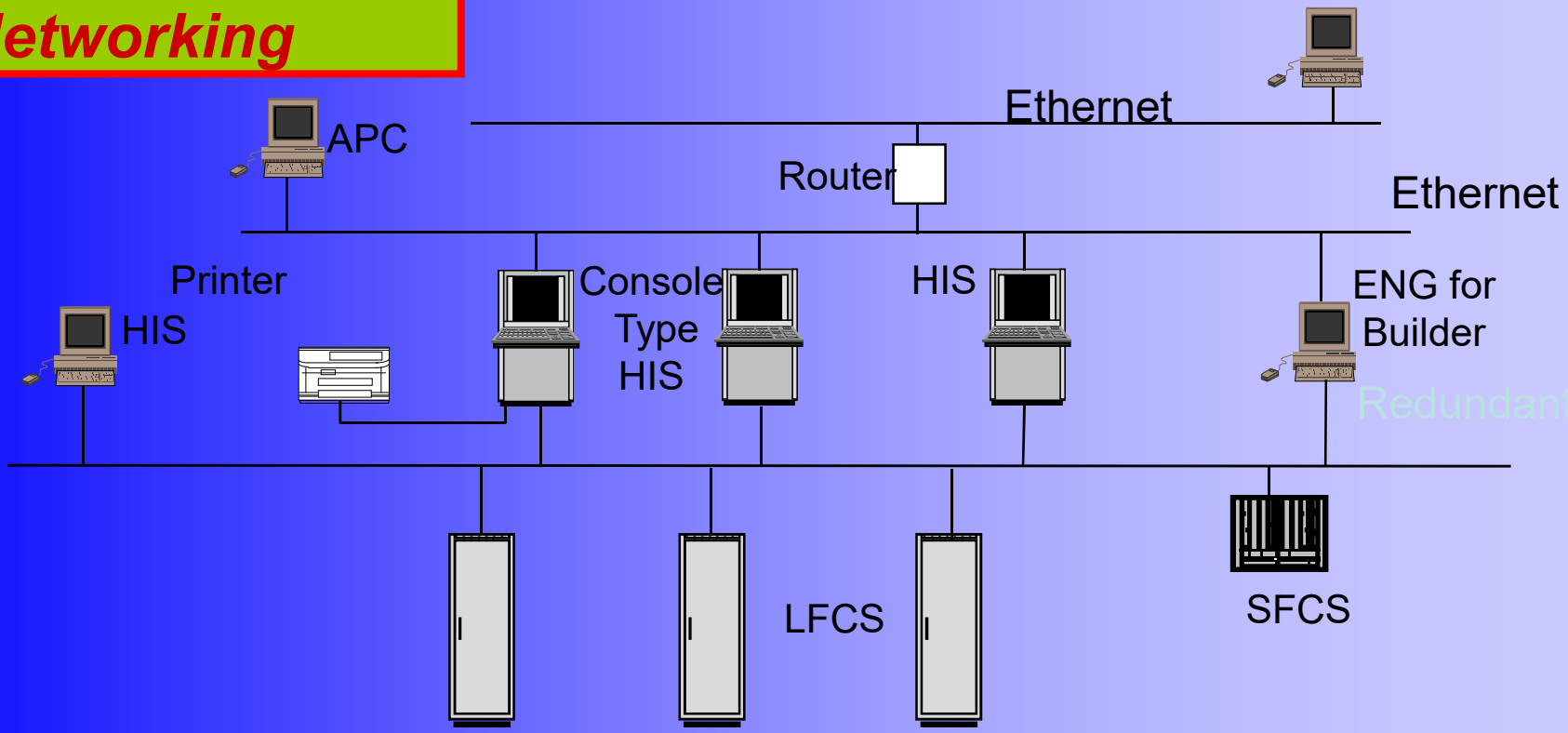


Max. System Configuration



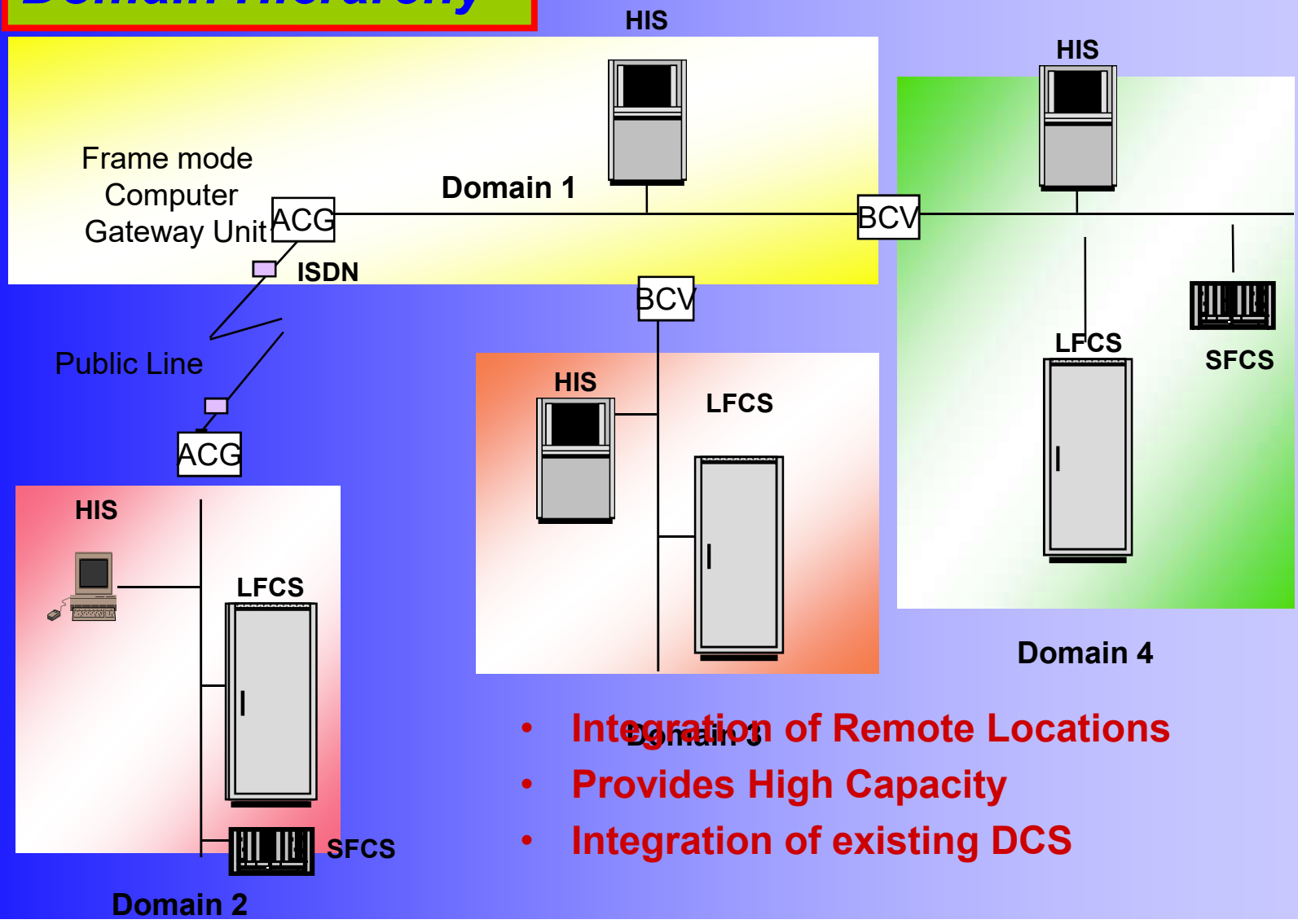
Max. No. of Tags	: 100,000 per HIS	: 100,000 per HIS
Max. No. of Stations	: 64	: 256
Total Length of V-net	: 500 m or 20 km	: 500 m or 20 km
Max. Length of RIO bus	: 20 km per LFCS	: 20 km per LFCS
Max. No. of Domains		: 16

Networking



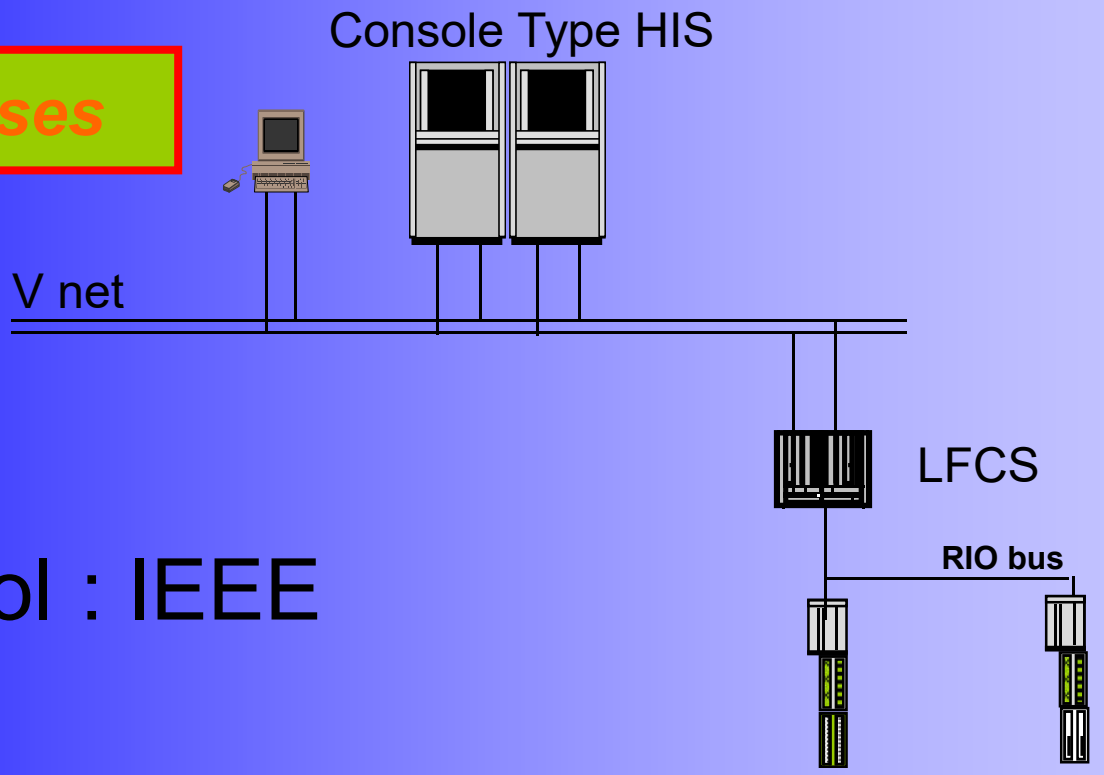
- **V net: high performance process data transfer**
- **Ethernet (Internal System Bus): file server network**
  - **Sharing of external devices**
  - **Sharing of trend / graphic and OPC Server**
- **Ethernet: Standard Interface with Computer Systems**

Domain Hierarchy



- Integration of Remote Locations
- Provides High Capacity
- Integration of existing DCS

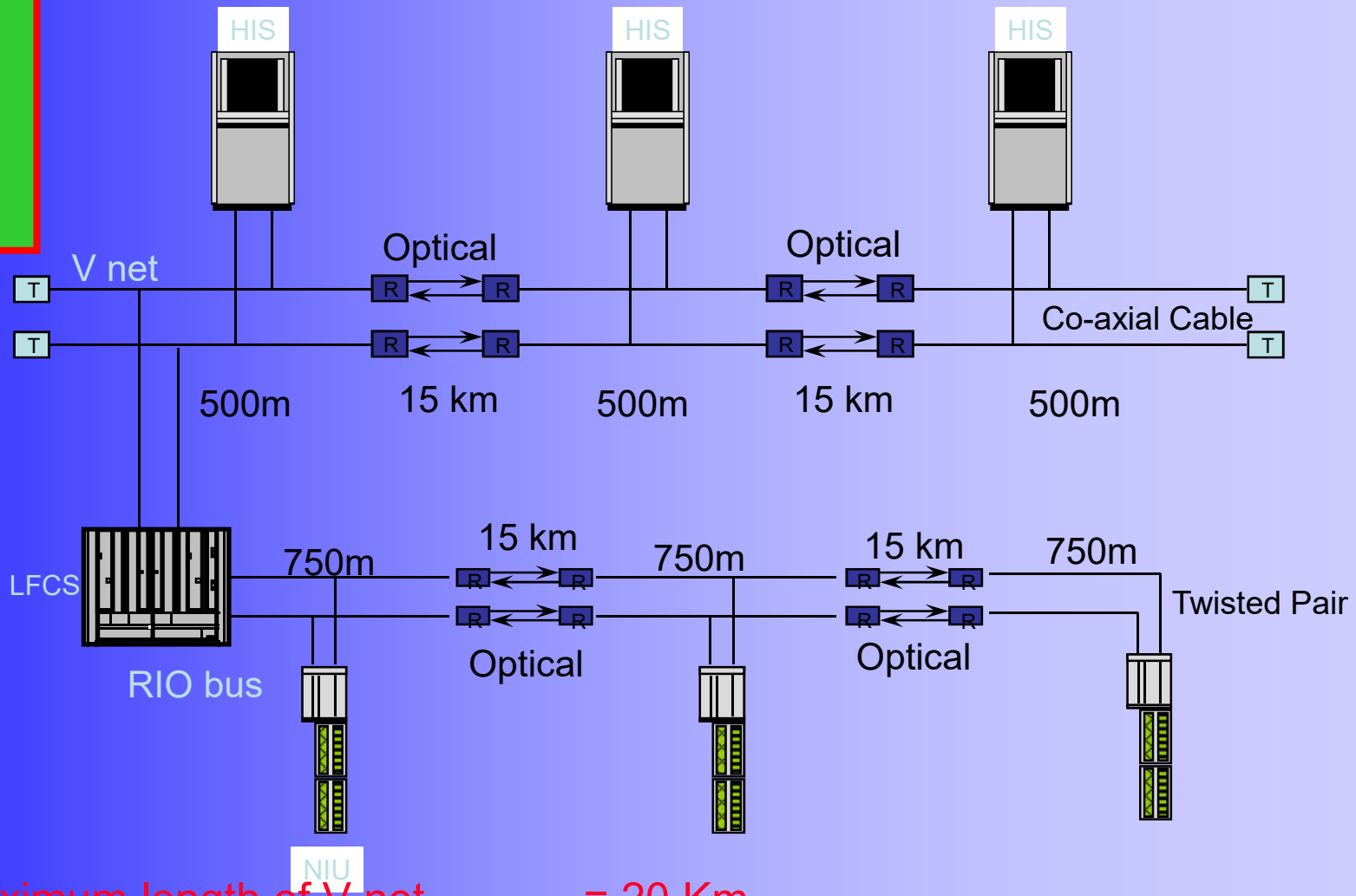
System Buses



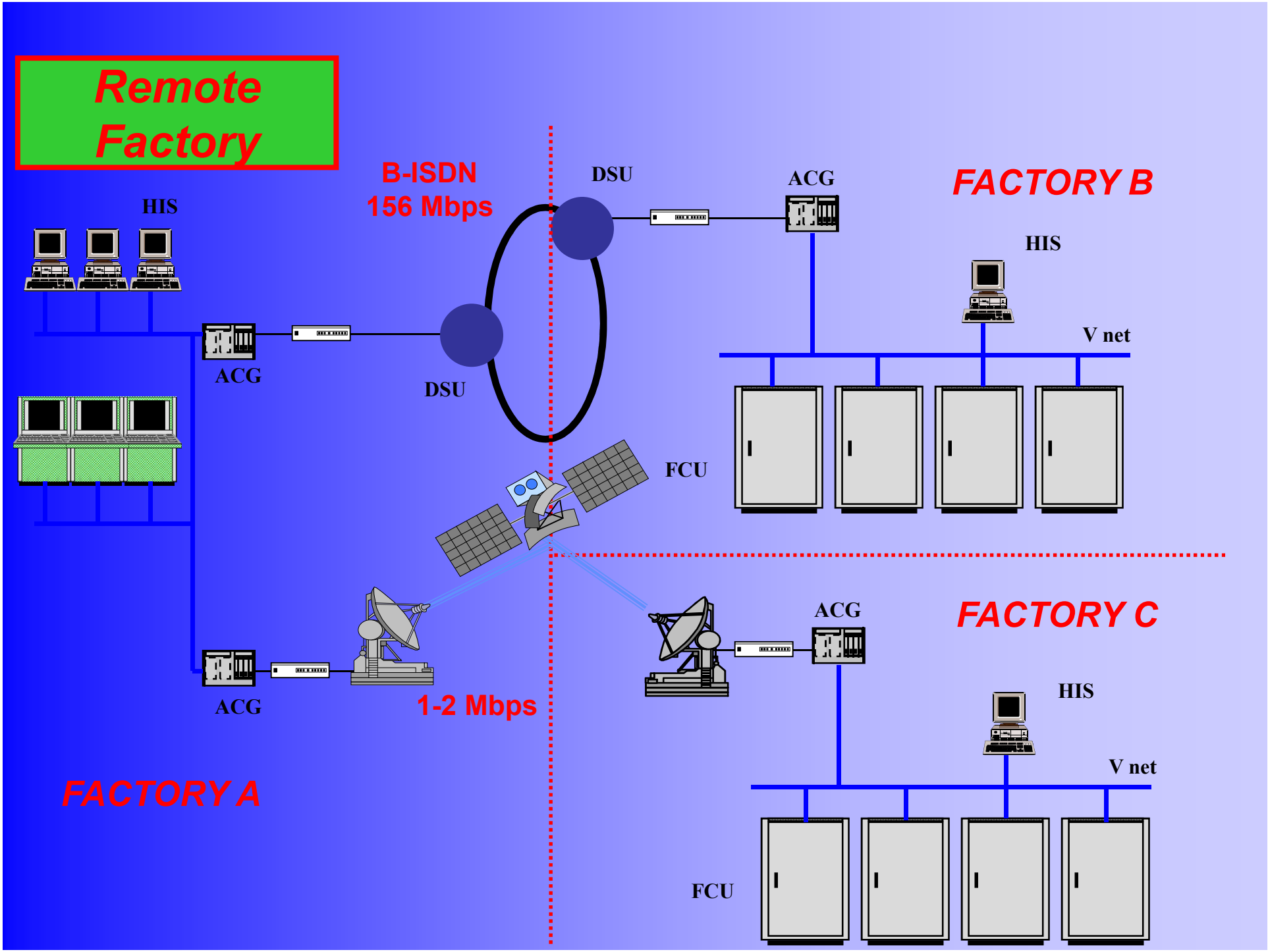
- V net:
- Protocol : IEEE 802.4
- Access Control : Token Passing
- Trans. Speed : 10 Mbps

- **Remote I/O bus:**
- **Communication : Polling**
- **Trans. Speed : 2 Mbps**

System Buses : Extension Details



- Maximum length of V net = 20 Km
- Maximum length of RIO Bus= 20 Km

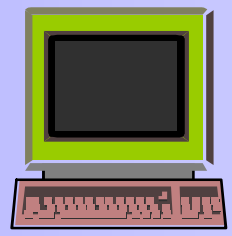

Remote Factory
B-ISDN
156 Mbps
DSU
ACG
FACTORY B
HIS
V net
HIS
ACG
DSU
FCU
ACG
1-2 Mbps
ACG
FACTORY C
HIS
V net
FCU
FACTORY A

Operator Stations (HIS)

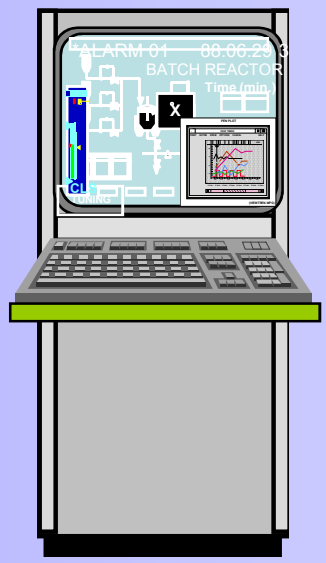
Features(Operation & Monitoring functions)

- Security
  - CS enhanced security package as a standard
- Graphics
  - Generic name (Data binding function)
  - Container functions (ActiveX)
  - Gradation support
- Hierarchical Window Operation
- Graphical Control Drawings
  - Integration of Graphic function and control drawing
- Long term Trend Data Storage

Human Interface Station



- Open Industry Standards
  - Windows-NT
  - Ethernet (TCP/IP)
  - Etc.
- Single Window Concept
  - Process Windows
  - Half-sized Windows
  - 100,000 Tags
- Management Information Functions
  - Data gathering & Data processing
  - Reporting, Logging, Long Term Trending
  - Etc..



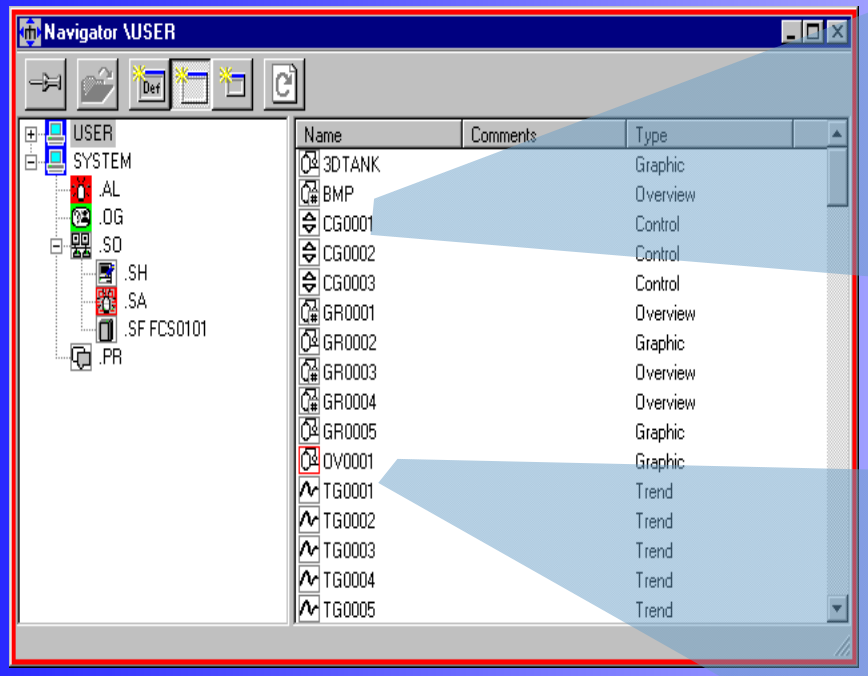
Operator Identification

- Operator Identification
  - by Key and/or
  - by User Name and Password
- Operation Log File (Time, User Name, Batch ID etc.):
  - Audit Trail (Log in and out)
  - Process Alarms
  - Operator Actions
- Operator Authority and Station Authority can both be active

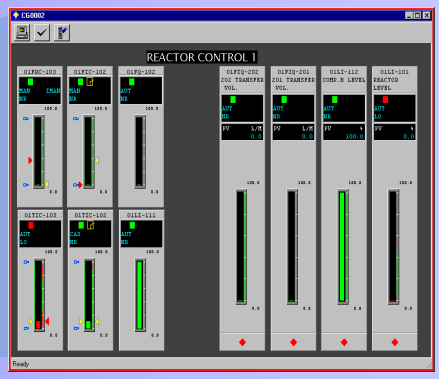
Operation and Monitoring Windows (1)

- **Window calling up by mouse clicking**

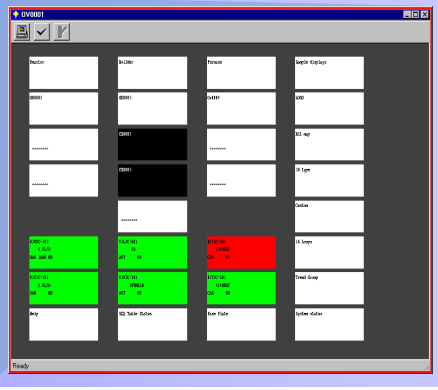
Navigator Window



Control Group Window



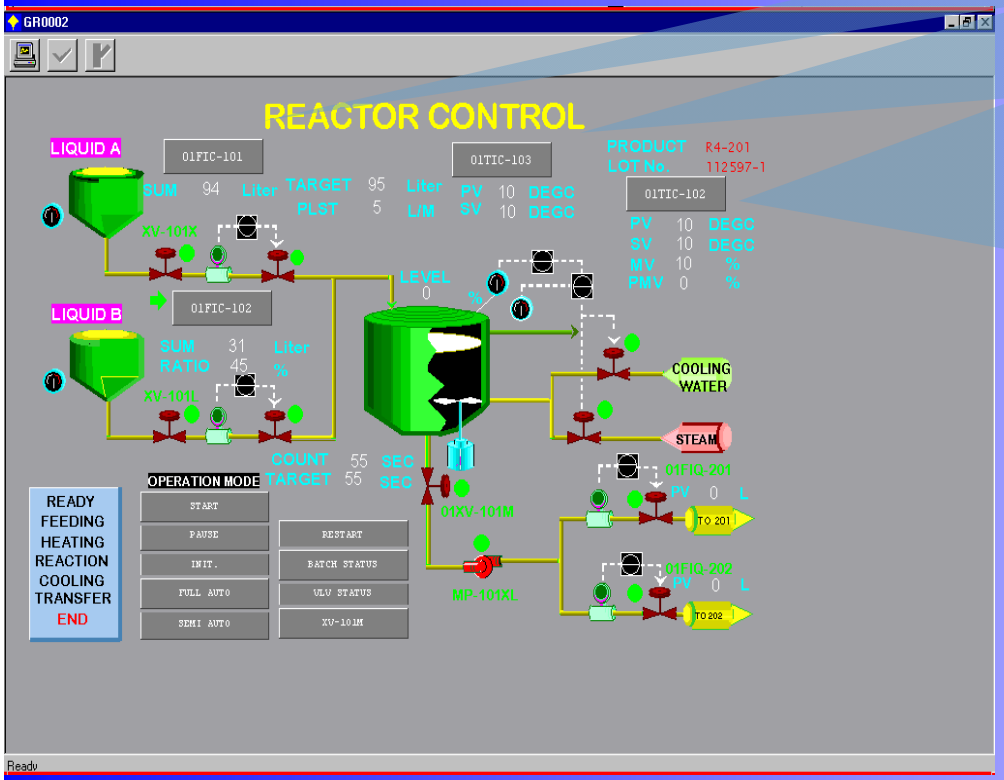
Overview Window

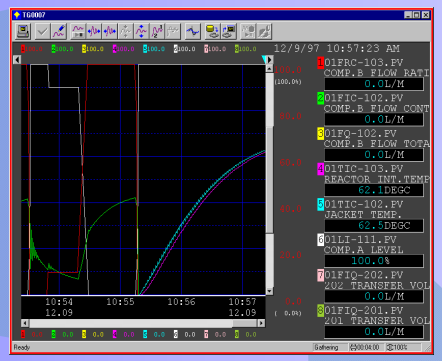


Operation and Monitoring Windows (2)

- CS3000 inherited the operation of CENTUM CS

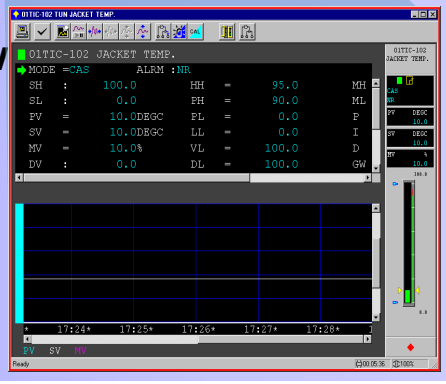
Custom Graphic Window





Trend Window

Tuning Window



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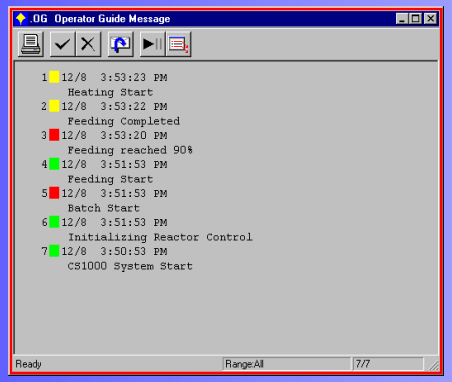
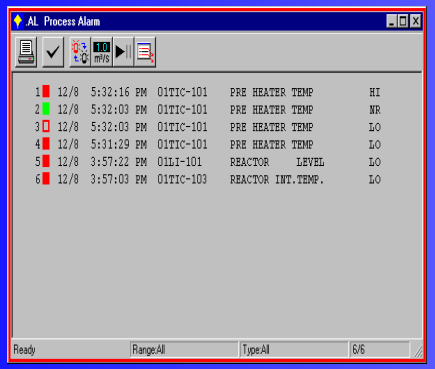
Operation and Monitoring Windows (3)

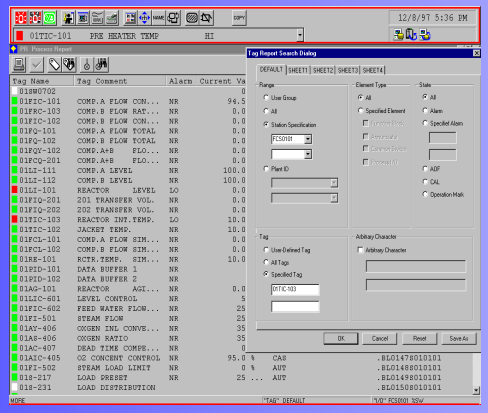
Operator Guide Window



Process Alarm Window



Process Report Window



- Operator Guide Window
- 40 Message / HIS
- Process Alarm Window
- 200 Alarm / HIS

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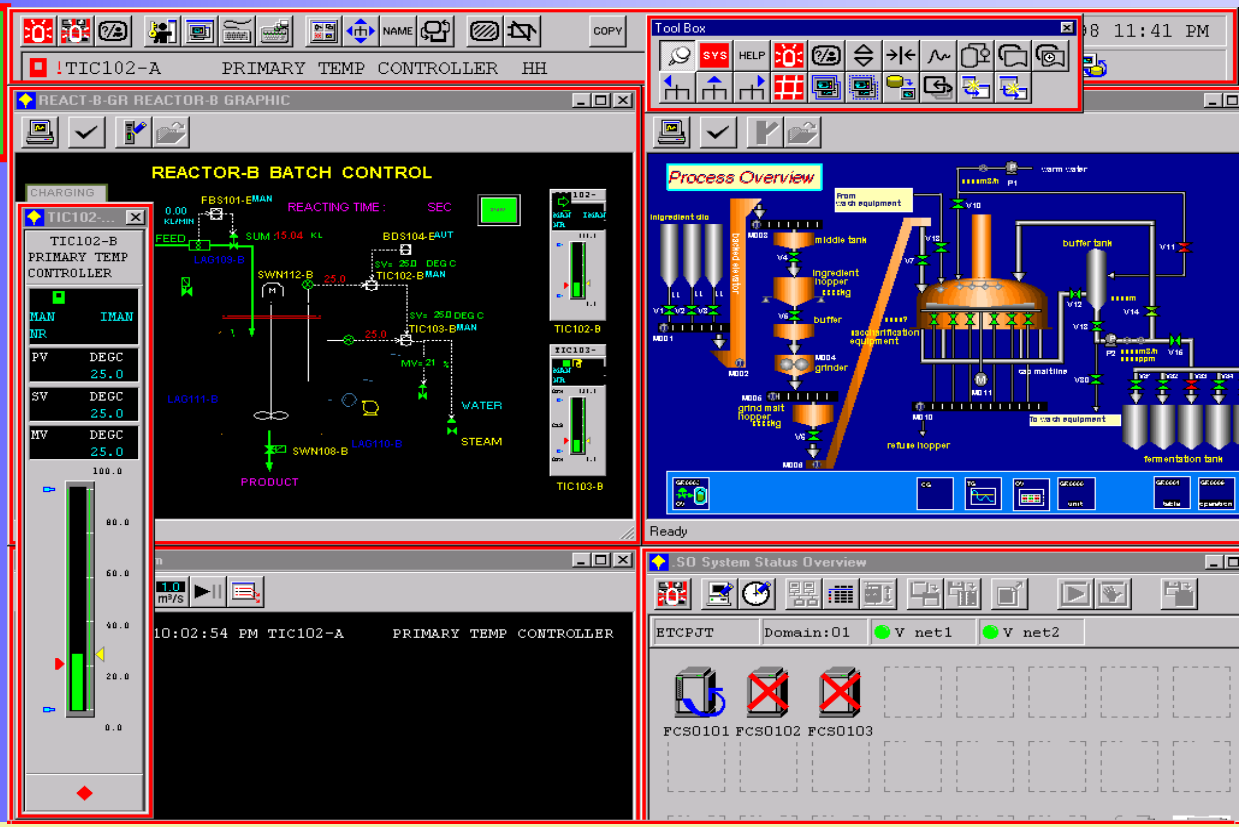
Window Operation



- Multi-Window operation
  - Call up of window without erasing current displays
  - Effective use of monitor by half-size window
- All Panels can be displayed in “half-size” windows

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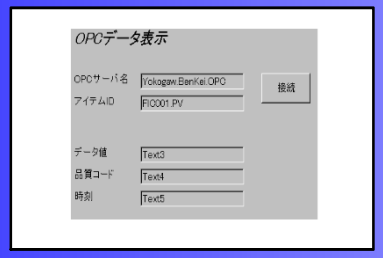
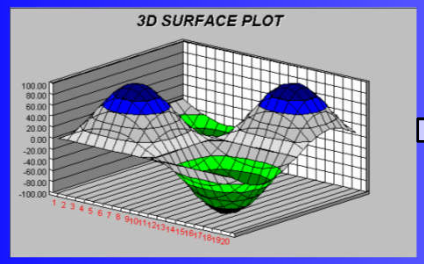
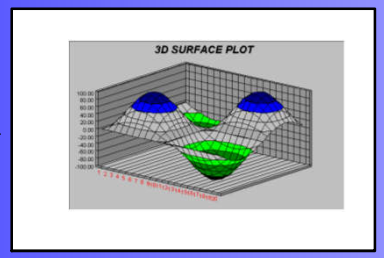
Graphic Container Function



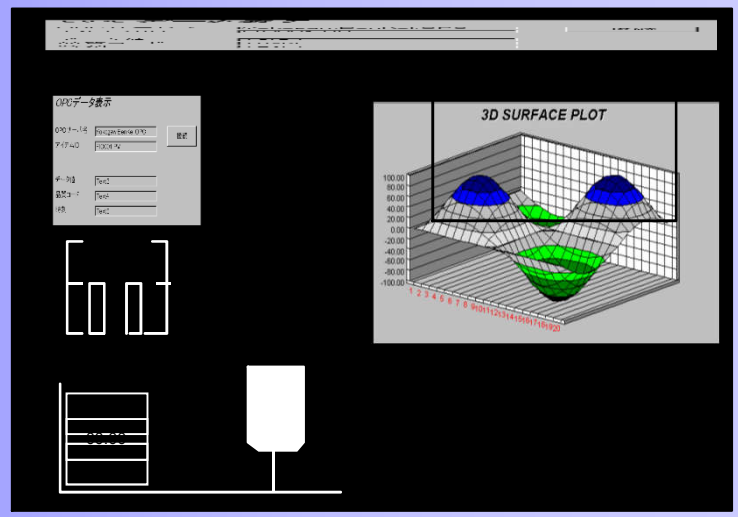
Active X Control Made By Visual Basic



General ActiveX Control



ActiveX Control Made By Visual Basic and General Active X Control



CS3000 Graphic Display

- Active X Control can be embedded in the graphic display
- Making Active X Control by VB, Dynamic graphic display can be realized.

Security

Check user name

User in

User Group

Check operation and monitoring scope

User Permission

Check operation and monitoring authority

- •Function block operation and monitoring
- •Windows operation and monitoring
- •Receipt of messages

Operation History

Tag Basis

Important Tag (Major Alarm)

Ordinary Tag (Medium Alarm)

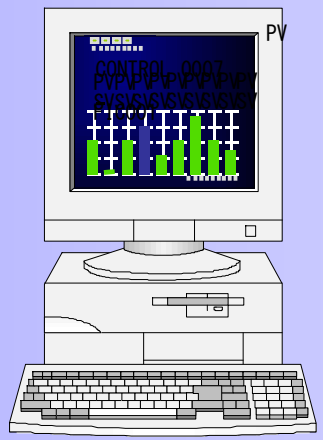
Auxiliary Tag1 (Minor Alarm)

Auxiliary Tag2 (Logging Alarm)

Operation Mark

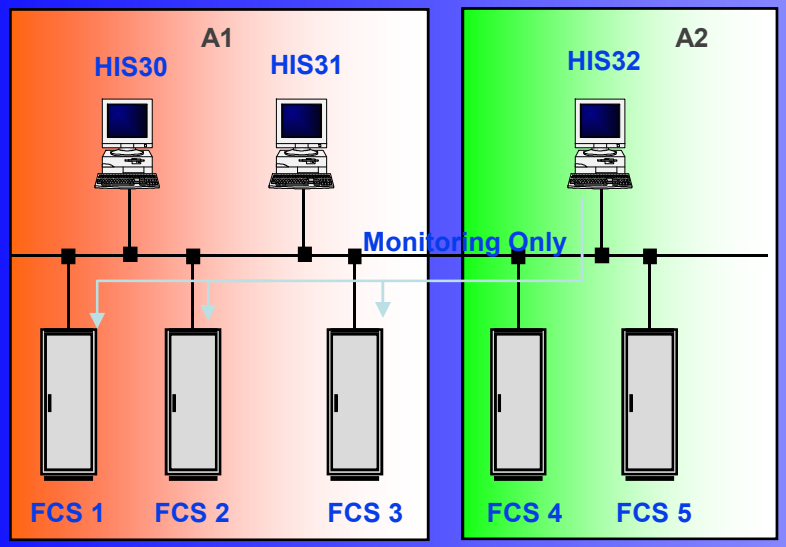
Key Access

Windows NT user security

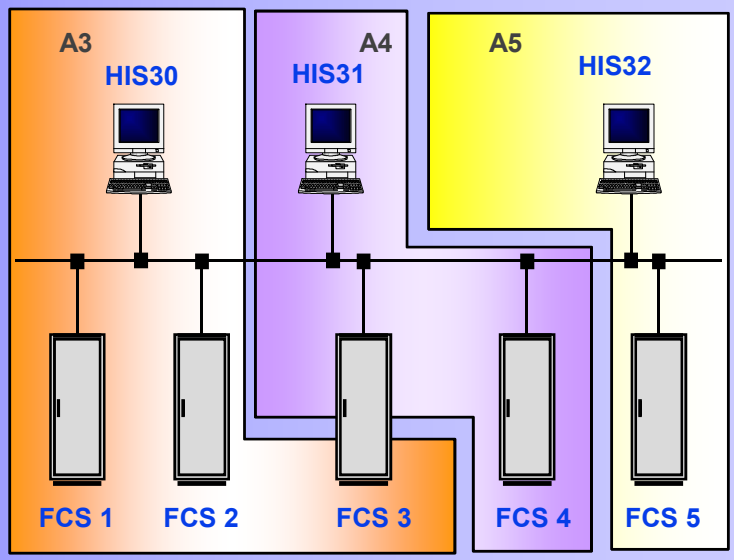


Operation and Monitoring Area

Example of operator A1 and A2

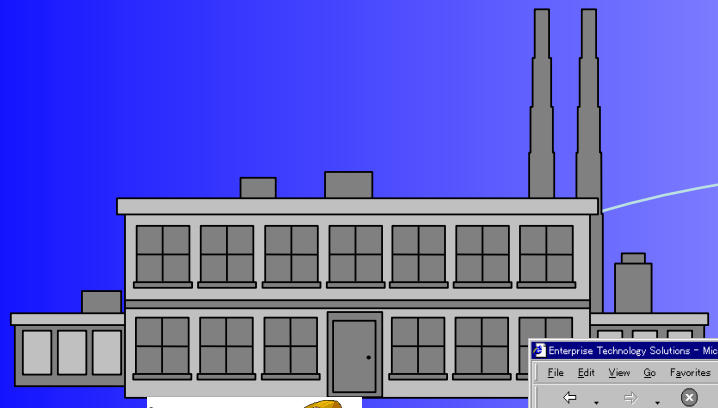


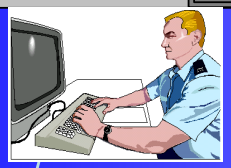
Example of Operator A3, A4 and A5

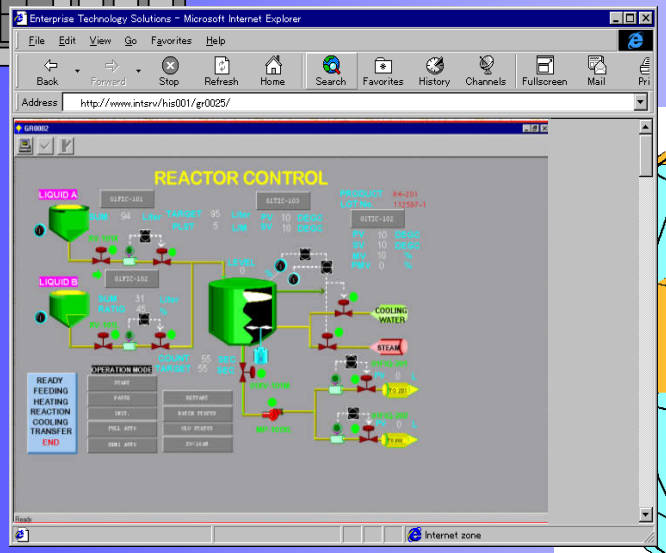


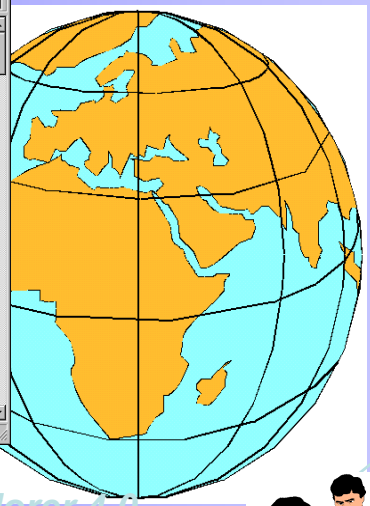
- Each operator has their own operation and monitoring area
- The operation level can be defined by the security function

Web Technology in CS3000







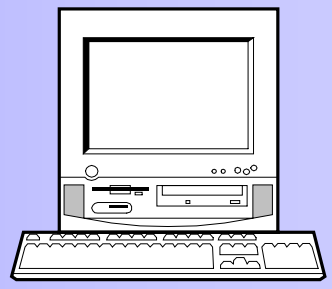


HIS Graphic browsed by Internet Explorer 4.0

CS3000 Graphic Web Display(1)

Phase 1 Plan

- CS3000 graphics display on the web(IE,Netscape)
- Develop conversion tool from CS3000 graphics to Web
- Develop WWW server to display graphics and process data communication



CS3000 Graphic Web Display(2)

Phase 1 Plan

Specifications

- **Web Graphics Conversion**
  CS3000, CS1000(E-type)

- **Monitoring on the Web**
  Graphics
  <not support>
  All Operation
  Monitoring / Faceplate, Trend, Overview

- **Method of Manual Data Update**
  Data to be updated Update PB on the Browser

CS3000 Graphic Web Display(3)

System Components

Phase 1 Plan

- **CS3000 (LHIS/LENG)**

  Fundamentals + OPC package

- **WWW Server**

  – **CS3000 Graphics Web Functions**

  Conversion Tool, Data Source Server, Security (Option)

  – **PC Desktop Application Software**

  WWW Server JAVA Development Environment

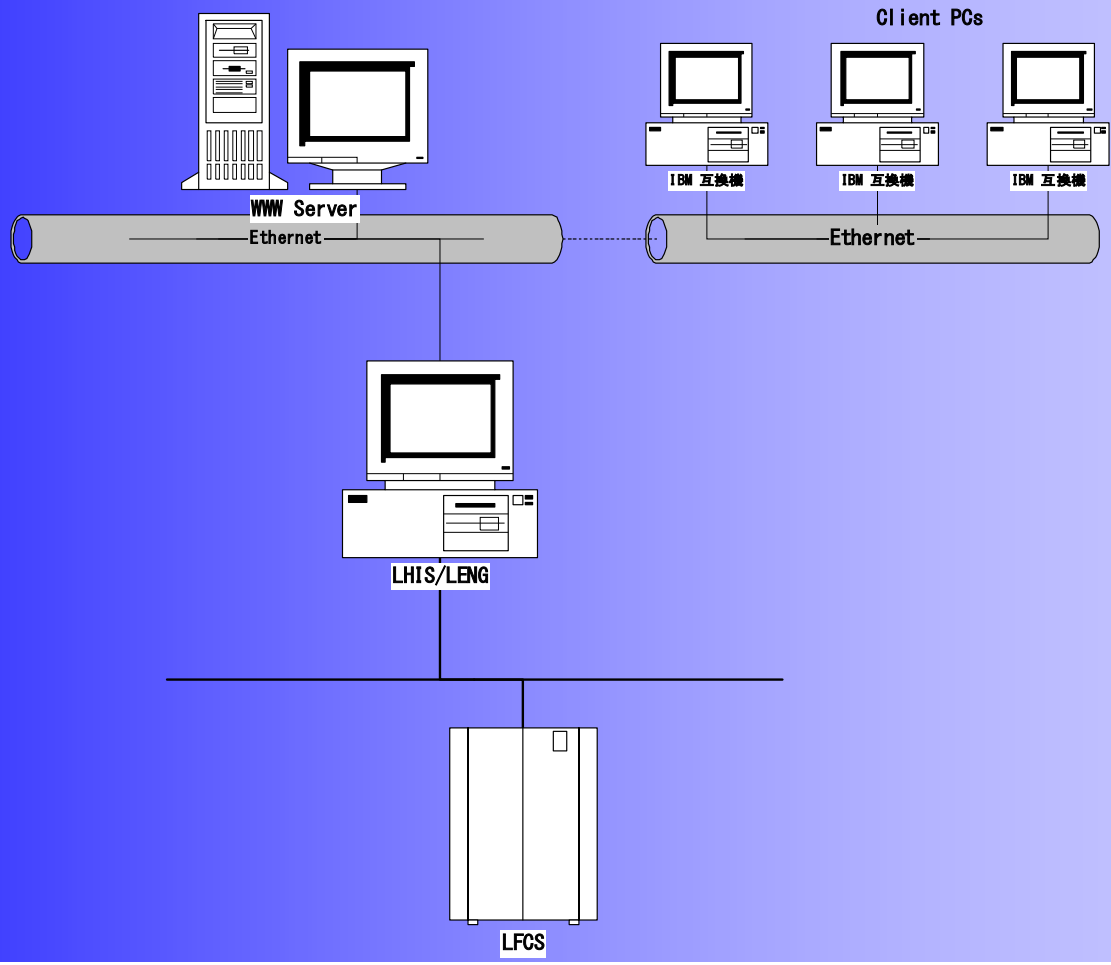
- **Windows95 or Windows-NT4.0**

  Browser (Internet Explorer or Netscape)

CS3000 Graphic Web Display(4)

Phase 1 Plan

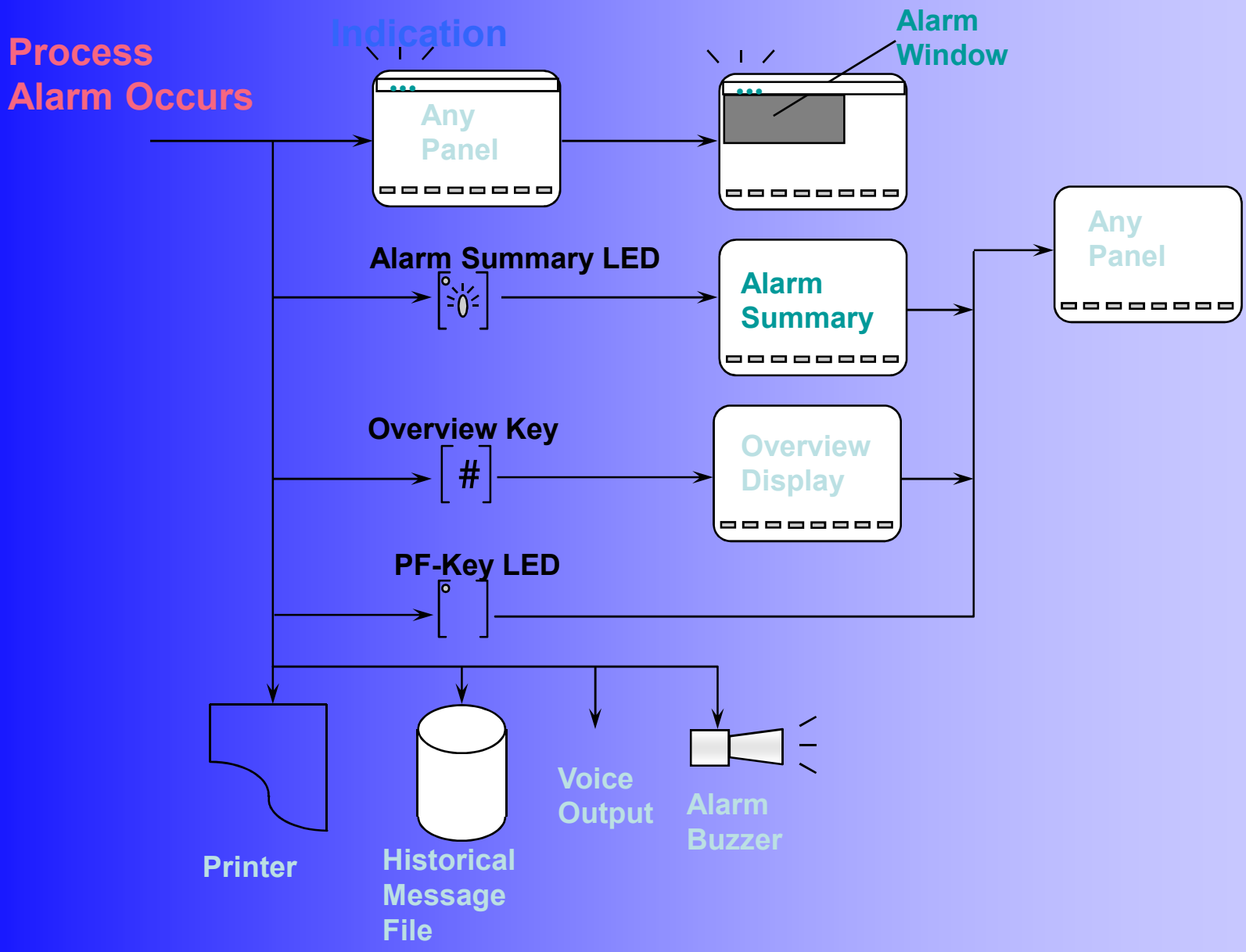
System Configuration



Flexible Alarm Handling

- Standard Alarm Generation and Indication
- User Definable Priority Profiles
- Flexible Alarm Reduction
- Configurable Alarm Suppression
- Configurable Alarm Indication

Standard Alarm Generation and Indication



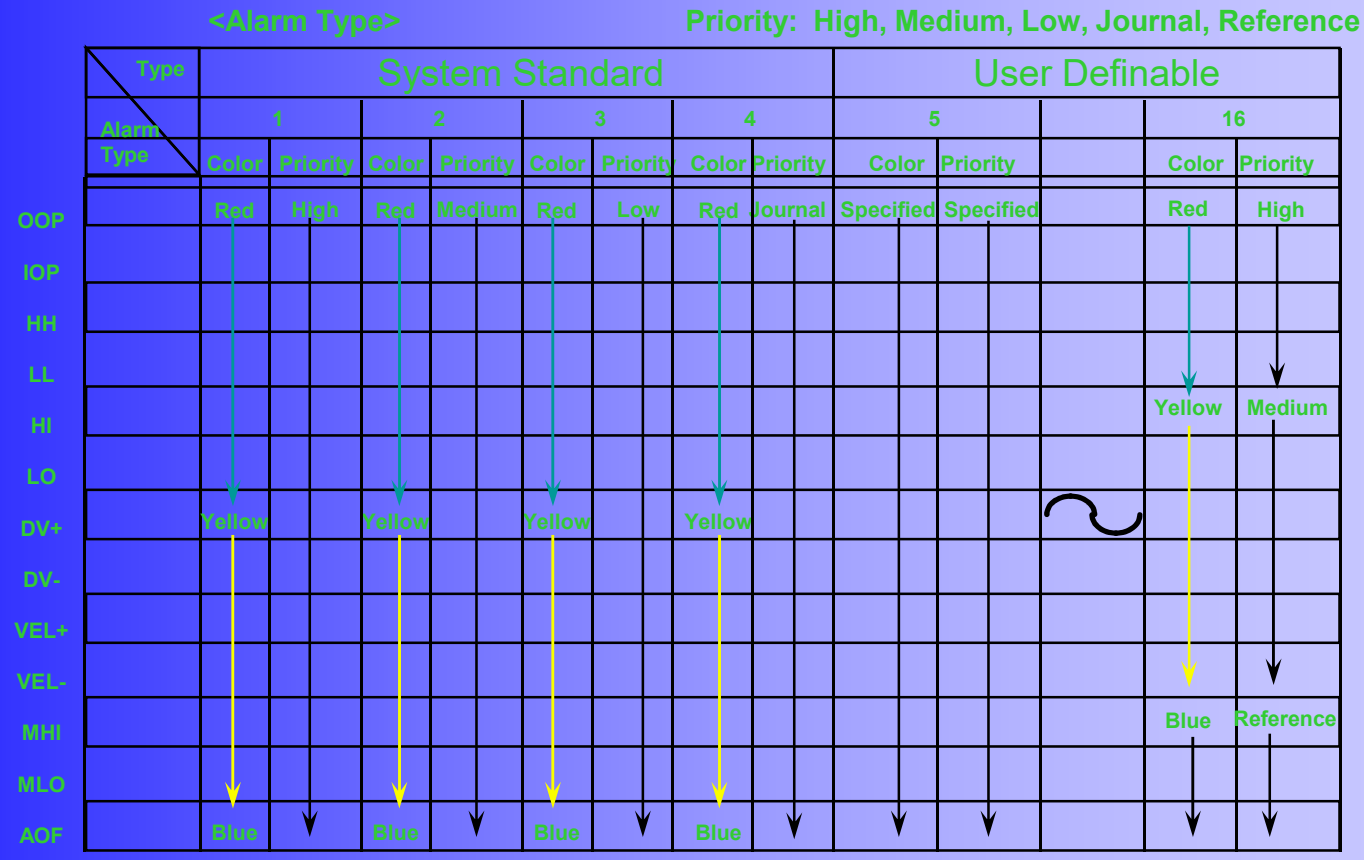
Configurable Alarm Indication

Action / Priority	CRT Display	Audible Al	Print-ing	File Storage	Alarm Action	Re-Alarm
High	Yes	Yes	Yes	Yes	Latching	Yes
Medium	Yes	Yes	Yes	Yes	Latching	No*
Low	Yes	Yes	Yes	Yes	Non-Latching	No*
Journal	No *	No *	Yes	Yes	Self-Acknowl	No*
Reference	No *	No *	No	Yes	Self-Acknowl	No*

Default settings
* = Fixed items

- Recovery Alarm Indication
- Re-alarming Possibility
- Configurable Alarm Tone

User Definable Priority Profiles



- Alarm Profile assignment to each Software Block

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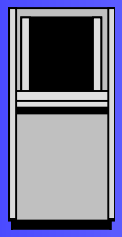
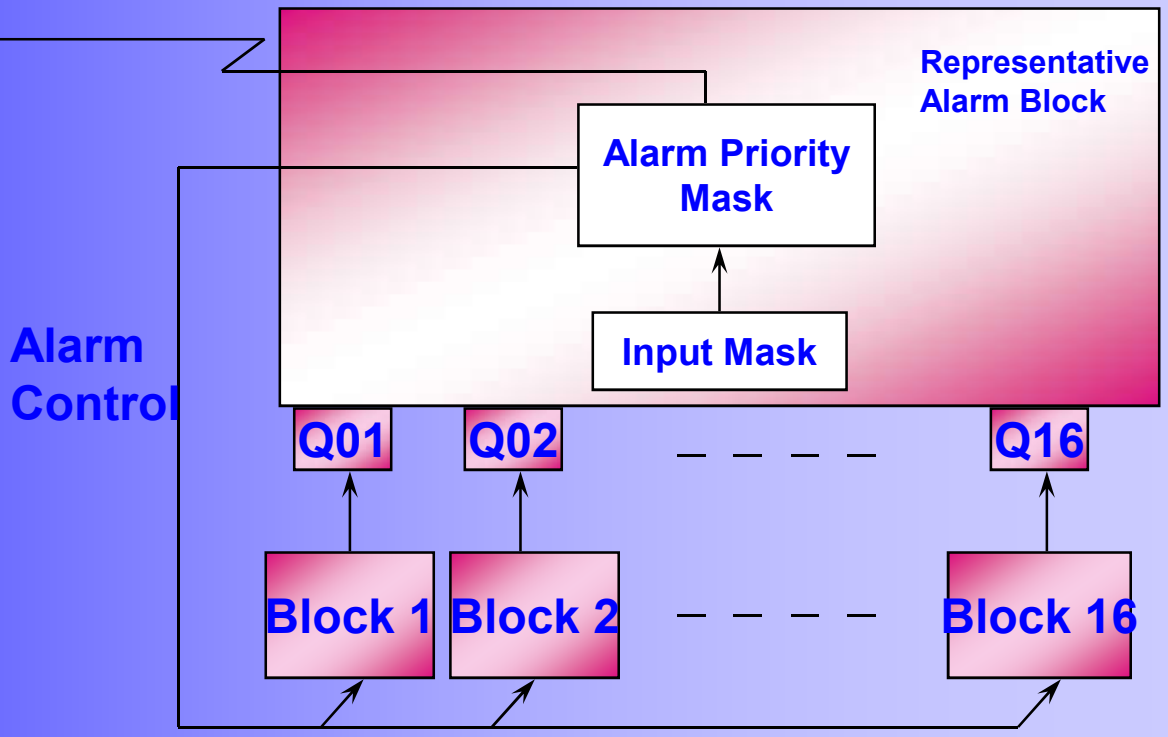
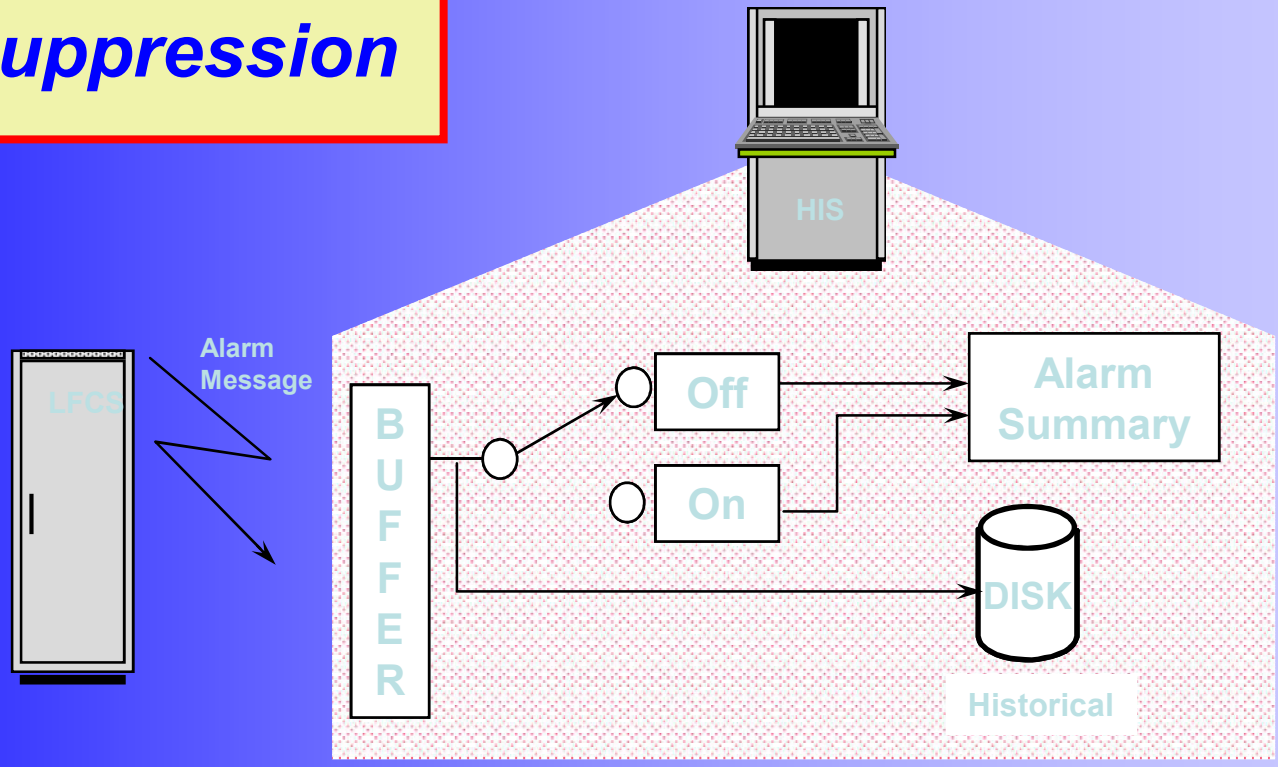
Flexible Alarm Reduction





- Selective Representation
- On-line Masking Modification
- Relative Alarm Suppression

Alarm Suppression

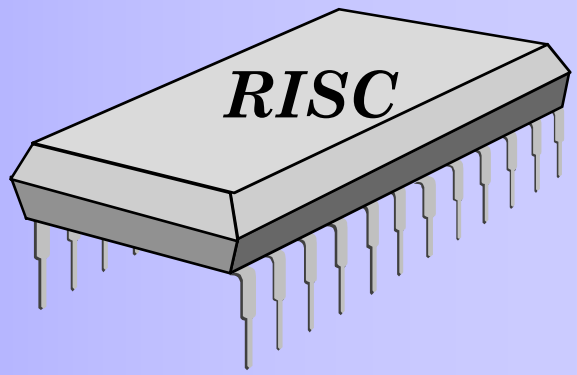


- On-line activation of Alarm Suppression:
  - Only highest alarm per TAG
  - Only high alarms
  - Only medium and high alarms
- Selection of Control Area on Alarm Summary

Field Control Station

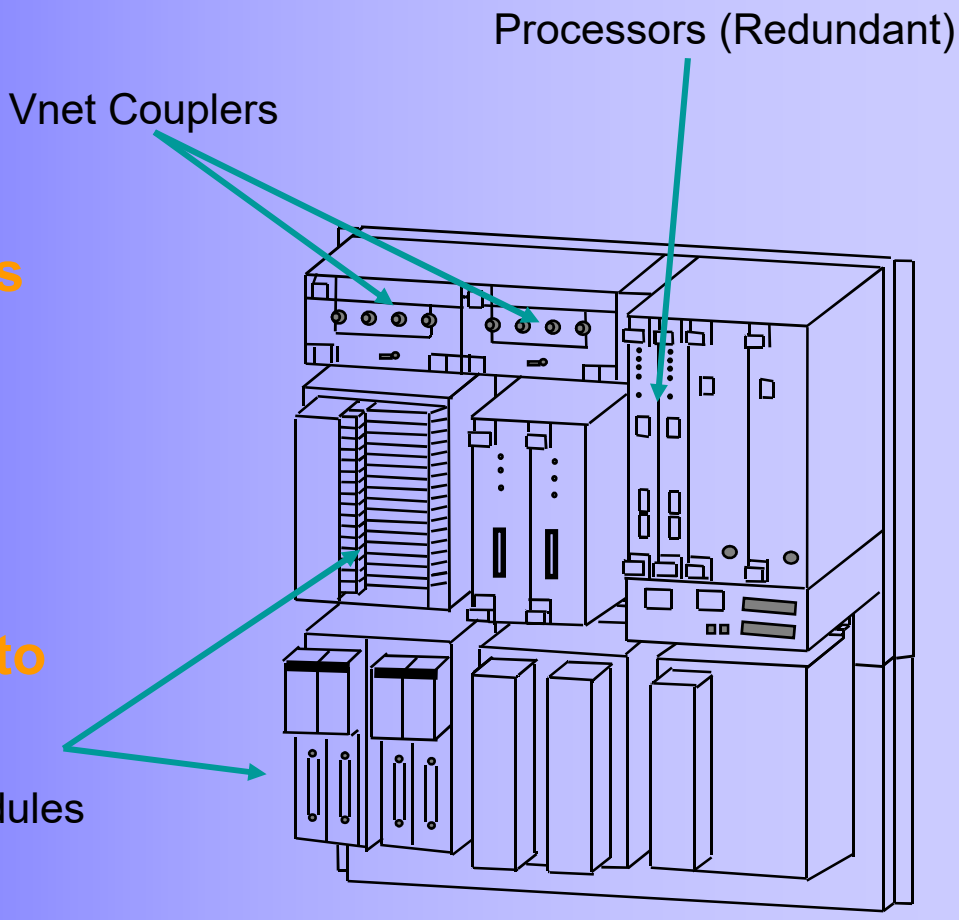
Field Control Station

- Two Sizes of Field Control Stations
  - Standard FCS
  - Compact FCS
- Standard Function Blocks
  - (PID, SFC, etc.)
- High Reliability & Data Integrity
  - Pair and Spare (for LFCS)
  - ECC
- Direct Connection of Subsystems
- Hybrid Faceplate Blocks
  - Complex Control Strategies

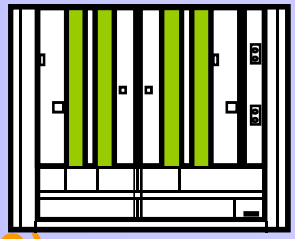


Compact Field Control Station (SFCS)

- RISC Processor R4300
  - 8/16 Mbytes RAM Versions
- Centralized I/O
- 1,500 Max. Function Blocks
- Two types of FCS
  - 2 I/O Nests (IOUs)
  - 5 I/O Nests (IOUs)
- Supports Communication to
  - DARWIN Data Acquisition
  - PLCs
  - Fieldbus



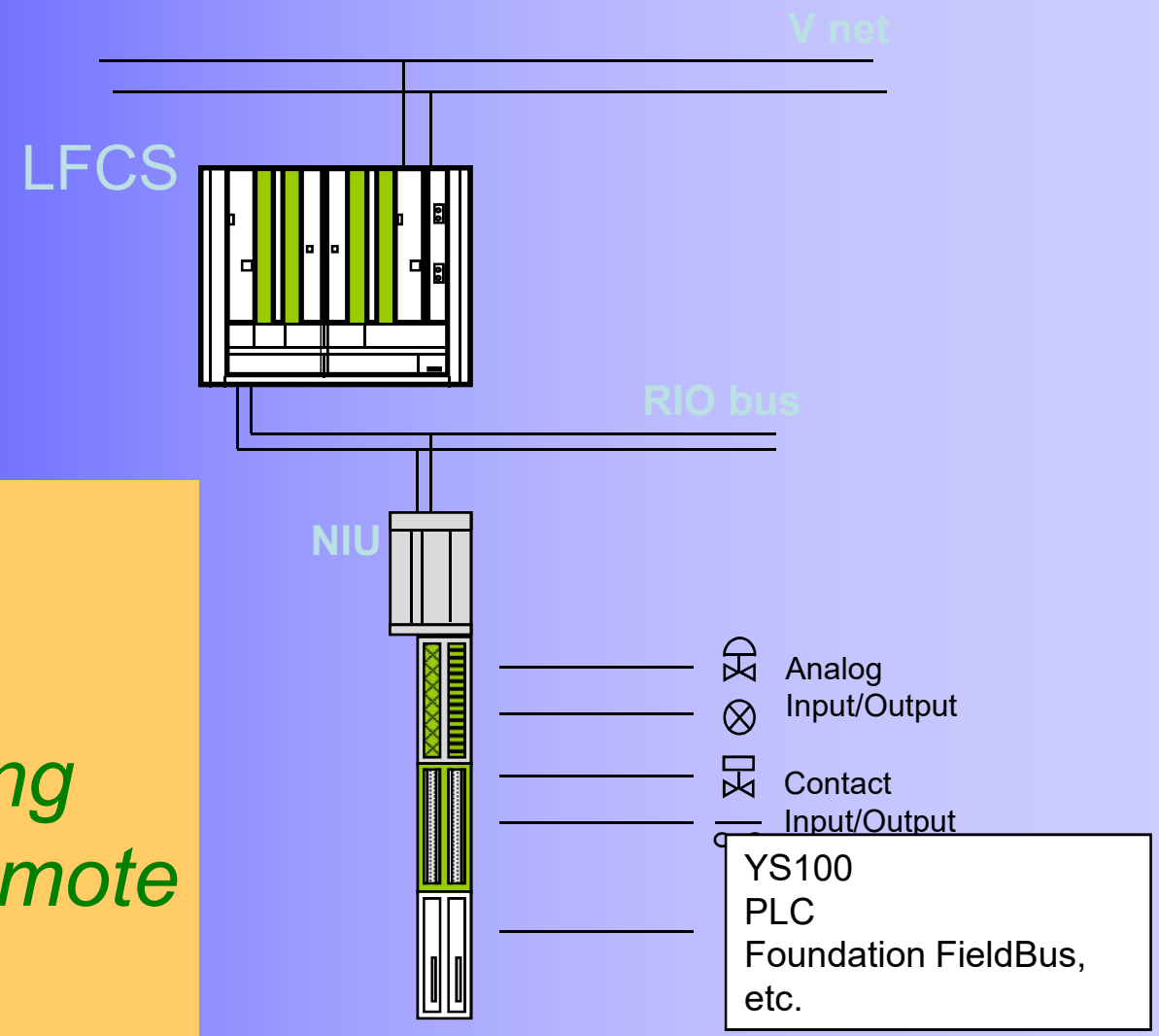
Standard Field Control Station (LFCS)



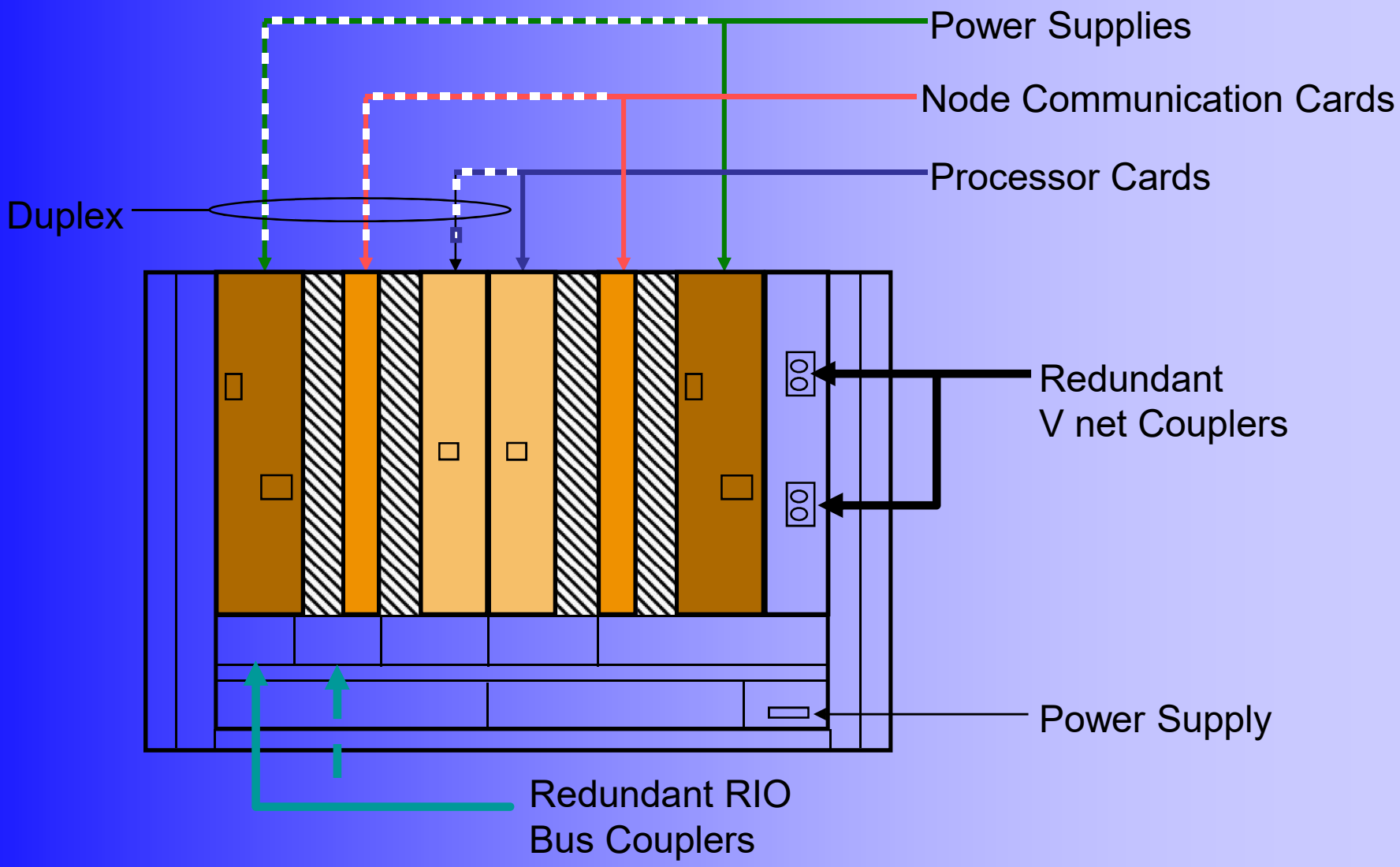
- High capacity because of RISC Processor (R3000)
- Reduced wiring costs through Remote I/O
- High Reliability and Data Integrity
  - Pair and Spare redundancy
  - ECC
- Standard Function Blocks (PID, SFC, etc.)
- User Definable Function Blocks
- Direct Connection of Subsystems

LFCS Architecture

- *Remote I/O*
- *Dual Redundant*
- *Reduction of wiring costs through Remote I/O*

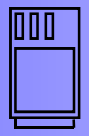


Standard FCU Chassis

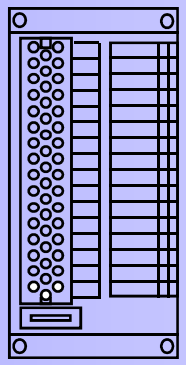


I/O Modules (1)

Analog I/O Module

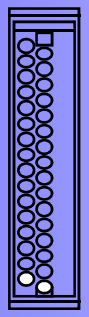


Analog I/O Unit

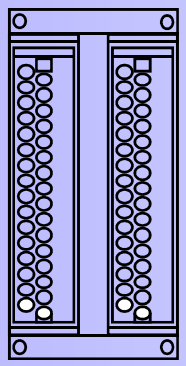


- Current/Voltage In
- mV, Thermocouple, RTD Input
- Pulse Input
- Current/Voltage Out

Multiplexer Module (16 pt.)



Multiplexer Unit

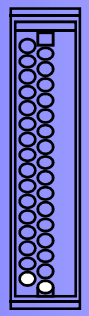


- Voltage Input
- mV Input
- Thermocouple Input
- RTD Input
- 2-wire transmitter input
- 4-20 mA Output

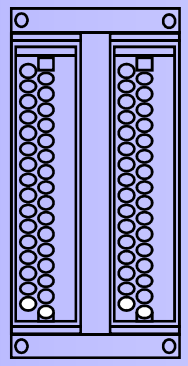
I/O Module (2)

Terminal Type
digital I/O Module

- 16 -pt. Input (isolated)
- 16 -pt Output (isolated)
- 32 -pt. Input
- 32 -pt. Output

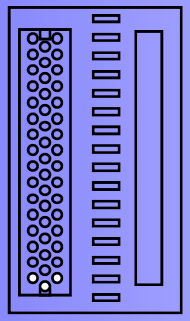


Terminal Type
I/O Unit

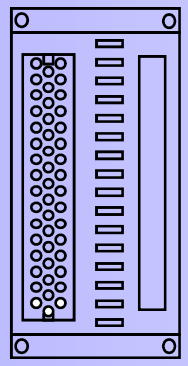


Relay I/O Module

- 16 -pt. Input
- 16 -pt. Output



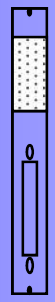
Relay I/O Unit



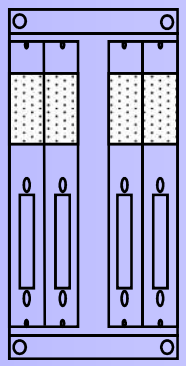
I/O Module (3)

Connector Type
digital I/O Module

- 16 -pt. Input (isolated)
- 16 -pt Output (isolated)
- 32 -pt. Input
- 32 -pt. Output

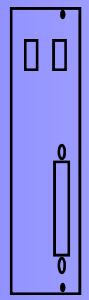


Connector Type
I/O Unit

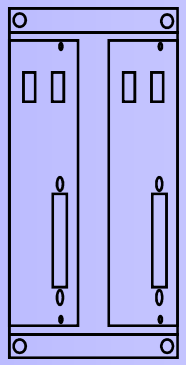


Communication Module

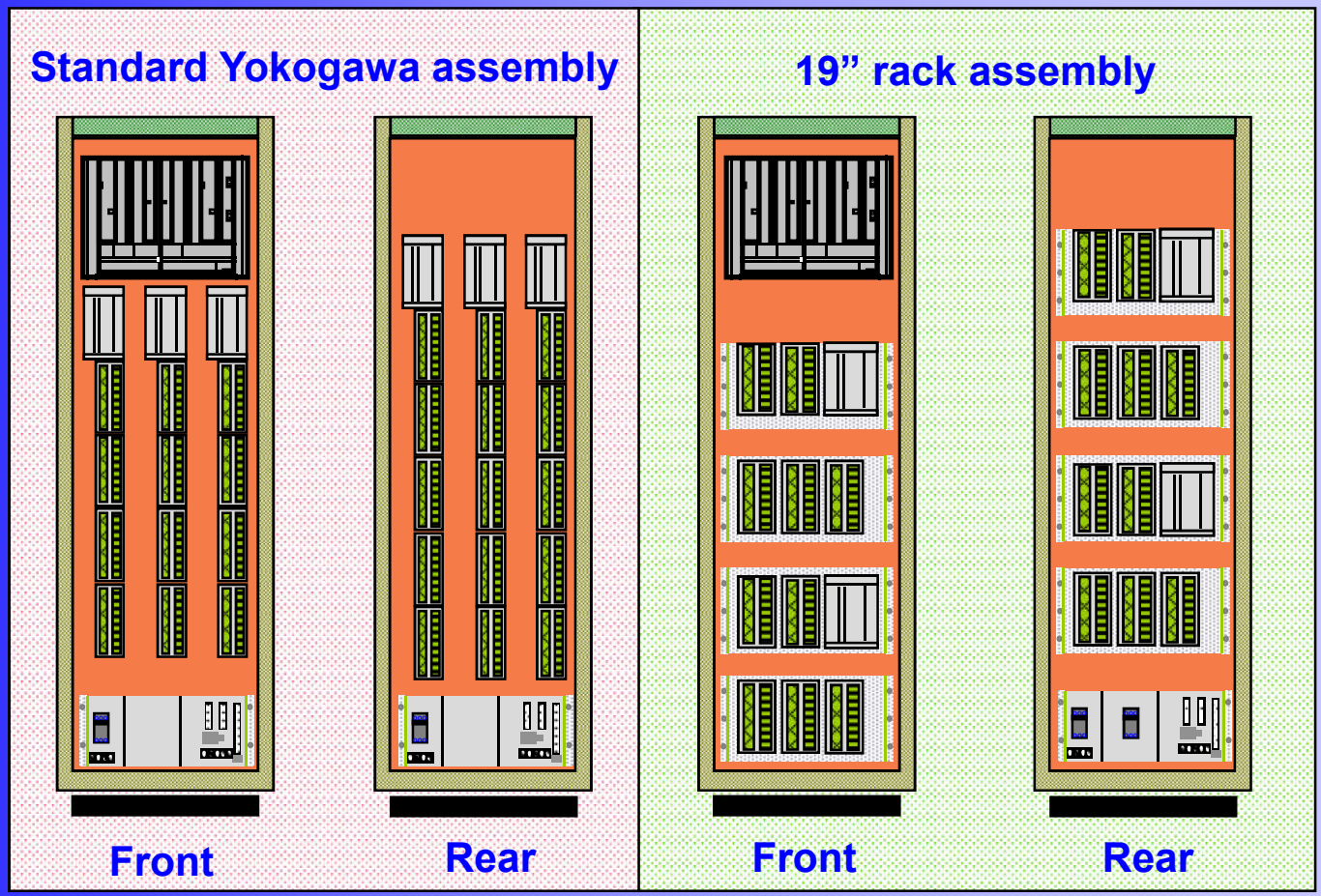
- RS-232C
- RS-422
- RS-485



Communication
Unit



Installation of LFCS Control Cabinets



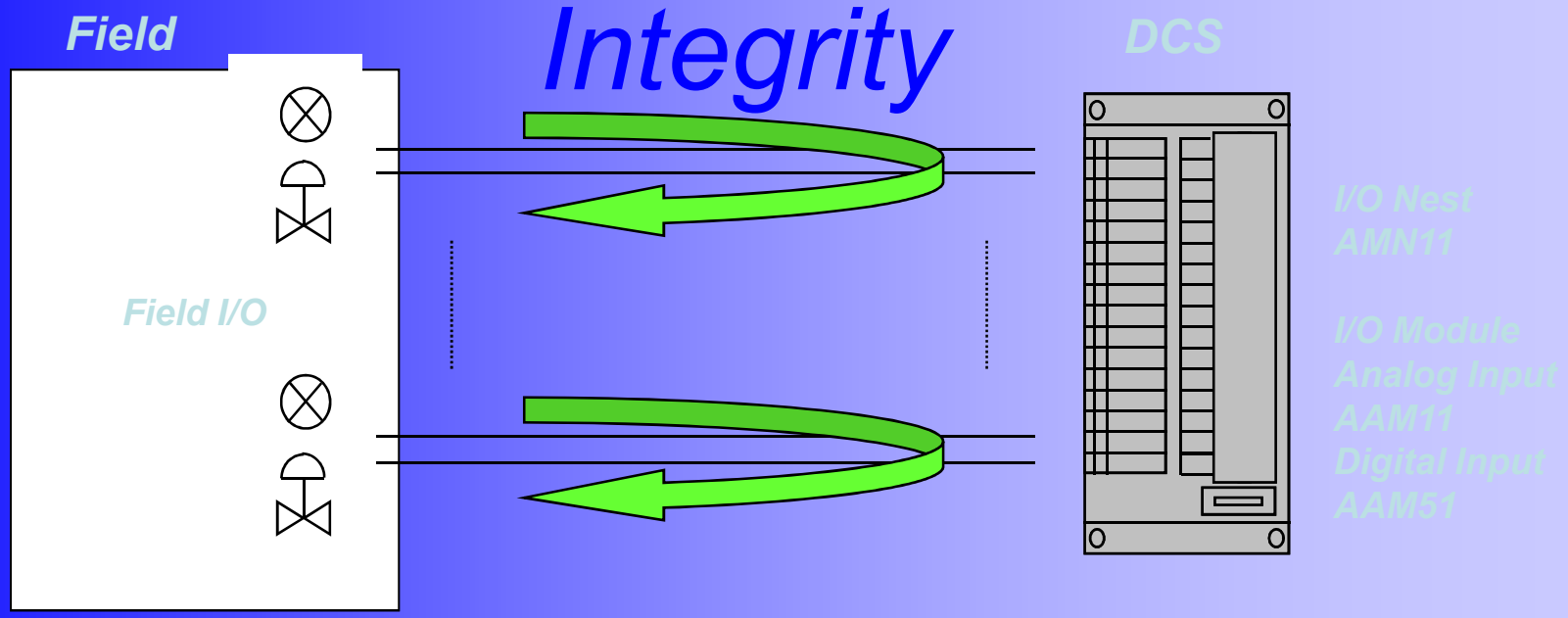
LFCS Specifications

		Standard Type	Enhanced Type
Processor Card	CPU R3000(25MHz)	Single or Duplex	
	RAM (with ECC)	16 M byte	
	Control Bus V net	Duplex	
I/O Interface RIO bus		Single or Duplex	

Full Redundancy

Processor Card	Pair and Spare
Control Bus	Alternate Use
RIO bus	Alternate Use

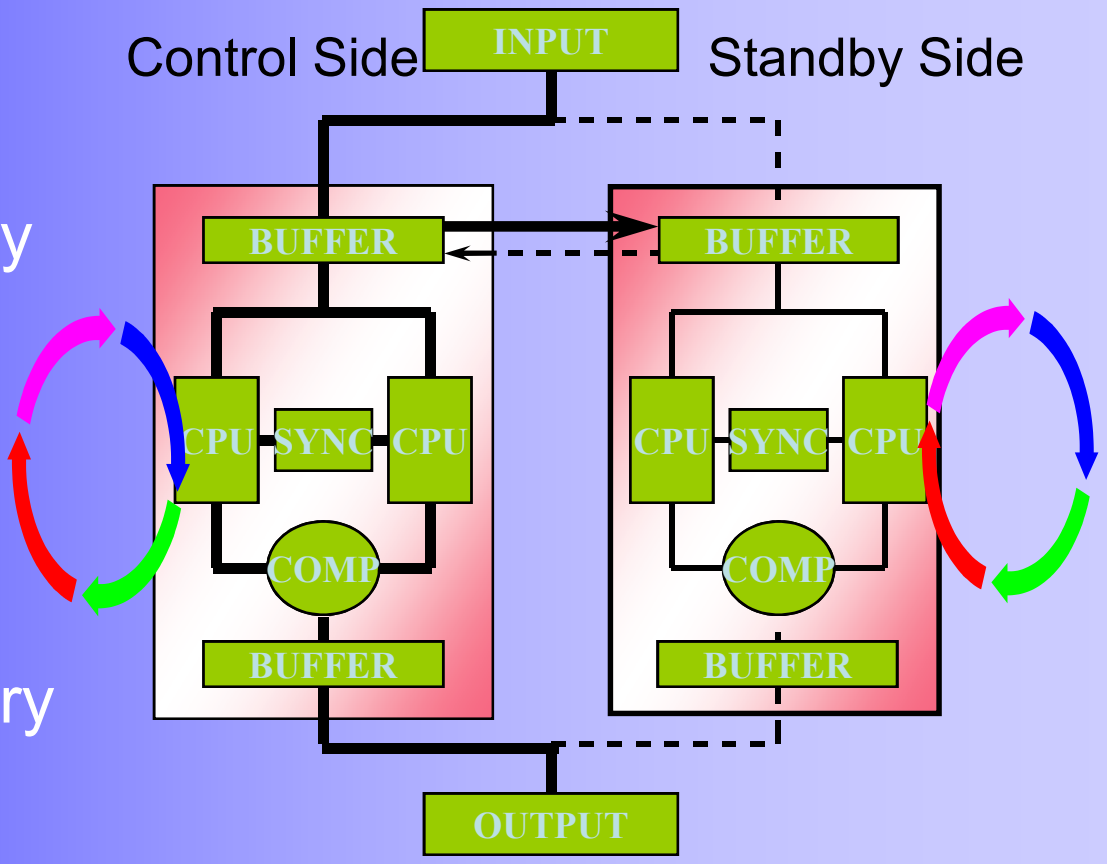
Single Loop Integrity



- Security for a single loop
- Minimizing the quantity of hardware
- Three direction isolation protects signals from faults caused by other channels

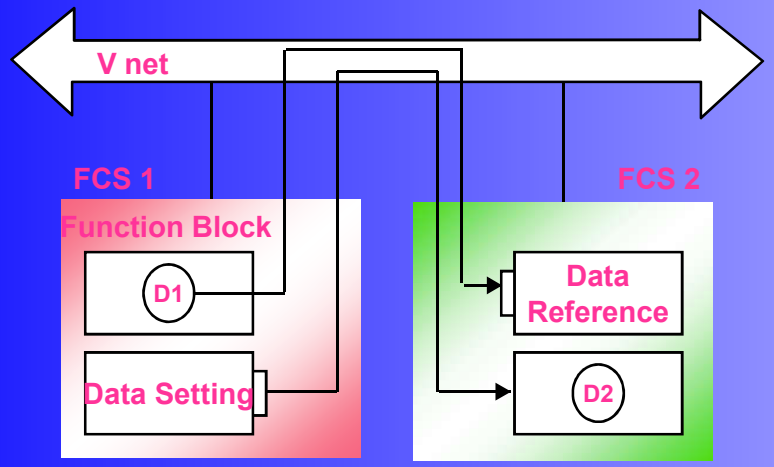
Pair and Spare Redundancy

- Guaranteed Integrity of Calculated Data
- Bumpless Transfer
- Independent Memory and ECC

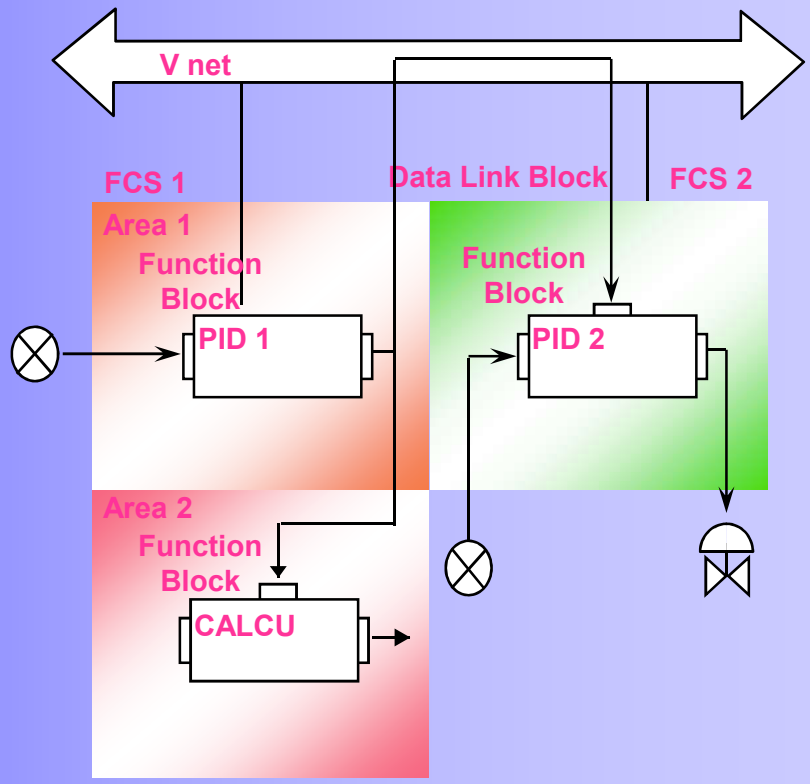


Peer-to-Peer Communications

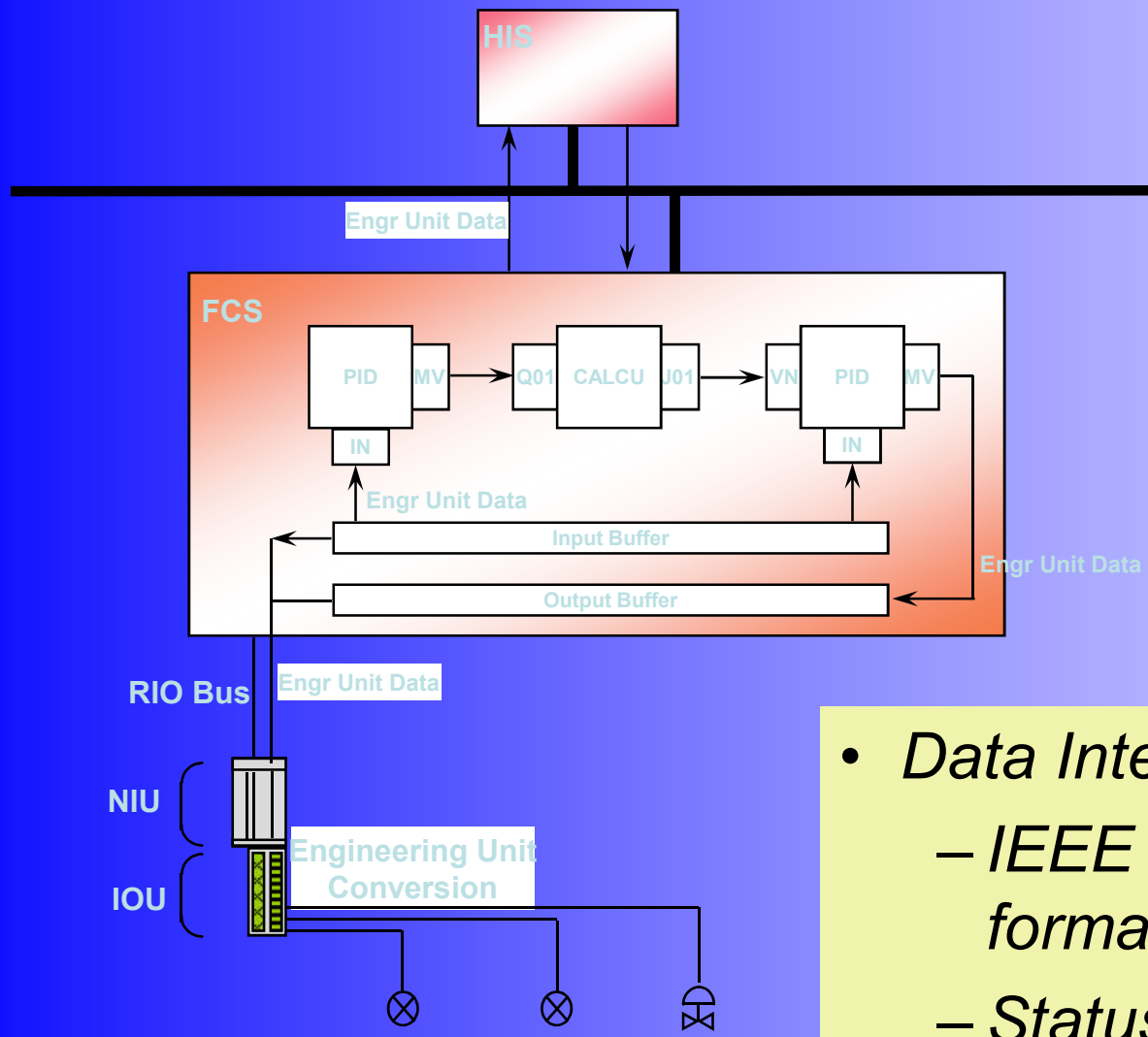
Data Reference / Setting



Cascade Connection

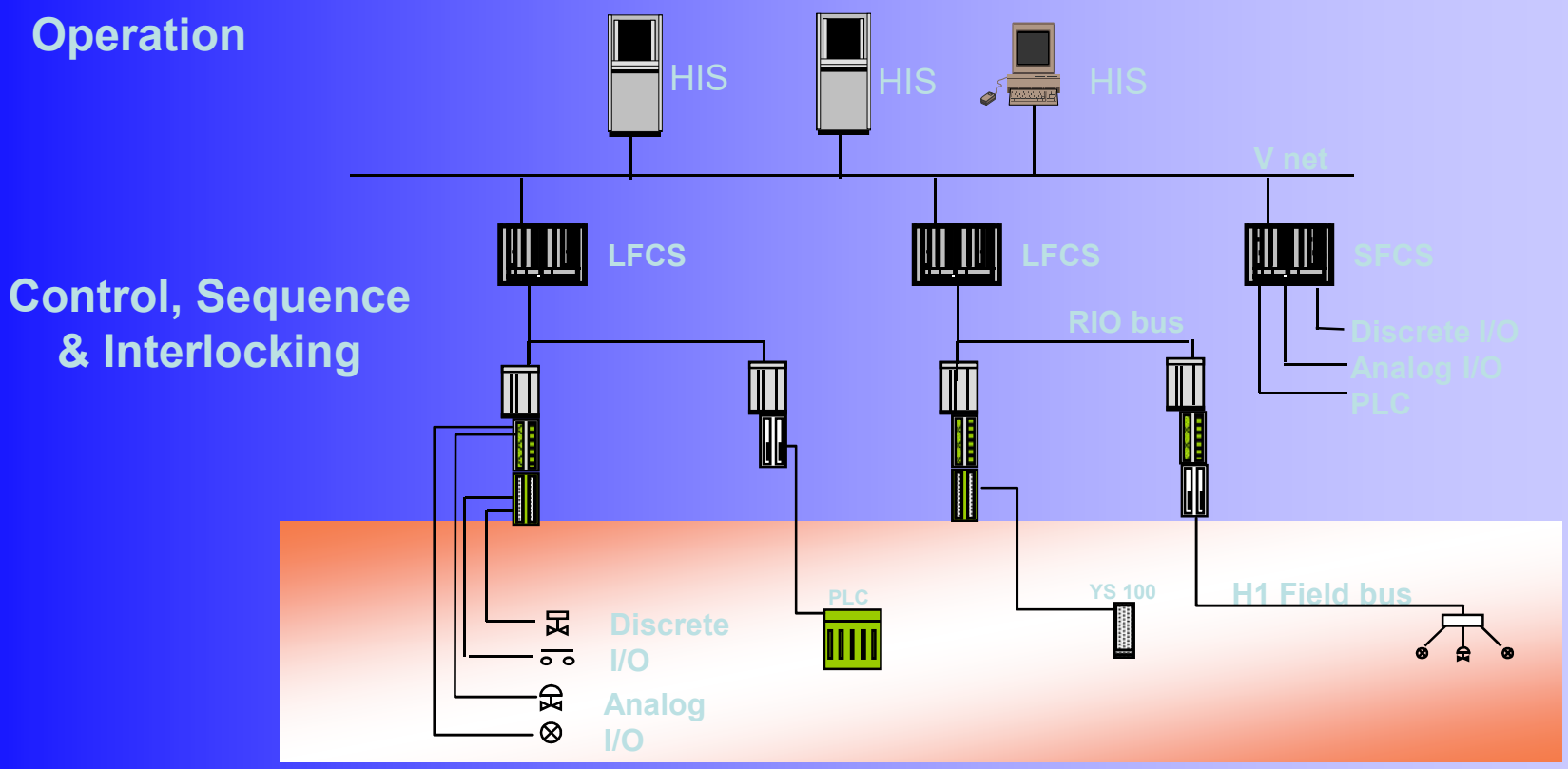


Internal Data



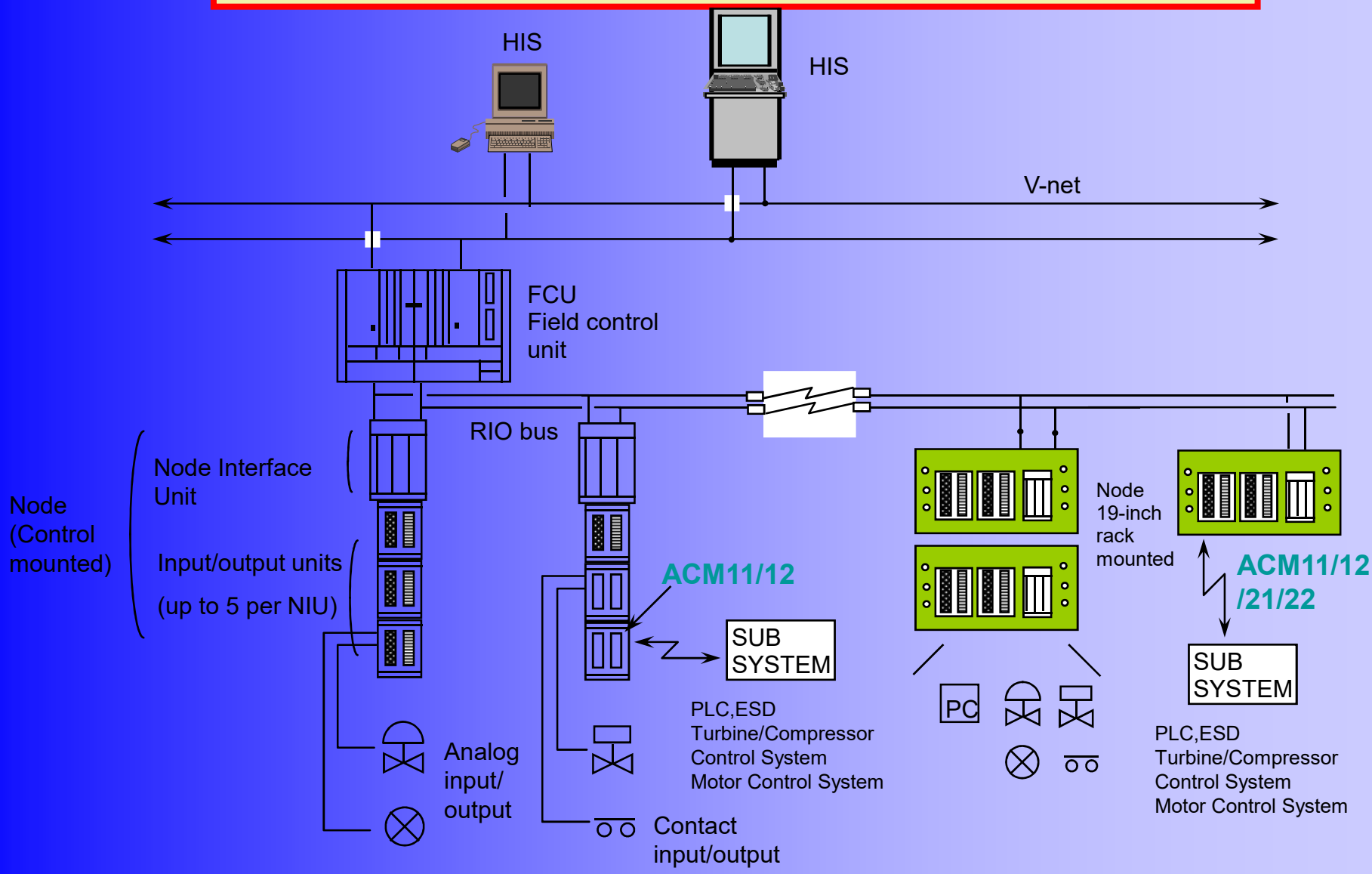
- *Data Integrity through:*
  - *IEEE 754 floating point format*
  - *Status attached to data*
- *Engineering Unit Data*

Integration of Subsystems



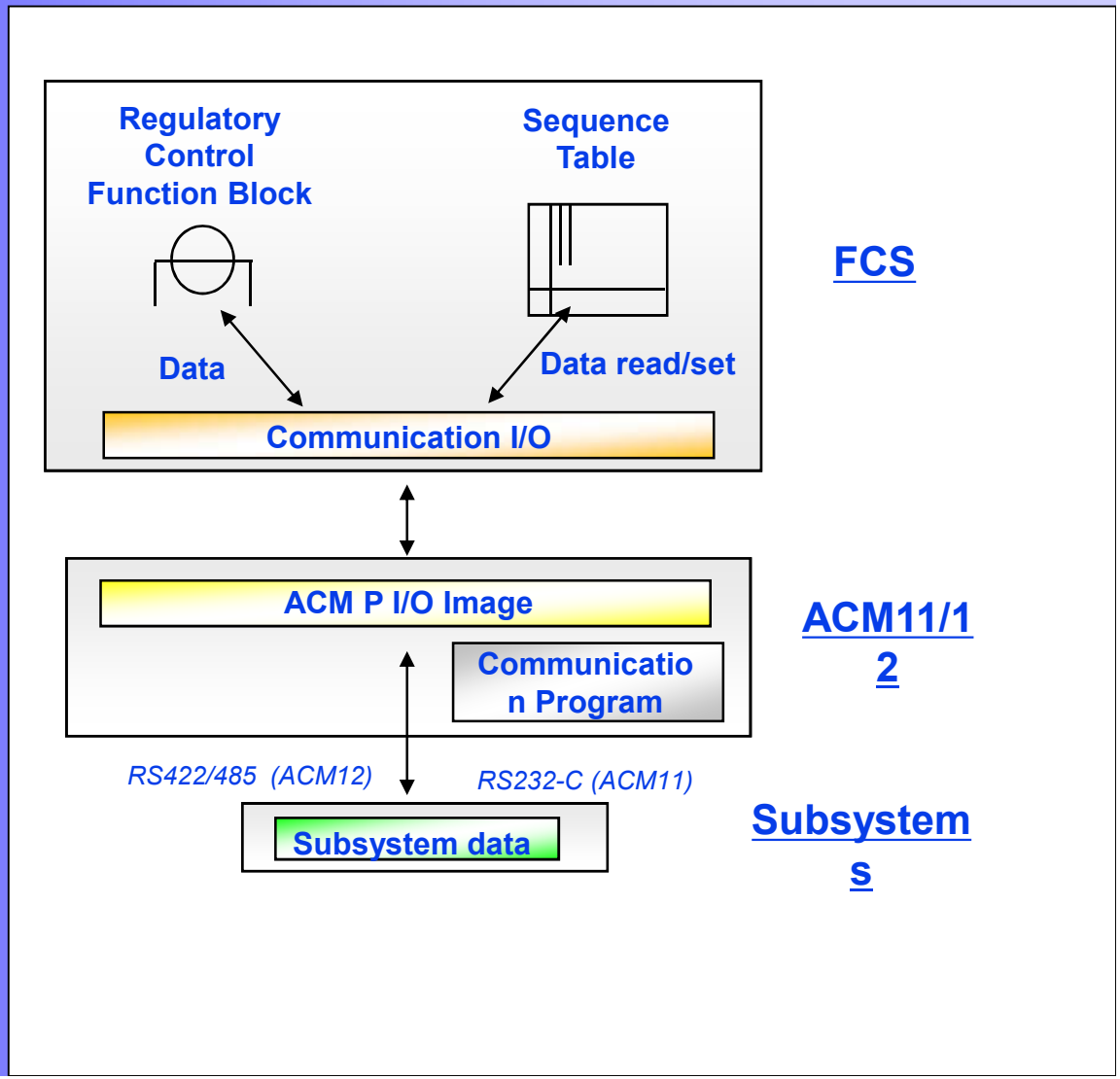
- Plug-in Communication Cards
- Various types of Protocol Drivers available

Hardware Configuration for RS Communication

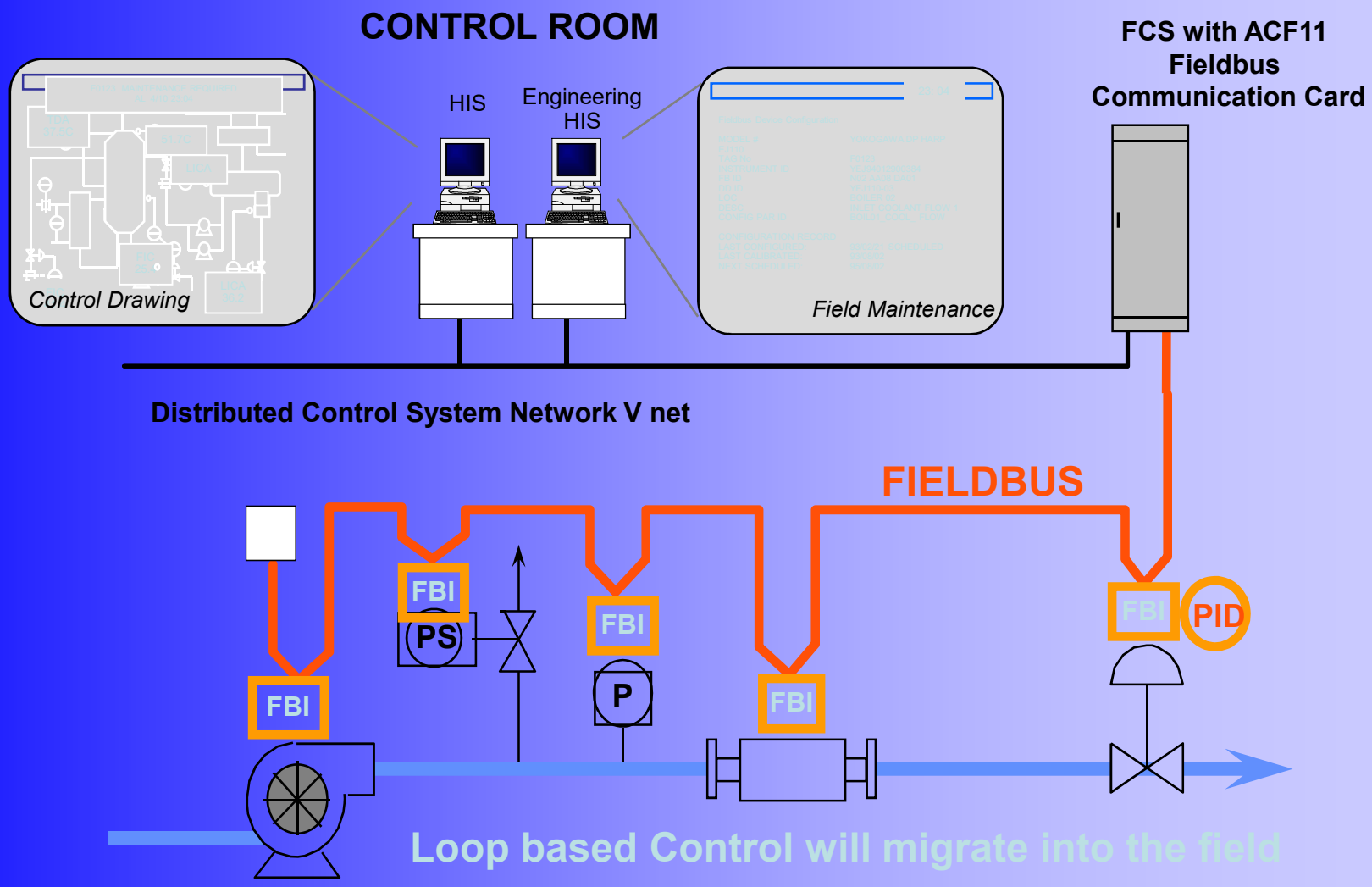


Subsystem Communication

- **MODBUS RTU Communication (including redundant)**
- **Read/Write Support**
- **Communication**
  - ROTORK
  - SAAB
  - TRIPLEX
  - MODICON
  - ENRAF
  - TRICONEX
  - WOODWARD
  - P & F
  - UOP
  - SIEMENS
  - AUGUST
  - MEMOCON
  - etc.



Fieldbus Communication



Ethernet Interface Module for Integration of Subsystems(1)

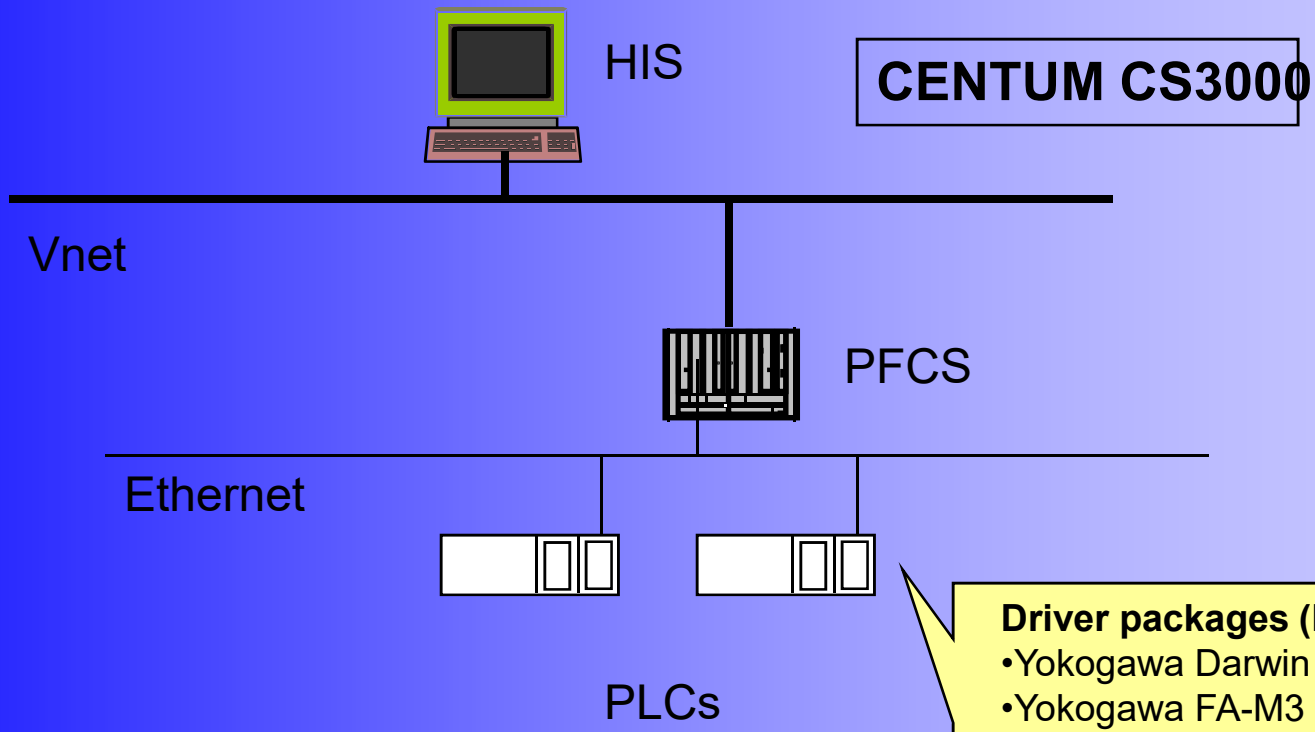
Phase Plan 2

- Providing high performance field communication
- New communication module
  - Compliance : IEEE802.3 10Base-T
  - Speed : 10M bps
  - Q'ty : Two modules per FCS
  - Support FCS: SFCS
  - Target performance: 30k byte per sec. at 20% CPU load
    (Analogue 2,500 points or Digital 40,000 points)

Ethernet Interface Module for Integration of Subsystems(2)

Phase Plan 2

- Configuration example



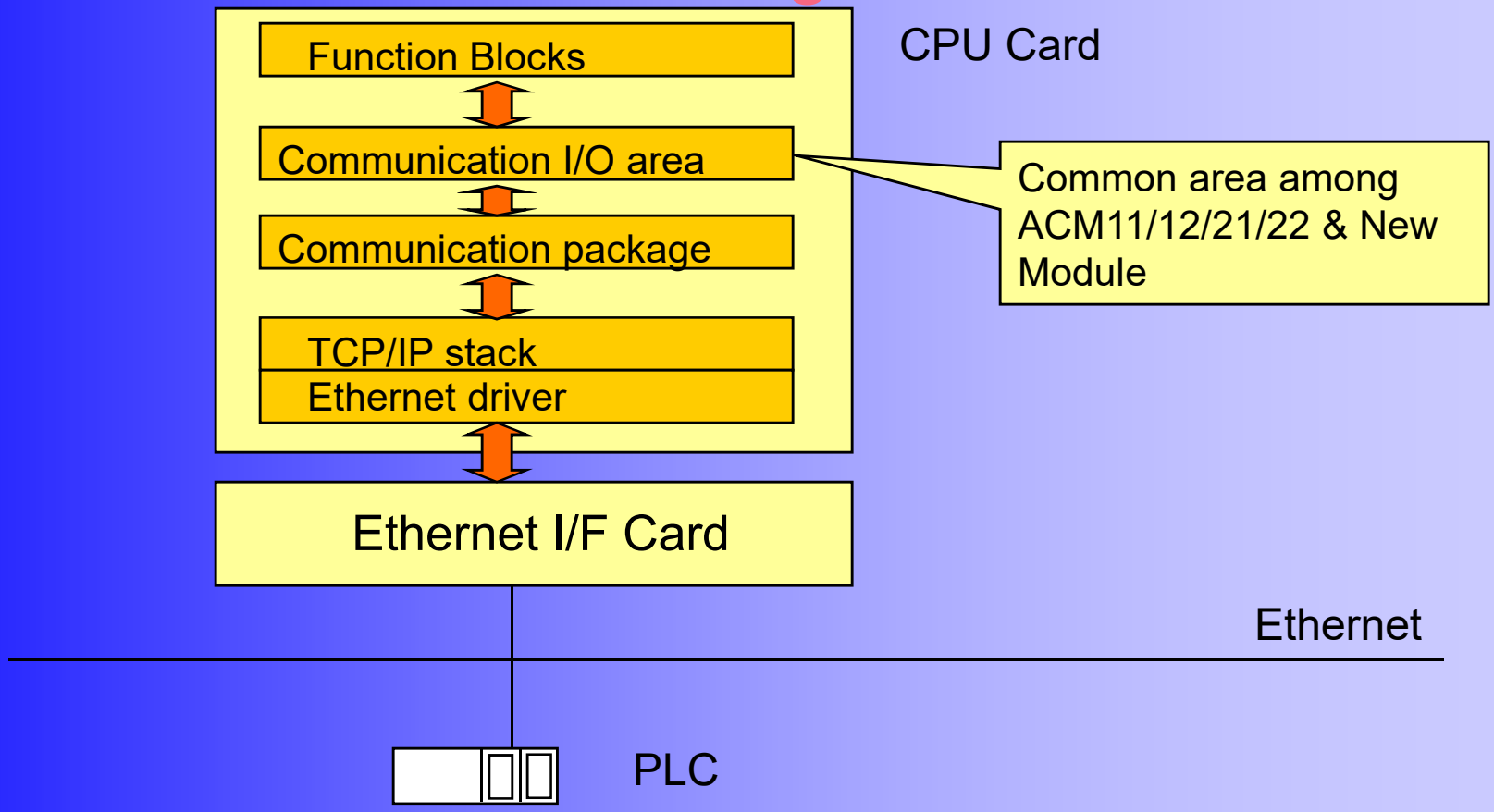
Driver packages (Plan)*
- Yokogawa Darwin
- Yokogawa FA-M3
- Mitsubishi Melsec
- Omron SYSMAC
- Allen Bradley
- AEG Shneider (Modicon)

*Note: Driver Package line up may change without notice.

Ethernet Interface Module for Integration of Subsystems(3)

Phase Plan 2

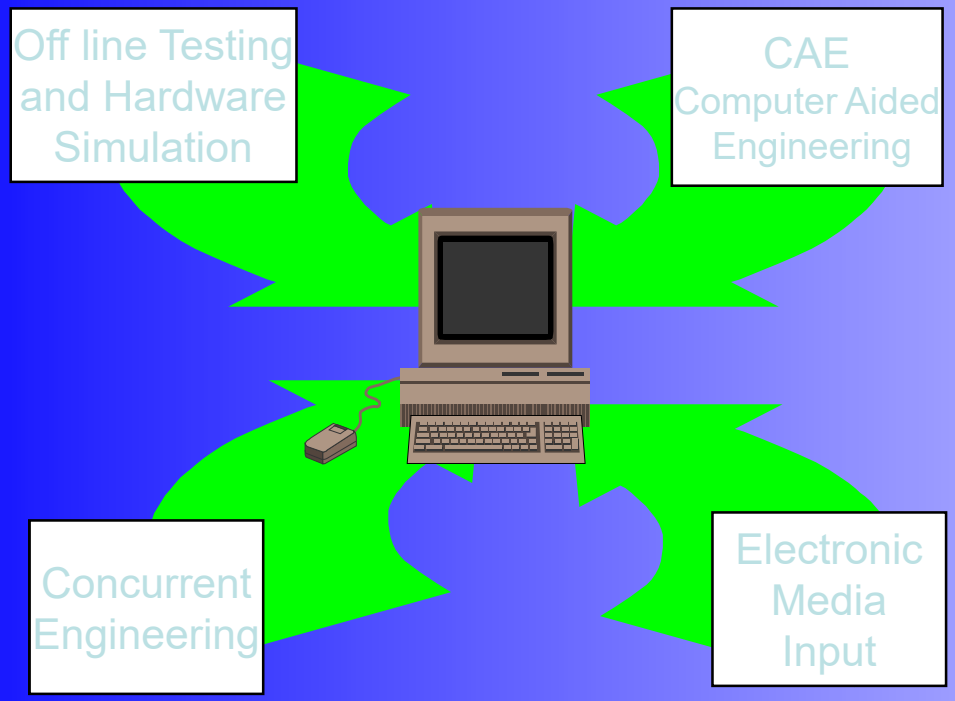
- Internal function diagram



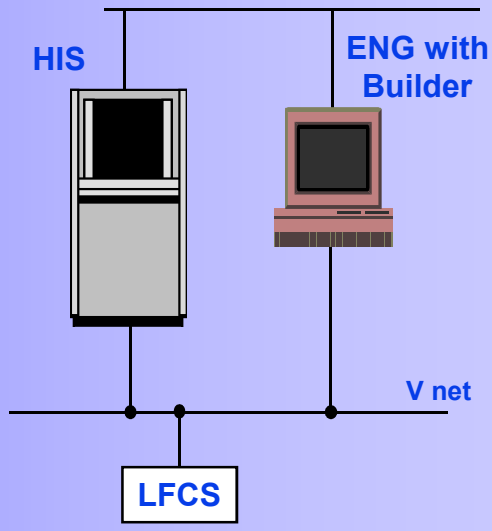
Engineering Functions

Engineering

Off line Engineering without Target Hardware
by using Hardware Simulation Technology



On line Engineering

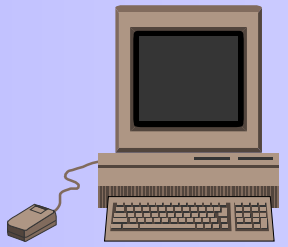


Order → Start-up

- Engineering can start direct after ordering
- Engineering up to Configuration Testing can be done Off Line

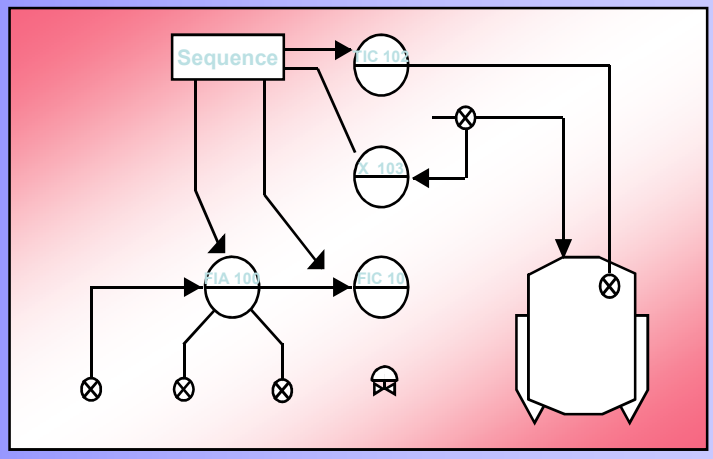
Engineering Station (ENG) with Builder

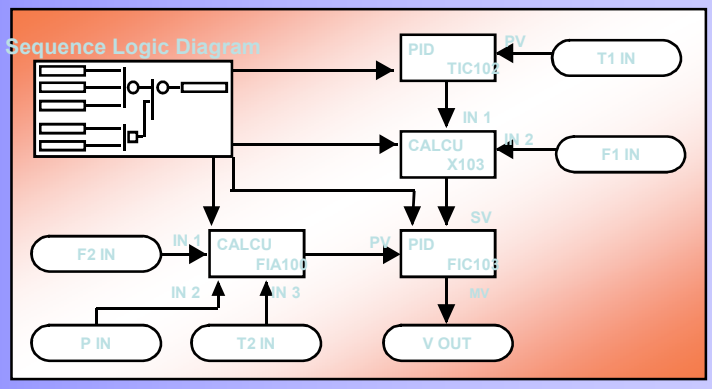
- Single Data Base Concept
  - Concurrent Engineering
- Computer Aided Engineering (CAE)
  - Control Drawings, Graphical Connection
  - Extensive “Instruments” Library
  - “Pick & Click”, Fill in the Forms
- Off-Line Testing
  - Engineering & Testing without Target Hardware
  - Engineering can start immediately after PO
- Extensive Self-documentation
- Electronic Engineering Data-exchange
  - Engineering Tools
  - PID-IN, dBase, Etc...



Control Drawing

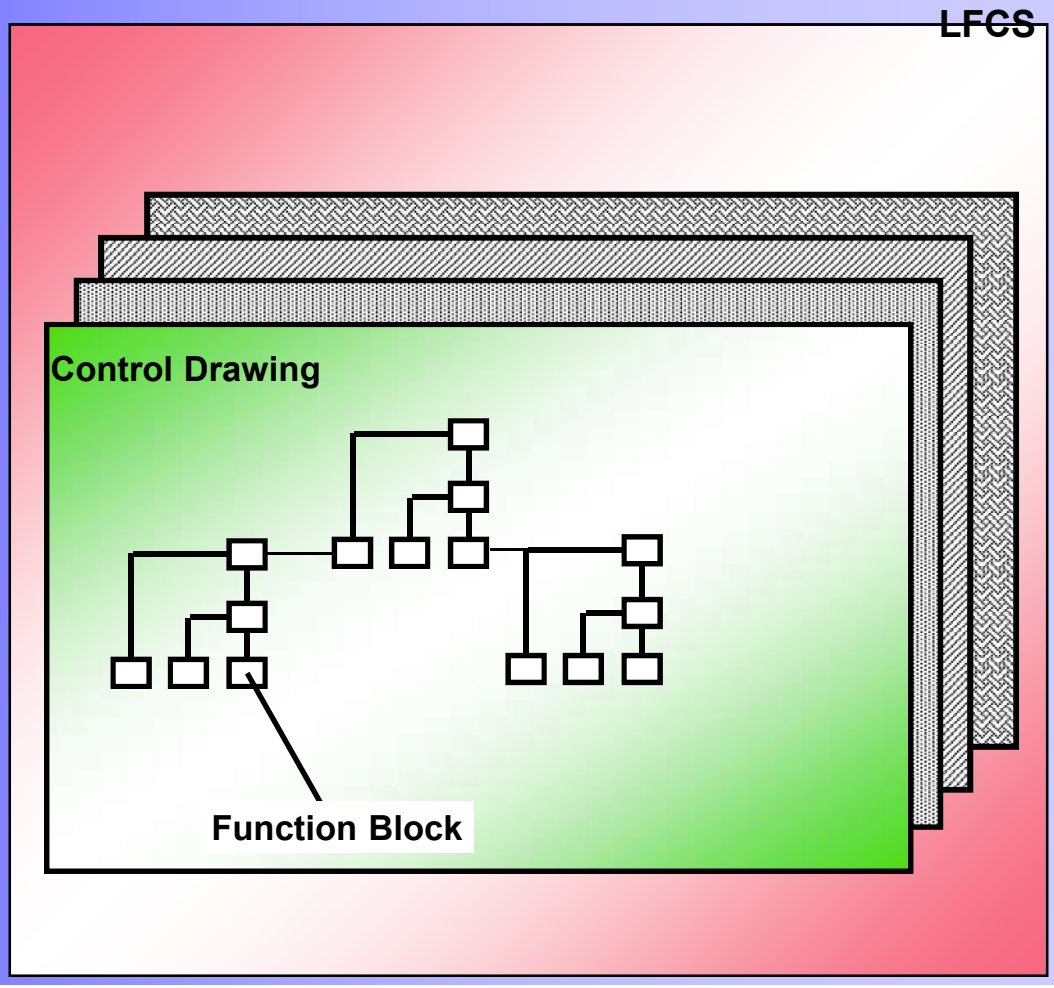
- Control, Sequence and Interlocking
- Engineering Corresponding to P&ID
- Modular Engineering



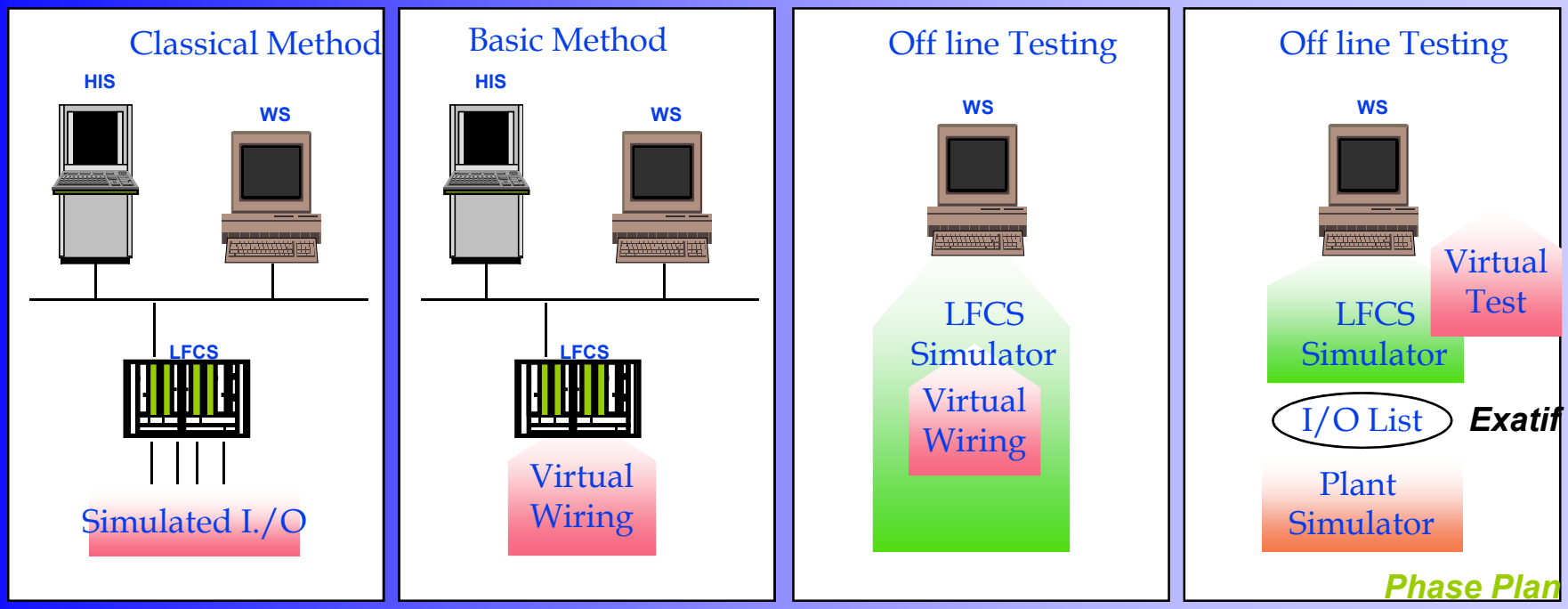


Control Configuration`

- P&ID Compatibility
- Graphical Self-Documentation;
- As Built
- Integration of Control, Sequence and Interlocking



Configuration Testing



- Complete Off Line Testing of the Configuration

UCUF

UNION FENOSA gas
SEGAS Services

DCS Systems

Consortium

Training Simulator

- Familiarize with the Man Machine Interface
- Start-up and Shutdown Training
- Operation Familiarization Training
- Exceptional Situations Training
- Operation Analysis

REMOTE MAINTENANCE SUPPORT (RMS)

- Detailed Maintenance Information Acquisition & Analyzing by Service Center Specialists
- Hardware and Software Revision Management
- Initiation of Test Programs
- Remote Analysis, Support and Advise
  - **Customer**
  - **Local Service Engineer**
  - **Etc.**